

ケニア共和国  
再生可能エネルギーによる  
地方電化モデル構築プロジェクト  
終了時評価調査報告書

平成26年10月  
(2014年)

独立行政法人国際協力機構  
産業開発・公共政策部

産公
JR
14-106

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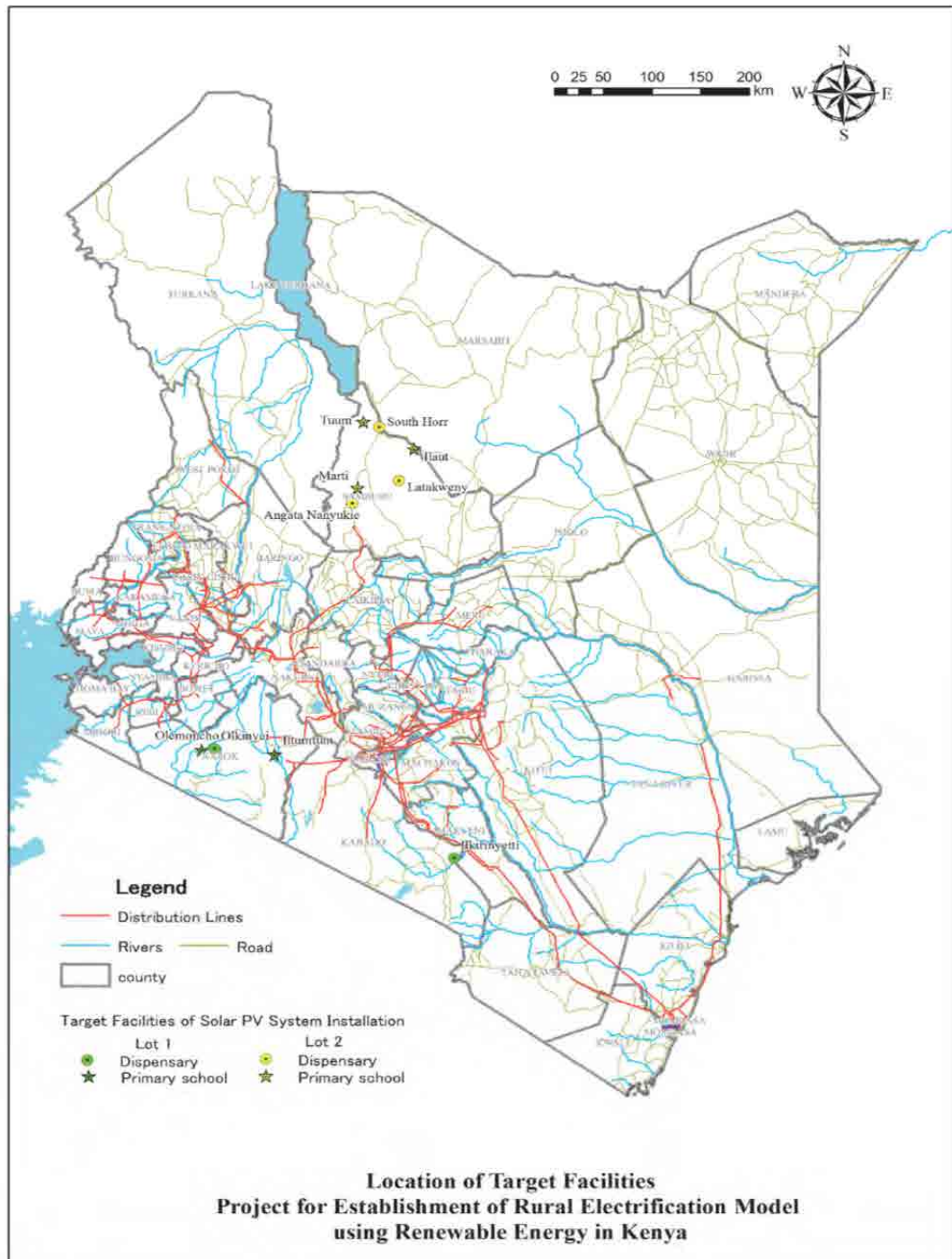
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## プロジェクトの位置図



Prepared by JET

### Location of Target Facilities

出典：JICA Expert Team (2014) Project for Establishment of Rural Electrification Model Using Renewable Energy in the Republic of Kenya: Progress Report 5 (p.ix)

# 写 真



ナロック・カウンティ保健事務所での終了時評価調査団合同評価者による面談の様子



Iltumtum 小学校に設置された太陽光パネル



Olkinyei 診療所に設置された太陽光パネル



Iltumtum 小学校の授業の様子。夜間に行われる補習授業では、天井の照明が点灯する。



Olkinyei 診療所の看護師



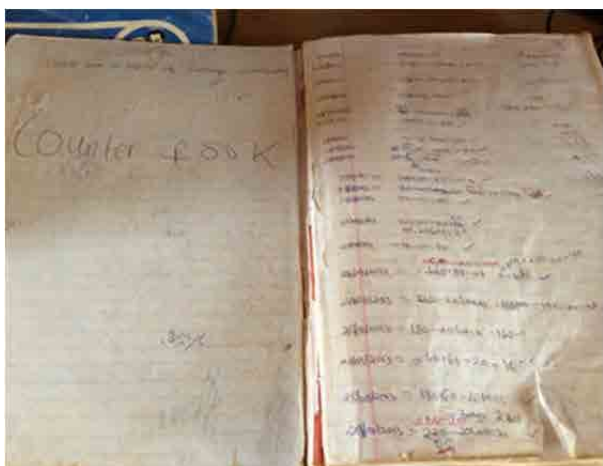
Iltumtum 小学校に設置された充電小屋。地域住民向けの充電サービスが行われている。



カジアド・カウンティ Ilkilnyeti 診療所



Ilkilnyeti 診療所のワクチン保存用冷蔵庫



Ilkilnyeti 診療所の充電ビジネス台帳



Ilkilnyeti 診療所から近い市場の充電サービス  
(発電機利用)



Ilkilnyeti 診療所から近い市場の充電サービス  
(店の外観)



合同調整委員会 (JCC)



## 略 語 表

略 語	英文正式名	和 名
AFD	French Agency for Development	フランス開発局
BRIGHT	Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy	再生可能エネルギーによる地方電化推進のための人材育成プロジェクト
C/P	Counterpart	カウンターパート
EAC	East African Community	東アフリカ共同体
F/S	Feasibility Study	フィージビリティ調査
GIS	Geographical Information System	地理情報システム
JCC	Joint Coordinating Committee	合同調整委員会
JICA	Japan International Cooperation Agency	独立行政法人国際協力機構
JKUAT	Jomo Kenyatta University of Agriculture and Technology	ジョモケニヤッタ農工大学
KPLC	Kenya Power and Lighting Company	ケニア電力電灯会社
MHP	Micro Hydro Power	小水力発電
M/M	Minutes of Meeting	ミニッツ（協議議事録）
MoE&P	Ministry of Energy and Petroleum	エネルギー石油省
MoEST	Ministry of Education, Science and Technology	教育科学技術省
MoH	Ministry of Health	保健省
MOU	Memorandum of Understanding	覚書
NERA	National Electrification and Renewable Energy Authority	国家電化再生エネルギー庁
O&M	Operation and Maintenance	運転・保守管理
ODA	Official Development Assistance	政府開発援助
OJT	On-the-Job Training	実務研修
PDM	Project Design Matrix	プロジェクト・デザイン・マトリックス
PV	Photovoltaic	太陽光発電
R/D	Record of Discussions	討議議事録
REA	Rural Electrification Authority	地方電化庁
REMP	Rural Electrification Master Plan	地方電化マスタープラン
UNIDO	United Nations Industrial Development Organization	国際連合工業開発機関

USD	United States Dollar	米国ドル
WG	Working Group	ワーキンググループ

## 評価調査結果要約表

1. 案件の概要	
国名：ケニア共和国	案件名：再生可能エネルギーによる地方電化モデル構築プロジェクト
分野：エネルギー	援助形態：技術協力プロジェクト
所轄部署：産業開発・公共政策部 資源・エネルギーグループ	協力金額：約 2.9 億円（2013 年 3 月までの実績）
協力期間 (R/D) 2011 年 10 月 2012 年 3 月～ 2015 年 2 月(3 年間)	先方関係機関：エネルギー石油省 (MoE&P)、地方電化庁 (REA)
	日本側協力機関：日本工営株式会社等
	他の関連協力： JICA 技術協力プロジェクト：ケニア国「再生可能エネルギーによる地方電化推進のための人材育成プロジェクト」(BRIGHT プロジェクト) (2011 年～2015 年)
1-1 協力の背景と概要	
<p>ケニア共和国（以下、「ケニア」と記す）政府は、安定的かつバランスの取れた経済基盤の構築及び貧困削減を目的として、基礎インフラである電力供給の強化に積極的に取り組んでいる。ケニアにおけるエネルギー分野は、エネルギー石油省（Ministry of Energy and Petroleum : MoE&amp;P）が管轄しており、地方電化の実施機関として、地方電化庁（Rural Electrification Authority : REA）が 2006 年に制定されたエネルギー法 No. 12 の第 66 条に基づき設立され、2007 年より始動している。REA の権限や使命、展望は、2030 年までに産業化された中進国への発展をめざす Vision 2030 をはじめとする国家計画と一致する。Vision 2030 が掲げる 2030 年までの中進国化の実現のためには、2030 年までに 100%の電化率達成が期待される。こうした要望を受け、地方電化マスタープラン（Rural Electrification Master Plan : REMP）は、2009 年時点で 10%未達の地方電化率を、2020 年までに 40%に引き上げることを目標としている。REMP では、特に Trading Center、Secondary School、Health Center を地方電化における重要公共施設と位置づけ、これら施設の電化率は 10%（2003 年）から約 84%（2014 年 6 月）まで改善されている。REMP の展開計画として、REA 戦略計画（Strategic Plan）が 5 年ごとに作成されており、最新の戦略計画（2013/2014～2017/2018）及び MoE&amp;P による新エネルギー政策において、再生可能エネルギーの重点的な活用が明確に示されている。また、2010 年に公布された新憲法思想である地方分権化を踏まえ、今後は中央政府としての機能を国家レベルの政策立案に集中し、個別案件の計画、実施は郡（カウンティ：County）政府に移管することを計画している。こうした国家的な需要や政策の動向を受け、MoE&amp;P、REA とともに再生可能エネルギーによる地方電化モデルの構築の必要性を認識し、REA は技術協力の要請をわが国に行った。JICA はこの要請を受け、本プロジェクトを 2012 年 3 月より、3 年間の予定で開始している。</p>	
1-2 協力内容	
(1) 上位目標： <u>ケニア国民の生活の質を向上させるため、再生可能エネルギーを利用した地方電化モデルが国内に普及する。</u>	

(2) プロジェクト目標：未電化地域における再生可能エネルギー利用による地方電化モデルを構築する。

(3) 成 果

1. パイロット・プロジェクトを通じて、未電化地域における保健施設の太陽光発電による電化の実用モデルが開発される。
2. パイロット・プロジェクトを通じて、未電化地域における学校施設の太陽光発電による電化の実用モデルが開発される。
3. 風力、小水力、バイオガスを活用した地方電化プロジェクトを実施する REA/MoE&P の能力が向上する。
4. 再生可能エネルギーによる地方電化モデルがケニア国内で普及するための政策・制度に関する提言が行われる。

(4) 投入（評価時点）

<日本側>

短期専門家派遣：11 人（90.96 人月）

機材供与：0.34 億円

研修員受入：（本邦）3 人、（第三国：インド、タイ）7 人

ローカルコスト負担：0.621 億円

<ケニア側>

カウンターパート配置：19 人

ローカルコスト負担：0.028 億円

土地・施設提供：執務室、机、椅子、キャビネット、電気、水道、飲料水、茶など

2. 評価調査団の概要

調査者	日本側		
	1	総括／地方電化	小川 忠之 JICA 国際協力人材部 国際協力専門員
	2	協力計画	梶谷 有希 JICA 産業開発・公共政策部 資源・エネルギーグループ第二チーム
	3	評価分析	首藤 久美子 有限会社アイエムジー 上席研究員
	ケニア側		
	1	Ms. Judith Kimeu	REA 再生可能エネルギー部 アシスタント・エンジニア
	2	Mr. Hannington Gochi	REA 再生可能エネルギー部 シニア・テクニシャン
調査期間	2014 年 9 月 30 日～10 月 16 日		評価種類：終了時評価

3. 評価結果の概要

3-1 実績の確認

(1) 投 入

日本側、ケニア側とも投入は基本的に計画どおり行われた。ケニア側からの投入であるプロジェクト事務所は、C/P 機関である REA 及び MoE&P から距離があり、効率性を大きく阻害している。プロジェクト開始当初に比べ C/P は大幅に増員されたものの、C/P は他業務で多忙であり、専門家からの技術移転を受ける時間が十分に取れない状況である。

## (2) 成 果

### 1) 成果 1 (診療所における太陽光発電モデルの開発)

成果 1 は現在のところ、一定程度達成されている。パイロット活動の継続したモニタリング、モニタリング結果の集計、財務分析、ガイドライン及びマニュアル作成、そして太陽光発電モデルの完成といった成果 1 達成のために必要な活動は、現在も進行中である。また、太陽光発電設備の運転・保守管理 (Operation and Maintenance : O&M) の全国的な適用性について、不確実性がまだ残されている。残り期間で、特に財政面・組織面から O&M モデルの持続性を高める取り組みを強化していく必要がある。

### 2) 成果 2 (学校における太陽光発電モデルの開発)

成果 2 の達成度は基本的に成果 1 と同様である。ただし、学校を管轄する教育科学技術省との太陽光発電設備の O&M に関する協議が始まったばかりであり、成果 1 に比べ、モデルの組織・財政的持続性について不確実性がより高い状況にある。

### 3) 成果 3 (小水力、バイオガス、風力発電技術に関する C/P の能力向上)

現在行われているガイドライン作成、簡易プレ・フィージビリティ調査 (F/S) 結果の取りまとめと発表等が計画どおりに実施されれば、成果 3 は一定程度達成できると見込まれる。当初計画されていた成果 3 に係るパイロット・プロジェクト活動は、1 年目終盤に中止が決定したため、C/P の、研修等で学んだ知識を実践で活用する機会は少なくなった。そうした状況の中で、残り協力期間で C/P の実践力を高めていくためには、現在実施されている成果 3 の活動に、C/P がより主体的に参加していくことが必要である。

### 4) 成果 4 (政策・制度に関する提言)

国際ワークショップの開催、提言の実施等の計画されている活動が完遂されれば、成果 4 は比較的高く達成できる見込みである。ただ、プロジェクトが今後提示する提言が、有効かつ現実的に実行可能なものになるかどうかは、成果 1～3 の達成度に大きく左右される。専門家は現在、成果 1～3 の知見に基づき提言案を作成中であるが、今後、C/P 機関との密な協議を重ね、真に役立つ提言を行っていくべきである。

## (3) プロジェクト目標の達成度

プロジェクト目標は現在、一定程度達成されている。未完の活動が成功裡に完了すれば、プロジェクト終了時には達成度が比較的高まると予想される。C/P の全面的な参加を得て 4 つの成果を十分に達成させることが、プロジェクト目標の高い達成に欠かせない。

## (4) 実施プロセス

### 1) 正の要因

#### a) ジョモケニヤッタ農工大学 (JKUAT) 及び BRIGHT プロジェクトとの連携

C/P やカウンティ保健事務所の職員は、ジョモケニヤッタ農工大学 (Jomo Kenyatta University of Agriculture and Technology : JKUAT) 及び本プロジェクトと同時期に JKUAT を C/P として実施されている JICA 技術協力プロジェクト「再生可能エネルギーによる地方電化推進のための人材育成プロジェクト」(通称“BRIGHT プロジェクト”) が主催する研修やセミナーに参加したり、発表を行ったりしている。こうした JKUAT や BRIGHT プロジェクトとの連携は、プロジェクトの効率性を高めている。

## 2) 負の要因

### a) C/P の業務多忙

C/P はディーゼルによる発電業務等、プロジェクト以外の業務で多忙であり、専門家から C/P に対する技術移転の障害となっている。特に成果 1、2 のパイロット対象地を訪問したり、成果 3 のプレ F/S を実施するために地方出張をすることが時間の制約上難しく、特に成果 1、2 については専門家チームが単独で現場の活動を実施せざるを得ない状況が数多く発生している。

### b) プロジェクト事務所の距離

プロジェクト事務所は REA や MoE&P から離れた場所にあり、専門家が C/P と緊密に意思疎通を行うのが難しい状況である。専門家と C/P の物理的な距離は円滑なプロジェクト活動実施に大きな障害となっている。

### c) ケニアにおける急速な電力系統延伸

REA は、ケニアの未電化地域に急速に電力系統の延伸を行っている。系統延伸の対象地は、その性質上、プロジェクトの太陽光発電対象候補地と重複しがちである。実際、第 2 ロット選定の際には、選定した場所が系統延伸の対象地であることが後で明らかになるなどして、何度も選定をやり直さなければならなかった。プロジェクトがパイロット対象地、特に第 2 ロット候補地を最終的に決めるまでには長い時間を要した。

### d) 国際連合工業開発機関との連携準備（後に中止）

プロジェクトは第 1 年次、成果 3 の小水力、バイオガス、風力を用いたパイロット活動実施のため、およそ 9 カ月をかけて国際連合工業開発機関（UNIDO）との連携に向けて準備を行った。しかし、検討の結果、UNIDO との連携は有効ではないという結論に達し、連携計画は中止となった。プロジェクトは成果 3 のデザインを大幅に変更しなければならなくなり、また UNIDO との連携準備のために多くの時間を費やし効率性を低下させた。

### e) ケニアにおけるカウンティ制への移行

近年、ケニアの地方分権化は本格化し、カウンティ制度へと急速に移行している。中央政府とカウンティ政府の役割や権限は 2013 年半ばころから大きく変化した。プロジェクトは変化する環境の中、パイロット太陽光発電システムの O&M に関する検討を中央・地方政府の両方で随時調整する必要が生じ（特に成果 1 のために）、関係者の役割の整理や協議実施等に時間を要している。

### f) 太陽光発電システム設置業者の工事をめぐるトラブル・不具合発生

ケニアの太陽光発電システム設置業者の電気工事技術は、予想以上に低いことが明らかになった。パイロット対象地では、工事の際に不具合が繰り返し生じ、その都度、プロジェクトが問題解決のために奔走しなければならない状況となった。専門家は、現場でのトラブル解決に時間を取られ、ナイロビで行うべき仕事になかなか手が回らないという課題を抱えている。

### g) 第 2 ロットへの距離

第 2 ロット選定の際には、電力系統延伸の見込みが低い、ナイロビから遠く離れた地域を選ばなければならなかった。パイロット活動の目的にかんがみると、こうした地域を選択することは適切だったといえるが、当該地域は治安上の問題もあり、さらに移動に長時間を要するため、プロジェクトの効率性が阻害された。専門家も C/P も、限られたプロジェクト期間中に第 2 ロットを頻繁に訪れるのは難しいため、成果 1、

2の現場での技術移転に支障を来している。

#### h) ケニア政府ラップトップ・プログラムの開始

2013年4月にケニア国大統領は「すべての小学校を電化し、1校当たり50台のラップトップコンピュータを配布する」というラップトップ・プログラム計画を発令した。同プログラムに従事するために、2014年4月頃からC/Pの業務はこれまでにまして多忙となった。C/Pがプロジェクト活動に充てられる時間は以前よりも更に少なくなった。

### 3-2 評価結果の要約

#### (1) 妥当性

妥当性は比較的高い。プロジェクトはケニアの優先開発政策や日本の対ケニア ODA 政策に合致しているほか、再生可能エネルギー、コミュニティ開発、O&M、ビジネス分析といった日本が得意とする技術分野の強みを生かし、対象グループ、特に未電化地域の公共施設のニーズに適切に対応した活動を展開している。一方で、近年のケニアにおける急速な電力系統の延伸に伴い、パイロット活動が行われている場所にも一部配電線延伸が行われる状況が生じている。REA/MoE&P において、プロジェクト開始時に戦略的かつシステムチックな地方電化計画が行われていれば、こうした混乱は避けることができたであろう。

#### (2) 有効性

有効性は現在のところ中程度である。プロジェクト目標は終了時までには比較的高いレベルで達成されることが見込まれるものの、成果1から4のすべてにおいて、不確実性が残されている。現在実施中の活動が円滑に、かつ成功裡に進み、関係機関が本報告書で提示する提言にのっとりアクションを取るのであれば、終了時には有効性は高まるだろう。

#### (3) 効率性

効率性は中程度。日本とケニア両方からの投入は基本的に計画どおり実施されたものの、C/P が他業務で多忙なため、特に中間レビュー以前はプロジェクト活動になかなか従事できず、専門家から C/P への技術移転が十分にできなかった。1年目に産業施設におけるパイロット活動実施計画が中止となったため、プロジェクトの枠組みを再構築するのに時間を要した。系統延伸との重複を避けるためのパイロット地選定のやり直し、太陽光発電設備のシステム不具合発生、遠隔地における第2ロット活動の実施等の要因により、さまざまな主要な活動に遅れが生じた。さらに、2013年半ばからのカウンティ制への移行により、太陽光発電設備 O&M に関する関係機関とその役割・権限の特定に時間を要した。他方、JKUAT と BRIGHT プロジェクトとの連携はプロジェクトの効率性向上に一定程度寄与している。

#### (4) インパクト

インパクトは中程度。上位目標の達成度は、プロジェクト目標達成度に大きく依存する。また、プロジェクトが今後最終化するモデルが、いかに実践的で汎用性のあるものになるかによっても上位目標の達成度は左右される。現在のところ、プロジェクト目標の達成度には不確実性があり、よって上位目標の達成度も不確実な部分が多い。プロジェクトの正のインパクトは、①再生可能エネルギー技術の関係者が O&M コストに関して意識を高めたこと、②今後実施される設備設置に関して、設備の利用者・所有者と O&M に関する協

議を行う可能性が高まったこと、の2点である。また、パイロット活動実施地では、地域住民の生活の向上が確認できている。例えば、女子児童や女性スタッフは夕方・夜間照明があるため、以前よりも安心して行動できるようになった。夜間の出産や予防接種が容易になったりするなど、特に女性や子どもに対してより良い保健サービスが提供されるようになった。一方で、ラップトップ・プログラムにおいては、プロジェクトが推奨する設計に関する仕様を時間の制約上、採用してもらえなかった。もし採用されたならば、ケニア全国約3,000の小学校に顕著なインパクトを与えることができたであろう。

#### (5) 持続性

持続性は中程度。REAは国家電化再生エネルギー庁(National Electrification and Renewable Energy Authority : NERA)へ組織改編されることが計画されているため、今後の政策的、組織的持続性は判断しがたい状況である。ただ、今後提示されるプロジェクトからの提言が再生可能エネルギー関連政策に反映されれば、政策的持続性は高まるだろう。太陽光発電システムのO&Mに関する役割や責任については、中央・地方政府等の関係組織間で今後明確化させ、組織的持続性を高めていく必要がある。太陽光、小水力、バイオガス、風力の4つのすべての技術分野について、C/Pの実践スキルは理論的な知識に比べて十分でないため、技術的持続性については課題が多い。財務面での持続性については、特に太陽光発電システムのO&Mに関して、今後、プロジェクトが提案するモデルを普及していくための政府予算を獲得していくといった努力が求められる。

### 3-3 効果発現に貢献した要因

#### (1) 計画内容に関すること

該当なし。

#### (2) 実施プロセスに関すること

該当なし。

### 3-4 問題点及び問題を惹起した要因

#### (1) 計画内容に関すること

該当なし。

#### (2) 実施プロセスに関すること

[3-1 実績の確認]の[(4) 実施プロセス]に記載したすべての負の要因が、プロジェクト期間を通じて、成果発現を阻害した。

### 3-5 結論

現在のところプロジェクト目標の達成度は中程度であるが、未完の活動が遅滞なく効果的に実施され、また本報告書の提言にのっとりたアクションが取られれば、プロジェクト終了時の達成度は高まる見込み。

プロジェクトは、種々の効率性の低下という課題を抱えながら活動を続けてきた。今後、O&M体制について、関係機関の理解を促進し、理解を取り付けるとともに、モデルの定着を確実なものにするよう、実効性の高い提言を提示し、C/P機関からの承認を得る必要がある。こうした課題が解決されれば、プロジェクト目標の達成見込みは向上するだろう。



プロジェクトは、上で指摘した残された活動を残り期間で確実に実施するとともに、本報告書で示す提言に従ってアクションを取ること。プロジェクトは、予定どおり 2015 年 2 月末をもって終了するのが妥当である。

### 3-6 提言

#### 3-6-1 プロジェクトに対する提言（プロジェクト残り期間で取り組むべきこと）

##### (1) O&M モデルの確立による持続性の担保

保健省、教育科学技術省、カウンティ政府等と協力して、太陽光発電設備の O&M に関する協議を継続し、体制・仕組みの整備をめざすこと。O&M モデルへの組織的・財政的コミットメントを得るために、協議の際にはハイレベルの対話を行い、覚書 (MOU) の締結をめざすべきである。

教育科学技術省における O&M 体制については、例えば、中央政府と学校をリンクさせる強いファシリテーション機能をカウンティの教育事務所にもたせ、学校が太陽光発電システムの営繕に費用が必要となった場合に、即座に中央の教育科学技術省につないでいけるような体制の導入を提言するのも一案だろう。

また、充電サービスを行う施設では、充電ビジネスから得た現金の取り扱いや管理に関して一部、着服等のリスクが関係者より指摘されていることから、どのような管理方法が望ましいかについても議論をする必要があるだろう。

なお、O&M モデルは C/P 機関の正式な承認を得るとともに、モデルの改善を継続的に行っていく責任部署を明確化させること。

##### (2) モデルの適用可能性に関する定量分析の実施と C/P への情報提供

将来想定されるモデルの適用範囲、概略数量、そして将来必要となる O&M コストを試算し、REA/MoE&P に提供することを推奨する。また、このためには充電ステーションを設置するサイトの選定条件を明示することが必要になるため、パイロット活動で得られた知見を踏まえ、適切な条件設定を行うこと。

##### (3) 実現性の高い提言の策定

成果 4 を達成するため、構築されたモデルに基づいて C/P に対して提言を行う際には、関連機関と十分な議論を実施し、実現性の高い提言を行うこと。そして、C/P 及び関連機関が提言に従ったアクションを取ることができるよう、十分な理解と支援を働きかけること。今後、REA がモデルを採用した業務を行っていくことが重要である。そのため、業務完了報告書においてモデルの有用性が確認されたら、プロジェクト終了前に、REA の「年間再生エネルギー業務計画 (パフォーマンス・コントラクト)」にモデルを適用する旨の記載を促すとともに、REMP 改定時にもモデルを反映させるよう働きかけること。

##### (4) C/P の十分な参加を得た技術移転の実施

技術移転が不十分な個所を補うため、残り期間で専門家から C/P への知識・技術の移転を重点的に実施することが必要である。4 つの技術分野すべてにおいて技術移転を推進するためには、C/P の積極的な参加が不可欠である。例えば、来年 2 月に開催が予定されている国際ワークショップの準備や発表は、C/P が中心となって行っていくこと。

(5) 指標達成状況、課題、提言の記録

評価時点では、重要なプロジェクト目標・成果指標のいくつかが未達成で、今後数カ月で達成できる見込みのものが多かった。事業完了報告書作成時（2015年2月）には、すべての指標の達成状況を明確に記載し、プロジェクトの最終的な目標・成果達成度を明示すること。加えて、残された課題に関して、C/P 機関・関連機関と十分に協議したうえで、持続性向上のための提言を行い、事業完了報告書にも同内容を記載すること。

3-6-2 C/P 機関に対する提言（中長期的に取り組むべきこと）

(1) 継続的なモデルの活用と改善

C/P 機関は、プロジェクトが提示したモデルの有効活用とモデルの継続的な改善を行うこと。また、関連省庁との調整を担当する責任者の任命を行うなど、モデルの維持発展のための体制を整備する必要がある。

(2) 継続的なガイドラインの活用と改定

小水力、バイオガス、風力技術に関しては、1年次にパイロット活動が中止になり、C/P は計画、分析、設計、設置、モニタリングといった一連のサイクルを現場で実施する機会を失った。プロジェクトは代わりに C/P に対して集中的な研修を実施し、さらに将来的に役立つガイドラインを作成しているところである。C/P は研修受講経験を生かし、今後、小水力、バイオガス、風力技術の現場でこれまで習得した知識を活用していくべきである。そのためには、太陽光発電を含めたガイドラインの利用及び継続的な改定を行っていく必要がある。REA は、ガイドライン改定やアップデートを担当すること。

(3) REMP のデータベースの改善

サイト選定の重複等を避けるため、REMP に関するデータベースを地理情報システム (GIS) を活用して整備をし、ドナーを含む関連機関に提供すること。GIS を活用したデータベースが実現すれば、将来の開発計画に係るサイト選定が容易になるだろう。

(4) JKUAT とのナレッジ共有と人的交流

REA 及び MoE&P の、JKUAT とのナレッジ共有や人的交流は有益であることが明らかになった。再生可能エネルギー技術について、JKUAT と継続した交流を行うこと。プロジェクトが作成したガイドライン等の各種文書についても、JKUAT と共有し、JKUAT の研修教材として活用してもらうなどの連携が有効である。また、JKUAT で行われている太陽光発電に関する研修には、保健省、教育科学技術省、カウンティ政府の関係者等を継続的に参加させるようにすること。

(5) 設置工事に関する基礎技術の向上

パイロット・サイトでの太陽光発電設備設置に際し、業者による屋内配線、スイッチ、ブレーカー設置といった基礎的な電気工事技術が低いことが明らかになった。そのため、担当の専門家は、工事の不具合を修正する業務に追われることとなった。専門家が不在で工事が行われた場合、設置後にさまざまな不具合やトラブルが発生する可能性が高い。基礎的な設置工事の質を高めるためには、REA は入札図書作成の際などに適正な詳細設計を実施し、それに従って業者を監督・検査することが重要である。

### 3-7 教訓

#### (1) 急速に変化する状況への対応

プロジェクトでは成果の達成に遅れがみられる。内部要因・外部要因を合わせて8つの要素が、プロジェクト期間を通してプロジェクトに負の影響を与えているためである。プロジェクト実施者は、こうした問題に対し、プロジェクト開始前及び開始後に適切な対応策を講じ、負の影響を最小に抑えるべきだった。場合によっては、活動範囲の変更や専門家派遣方法の変更を含む、思い切ったプロジェクトデザインや手法の変更を考えるべきであろう。



## Summary of Evaluation

<b>I. Outline of the Project</b>		
Country: Republic of Kenya		Project title: The Project for Establishment of Rural Electrification Model Using Renewable Energy
Issue/Sector: Energy		Cooperation scheme: Technical Cooperation Project
Division in charge: Industrial Development and Public Policy Department		Total cost: Approx. 290.1 million yen (as of March 2013)
Period of Cooperation	(R/D) October 2011	Partner Country's Implementing Organization: Ministry of Energy and Petroleum (MoE&P), Rural Electrification Authority (REA)
	March 2012 – February 2015 (3 years)	
		Supporting Organization in Japan: Nippon Koei etc.
Related Cooperation: Capacity Development for Promoting Rural Electrification Using Renewable Energy (BRIGHT Project) (2011-2015)		
<b>1. Background</b>		
<p>The government of Kenya has been actively working on the enhancement of electric power supply aiming for the stable and balanced economic foundation as well as poverty reduction. Ministry of Energy and Petroleum (MoE&amp;P) has been in charge of the energy sector in Kenya and the Rural Electrification Authority (REA) was established under section 66 of the Energy Act No. 12 of 2006 and became operational in July 2007. REA's mandate, vision and mission are aligned with the national development plan such as Vision 2030. Vision 2030 is designed as a vehicle for accelerating the transformation of the country into an industrialized middle income nation. To achieve this goal, electricity has been identified as one of the drivers where it is expected to achieve 100% electrification rate by 2030.</p> <p>Regarding the rural electrification, Rural Electrification Master Plan (REMP) has been prepared and updated to attain its goal; 40% of rural electrification rate by 2020 which was below 10% in 2009. Trading centers, secondary schools, health centers are prioritized as important public facilities under REMP, so the electrification rate of those facilities has improved from 10% (2003) to 89% (June, 2013). As a rolling plan of REMP, REA strategic plan has been prepared and updated every 5 years. The latest plan (REA strategic plan 2013/2014-2017/2018) as well as new energy policy by MoE&amp;P clearly states the focus on the utilization of renewable energy. Additionally, in order to promote the decentralization policy under the new constitution (2010), the function of central government is expected to focus on the national level policy formulation, while the county government will be responsible for the planning and implementation of each project.</p> <p>Therefore, both MoE&amp;P and REA recognized the need for establishment of the rural electrification model by renewable energy to meet these national demands and requested a technical cooperation to Japan International Cooperation Agency (JICA). In response to the request, The Project for Establishment of Rural Electrification Model Using Renewable Energy started in March 2012 for the three-year cooperation period.</p>		

## 2. Project Overview

### (1) Overall Goal

Rural electrification models using renewable energy are disseminated in the country to improve the quality of Kenyan's life.

### (2) Project Purpose

Rural electrification models using renewable energy are established.

### (3) Outputs

- 1) A practical model for photovoltaic (PV) electrification of health service institutions in nonelectrified areas is developed through pilot projects.
- 2) A practical model for PV electrification of schools in nonelectrified areas is developed through pilot projects.
- 3) The Capacity of REA / MoE&P to undertake project using Micro HydroPower (MHP), Biogas and Wind technologies is enhanced.
- 4) Necessary policy and institutional frameworks for rural electrification using renewable energy are recommended.

### (4) Inputs

#### Japanese side:

Short-term Expert: 11 (90.96M/M)	Equipment: 28,967,847 KSh. (34 million yen)
Trainee received: 3 trainees (in Japan), 7 trainees (in Third Countries: India and Thailand)	Local cost: 51,642,688KSh. (62.1 million yen)

#### Kenyan side:

Counterpart personnel (C/P): 19	Local cost: 2,360,404KSh. (2.8 million yen)
Land and facilities: An office space including desks, chairs, a lockable cabinet, electricity, water, drinking water and tea	

## II. Evaluation Team

Members of Evaluation Team	The Japanese side		
	Mr. Tadayuki Ogawa	Leader/ Rural electrification	Senior Advisor, JICA
	Ms. Yuki Masuya	Evaluation planning	Energy and Mining Group, Industrial Development and Public Policy Department, JICA
	Dr. Kumiko Shuto	Evaluation analysis	Senior Consultant, IMG Inc.
	The Kenyan side		
	Ms. Judith Kimeu	Assistant Engineer, Renewable Energy Department, REA	
Mr. Hannington Gochi	Senior Technician, Renewable Energy Department, REA		
Period of Evaluation	September 30 – October 14, 2014	Type of Evaluation: Terminal Evaluation	

### **III. Results of Evaluation**

#### **1. Project Performance**

##### 1-1. Inputs

Inputs both from the Kenyan and Japanese sides are provided basically as planned. Among the inputs provided, the distance between the project office and REA/MoE&P has caused inefficiency to a high degree. Although the number of the C/Ps increased substantially compared with the situation at the beginning, their limited availability for project activities, due to their other duties, has hampered effective technical transfer from the Experts.

##### 1-2. Outputs

###### (1) Output 1 (solar PV model at dispensaries)

Output 1 is judged to be achieved to some degree at present and many of the activities for achieving this output, such as further monitoring, synthesizing monitoring results, finalizing financial analysis, developing guidelines/user manuals and, finally, completing the models are still ongoing. Furthermore, there is still a certain level of uncertainty with regard to nationwide applicability of O&M of the solar PV systems. More efforts to ensure sustainable O&M models of the solar PV systems, particularly financial and institutional arrangements, need to be made in the remaining implementation period.

###### (2) Output 2 (solar PV model at schools)

The achievement of Output 2 is basically the same as that of Output 1. Output 2, however, has more challenges than Output 1 in terms of institutional and financial arrangements of sustainable O&M of solar PV systems since involvement of Ministry of Education, Science and Technology (MoEST) in establishing the O&M mechanism is still nascent.

###### (3) Output 3 (capacity development on MHP, biogas and wind technologies)

Output 3 is expected to be achieved to some degree if the ongoing activities, such as the preparation of guidelines and documentation/ presentation of Simple Pre- Feasibility Study (F/S), are completed as planned. Since the pilot projects for Output 3 were cancelled toward the end of the first year of the project period, most of the C/Ps had little chance to practice what they have learned in trainings. The C/Ps' more active participation is needed in the ongoing activities for Output 3 so that their practical knowledge will improve in the remaining project period.

###### (3) Output 4 (recommendation on policy and institutional frameworks)

Output 4 is expected to be achieved to a relatively high degree if the remaining activities, such as holding the International Workshop and proposition of recommendations are completed as planned. On the other hand, whether or not the Project can present truly effective and realistic recommendations depends largely on successful production of Output 1 through 3. The Experts are now preparing recommendations based on findings from the three Outputs. Close discussions with the C/P institutions need to be undertaken in order to produce truly useful recommendations.

##### 1-3. Achievement of Project Purpose

The Project Purpose is achieved to some degree at present. If unfinished activities are conducted successfully, the achievement level is expected to be relatively high at the end of the project period.

Successful completion of all the activities for the four Outputs with full participation from the C/Ps is required to attain a high level of achievement.

#### 1-4. Implementation process

##### <Positive factors>

##### (1) Collaboration with JKUAT and the BRIGHT Project

The C/Ps and staff of County Offices of the MoH have been attending and/or making presentations at various seminars and trainings organized by the JKUAT and/or JICA's technical cooperation project "The Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy (the BRIGHT Project)". Such collaboration with JKUAT and the BRIGHT Project is contributing to raising efficiency of the Project.

##### <Challenges>

##### (1) Demanding work volume of the C/Ps

Demanding work volume of the C/Ps outside the Project, such as work for diesel power generation, has been impeding effective and efficient technical transfer from the Experts to C/Ps. In particular, the C/Ps have been having a hard time finding time to go to the pilot sites (for Output 1 and 2) and pre F/S sites (for Output 3). Hence much of the field activities, particularly activities for Output 1 and 2, have been conducted by the Expert Team alone, without much participation from the C/Ps.

##### (2) Inconvenient location of the project office

The project office is located far from REA/ MoE&P, making the Experts and C/Ps difficult to see each other in person. This physical distance inhibits smooth project operation to a significant degree.

##### (3) Effects of rapid grid extension in Kenya

REA has been vigorously extending electrical grids to non-electrified areas in Kenya. The sites extended by grid, by nature, often overlap with the Project's potential and existing solar PV pilot sites. In fact, the Project had to re-select the pilot sites for Lot 2 several times since it became apparent the area would be soon covered by grid extension plans. It took much longer time for the Project to finalize its selection of the pilot sites, particularly for Lot 2.

##### (4) Time spent for planning collaboration with UNIDO

In the first year of the Project, the Project Team spent about nine months planning the details of collaboration with UNIDO. The collaboration was planned to facilitate pilot activities of MHP, biogas and wind power, which was for Output 3. However, after research, it was realized that such collaboration would not be effective and a decision was made to cancel the plan. The Project had to modify the plan for Output 3 substantially and the time spent for planning since the commencement of the Project was wasted to a large extent.

##### (5) Transition to the County System in Kenya

Kenya has seen a transition to the County System in the last few years. The roles and responsibilities of the central government and county governments dramatically changed particularly in mid to late 2013 (for Output 1). This change has caused the Project to spend a lot time for coordination with both



national and sub-national stakeholders with regard to the O&M of the pilot solar PV systems.

(6) Poor performance of solar PV systems installers contracted by the Project

The level of skills and techniques of local solar PV systems installers contracted by the Project was much lower than anticipated. The solar PV systems at the pilot sites are facing repeated technical and mechanical troubles which need to be rectified frequently by the Project. The Project Team has to spend such a long time shooting troubles in the fields that some of the work that needs to be done in Nairobi is being delayed.

(7) Remoteness of the pilot sites of Lot 2

The Project had to select pilot sites for Lot 2 which were far in the distance from Nairobi because there was no other choice. The selection was appropriate considering typical areas where off-grid electrification systems operate. However, the sites have security issues and require a long travel time. It is not possible for the Experts and C/Ps to visit the sites often within the limited timeframe of the Project, which in turn hampers technical transfer activities for Output 1 and 2.

(8) Heavy workload of the C/Ps for the Laptop Program

The C/Ps' work volume for the Kenyan Government's Laptop Program has become increasingly large since around April 2014. The time they can spend for project activities has become even less than before.

## **2. Summary of Evaluation Results**

(1) Relevance

Relevance is relatively high. The project is well aligned with Kenya's development priority as well as with Japan's ODA policy towards Kenya. The project is also appropriately responding to the needs of the target group, especially the needs of those public facilities in nonelectrified areas by mobilizing Japan's comparative advantage of expertise in renewable energy, community participation, O&M, and business analysis. On the other hand, Kenya has been seeing rapid grid extension in recent years and some of the sites selected for the pilot project have become covered by such an extension. Such a situation could have been avoided if strategic and systematic planning on rural electrification had been in place at REA/MoE&P before the commencement of the Project.

(2) Effectiveness

Effectiveness is fair at present. Although the project purpose is expected to be achieved to a relatively high degree by the end of the planned period, there is still uncertainty regarding the achievements of all the Outputs, from Output 1 through 4. If ongoing activities are completed smoothly and effectively and the concerned institutions take action in accordance with the recommendations to the Project specified in this report, effectiveness is expected to be higher at the completion of the Project.

(3) Efficiency

Efficiency is fair. Inputs from both Japanese and Kenyan sides are basically provided as planned. However, the C/Ps, having many other duties, are not able to spend sufficient amount of time for project activities especially before the Mid-term Review, hence lowering the level of technical transfer from the

Experts to the C/Ps. The plan for pilot projects at industrial facilities was cancelled in the first year and it took time to rearrange the project framework. Various key activities were delayed due to reasons such as solar PV pilot site re-identification to avoid grid extension, system troubles at solar PV systems and Lot 2 being in a remote area. Furthermore, Kenya's transition to the County System around mid-2013 required time to identify stakeholders and their roles and responsibilities regarding O&M of solar PV systems. On the other hand, collaboration with the JKUAT and BRIGHT Project is contributing to raised efficiency to a certain extent.

#### (4) Impact

Impact is fair. The achievement level of the Overall Goal will largely depend on that of the Project Purpose. It will also depend on the practicality and replicability of the electrification models to be finalized in the remaining project period. Since there is a certain level of uncertainty regarding the achievement of the Project Purpose at the moment, the Overall Goal is also subject to uncertainty. Positive impacts of the Project are: (1) Stakeholders of renewable energy technologies increased their awareness regarding the high O&M cost and (2) It is likely that REA will discuss O&M issues with potential facility owners/users in future implementation of systems instalment. There are also impacts at the community-level which improved daily lives of the community members after the installation of solar PV systems at the pilot sites. For instance, personal security of female pupils and staff has improved with lighting at evening and night time. The community members, particularly women and children, are now enjoying improved public health services such as being provided better care during deliveries at night and getting immunizations at local dispensaries. On the other hand, REA could not adopt some specifications suggested by the Project regarding the solar PV systems design for the Laptop Program due to time constraints, which, if realized, would have been a remarkable impact affecting as many as 3,000 primary schools in Kenya.

#### (5) Sustainability

Sustainability is fair. Presently, the level of policy and institutional sustainability is difficult to judge since REA is planned to be transformed into the National Electrification and Renewable Energy Authority (NERA). However, if the suggestions from the Project are incorporated into the current policies on renewable energy in future, policy sustainability will be high. The roles and responsibilities regarding the O&M of solar PV systems need to be further clarified and ensured among the national and county governments for better institutional sustainability. Technical sustainability is facing challenges because the C/Ps' practical skills have room for improvement compared with their theoretical knowledge in all four renewable energy technologies. Financial sustainability also needs to be improved, particularly for the appropriate O&M of solar PV systems, since the governments' budgets for pushing forward model dissemination is yet to be secured.

### **3. Factors that promoted realization of effects**

#### (1) Factors concerning the planning

N/A

#### (2) Factors concerning the implementation process

N/A

#### **4. Factors that impeded realization of effects**

(1) Factors concerning the planning

N/A

(2) Factors concerning the implementation process

All the negative factors listed in “1-4. Implementation process” have impeded realization of effects in some way or other throughout the project period.

#### **5. Conclusion**

At the time of the Terminal Evaluation, the achievement level of the Project Purpose was fair. However, the achievement level will be higher if the remaining activities are completed successfully without delay in the remaining project period and appropriate action is taken in accordance with the recommendations proposed in this report.

The Project Team has been conducting planned activities despite the challenges of multiple adversities which contributed to lowering efficiency. There are still many issues to be addressed in the remaining implementation period until the Project can present practical and sustainable models. In particular, presenting optimal O&M mechanisms of solar PV systems requires obtaining understandings and agreement from relevant organizations. The Project will then need to give effective recommendations to C/P organizations, which should be authorized and endorsed, so that the models will take root at the C/P organizations. If these issues are addressed properly, the achievement level of the Project Purpose will be much higher.

The Project is advised to take action explained above as well as to follow recommendations presented in the next section. The Project should be completed in February 2015 as originally planned.

#### **6. Recommendations**

##### **Recommendation to the Project (To be addressed in the remaining project period)**

(1) Ensuring sustainability by establishing the O&M models

The Project should continue discussing the O&M models of solar PV systems with relevant institutions including MoH, MoEST, county governments and so forth so as to ensure sustainability of the solar PV systems. Having high-level dialogues and then entering into MOUs with relevant institutions is strongly recommended since it would officially promise institutional and financial commitment to the O&M models. Providing quantitative data on projected annual O&M cost, both total and itemized, by the Project to the prospective signees of the MOUs would facilitate informed decision-making at the signees' sides.

With regard to MoEST's institutional framework for O&M, an option such as giving a stronger facilitator role to County Education Offices is to be considered. The Offices could then effectively link the solar PV-installed schools and MoEST when the schools are in need of financial resources for solar PV O&M.

Furthermore, appropriate management and handling of cash generated from the battery charging business needs to be discussed in order to prevent possible misconduct at the facilities.

The proposed O&M models, on the other hand, should be authorized by the C/P organizations.

Departments/persons responsible for continuous improvement of the models should also be identified and appointed.

(2) Conducting and presenting a quantitative analysis on applicability of the models

A quantitative analysis on applicability of the proposed models is recommended to be conducted and presented to REA/MoE&P. It is beneficial for the C/P organizations to be equipped with quantitative information on, but not limited to, (1) a projected scope of applicability of the proposed models to their future rural electrification plans, (2) the estimated number of applicable cases, and (3) required O&M costs. When conducting the quantitative analysis, site-selection criteria for battery charging stations need to be clarified also. Thus, the Project is advised to build upon its knowledge acquired through its experience on the pilot activities and propose most appropriate criteria.

(3) Formulating realistic policy recommendations

In order to complete the work for Output 4, which is about proposing recommendations on policy and institutional frameworks for rural electrification using renewable energy, the Project is advised to have close dialogues with relevant institutions regarding the proposed solar PV models. The Project, then, should formulate realistic policy recommendations and garner support for their implementation by the concerned institutions. It is important to facilitate active adoption of the proposed models by REA in future. Therefore, if the models are deemed effective in the Project Completion Report, application of the models is advised to be specified in REA's "Annual Renewable Energy Work Programme (Performance Contract)" as well as in Rural Electrification Master Plan (REMP) at the time of updating. The Project and REA are encouraged to work on this issue before the Project terminates.

(4) Working on intensive technical transfer with strong participation from the C/Ps

In order to fill the knowledge/skills gap, it is advised that the technical transfer from the Experts to C/Ps be undertaken actively during the remaining project period. Strong participation from the C/Ps in such activities is key for attaining satisfactory levels of technical transfer in each field of renewable energy technology. The C/Ps' participation includes, but not limited to, preparation and presentation of papers for the International Workshop to be held in February next year.

(5) Recording the achievements of the Objectively Verifiable Indicators, challenges and recommendations

At the time of the Terminal Evaluation, some of the key Objectively Verifiable Indicators in PDM have not reached their targets. They are expected to be attained in the next few months as the Project progresses. When writing the Project Completion Report to be submitted in February 2015, the achievement levels of those indicators should be clearly written so that an objective judgment of project performance can be made easily. Furthermore, remaining challenges and measures to be taken for raising sustainability should be discussed with the C/P and other related organizations and the results of the discussions should be delineated in the Project Completion Report.

**Recommendation to the C/P institutions (To be addressed as medium- to long-term measures)**

(1) Utilizing and improving the proposed models continuously

The C/P organizations are recommended to continue utilizing and improving the solar PV models proposed by the Project. Assignment of the departments/persons responsible for the coordination with relevant institutions is also recommended to make an institutional effort to improve the models.

(2) Utilizing and revising the guidelines continuously

As for MHP, biogas and wind technologies, pilot project implementation was cancelled in the first year of the project period. Thus, the C/Ps did not have a chance to experience the whole cycle of planning, analysis, system designing, installation and monitoring which are necessary for carrying out activities on the ground. The Project, instead, gave intensive training to the C/Ps and guidelines are being developed for future use. It is strongly recommended that the C/Ps will build on their training experience in the Project and leverage their increased knowledge in actual implementation of MHP, biogas and wind technologies in the field. In doing so, utilizing and revising the guidelines, including one on solar PV systems, should be conducted continuously. REA should be responsible for revising and updating the guidelines.

(3) Improving database on the Rural Electrification Master Plan (REMP)

Current database for the REMP needs to be improved making use of Geographical Information System (GIS). The improvement will help relevant organizations including development partners avoid duplication or overlap of future project sites. It will also facilitate easier decision-making concerning locations of future development.

(4) Exchanging knowledge and human resources with JKUAT

REA's and MoE&P's knowledge sharing and exchange with JKUAT have been proved to be beneficial. Continuous exchange of knowledge and human resources with JKUAT is advisable for strengthening capacity on renewable energy technology at REA and MoE&P. Such knowledge exchange includes, but not limited to, sharing REA's guidelines and other documents produced by the Project so that JKUAT can utilize them in their training courses. With regard to JKUAT's trainings on solar PV systems, regular attendance to such trainings by MoH, MoEST, and County Governments should be ensured.

(5) Improving basic skills for installation work of electrical facilities

It has been observed that the quality of basic installation work for wiring, switches, breakers, etc. was rather low. Thus, the responsible Expert became fully occupied with fixing those poor installations. Without the supervision of the Experts, most solar PV systems installed by local contractors may soon experience faults and malfunctions. In order to improve the quality of basic installation works, it is important for REA to compile detailed appropriate designs and rigorously supervise/ inspect the contractors' job accordingly.

## **7. Lessons learnt**

### **(1) Taking appropriate measures to minimize negative factors before and during the Project**

There is no doubt that the current delay in producing sufficient outputs is largely attributable to many negative factors. There are as many as eight factors, both internal and external, which have been negatively influencing the Project throughout the implementation period. The project implementers should have made more efforts to identify and tackle these critical issues both before and during the project period so that unfavourable ramifications would be minimized. In some cases, drastic modifications on project design and modalities, including revision in project scope and change in the mode of expert dispatch, to name a few, could have been considered so as to best address major issues.

# 第1章 評価調査の概要

## 1-1 調査団派遣の経緯と目的

ケニア共和国（以下、「ケニア」と記す）政府は、安定的かつバランスの取れた経済基盤の構築及び貧困削減を目的として、基礎インフラである電力供給の強化に積極的に取り組んでいる。ケニアにおけるエネルギー分野は、エネルギー石油省（Ministry of Energy and Petroleum : MoE&P）が管轄しており、地方電化の実施機関として、地方電化庁（Rural Electrification Authority : REA）が2006年に制定されたエネルギー法 No. 12 の第66条に基づき設立され、2007年より始動している。REAの権限や使命、展望は、2030年までに産業化された中進国への発展をめざす Vision 2030 を初めとする国家計画と一致する。Vision 2030 が掲げる2030年までの中進国化の実現のためには、2030年までに100%の電化率達成が期待される。こうした要望を受け、地方電化マスタープラン（Rural Electrification Master Plan : REMP）は、2009年時点で10%未満の地方電化率を、2020年までに40%に引き上げることを目標としている。REMPでは、特に Trading Center、Secondary School、Health Center を地方電化における重要公共施設と位置づけ、これら施設の電化率は10%（2003年）から約84%（2014年6月）まで改善されている。REMPの展開計画として、REA戦略計画（Strategic Plan）が5年ごとに作成されており、最新の戦略計画（2013/2014年～2017/2018年）及びMoE&Pによる新エネルギー政策において、再生可能エネルギーの重点的な活用が明確に示されている。また、2010年に公布された新憲法の実施思想である地方分権化を踏まえ、今後は中央政府としての機能を国家レベルの政策立案に集中し、個別案件の計画、実施は郡（カウンティ : County）政府に移管することを計画している。こうした国家的な需要や政策の動向を受け、MoE&P、REAともに再生可能エネルギーによる地方電化モデルの構築の必要性を認識し、REAは技術協力の要請をわが国に行った。JICAはこの要請を受け、本プロジェクトを2012年3月より、3年間の予定で開始している。

今回実施した終了時評価調査は、2015年2月のプロジェクト終了を控え、プロジェクト活動の実績、成果を評価、確認するとともに、今後のプロジェクト活動に対する提言及び今後の類似事業の実施にあたって教訓を導くことを目的とした。

## 1-2 調査団の構成と調査期間

調査団の構成は以下のとおり。

団内担当分野	氏名	所属・役職
総括／地方電化	小川 忠之	JICA 国際協力人材部 国際協力専門員
協力企画	榎谷 有希	JICA 産業開発・公共政策部 資源・エネルギーグループ第二チーム
評価分析	首藤 久美子	有限会社アイエムジー 上席研究員

2014年9月中旬に文献調査や国内における関係者インタビュー等を開始し、2014年9月30日から10月16日にかけて現地調査を行った。詳しい現地調査日程については付属資料2「署名済みミニッツ（M/M）」のANNEX 1: Study Scheduleを参照のこと。

### 1-3 対象プロジェクトの概要

#### 1-3-1 プロジェクトの要約

プロジェクトは、プロジェクト・デザイン・マトリックス（PDM）初版であるバージョン 0（2011 年 11 月 27 日）から数度の改訂を経て、評価時にはバージョン 3.1（2013 年 10 月 15 日）に基づいて実施されていた。PDM バージョン 3.1 は、付属資料 2「署名済み M/M」の ANNEX 2 として添付したが、主な内容は以下のとおり。

(1) 上位目標：ケニア国民の生活の質を向上させるため、再生可能エネルギーを利用した地方電化モデルが国内に普及する。

(2) プロジェクト目標：未電化地域における再生可能エネルギー利用による地方電化モデルを構築する。

(3) 成果：

1. パイロット・プロジェクトを通じて、未電化地域における保健施設の太陽光発電による電化の実用モデルが開発される。
2. パイロット・プロジェクトを通じて、未電化地域における学校施設の太陽光発電による電化の実用モデルが開発される。
3. 風力、小水力、バイオガスを活用した地方電化プロジェクトを実施する REA/MoE&P の能力が向上する。
4. 再生可能エネルギーによる地方電化モデルがケニア国内で普及するための政策・制度に関する提言が行われる。

(4) 活動：アウトプット 1、2 及び 3 の小グループで構成され、カウンターパート（C/P）の役割と機能を明確にしたワーキンググループ（WG）を設ける。

1) すべての成果達成のための活動

1. 専門家と C/P は、プロジェクトの現状にかかる週報を作成・配布し、関係者と共有する。
2. REA はプロジェクト月例会議を開催する。
3. 日本人専門家は、成果達成度合いを指標に基づきモニターし報告するため、PDM に沿った進捗要約表を含むプロGRESSレポートを作成する。

2) 成果 1 のための活動

1-1 国家レベル

- 1-1-1 保健施設の太陽光発電（PV）利用による電化に関する、既存の政策・調査研究・プロジェクトについてレビューする。
- 1-1-2 モデル構築と普及のための協議を国家レベルで行うため、REA、MoE&P、保健省（Ministry of Health : MoH）とともに、プロジェクトの進捗・情報共有のための会議を少なくとも 2 回開催する。
- 1-1-3 保健施設電化モデルの推進のための制度的枠組みとともに政策提言を準備する。

- 1-1-4 現在の法規制等に沿って、太陽光パネル、蓄電池、有毒物質の廃棄にかかる提案を行う。
- 1-2 カウンティ/サブカウンティレベル
  - 1-2-1 プロジェクト・サイトを含むカウンティの医療オフィサーに対し、Lot 1（第1ロット）対象サイトは少なくとも2回、Lot 2（第2ロット）対象サイトは少なくとも1回、会計簿とキャッシュフロー計算書を提出する。
  - 1-2-2 カウンティの医療オフィサーに対し、Lot 1 対象サイトは少なくとも2回、Lot 2 対象サイトは少なくとも1回、運転維持管理レポートを提出する。
  - 1-2-3 モデル構築と普及のための協議をカウンティレベルでの行うため、REA、MoE&P（いずれもモニタリングメンバー）、カウンティ/サブカウンティの医療オフィサーとともに、プロジェクトの進捗・情報共有のための会議を少なくとも2回開催する。
  - 1-2-4 対象施設と周辺コミュニティにおいてベースライン調査を実施する。
  - 1-2-5 再生可能エネルギーの活用と普及に関して、カウンティ/サブカウンティの医療オフィサーのキャパシティ及びニーズアセスメントを行う。
- 1-3 ローカル/施設レベル
  - 1-3-1 対象コミュニティとステークホルダーのキャパシティ及びニーズアセスメントを行う。
  - 1-3-2 持続可能な財務計画を準備する。
  - 1-3-3 充電小屋のオペレータ、保健施設スタッフ、管理委員会のメンバーに対し、講義や実務研修（OJT）を通じて、十分な財務研修を行う。
  - 1-3-4 充電小屋のオペレータが正確に日々の取引（充電による収入等）を記録する。
  - 1-3-5 指定された看護師、管理委員会の財務担当者及び委員長は、正確に会計簿とキャッシュフロー計算書を記録する。
  - 1-3-6 指定された看護師、管理委員会の財務担当者及び委員長は、運転維持管理レポートを準備する。
  - 1-3-7 蓄電池充電システムによる収入に応じて、電化モデルを持続可能にするための財務支援を提供してくれる行政組織や団体を特定し、合意を得るよう努める。
  - 1-3-8 「システム設計」「持続可能な維持管理」を含むパイロットプロジェクトの詳細計画を、OJTを通じて REA 及び MoE&P のスタッフとともに作成する。
  - 1-3-9 運転維持管理に関する協議を行うため、各パイロット施設に対し、管理委員会のメンバーと施設所有者とともに、少なくとも1回ステークホルダー会合を開催する。
  - 1-3-10 各パイロット施設に対し、カウンティ/サブカウンティの医療オフィサー及びパイロット施設の利用者とともに、少なくとも1回情報共有のための会議を開催する。
  - 1-3-11 各パイロット施設に対し、カウンティ/サブカウンティの医療オフィサー、パイロット施設の所有者、管理委員会のメンバー、及び施設利用者とともに、プロジェクト期間の終了段階において、少なくとも1回の評価会を行う。



### 3) 成果2のための活動

#### 2-1 国家レベル

- 2-1-1 学校施設の太陽光発電（PV）利用による電化に関する、既存の政策・調査研究・プロジェクトについてレビューする。
- 2-1-2 モデル構築と普及のための協議を国家レベルで行うため、REA、MoE&P、教育科学技術省（Ministry of Education, Science and Technology : MoEST）とともに、プロジェクトの進捗・情報共有のための会議を少なくとも2回開催する。
- 2-1-3 学校施設電化モデルの推進のための制度的枠組みとともに政策提言を準備する。
- 2-1-4 現在の法規制等に沿って、太陽光パネル、蓄電池、有毒物質の廃棄にかかる提案を行う。

#### 2-2 カウンティ/サブカウンティレベル

- 2-2-1 プロジェクト・サイトを含むカウンティの教育オフィサーに対し、Lot 1 対象サイトは少なくとも2回、Lot 2 対象サイトは少なくとも1回、会計簿とキャッシュフロー計算書を提出する。
- 2-2-2 カウンティの教育オフィサーに対し、Lot 1 対象サイトは少なくとも2回、Lot 2 対象サイトは少なくとも1回、運転維持管理レポートを提出する。
- 2-2-3 モデル構築と普及のための協議をカウンティレベルでの行うため、REA、MoE&P（いずれもモニタリングメンバー）、カウンティ/サブカウンティの教育オフィサーとともに、プロジェクトの進捗・情報共有のための会議を少なくとも2回開催する。
- 2-2-4 対象施設と周辺コミュニティにおいてベースライン調査を実施する。
- 2-2-5 再生可能エネルギーの活用と普及に関して、カウンティ/サブカウンティの教育オフィサーのキャパシティ及びニーズアセスメントを行う。

#### 2-3 ローカル/施設レベル

- 2-3-1 対象コミュニティとステークホルダーのキャパシティ及びニーズアセスメントを行う。
- 2-3-2 持続可能な財務計画を準備する。
- 2-3-3 充電小屋のオペレータ、学校施設スタッフ、管理委員会のメンバーに対し、講義やOJTを通じて、十分な財務研修を行う。
- 2-3-4 充電小屋のオペレータが正確に日々の取引(充電による収入等)を記録する。
- 2-3-5 学校長、管理委員会の財務担当者及び委員長は、正確に会計簿とキャッシュフロー計算書を記録する。
- 2-3-6 学校長、管理委員会の財務担当者及び委員長は、運転維持管理レポートを準備する。
- 2-3-7 蓄電池充電システムによる収入に応じて、電化モデルを持続可能にするための財務支援を提供してくれる行政組織や団体を特定し、合意を得るよう努める。
- 2-3-8 「システム設計」「持続可能な維持管理」を含むパイロット・プロジェクトの詳細計画を、OJTを通じてREA及びMoE&Pのスタッフとともに作成する。

- 2-3-9 運転維持管理に関する協議を行うため、各パイロット施設に対し、管理委員会のメンバーと施設所有者とともに、少なくとも1回ステークホルダー会合を開催する。
  - 2-3-10 各パイロット施設に対し、カウンティ/サブカウンティの教育オフィサー及びパイロット施設の利用者とともに、少なくとも一回情報共有のための会議を開催する。
  - 2-3-11 各パイロット施設に対し、カウンティ/サブカウンティの教育オフィサー、パイロット施設の所有者、管理委員会のメンバー、及び施設利用者とともに、プロジェクト期間の終了段階において、少なくとも1回の評価会を行う。
- 4) 成果3のための活動
- 3-1 風力、小水力、バイオガスによる既存の地方電化サイトに関するインベントリ調査及びレビューを行う。
  - 3-2 計画、設計、調達、モニタリング、維持管理に関する技術研修の内容を反映し、風力、小水力、バイオガスによる地方電化のためのガイドラインを作成する。
  - 3-3 REA / MoE&P スタッフに対し、風力、小水力、バイオガスによる地方電化に関する技術研修を行う。
  - 3-4 風力、小水力、バイオガスの技術的検討に焦点をあてた簡易なプレフィージビリティスタディを、実施する。
  - 3-5 風力、小水力、バイオガスによる地方電化に関する技術的な提言を行う。
  - 3-6 技術研修とガイドライン開発のために必要なデータと機器を収集する。
  - 3-7 風力、小水力、バイオガス地方電化に関するガイドラインの検証・確認を行うために、ステークホルダーワークショップを開催する。
- 5) 成果4のための活動
- 4-1 アウトプット1～3の活動として行われる、各電化モデルの普及促進に向けた政策及び制度的枠組みの問題・課題抽出の活動をモニタリングする
  - 4-2 ケニア及び東アフリカ諸国のエネルギー分野の関係者及びドナーを対象に、再生可能エネルギーによる地方電化モデルに関する情報共有のためのワークショップを開催する。
  - 4-3 政策提言を取りまとめる。
  - 4-4 『再生可能エネルギーによる地方電化推進のための人材育成プロジェクト』にて推進される、再生可能エネルギーにおける産学官プラットフォームの形成・運営への側面支援を行う。

### 1-3-2 プロジェクト期間

2012年3月～2015年2月（約3年間）

### 1-3-3 プロジェクト実施機関

エネルギー・石油省（MoE&P）

地方電化庁（REA）

#### 1-3-4 対象地域

パイロット・プロジェクト対象地：カジアド・カウンティ（1カ所）、ナロック・カウンティ（3カ所）、サンプル・カウンティ（6カ所）（計10カ所）

#### 1-3-5 対象者

##### MoE&P 及び REA 職員

MoEST 職員、MoH 職員、パイロット・プロジェクト対象地のカウンティ/サブ・カウンティ教育及び保健職員、パイロット・プロジェクトの管理委員会メンバー、その他太陽光発電施設運用者・利用者等

### 1-4 調査結果

#### 1-4-1 合同終了時評価報告書

第2章に記載した調査方針に基づき、評価5項目をベースに C/P と共に合同終了時評価報告書（Joint Terminal Evaluation Report）を作成した。同報告書の内容は、第3～5章に示す。

#### 1-4-2 終了時評価結果に関する合意

2014年10月14日に開催した合同調整委員会（JCC）により、本終了時評価結果についてケニア・日本側のプロジェクト関係者と共有・合意し、付属資料2のとおり合同終了時評価報告書を含む M/M を同10月14日に締結した。

#### 1-4-3 団長所感

地方電化に係る最新状況を踏まえた本プロジェクトの方向性について以下に記す。

##### （1）地方電化事業の進捗状況と環境変化

ケニアの電化率は2010年に全国平均で約18%であったが<sup>1</sup>、総額45billion Kshに達する地方電化プログラム（REP）の進展により、グリッド延伸とオフグリッドの再生可能エネルギー利用、またはディーゼル発電によるミニグリッド電化が進められ、現在は約36%まで向上している<sup>2</sup>。また、2009年に策定された REMP において、優先電化対象として位置づけられている公共施設についても、2014年6月時点で約21,000カ所（全体の84%）について電化完了している。REA としては、2015年6月を目標に小学校の電化を完了し、2016年までに重要公共施設（診療所、トレーディング・センター、中学校）の電化を完了する計画となっており、今後電化政策の中心は公共施設から住宅<sup>3</sup>へと次第にシフトしていくものと想定される。

##### （2）プロジェクト終了後にモデルを適用するための計画

本プロジェクトにて策定される電化モデル、特に充電サービスを含む財務モデルがプロ

<sup>1</sup> World Energy Outlook (2012)

<sup>2</sup> REA の Corporate Department からの聞き取りによる。

<sup>3</sup> 従来、住宅の電化は主に配電会社（KPLC）の所掌であったが、Last Mile Connectivity Project では REA も KPLC のパートナーとして住宅電化を実施予定。

プロジェクト終了後に適用されるためには、上記の急速な環境変化を踏まえ、モデルの適用対象となり得る公共施設の範囲、対象施設数などを含む定量的な計画策定が必要である。このためには、パイロットプロジェクト実施により得られた知見を活用しながら、モデル対象施設の選定クライテリア、フローチャートなどを策定し、C/P がモデルを適用するためのガイドライン等に記載していくことが望ましい。プロジェクト終了後は、REMP や地方電化戦略等の改定において、モデルの適用計画が反映されることが持続性の確保に重要であるため、今回の M/M において REA/MoE&P に要請、確認している。

### (3) モデル普及のための資金確保

本プロジェクトは、未電化地域における携帯電話利用者数の増加を想定し、携帯電話充電サービスによる収益により、公共施設に設置される PV システムの運転・保守管理（Operation and Maintenance : O&M）費用を充填するというビジネスモデルを中心として協力が開始された。しかしながら、上述したグリッド電化の急速な進展、更には M-Kopa 等民間企業による低価格なピコソーラー<sup>4</sup>普及などの要因もあり、パイロットプロジェクトでの実績を見ると、ほとんどのサイトで充電サービスによる収益は O&M 費用の 10% 程度以下にとどまっており、追加的な資金確保が必要な状況である。本プロジェクトとは別のパイロット事業において、REA では施設利用者から電気料金を徴収する制度を試行しており、将来のモデル展開、普及にあたっては、利用者のオーナーシップを高め維持管理の持続性を高める観点からも、便益に応じた負担を求めることが重要な課題になると考えられる。

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<sup>4</sup> LED 採用により PV モジュールの容量を 8~10W 程度まで小型化し、低価格化を実現しているが、携帯電話充電も可能。

## 第2章 評価の方法

### 2-1 評価手法

プロジェクト終了まで残すところ約半年となり、これまでプロジェクト目標がどれだけ達成されたか、上位目標の達成見込みはどの程度かなどを判断する時期を迎えた。プロジェクト終了を控えたこの時期に、終了時評価を行うことにより、プロジェクト活動の実績・成果の評価・確認を行った。また、今後の提言及び他の類似事業の実施にあたっての教訓も導き出した。

本終了時評価では、「新 JICA 事業評価ガイドライン第1版」(2010年6月)に従い、プロジェクトの実績と実施プロセスを把握した後、以下の評価5項目(妥当性、有効性、効率性、インパクト、持続性)の観点から分析を行った。

#### ① 妥当性 (relevance)

プロジェクトのめざしている効果(プロジェクト目標や上位目標)が、受益者のニーズに合致しているか、問題や課題の解決策として適切か、相手国と日本側の政策との整合性はあるか、プロジェクトの戦略・アプローチは妥当か、公的資金である政府開発援助(ODA)で実施する必要があるかといった「援助プロジェクトの正当性・必要性」を問う視点。

#### ② 有効性 (effectiveness)

プロジェクトの実施により、本当に受益者もしくは社会への便益がもたらされているのか(あるいは、もたらされるのか)を問う視点。

#### ③ 効率性 (efficiency)

主にプロジェクトのコストと効果の関係に着目し、資源が有効に活用されているか(あるいはされるか)を問う視点。

#### ④ インパクト (impact)

プロジェクト実施によりもたらされる、より長期的、間接的効果や波及効果をみる視点。予期していなかった正・負の効果・影響を含む。

#### ⑤ 持続性 (sustainability)

援助が終了しても、プロジェクトで発現した効果が持続しているか(あるいは持続の見込みはあるか)を問う視点。

本評価はプロジェクト終了前の評価調査のため、④インパクト、⑤持続性に関しては、評価時点での予測となっている。終了時評価では、これまでの実績を確認し、5項目に従った評価を行い、提言と教訓を引き出すことを目的としている。

評価実施に際し、プロジェクト管理のための要約表である PDM に基づき、計画の達成状況や達成見込みを調べるための評価グリッド(付属資料2「署名済みM/M」の ANNEX 3: Evaluation Grid を参照)を作成し、具体的な評価設問を定めた。

終了時評価時点で、プロジェクトでは、2013年10月15日に改訂された PDM バージョン 3.1 を使用していた。したがって、PDM バージョン 3.1 に基づいて情報を収集・分析した。

### 2-2 データ収集・分析方法

調査では、さまざまな情報源から、複数のデータ収集手法を用いて情報収集を行った。調査手法及び情報源のトライアングレーションが可能となり、調査の信頼性を高めることができるか

らである。

今回の調査、特に現地調査では、定量的なデータとともに、定性的な情報の収集にも注力している。定量的なデータは既存の資料で既にある程度入手可能だったのに対し、定性的な情報、特にプロジェクト実施にあたっての貢献要因・阻害要因といった詳細な情報については、現地調査における情報収集が不可欠だったからである。したがって、インタビュー、観察、そして自由記述欄を多く設けた質問票調査など、定性的な情報を引き出すための手法を中心に調査がなされた。表2-1にデータの入手手段と情報源をまとめた。また、主要な面談者については、付属資料1「主要面談者リスト」に記した。

表2-1 データ入手手段と情報源

データ入手手段	情報源
文献・資料調査	政策文書、プロジェクト関連資料、プロジェクト報告書、合同調整委員会（JCC）等各種会議議事録等
質問票調査	プロジェクト専門家、カウンターパート（C/P）
インタビュー	プロジェクト専門家、C/P、ケニア中央政府及びナロック・カウンティ政府関係者
観察・インタビュー	Lot 1：Iltumtum 小学校（ナロック・カウンティ）、Olkinyei 診療所（ナロック・カウンティ）、Ilkilnyeti 診療所（カジアド・カウンティ）

文献・資料調査は、主に現地調査前に国内で行い、プロジェクトのアウトプットと実施プロセスを中心に確認した。また、現地調査開始前に質問票をプロジェクト専門家及びC/Pに対し電子メールで配布し、調査団の現地入り前に質問票を回収した。現地入りしてからは、質問票配布先やその他関係者に対してインタビューを行い、補足情報の収集を行った。質問票の配布先でない政府関係者等に対しても、それぞれ1時間程度のインタビューを行った。

評価者はパイロット・プロジェクトとして太陽光発電設備が設置されたLot 1のIltumtum小学校（ナロック・カウンティ）、Olkinyei診療所（ナロック・カウンティ）、Ilkilnyeti診療所（カジアド・カウンティ）の様子も観察し、関係者に対し臨機応変にインタビューを行いながら定性データを中心に情報収集した。

上記のデータ収集により得られた情報は、前節「評価手法」で示した評価5項目ごとに分析された。最終的なデータの分析結果は、「第4章 評価結果」に示した。

### 2-3 評価調査の制約・限界

時間や資源の制約からすべての専門家やC/Pに対してインタビューを行うことは不可能だった。また、10カ所あるパイロット・プロジェクトのすべての太陽光発電設置場所を訪問するのは難しく、訪問先はLot 1の4カ所のうち、3カ所を訪問するのみにとどまった。特にLot 2（6カ所）については、ナイロビから長時間の移動時間を要するため訪問を断念せざるを得なかった。そのため、文献調査によって関連情報を収集するなどして、サンプルの偏りの問題を克服するようにした。

調査では、プロジェクト実施に直接携わっている多数のC/Pやプロジェクト専門家から情報を

得ることができたので、調査枠組みの中で得られた収集情報は一定の信頼性と妥当性を維持しているといえる。

## 第3章 プロジェクトの実績

### 3-1 投入実績

#### 3-1-1 日本側の投入

##### (1) 専門家派遣

プロジェクト開始時より、総括、地方電化、太陽光発電、小水力、バイオマス・バイオガス発電、風力発電、コミュニティ開発、財務管理計画、環境社会配慮といった11の分野で短期専門家が派遣されてきた。これまでに投入された専門家は90.96人月である。詳細は、付属資料2「署名済みM/M」のANNEX 4: List of Japanese Expertsを参照のこと。

##### (2) 研修員受入れ

これまで3人のC/Pが本邦研修を受講し、7人のC/Pが第三国研修（インド、タイ）に参加した。本邦・第三国研修参加者の詳細は、同ANNEX 5: List of Counterpart (C/P) Training in Japan and Third Countriesを参照のこと。

##### (3) 供与機材

流速計、衛星電話、コンピュータ、コピー機等、総額約34百万円分（28,967,847Ksh）の機材がこれまで供与された。これらの機材は日常的に使用されており、維持管理状況もおおむね良好である。供与機材の詳細については、同ANNEX 6: List of Provided Machinery and Equipmentを参照。

##### (4) 現地活動費

第3年次末までに約62.1百万円（51,642,688 Ksh）が現地活動費として支出された（表3-1）。

表3-1 現地活動費

（単位：Ksh）

	1年次 (2012年度)	2年次 (2013年度)	3年次 (2014年度) <sup>5</sup>	3年次 (2014年度) <sup>6</sup>	計
給与・日当	5,751,215	5,890,252	3,576,895	3,220,000	18,438,362
車両関係（燃料、整備等）	3,217,107	6,861,977	4,543,732	3,350,000	17,972,816
車両借上、タクシー	1,510,86	2,483,163	1,710,700	1,150,000	6,854,723
通信・インターネット	354,293	399,470	273,040	150,000	1,176,803
会議（ワークショップ、セミナー）	6,150	87,850	0	580,000	674,000
消耗品	899,425	560,795	60,170	290,000	1,810,390
C/P旅費	0	0	0	560,000	560,000
国外研修	997,000	1,531,760	1,215,000	0	3,743,760
印刷	1,564	55,000	33,030	132,000	221,594
機材維持管理	0	95,120	95,120	0	190,240
計	12,737,614	17,965,387	11,507,687	9,432,000	51,642,688

出典：プロジェクト提供資料

<sup>5</sup> 8月まで。

<sup>6</sup> 9月以降の計画値。



### 3-1-2 ケニア側の投入

#### (1) 人員配置

地方電化庁（REA）及びエネルギー石油省（MoE&P）の職員計 19 人が C/P として活動し、専門家から技術移転を受けている。C/P の人数は、2012 年 4 月のプロジェクト開始時には 9 人であったところ、期間中に大幅に増員がなされ、19 人となった。C/P は皆、プロジェクト活動を行うに十分な能力を有しているが、多くの職員が他業務で多忙であり、タイムリーなプロジェクト活動の遂行が困難になる局面が多い。

C/P 配置の詳細については、付属資料 2「署名済み M/M」の ANNEX 7: List of Counterpart Personnel (C/P)を参照のこと。

#### (2) ローカルコスト負担

ケニア政府は、プロジェクトの活動コストとしてこれまで約 2.8 百万円 (2,360,404 Ksh) を負担している（表 3-2）。

表 3-2 ケニア側によるローカルコスト負担

(単位：Ksh)

	2012 年度	2013 年度	2014 年度	計
国外研修日当	574,980 <sup>7</sup>	736,690 <sup>8</sup>	962,984 <sup>9</sup>	2,274,654 <sup>10</sup>
国内日当	2,250	45,250	38,250	85,750
計	577,230	781,940	1,001,234	2,360,404

出典：プロジェクト提供資料

#### (3) 土地・建物・設備

机、イス、キャビネット、電気、水道、飲料水、お茶などの備わったプロジェクト事務所が提供されている。プロジェクト事務所は REA 及び MoE&P から離れており、また、ナイロビ市内の恒常的な交通渋滞により、C/P 機関への移動が困難な状況である。

## 3-2 成果の実績

### 3-2-1 成果 1 の達成状況

成果 1 は「パイロット・プロジェクトを通じて、未電化地域における保健施設の太陽光発電による電化の実用モデルが開発される。」である。表 3-3 は、PDM バージョン 3.1 に記載された成果 1 の指標とそれぞれの達成状況を示している。

<sup>7</sup> 実際の支出額は USD6,845。

<sup>8</sup> 実際の支出額は USD8,720。

<sup>9</sup> 実際の支出額は USD11,145。

<sup>10</sup> 実際の支出額は USD26,710。

表 3 - 3 成果 1 の指標と指標の達成状況

指 標	達成状況
<p>0. All level</p> <p>0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member.</p> <p>0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&amp;P are provided based on their Objective &amp; Achievement Sheet through on-the-job Training (OJT).</p> <p>0-2 At least 3 monitoring team members achieve their objectives through trainings. Achievements are confirmed by trainee's self-assessment and evaluation by Project Experts (JEs).</p> <p>0-3 PV electrification, operation and maintenance manual for health service institutions with battery charging business is prepared for C/Ps including user manual and accounting manual.</p> <p>0-4 At least 2 people from health institution and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&amp;M of PV facilities including disposal of solar panels, batteries and toxic materials.</p>	<p>0-0 Lot 1: 3 回、Lot 2: 1 回</p> <p>0-1 Lot 1: 5 回、Lot 2: 1 回</p> <p>0-2 Objective &amp; Achievement Test は未実施（11 月頃に実施する予定）</p> <p>0-3 ガイドライン（マニュアル）案及びユーザーマニュアル案は作成された。2015 年 1 月に完成する予定。</p> <p>0-4 Lot 1: Olkinyei 診療所 O&amp;M1: 7 人、O&amp;M2: 15 人 Ilkilnyeti 診療所 O&amp;M1: 5 人、O&amp;M2: 10 人、O&amp;M3: 5 人</p> <p>Lot 2 : Langata 診療所: 5 人 South Horr 診療所: 3 人 Angata Nanyukie 診療所: 3 人</p>
<p>1. National Level</p> <p>1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the model.</p>	<p>1-1 保健省、REA、MoE&amp;P でプロジェクトに関する情報共有会議が行われている。 （2014 年 3 月 11 日実施） 第 2 回の共有会議を 2015 年 1 月に実施予定。</p>
<p>1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.</p>	<p>1-2 パイロット・サイトを選定するための選定基準を作成し、Lot 1 及び Lot 2 のサイトが選定されている。</p> <ul style="list-style-type: none"> <li>• Not near to the existing grid line</li> <li>• Not belonging to private or mission</li> <li>• Not overlapping with candidate sites of other donors</li> <li>• Confirmed safe security environment</li> </ul>
<p>2. County/Sub-county Level</p> <p>2-1 Collaboration among C/Ps, County and Sub-county medical officers is initiated and maintained to support the establishment, operation and maintenance of the model.</p>	<p>2-1 カウンティ保健事務所、REA、MoE&amp;P でプロジェクトに関する情報共有会議が実施されている。（カジアド・カウンティ：2014 年 6 月 13 日、ナロック・カウンティ：2014 年 6 月 16 日、サンプル・カウンティ：2014 年 6 月 19 日）</p>
<p>3. Local/Institutional Level</p> <p>3-1. The target health institutions secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</p>	<p>3-1 O&amp;M に関して各カウンティ保健事務所と REA 間で MOU を締結する予定</p>

3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is conformed through monitoring.	3-2 Lot 1: 5 回、Lot 2: 1 回 (2014年8月31日)
3-3. Awareness raising activities on installed solar PV system at target health institutions and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.	3-3 Lot 1: 9 回、Lot 2: 6 回

出典：プロジェクト提供資料

### (1) 成果1の達成状況

成果1は現在のところ、一定程度達成されている。パイロット活動の継続したモニタリング、モニタリング結果の集計、財務分析、ガイドライン及びマニュアル作成、そして太陽光発電モデルの完成といった成果1達成のために必要な活動は、現在も進行中である。また、太陽光発電設備の運転・保守管理(O&M)の全国的な適用性について、不確実性がまだ残されている。残り期間で、特に財政面・組織面からO&Mモデルの持続性を高める取り組みを強化していく必要がある。

### (2) 達成状況の詳細

現在の診療所(dispensary)における太陽光発電システムによる電化状況は表3-4のとおり。

表3-4 診療所における太陽光発電設備の設置状況

ロット	施設名	カウンティ	設置時期
Lot 1	Olkinyei 診療所	ナロック	2013年7月
Lot 1	Ilkilnyeti 診療所	カジアド	2013年7月
Lot 2	Latakweny 診療所	サンプル	2014年8月
Lot 2	South Horr 診療所	サンプル	2014年8月
Lot 2	Angata Annyokei 診療所	サンプル	2014年8月

出典：プロジェクト提供資料

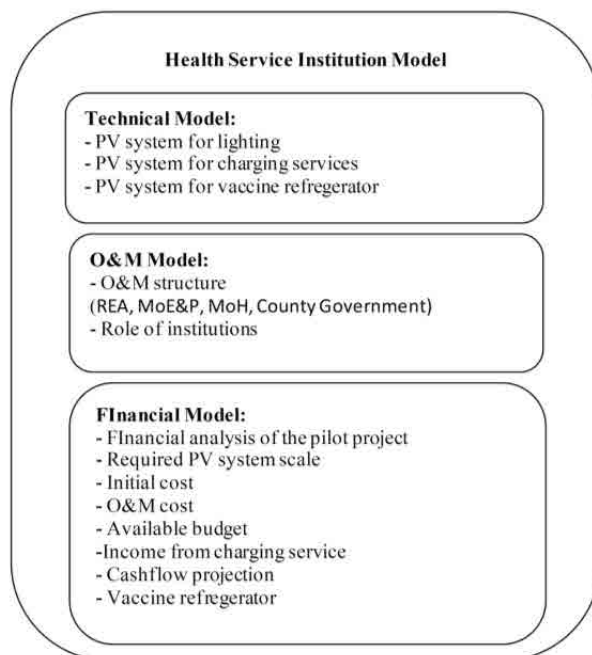
Lot 1として、2013年7月にナロック・カウンティのOlkinyei診療所及びカジアド・カウンティのIlkilnyeti診療所に、計画の4~5カ月遅れで太陽光発電設備が設置された。遅れが生じた主な理由は、プロジェクト専門家とJICA本部との間で、適切なシステムの設計に関する議論が長期化したためである。また、当初予定されていたカジアド・カウンティ内のMeto診療所への太陽光発電システム設置は、設置直前の2013年7月に急遽中止となった。これは、当該地域において、電力システムによる電化のための工事が開始されたためである。中止が決定される以前、Meto診療所においては、コミュニティ首長、校長、診療所看護師等の参加を得て、既に財務管理説明会、会計業務の研修、ステークホルダー会合等の各種準備活動が実施され、関係者間の議論が進んでいた。なお、Olkinyei診療所についても同様に、当該地区に電力システムの延伸がなされることが明らかになったが、こうした情報が入ったのは太陽光発電システム設置後であった。

Lot 2 では、サンプル・カウンティにおいて Latakweny 診療所、South Horr 診療所、Angata Annyokei 診療所の 3 カ所が 2013 年 9 月にパイロット・サイトとして選定され、2014 年 4 月にシステムが設置された。この 3 診療所が最終的に選定されるまでには、プロジェクトは何度か対象地選定のやり直しを余儀なくされた。これは、既に選んだ対象地が、REA の系統延伸の対象地として既に計画されていることが明らかになるという事態が続いたためである。こうしたことから、計画から 11 カ月と大幅に遅れて Lot 2 の対象地が最終決定された。

以上のように Lot 1、Lot 2 に関する活動が遅延したことで、時間や労力の面で効率性が阻害され、さらに、システム設置後のモニタリングに十分な時間が得られない結果となり、成果 1 の達成が阻害された（成果 2 も同様）。設置が遅れたことで、システム設置後のモニタリングが予定よりも短い時間枠の中で実施されることになったため、特に Lot 2 に関しては高い信頼性を得るのに十分な情報・データが得られているとは言い難い状況である。

太陽光発電システムの設置後は、数カ所でシステムトラブル等が発生したものの、プロジェクトは現在、2 つのロットでカウンティやサブカウンティ保健事務所の職員等を巻き込みながらモニタリングを実施している。日常的な設備の運用・管理が適切に行われている診療所がある一方で、施設の人員の交代等の理由により管理責任の所在があいまいになってしまっていたり、充電ビジネスがほとんど行われなくなっていたり、あるいはバッテリー水の水位が適切に保たれていないなど、太陽光発電システムの日常的な管理に問題が散見される施設もある。なお、これまで 4 人の職員がジョモケニヤッタ農工大学（Jomo Kenyatta University of Agriculture and Technology : JKUAT）で開催された研修に参加し、太陽光発電システムの O&M 方法等を学んでいる。

こうしたシステム設置、地域の関係者の参加、モニタリングの実施等により、プロジェクトは現在、①設計、②持続的 O&M、③持続的財務計画の 3 側面から成る実践的なモデルを構築中である（図 3-1）。



出典：JICA Expert Team (2014) Project for Establishment of Rural Electrification Model Using Renewable Energy in the Republic of Kenya: Progress Report 5 (p.29)

図 3-1 診療所における太陽光発電モデル

成果 1 の指標達成状況は、表 3-3 に示したとおり、多くの活動が現在も実施中であり、プロジェクト終了時に達成状況を再度確認する必要があると判断される。例えば、サブ・グループメンバーによる Lot 2 のモニタリング実施(指標 0-0)、Objective & Achievement Test (指標 0-2)、O&M ガイドラインと利用者マニュアルの作成(指標 0-3)、覚書(MOU)の締結(指標 3-1)、Lot 2 の定期モニタリング(指標 3-2)等の達成状況については、今後の進捗を注視していく必要がある。

こうした実施中の活動のなかでも、特に注目すべきは、C/P の能力向上度を測る指標となる Objective & Achievement Test の結果、ガイドライン・マニュアルの完遂、そして何よりも MOU の締結である。MOU は主に、太陽光発電システムの O&M に必要なバッテリーやインバーター、チャージコントローラー等の修繕・交換にかかる高額な費用の負担をカウンティ保健事務所に約束させることを意図したものである。各診療所の日々の充電サービスからの収入では、これらの機材の交換費用を捻出できないことが明らかになっているため、MOU の締結は太陽光発電設備の財政的持続性の観点から非常に重要である。MOU の締結が実現し、カウンティ保健事務所の太陽光発電システム O&M へのコミットメントが確約されれば、プロジェクトが開発したモデルの財政的・組織的持続性を担保するための大きな一歩となるだろう。カウンティ保健事務所と REA が、MOU にのっとり、それぞれの役割を果たしていくことができれば、提示するモデルの財政的・組織的持続性に関する不確実性が大きく低減されることになる。

次に、成果 1 について更に重要なことは、プロジェクト専門家から C/P に対して、モデル開発についての技術移転がどれだけ実現したのかという観点である。これについては、今年 11 月に実施される予定の Objective & Achievement Test の結果を待たなくてはならないが、専門家や C/P とのインタビューでは、成果 1 への C/P の参加は、専門家とのシステム

設計に関する議論や意見交換に限定されていることが明らかになった。REA は基本的にシステムの設置を行う機関であり、O&M は設備利用者が行うという考え方が基本のため、持続的な O&M や財務計画に関する REA の役割や責任は不明確で、そのために C/P のこうした分野への参加は限定的だった。誰が、または REA 内のどの部署が、専門家と共に持続的 O&M や財務計画に関するモデル開発を行っていくのかについては、いまだに不明瞭な状況である。実際、プロジェクトの最新進捗報告であるプログレスレポート第 5 号（2014 年 9 月付けドラフト）でも、以下の記述がある。

「いわゆるソフトコンポーネントに関する専門家から REA への技術移転は本プロジェクトの主要な目的のひとつであるが、これまで十分な技術やノウハウの移転が実現したとは言い難い。REA の使命は工事・設置までであり、O&M までカバーしないからである。そのため、REA には O&M を担当する人材も、予算も経験もない。MoE&P も同様の状況である」(p.96)

C/P のパイロット・サイト訪問についても、同様に参加は限られている。これは主に C/P の他業務が多忙なためである。特に 2014 年 4 月頃にケニア政府のラップトップ・プログラム（後述）が開始してからは、C/P は多忙を極め、Lot 2 のようなナイロビから距離があるサイト訪問は困難になった。モデル開発のプロセスに C/P があまり関与できていないという状況は、専門家から C/P に対する技術移転を達成するための障害となっている。

### 3-2-2 成果 2 の達成状況

成果 2 は「パイロット・プロジェクトを通じて、未電化地域における学校施設の太陽光発電による電化の実用モデルが開発される。」である。表 3-5 は、PDM バージョン 3.1 に記載された成果 2 の指標とそれぞれの達成状況を示している。

表 3-5 成果 2 の指標と指標の達成状況

指 標	達成状況
0. All level 0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member.	0-0 Lot 1: 2 回、Lot 2: 1 回
0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&P are provided based on their Objective & Achievement Sheet through OJT.	0-1 Lot 1: 5 回、Lot 2: 1 回
0-2 At least 3 monitoring team members achieve their objectives through trainings. Achievements are confirmed by trainee's self-assessment and evaluation by JEs.	0-2 Objective & Achievement test は未実施（11 月頃に実施する予定）
0-3 PV electrification, operation and maintenance manual for schools with battery charging business is prepared for C/Ps including user manual and accounting manual.	0-3 ガイドライン（マニュアル）案及びユーザーマニュアル案は作成された。2015 年 1 月に完成する予定。

<p>0-4 At least 3 people from school and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&amp;M of PV facilities including disposal of solar panels, batteries and toxic materials.</p> <p>1. National Level</p> <p>1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the model.</p> <p>1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.</p> <p>2. County/Sub-county Level</p> <p>2-1 Collaboration among C/Ps, County and Sub-county education officers is initiated and maintained to support the establishment, operation and maintenance of the model.</p> <p>3. Local/Institutional Level</p> <p>3-1. The target schools secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</p> <p>3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is conformed through monitoring.</p> <p>3-3. Awareness raising activities on installed solar PV system at target schools and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.</p>	<p>0-4</p> <p>Lot 1:</p> <p>Itumtum 小学校 O&amp;M1: 35 人、O&amp;M2: 4 人</p> <p>Olemoncho 小学校 O&amp;M1: 30 人、O&amp;M2: 10 人</p> <p>Lot 2:</p> <p>Marti 小学校: 7 人 Tuum 小学校: 10 人 Illaut 小学校: 3 人</p> <p>1-1 教育科学技術省、REA、MoE&amp;P でプロジェクトに関する情報共有会議が行われている。(2014 年 3 月 14 日実施) 第 2 回の共有会議を 2015 年 1 月に実施予定。</p> <p>1-2 パイロット・サイトを選定するための選定基準を作成し、Lot 1 及び Lot 2 のサイトが選定されている。</p> <ul style="list-style-type: none"> <li>• Not near to the existing grid line</li> <li>• Not belonging to private or mission</li> <li>• Not overlapping with candidate sites of other donors</li> <li>• Confirmed safe security environment</li> </ul> <p>2-1 カウンティ教育事務所、REA、MoE&amp;P でプロジェクトに関する情報共有会議が実施されている。(ナロック・カウンティ: 2014 年 6 月 16 日、サンプル・カウンティ: 2014 年 6 月 19 日)</p> <p>3-1 O&amp;M に関して教育科学技術省と REA 間で MOU を締結する予定</p> <p>3-2 Lot 1: 5 回、Lot 2: 1 回 (2014 年 8 月 31 日)</p> <p>3-3 Lot 1: 9 回、Lot 2: 6 回</p>
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出典: プロジェクト提供資料

### (1) 成果 2 の達成状況

成果 2 の達成度は基本的に成果 1 と同様である。ただし、学校を管轄する教育科学技術省 (MoEST) との太陽光発電設備の O&M に関する協議が始まったばかりであり、成果 1 に比べ、モデルの組織・財政的持続性について不確実性がより高い状況にある。

(2) 達成状況の詳細

現在の学校施設における太陽光発電システムによる電化状況は表3-6のとおり。

表3-6 学校施設における太陽光発電設備の設置状況

ロット	施設名	カウンティ	設置時期
Lot 1	Olemoncho 小学校 (寮付)	ナロック	2013年7月
Lot 1	Iltumtum 小学校 (寮付)	ナロック	2013年7月
Lot 2	Tuum 小学校	サンプル	2014年8月
Lot 2	Illaut 小学校	サンプル	2014年8月

出典：プロジェクト提供資料

成果2は、基本的に成果1と同様の達成状況である。しかし、成果2は、O&Mに関して、成果1よりも、より多く課題を抱えているといえる。

ナロック・カウンティのOlemoncho小学校、Iltumtum小学校の2校には太陽光発電システムが2013年7月に設置され(Lot 1)、サンプル・カウンティのTuum小学校、Illaut小学校、Marti小学校には2014年4月に設置された(Lot 2)。成果1のLot 1とは異なり、系統延伸によって設置が中止となった小学校はなかったものの、Olkinyei診療所と同様、ナロック・カウンティのIltumtum小学校には、システム設置後に電力システムによる電化が行われることが明らかになった。

成果1の診療所と同様、成果2の小学校も、発電システムの日常的な運用・管理が適切に行われていないケースが散見されている。また、成果1と同様に、日常的な充電サービスからの収入だけでは、バッテリーやインバーター、チャージコントローラー等の交換に必要な財政的資源を確保できないという課題を抱えている。成果1の場合、カウンティ保健事務所がO&M費用を負担する方向で前向きな協議が進んでいるが、成果2の場合、MoESTとの協議はまだ緒に就いたばかりである。教育政策の実施に関しては、保健政策の実施と異なり、カウンティ政府への地方分権が行われないことが決定しているため、成果1のように、カウンティの出先機関がO&M費用を負担するという体制にはなり得ないと目されている。そのため、今後、O&M費用の負担主体について、MoESTと協議を進めていく必要がある。

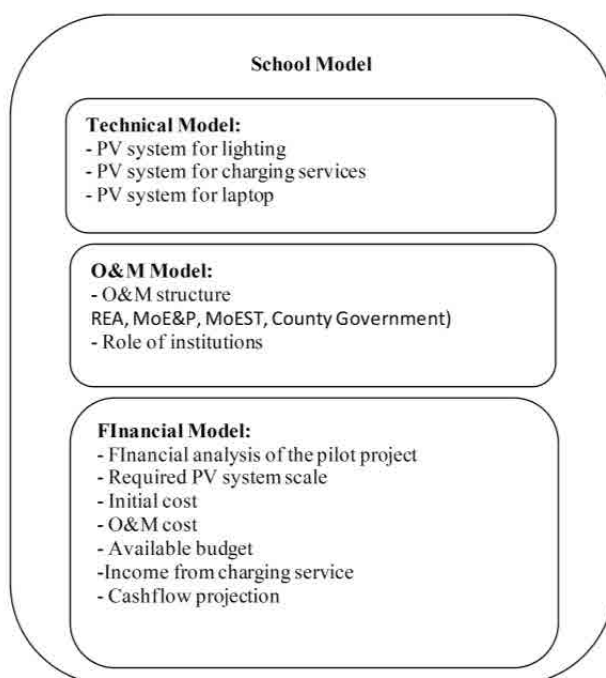
さらに、成果1と異なり、MoEST関係者の中で太陽光発電システムに関する研修を受けた職員はおらず、技術面からの体制整備も遅れている。これは、REA/MoE&PとMoESTの間でO&Mに関する議論が始まったばかりであり、財政面の手当てに関する体制整備を含め、全体の方向性がまだ明確化していないことなどが主な要因である。以上のことから、成果1と比べ、成果2は、プロジェクト残り期間で取り組むべき課題は多いといえる。

成果2は、成果1と同様、特にLot 2への設備設置に大きな遅延が生じたが、このLot 2の遅れに関しては、REAが行うケニア政府の小学校電化を目的としたラップトップ・プログラムの太陽光発電システムの仕様を決定する時期とLot 2の設置時期が重なってしまうという状況を招いた(この件については、[4-1-4 インパクト]で詳しく取り上げることとする)。ラップトップ・プログラムとは、2013年4月に大統領が発令した、すべ



での小学校を電化し、1校当たり50台のラップトップコンピュータを配布するという計画である。2014年3月から2015年6月の間に、約3,000の小学校に太陽光発電システムを設置するとしている<sup>11</sup>。現在、REAが地方電化の責任機関として、地方部の小学校の電化を進めている。

ラップトップ・プログラムにより、太陽光発電を含めた小学校電化の動きが加速しているという現在の状況は、プロジェクトにとってプラスとなる要素も含んでいる。プロジェクトが提唱する①設計、②持続的なO&M、③持続的な財政計画から成るモデルが、このラップトップ・プログラムで採用されれば、プロジェクトのインパクトは極めて大きなものになるだろう(図3-2)。しかし、現在のところ、[4-1-4 インパクト]で後述するように、この件に関する顕著なインパクトは得られていない。



出典：JICA Expert Team (2014) Project for Establishment of Rural Electrification Model Using Renewable Energy in the Republic of Kenya: Progress Report 5 (p.42)

図3-2 小学校における太陽光発電モデル

### 3-2-3 成果3の達成状況

成果3は、「風力、小水力、バイオガスを活用した地方電化プロジェクトを実施するREA/MoE&Pの能力が向上する。」である。表3-7は、PDMバージョン3.1に記載された成果3の指標とそれぞれの達成状況を示している。

<sup>11</sup> 2014年8月13日時点での太陽光発電システム設置件数は215校であった。

表 3-7 成果 3 の指標と指標の達成状況

指 標	達成状況
3-1. Training is conducted for at least 2 C/Ps for each renewable energy technology.	3-1 小水力: 3 人 バイオガス: 2 人 風力 2 人
3-2. Guidelines are established for each renewable technology (MHP, Biogas and Wind).	3-2 プログレスレポート 5 号においてマニュアル (ガイドライン) 案が作成されたので 10 月以降に委員会を立ち上げて会合をもつ計画。
3-3. Guidelines are utilized by relevant ministries, governmental agencies and County/Sub-county offices.	3-3 マニュアル完成後に REA 及び MoE&P 職員により活用される予定
3-4. Seminar and training for technical transfer are conducted for C/Ps based on their Objective & Achievement sheets.	3-4 小水力: 1 回、バイオガス: 1 回、風力 1 回
3-5. At least 6 C/Ps achieve their objective through training. Achievements are confirmed by trainee's self-assessment and evaluation by JEs.	3-5 11 月頃に Objective & Achievement test を実施する予定
3-6. At least one pre-feasibility study document for future practical model for MHP, Biogas and Wind is prepared.	3-6 簡易プレ F/S の進捗、小水力 (60%)、バイオガス (80%)、風力 (70%)。すべての技術について 2014 年 11 月末頃までに完成する予定。

出典: プロジェクト提供資料

(1) 成果 3 の達成状況

現在行われているガイドライン作成、簡易プレ・フィージビリティ調査 (F/S) 結果の取りまとめと発表等が計画どおりに実施されれば、成果 3 は一定程度達成できると見込まれる。当初計画されていた成果 3 に係るパイロット・プロジェクト活動は、1 年目終盤に中止が決定したため、C/P の、研修等で学んだ知識を実践で活用する機会は少なくなった。そうした状況の中で、残り協力期間で C/P の実践力を高めていくためには、現在実施されている成果 3 の活動に、C/P がより主体的に参加していくことが必要である。

(2) 達成状況の詳細

プロジェクトは初年度の 8~9 カ月間、国際連合工業開発機関 (United Nations Industrial Development Organization: UNIDO) が実施する「コミュニティ・パワー・センター (エネルギー・キオスク)」との連携を検討・模索していた。しかし、UNIDO の活動がさまざまな課題を抱えていることが明らかになり、REA、MoE&P、JICA、UNIDO 間での協議の結果、成果 3 における UNIDO との連携は実施されないこととなった。

最終的な決定は 2013 年 3 月に下され、成果 3 のパイロット・プロジェクト実施は行わないこととなり、C/P への能力向上のための研修実施を成果 3 の主要な活動とすることで合意した。この変更により、専門家から C/P へのより実践的な技術移転は困難になり、代替策として、セミナー、調査・計画手法指導等の実施による集中的な技術移転と、フィールドにおける簡易プレ F/S 実施指導等が行われることとなった。専門家は同時に、小水力、バイオガス、風力の 3 技術分野のガイドラインの作成にも着手した。

表3-7の指標3-1で示されたように、小水力の3人、バイオガスの2人、風力の2人のC/Pは計画どおり研修を受講した。実際のC/Pの能力向上実態については11月のObjective & Achievement Test(指標3-5)の結果を待たなくてはならないが、専門家やC/Pへのインタビューによると、C/Pの理論的知識は向上したものの、現場での実践の機会がほとんどなかったために、実践力にはまだ不安を感じているとのことだった。また、C/Pが、セミナー・研修に割くことができた時間は、どの技術分野もプロジェクト期間を通じて半日から1.5日と短かった。今後、専門家が作成するガイドラインをC/Pが将来のREAの事業に有効に活用して行き、実践力を高めていくことが望まれる。

指標3-6についてであるが、バイオガスを担当する1人のC/Pが簡易プレF/Sの結果をまとめたペーパー案を執筆したが、他の技術分野、つまり小水力と風力に関しては専門家が中心となって執筆を行った。ペーパーは、今年11月にJKUATで開催される第9回科学技術工業化会議で、C/Pが発表を行う予定である。

### 3-2-4 成果4の達成状況

成果4は、「再生可能エネルギーによる地方電化モデルがケニア国内で普及するための政策・制度に関する提言が行われる。」である。表3-8は、PDMバージョン3.1に記載された成果4の指標とそれぞれの達成状況を示している。

表3-8 成果4の指標と指標の達成状況

指 標	達成状況
4-1. International workshop is held to share the results of the project (e.g. EAC conference).	4-1 2015年2月に開催する予定
4-2. Technical transfer workshops for C/Ps are held 3 times.	4-2 合計3回 太陽光:1回(2013年9月27日)、 小水力、バイオガス:1回(2013年10月25日) 風力:計1回(2013年10月25日)
4-3. Recommendations for C/P to implement the effective electrification by renewable energy are provided to be reflected on their rural electrification policy.	4-3 最終報告書において最終化する予定

出典：プロジェクト提供資料

#### (1) 成果4の達成状況

国際ワークショップの開催、提言の実施等の計画されている活動が完遂されれば、成果4は比較的高く達成できる見込みである。ただ、プロジェクトが今後提示する提言が、有効かつ現実的に実行可能なものになるかどうかは、成果1～3の達成度に大きく左右される。専門家は現在、成果1～3の知見に基づき提言案を作成中であるが、今後、C/P機関との密な協議を重ね、真に役立つ提言を行っていくべきである。

#### (2) 達成状況の詳細

成果4の達成度は指標4-3の提言実施に大きく左右される。この指標が達成されるかどうかは、成果1～3が成功裡に実施されることが前提条件であり、その観点からいえば、

成果4の進捗はまだ道半ばといえるだろう。

フィールドでの経験の蓄積及び既存の政策の分析といった活動を経ながら、プロジェクトは実践的な提言作成に向けて確実に前進を続けている。プロジェクトの、C/P 機関の再生可能エネルギー政策に対する一番重要な貢献は、太陽光、小水力、バイオガス、風力の4つの技術分野における組織的枠組み（政策、規定、システム）、財務分析、技術分析、利用者便益等、多方面からの包括的かつ細部まで行き届いた分析結果の提供であろう。

C/P とのインタビューでは、プロジェクト以前は、REA は再生可能エネルギーを利用した電化を現場で実施する際、そうした多方面からの分析は行わずに行っていたとのことだった。現在は、C/P の意識が高まり、適正技術を考案すること、持続的な O&M 体制を整えること、そして持続的な財務計画を立てることの重要性を認識するようになった。

専門家は、成果1～3に係る活動で得られた知見を基に、提言案を作成しているところである。C/P 機関にとって有効で現実的、かつ実務に役立つ提言にするためには、専門家チームと C/P との密な議論が必要であり、今後、実務レベル、ハイレベルの両方において十分な協議を経たうえで提言を完成させる必要があるだろう。

### 3-3 プロジェクト目標の達成度

「未電化地域における再生可能エネルギー利用による地方電化モデルを構築する」が本プロジェクトのプロジェクト目標である。表3-9は、PDM バージョン3.1に記載されたプロジェクト目標の指標とそれぞれの達成状況を示している。

表3-9 プロジェクト目標の指標と指標の達成状況

指 標	達成状況
1. The developed guidelines and manuals are applied to the projects implemented by the REA and MoE&P (C/P).	1. 2014/2015年、2015/2016年に REA が実施する太陽光関連プロジェクトで、本プロジェクトで作成するガイドライン及びマニュアルが採用される見込み。
2. The Outputs of the Project are incorporated into implementation of REA Annual Renewable Energy Work Programme (Performance Contract).	2. 2015/2016年の REA Annual Renewable Energy Work Programme に、本プロジェクトで導入するモデルがデモンストレーションプロジェクトとして活用される予定。
3. Renewable energy facilities installed by the Project are operated and maintained properly with sustainable.	3. 2014年11月頃にプラントの所有権が REA を通じて、MoEST 及び保健省に移管される予定。その後で、REA と省庁間で維持管理について MOU を締結する。
4. Implementation structures of national/county governmental agencies and local stakeholders are established.	4. REA と省庁間で署名される MOU で実施体制が明確にされる。
5. Variety of expertise in renewable energy is increased among members of C/P (C/Ps).	5. 小水力、バイオガス、風力の技術について、C/P に対し技術移転が実施され、知識及び職務実施能力が向上した。

出典：プロジェクト提供資料

### (1) プロジェクト目標の達成状況

プロジェクト目標は現在、一定程度達成されている。未完の活動が成功裡に完了すれば、プロジェクト終了時には達成度が比較的高まると予想される。C/P の全面的な参加を得て 4 つの成果を十分に達成させることが、プロジェクト目標の高い達成に欠かせない。

### (2) 達成状況の詳細

プロジェクト目標の指標は、C/P のガイドライン・マニュアルの活用、開発されたモデルの採用、パイロット・プロジェクトで行われた太陽光発電システムの持続的な O&M、そして C/P のさまざまな再生可能エネルギーに関する専門知識の向上である。

プロジェクト目標の達成度は、保健省（具体的にはカウンティ保健事務所）、MoEST との太陽光発電システムの維持管理に係る MOU の締結と、MOU に従ったアクションが取られることに大きく左右される。また、C/P 機関が、プロジェクトが作成したガイドラインやモデルを実際に適用していく準備ができていくかどうか、プロジェクト目標の達成度に直接影響を与える要素である。

今後、プロジェクトは、残された活動を完遂し、ガイドライン、マニュアル、モデル、政策提言が実践的で有効なものになるように努めていく必要がある。また REA、MoE&P、保健省、MoEST、カウンティ政府との協議も密に行い、持続可能な O&M モデルを構築するとともに、C/P 機関がプロジェクトの効果を持続するための方向づけを行っていくべきである。

## 3-4 実施プロセスにおける特記事項

プロジェクトの実施プロセスにおいて、以下に挙げる事項がプロジェクトに正負の影響をもたらしている。

### 3-4-1 正の影響をもたらした要因

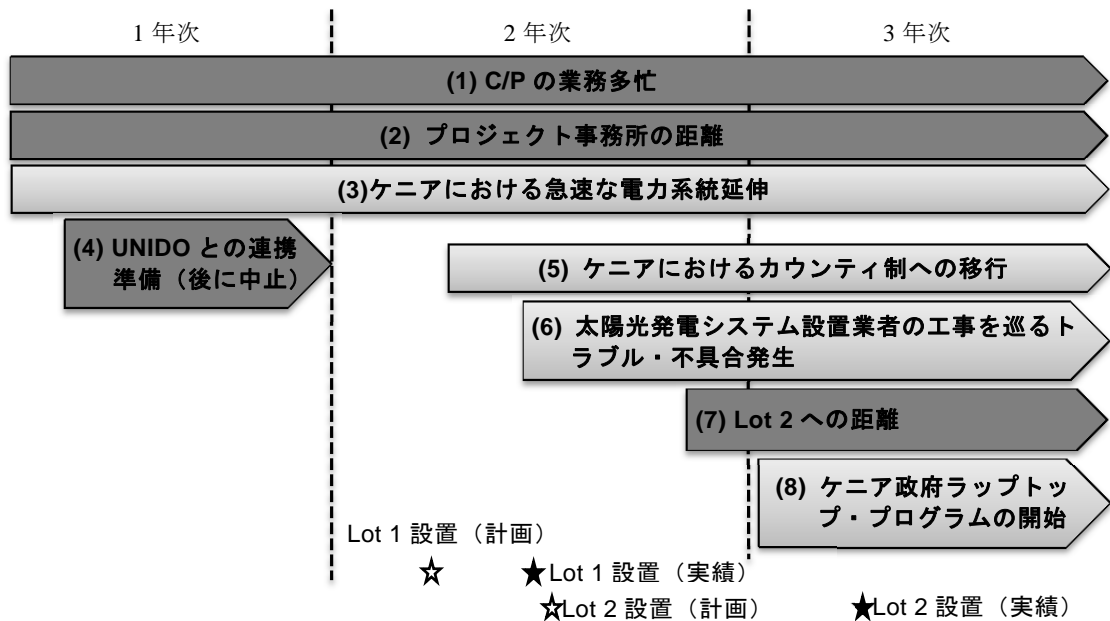
特に効率性向上の観点から正の影響をもたらした要因は 1 つ挙げられる。

#### (1) JKUAT 及び BRIGHT プロジェクトとの連携

C/P や保健省カウンティ事務所の職員は、JKUAT 及び本プロジェクトと同時期に JKUAT を C/P として実施されている JICA 技術協力プロジェクト「再生可能エネルギーによる地方電化推進のための人材育成プロジェクト」（通称“BRIGHT プロジェクト”）が主催する研修やセミナーに参加したり、発表を行ったりしている。こうした JKUAT や BRIGHT プロジェクトとの連携は、プロジェクトの効率性を高めている。

### 3-4-2 負の影響をもたらした要因

本プロジェクトは、プロジェクト実施の過程で、さまざまな負の影響を及ぼす課題に直面している。図 3-3 の(1)～(8)に挙げた 8 つの要因は、プロジェクトの有効性と効率性に大きな負の影響を与えているものとして特定されたものである。図 3-3 は、これら 8 つの要因が、プロジェクト期間中にどのタイミングで発生したのかを時系列で示したものである。



出典：終了時評価調査団

図 3-3 時系列で示した 8 つの負の要因

図に示した要因のうち、濃色の(1)、(2)、(4)、(7)は内部的要因といえるもので、REA、MoE&P、JICA といったプロジェクト実施者がある程度制御することが可能な要因であった。問題発生前、あるいは発生後に適切な対応ができていれば、負の影響をある程度緩和することができたと考えられる。

一方、淡色の(3)、(5)、(6)、(8)については、外部要因として考えられるべき要素であり、基本的に、プロジェクト実施者がこれらの要因を制御するのは困難だったであろう。実施者は、こうした問題が発生する前に状況を察知し、危険回避の手段を講じるべきだったといえる。

以下に、それぞれの要因についての詳細を記す。

#### (1) C/Pの業務多忙

C/P はディーゼルによる発電業務等、プロジェクト以外の業務で多忙であり、専門家から C/P に対する技術移転の障害となっている。特に成果 1、2 のパイロット対象地を訪問したり、成果 3 の簡易プレ F/S を実施するために地方出張をすることが時間の制約上難しく、特に成果 1、2 については専門家チームが単独で現場の活動を実施せざるを得ない状況が数多く発生している。

#### (2) プロジェクト事務所の距離

プロジェクト事務所は REA や MoE&P から離れた場所にあり、専門家が C/P と緊密に意思疎通を行うのが難しい状況である。専門家と C/P の物理的な距離は円滑なプロジェクト活動実施に大きな障害となっている。

#### (3) ケニアにおける急速な電力系統延伸

REA は、ケニアの未電化地域に急速に電力系統の延伸を行っている。系統延伸の対象地

は、その性質上、プロジェクトの太陽光発電対象候補地と重複しがちである。実際、Lot 2 選定の際には、選定した場所が系統延伸の対象地であることが後で明らかになるなどして、何度も選定をやり直さなければならなかった。プロジェクトがパイロット対象地、特に Lot 2 候補地を最終的に決めるまでには長い時間を要した。

#### (4) UNIDO との連携準備（後に中止）

プロジェクトは第1年次、成果3の小水力、バイオガス、風力を用いたパイロット活動実施のため、およそ9カ月をかけて UNIDO との連携に向けて準備を行った。しかし、検討の結果、UNIDO との連携は有効ではないという結論に達し、連携計画は中止となった。プロジェクトは成果3のデザインを大幅に変更しなければならなくなり、また UNIDO との連携準備のために多くの時間を費やし効率性を低下させた<sup>12</sup>。

#### (5) ケニアにおけるカウンティ制への移行

近年、ケニアの地方分権化は本格化し、カウンティ制度へと急速に移行している。中央政府とカウンティ政府の役割や権限は 2013 年半ば頃から大きく変化した。プロジェクトは変化する環境の中、パイロット太陽光発電システムの O&M に関する検討を中央・地方政府の両方で随時調整する必要が生じ（特に成果1のために）、関係者の役割の整理や協議実施等に時間を要している。

#### (6) 太陽光発電システム設置業者の工事をめぐるトラブル・不具合発生

ケニアの太陽光発電システム設置業者の電気工事技術は、予想以上に低いことが明らかになった。パイロット対象地では、工事の際に不具合が繰り返し生じ、その都度、プロジェクトが問題解決のために奔走しなければならない状況となった。専門家は、現場でのトラブル解決に時間を取られ、ナイロビで行うべき仕事になかなか手が回らないという課題を抱えている。

#### (7) Lot 2 への距離

Lot 2 選定の際には、電力系統延伸の見込みが低い、ナイロビから遠く離れた地域を選ばなければならなかった。パイロット活動の目的にかんがみると、こうした地域を選択することは適切だったといえるが、当該地域は治安上の問題もあり、さらに移動に長時間を要するため、プロジェクトの効率性が阻害された。専門家も C/P も、限られたプロジェクト期間中に Lot 2 を頻繁に訪れるのは難しいため、成果1、2の現場での技術移転に支障を来している。

#### (8) ケニア政府ラップトップ・プログラムの開始

ケニア政府によるラップトップ・プログラムに従事するために、2014年4月頃から C/P

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<sup>12</sup> ただし、準備期間中に収集した情報は、後に成果3のセミナー教材の中で活用することができた。また、小水力発電については、簡易プレ F/S の例として生かしているほか、風力発電やバイオガス発電については計画の一例としてガイドラインに活用している。しかし、9カ月の期間、プロジェクトの貴重な資源を後に中止となる計画のために使わなければならなかったのはプロジェクトの効率性を阻害した。

の業務はこれまでに増して多忙となった。C/P がプロジェクト活動に充てられる時間は以前よりも更に少なくなった。



## 第4章 評価結果

### 4-1 5項目ごとの評価<sup>13</sup>

#### 4-1-1 妥当性

##### <要約>

妥当性は比較的高い。プロジェクトはケニアの優先開発政策や日本の対ケニア ODA 政策に合致しているほか、再生可能エネルギー、コミュニティ開発、運転・保守管理（O&M）、ビジネス分析といった日本が得意とする技術分野の強みを生かし、対象グループ、特に未電化地域の公共施設のニーズに適切に対応した活動を展開している。一方で、近年のケニアにおける急速な電力系統の延伸に伴い、パイロット活動が行われている場所にも一部配電線延伸が行われる状況が生じている。エネルギー石油省/地方電化庁（REA/MoE&P）において、プロジェクト開始時に戦略的かつシステマチックな地方電化計画が行われていれば、こうした混乱は避けることができたであろう。

#### （1）ケニア開発計画との整合性

ケニア政府は、Vision 2030 の中で、2030 年までにすべての国民が電化の恩恵を受けることをめざしている。Vision 2030 はまた、エネルギー供給を増やすために、再生可能エネルギーの開発を行うことも明言している。「地方電化マスタープラン（REMP）2008～2018 年」では、2020 年までに地方住民の 40% を電化することをうたい、太陽光、風力、水力、バイオガスといったエネルギーに適する場所において再生可能エネルギーによる電化を行うとしている。

2013 年に起草された国家エネルギー政策では、エネルギー安全保障、気候変動対策、収入向上、雇用創出といった観点から再生可能エネルギーの重要性が認識された。同政策では、ケニアは、風力、太陽光、バイオマス発電の高い潜在力をもつことも確認されている。

プロジェクトは、再生可能エネルギーを用いた地方電化モデルの構築を進めており、こうしたケニア政府の政策的優先方針と合致した取り組みであるといえる。

#### （2）日本の援助政策との整合性

対ケニア共和国国別援助方針（2012 年）において、日本はケニアの電化に貢献することをめざしている。特に、エネルギーの安定供給は、ケニアの経済成長に欠かせない要素であるとの認識に立ち、「対ケニア共和国事業展開計画」（2012 年）では、本プロジェクトを「発電・送電能力向上プログラム」の一環として位置づけ、年々増大するケニアの電力需要に対応するための協力を展開している。

このような政策的文脈から判断して、プロジェクトは、日本のケニアに対する援助政策と強い整合性を保持しているといえる。

#### （3）対象グループのニーズへの合致

プロジェクトの対象グループは、エネルギー石油省（MoE&P）、地方電化庁（REA）、教

<sup>13</sup> 5項目評価の判定は、「高」「中」「低」の3段階で示した。

育科学技術省（MoEST）、保健省（MoH）、パイロット活動地のカウンティ/サブカウンティ教育事務所・保健事務所、そして小学校や診療所の職員など、多岐にわたっている。

プロジェクトはこれら対象グループのなかでも、特に MoE&P/REA 職員の再生可能エネルギーを利用した地方電化モデルの構築に関する能力向上をめざしている。カウンターパート（C/P）機関も、パイロット対象地の関係者も、地方電化を可能にする太陽光発電システムの設置・運用が適切に行えるようになることを望んでおり、プロジェクトはニーズに対応した活動を行っているといえる。MoE&P/REA 職員に関しては更に、小水力、バイオガス、風力発電についてもスキルと知識を向上させる必要があった。

他方、ケニアでは近年急速に配電線延伸が進んでおり、Lot 1 としていったんは選定されたカジアド・カウンティの Meto 診療所も、そうした延伸の対象地となった場所のひとつであった。同じく Lot 1 のナロック・カウンティの Olkinyei 診療所と Iltumtum 小学校についても、既に太陽光発電設備が設置されたものの、間もなく系統延伸が行われる予定である。REA/MoE&P において、戦略的かつシステムチックな地方電化計画が行われていれば、こうした状況は避けることができたであろう。

以上のことから、プロジェクトは対象グループのニーズに合致した活動を行っているといえるものの、パイロット活動実施地の一部に関してはサイト選択に関する妥当性が低下している状況である。

#### （４）日本の技術・スキルの優位性

プロジェクト専門家チームは、再生可能エネルギーの専門家のほか、コミュニティ参加、O&M、社会環境配慮、ビジネス分析といった社会経済分野の専門知識をもつ人材で構成されている。これは、地方において持続的な施設の設置と運営に必要な包括的な知識と技術を C/P に移転するために必要な陣容である。よって、日本のもつ技術・知識の優位性を生かした協力であるといえる。

#### （５）実施アプローチの適切性

プロジェクトは、サービスデリバリー型ではなく、技術移転を中心としたキャパシティデベロップメント型の協力を行っている。キャパシティデベロップメント型支援とは、C/P と日常的に活動を共にし、特定分野の能力、この場合は再生可能エネルギー分野での能力向上をめざすものである。他方、サービスデリバリー型支援とは、施設、政策文書、運用マニュアルといった目に見える成果物を提供することに重きが置かれ、時として C/P の関与は希薄になりがちである。プロジェクト開始時に C/P 機関が抱えていた課題は、汎用性のあるモデルの構築に必要なノウハウとスキルを身に付けることであった。この観点から、パイロット活動を通じて、専門家が C/P とナレッジを共有・交換して行くという本プロジェクトの実施方法は、キャパシティデベロップメント型支援アプローチとして適切だったといえる。

### 4-1-2 有効性

#### <要約>

有効性は現在のところ、中程度である。プロジェクト目標は終了時までには比較的高いレベ

ルで達成されることが見込まれるものの、成果1から4すべてにおいて、不確実性が残されている。現在実施中の活動が円滑に、かつ成功裡に進み、関係機関が本報告書で提示する提言にのっとなってアクションを取るのであれば、終了時には有効性は高まるだろう。

#### (1) プロジェクト目標の達成見込み

プロジェクト目標は、「未電化地域における再生可能エネルギー利用による地方電化モデルを構築する。」である。プロジェクト活動の進捗状況と4つの成果の達成状況にかんがみると、現在はプロジェクト目標達成半ばという状況である。これまでプロジェクトが達成した一番の貢献は、C/P 機関に対して、①再生可能エネルギー技術が適用される状況に合わせて最適な設計を行うこと、②財政面での実現可能性を検討すること、そして③実用的かつ機能的な O&M のための組織体制整備を行うこと、の3点の重要性を認識させることができたことであろう。また、専門家の支援により、REA が社会環境配慮に必要な手続きを行えるようになったことも、プロジェクトの貢献として挙げられる。プロジェクトは更に、小水力、バイオガス、風力に関しても C/P の知識を向上させることができた。

しかし、残りのプロジェクト期間で取り組むべき課題も多い。成果1、2（太陽光発電モデルの開発）に関しては、モデルを今後完成させ、特に O&M に関して保健省、カウンティ保健事務所、MoEST 等の関係機関との調整を行う必要がある。しかしプロジェクト終了時までには実務面及び財務面を含めた O&M 体制を明確化するのは困難であると推測されることから、構築モデルにおける O&M 体制を参考に C/P がプロジェクト終了後に必要な体制を整えていくこととなる。成果3については、C/P がこれまでセミナーや簡易プレ・フィージビリティ調査(F/S)等で習得した知識を整理し、文書化していく必要があるほか、今後開催されるマニュアル開発委員会において、ガイドラインを最終化させる必要がある。成果4は、すべての成果の集大成というべきものであり、プロジェクトチームと C/P との間で建設的な意見交換を経て、政策提言を実施していく必要がある。成果4が十分達成できれば、プロジェクト目標達成見込みも大いに高まるだろう。

#### (2) プロジェクトマネジメントシステム

中間レビュー調査では、専門家と C/P との間でのコミュニケーション不足がプロジェクトの阻害要因として指摘された。しかし、その後、REA のプロジェクトマネジャーを中心として月例ミーティングが開かれるようになり、プロジェクトの進捗確認やモニタリングが実施されたことにより、指摘された課題を解決することができた。中間レビュー調査以降は、コミュニケーション不足の問題は適切に対処されたといっていよう。

ただし、[3-4-2 負の影響をもたらした要因]でも述べてきたように、C/P が他業務で多忙なこと、プロジェクト事務所が REA/MoE&P から遠い場所にあることなどの阻害要因があるため、専門家と C/P 間の密なコミュニケーション、特に対面のコミュニケーションの取りにくさは、プロジェクト期間を通じて大きな課題であった。

#### (3) プロジェクト目標達成の貢献・阻害要因

プロジェクト目標達成の貢献・阻害要因のうち主なものは、既に [3-4-1 正の影響をもたらした要因]、[3-4-2 負の影響をもたらした要因] で述べてきた。ジョモ

ケニヤット農工大学（JKUAT）や BRIGHT プロジェクトとの連携という 1 つの要素が貢献要因として挙げられる一方で、阻害要因の数は 8 つにも上る。これらすべてがプロジェクトにとって障害となっているが、そのなかでも特に、専門家が実践的な情報共有やノウハウの伝授を行うという活動が、C/P が多忙なため思うように進まないという状況が一番の課題であろう。マニュアル、ガイドライン、モデル構築、科学論文といった目に見える成果物は計画どおり産出されているものの、これらに対する C/P の貢献度は高いとはいえない。これは、別の言い方をすると、成果 1、2、3 の技術移転が十分ではないことを意味する。

#### 4-1-3 効率性

##### <要約>

効率性は中程度。日本とケニア両方からの投入は基本的に計画どおり実施されたものの、C/P が他業務で多忙なため、特に中間レビュー以前はプロジェクト活動になかなか従事できず、専門家から C/P への技術移転が十分にできなかった。1 年目に産業施設におけるパイロット活動実施計画が中止となったため、プロジェクトの枠組みを再構築するのに時間を要した。系統延伸との重複を避けるためのパイロット地選定のやり直し、太陽光発電設備のシステム不具合発生、遠隔地における Lot 2 活動の実施等の要因により、さまざまな主要な活動に遅れが生じた。さらに、2013 年半ばからのカウンティ制への移行により、太陽光発電設備 O&M に関する関係機関とその役割・権限の特定に時間を要した。他方、JKUAT と BRIGHT プロジェクトとの連携はプロジェクトの効率性向上に一定程度寄与している。

##### (1) 日本側からの投入

C/P とのインタビューによると、プロジェクト専門家の専門分野は、C/P の能力向上ニーズに合致したもので、期待された成果の産出に貢献しているとのことだった。専門家チームは、システム設計だけでなく、財務、環境、参加型開発といった分野において十分な専門知識やスキルをもっていると先方から認知されている。国外の C/P 研修については、特にインドとタイで実施された第三国研修が、ケニアの社会経済状況や技術レベルに近い環境で具体的な再生可能エネルギー技術の実例を学ぶことができたことから、効果が高かった。

##### (2) ケニア側からの投入

ケニア側からの投入のうち、プロジェクト事務所が C/P 機関から離れていることが効率性阻害要因になっている。技術移転対象の C/P は、それぞれの技術分野についておおむね適切な人数が配置されているが、皆、業務多忙であり、プロジェクト活動への従事時間が確保できていない。C/P と共に活動を実施することが困難な場合も多く、専門家が単独で業務に携わっているケースが頻繁に見受けられる。

##### (3) 効率性の促進要因

[3-4-1 正の影響をもたらした要因]で述べたように、JKUAT や BRIGHT プロジェクトとの連携が効率性の促進要因として挙げられる。今年 11 月には、JKUAT が主催す

る第9回科学技術工業化会議で、C/Pの数名が発表を行うことになっている。

また、プロジェクトは、BRIGHTプロジェクト関係者に対し、パイロット地のひとつであるナロック・カウンティのItumtum小学校(Lot 1)を研修会場として提供し、2つのプロジェクト間の情報交換を実施した。

#### (4) 効率性の阻害要因

[3-4-2 負の影響をもたらした要因]で既に記述したように、それぞれの阻害要因が各活動の実施に影響を及ぼしているほか、8つの要因が相まって、プロジェクト全体の成果産出を阻害している。

#### 4-1-4 インパクト

##### <要約>

インパクトは中程度。上位目標の達成度は、プロジェクト目標達成度に大きく依存する。また、プロジェクトが今後最終化するモデルが、いかに実践的で汎用性のあるものになるかによっても上位目標の達成度は左右される。現在のところ、プロジェクト目標の達成度には不確実性があり、よって上位目標の達成度も不確実な部分が多い。プロジェクトの正のインパクトは、①再生可能エネルギー技術の関係者がO&Mコストに関して意識を高めたこと、②今後実施される設備設置に関して設備の利用者・所有者とO&Mに関する協議を行う可能性が高まったこと、の2点である。また、パイロット活動実施地では、地域住民の生活の向上が確認できている。例えば、女子児童や女性スタッフは夕方・夜間照明があるため、以前よりも安心して行動できるようになった。夜間の出産や予防接種が容易になったりするなど、特に女性や子供に対してより良い保健サービスが提供されるようになった。一方で、ラップトップ・プログラムにおいては、プロジェクトが推奨する設計に関する仕様を時間の制約上、採用してもらえなかった。もし採用されたならば、ケニア全国約3,000の小学校に顕著なインパクトを与えることができたであろう。

#### (1) 上位目標の達成見込み

プロジェクトの上位目標は、「ケニア国民の生活の質を向上させるため、再生可能エネルギーを利用した地方電化モデルが国内に普及する」である。上位目標の達成度を測定するための指標として、「(1) Number of public facilities who apply and follow the model has increased all over the non-electrified areas in Kenya」、「(2) Dissemination structure of national and county governmental agencies is established」の2つが設定されている。

まず、(1)の指標の達成見込みについてであるが、プロジェクトが今後実用的なモデルをREAに提示することができれば、ケニア国内において、モデルを活用した公共施設の電化が進む可能性があるだろう。実際、専門家チームとREAの間では、2015/2016年のREAによる太陽光発電システム設置業務において、モデルを適用するべく議論を開始させている。特に、充電ステーションの設置といった設計面でモデルを採用することが、モデル適用の第一歩として有望とみられている。

(2)の指標については、現在、太陽光発電施設のO&Mに関する覚書(MOU)を準備し、C/P機関、保健省、MoEST、カウンティ政府等に提示し、意見を聴取している状況である。

これらの機関が MOU に合意し、組織として O&M に取り組むことが決まれば、構築されたモデルの普及の体制が一気に整うとよいだろう。

以上のことから、プロジェクト期間中にプロジェクト目標が十分達成され、C/P 機関やその他関連機関がモデル普及に努めることになれば、上位目標についても達成される可能性が高まる。

## (2) 期待されたインパクト

パイロット活動地での太陽光発電設備の設置は、対象施設利用者の利便性向上に寄与している。例えば、小学校では、早朝や夜間に補習授業を行うことができるようになったほか、女子児童や女性職員は夕方・夜間照明があるため、安全性が高まり、以前よりも安心して行動できるようになった。診療所では特に夜間多く発生する女性の分娩を容易に介助できるようになった。診療所にワクチンを保存する冷蔵庫が設置されたため、母親は地元の診療所でいつでも子どもに予防接種を受けさせることができるようになった。プロジェクトは、特に女性と子どもに正のインパクトを与えているといえる。さらに、施設の近隣住民は、充電ステーションで携帯電話等の充電サービスを受けることができるようになり、利便性が向上した。

一方で、期待されていたものの、「実現に至らなかったインパクト」についても説明しておく必要がある。[3-2-2 成果2の達成状況]で説明したが、Lot 1、Lot 2 両方で太陽光発電設備の設置に遅延が発生した。特に、Lot 2 で計画よりも 11 カ月遅れてサイトが決定したことが、ケニア全土の小学校に正のインパクトを与える機会を逸してしまう状況を招いた。プロジェクトチームは 2013 年 9 月頃、ようやく決定した Lot 2 のサイトで、早急に太陽光発電システムを設置しなければならなかったことから、多忙を極めていた。一方で、ちょうど同時期、REA はラップトップ・プログラムのための太陽光発電システムの詳細仕様を決めるために奔走していた。REA は専門家に最適なシステム設計を支援してほしいと依頼したものの、専門家は Lot 2 の業務に忙しく、依頼に応えることはできなかった。例えば、専門家は後に、REA が採用した 12V という仕様は、ラップトップ・プログラムで想定される電力使用を考えると適切なものではなく、48V が適切であったと考えたが、REA に提言を行った時には既に業者への発注が終了していたため、仕様を変更することは不可能であった<sup>14</sup>。専門家は、もし Lot 2 業務が半年早ければ、あるいはラップトップ・プログラムの仕様決定時期が半年遅ければ、専門家の意見を REA に反映させることが可能であったろうと考えている。つまり、Lot 2 の 11 カ月の遅れが、全国約 3,000 の小学校にプロジェクトの推奨する設計モデルを適用する重要な機会を奪ってしまったのだといえる。

図 4-1 は、プロジェクトの Lot 1、Lot 2、そしてラップトップ・プログラムの業務の繁忙期を表したものである。網掛け円形部分は、プロジェクトが Lot 2 業務で忙しく、REA がラップトップ・プログラムの仕様を決定する際に、プロジェクトとして支援ができなかった 2013 年 9 月頃のタイミングを示している。

<sup>14</sup> REA は 1 つの業者に対して、48V の採用を実現させ、2 つの小学校だけは 48V の太陽光発電システムが導入されることになった。

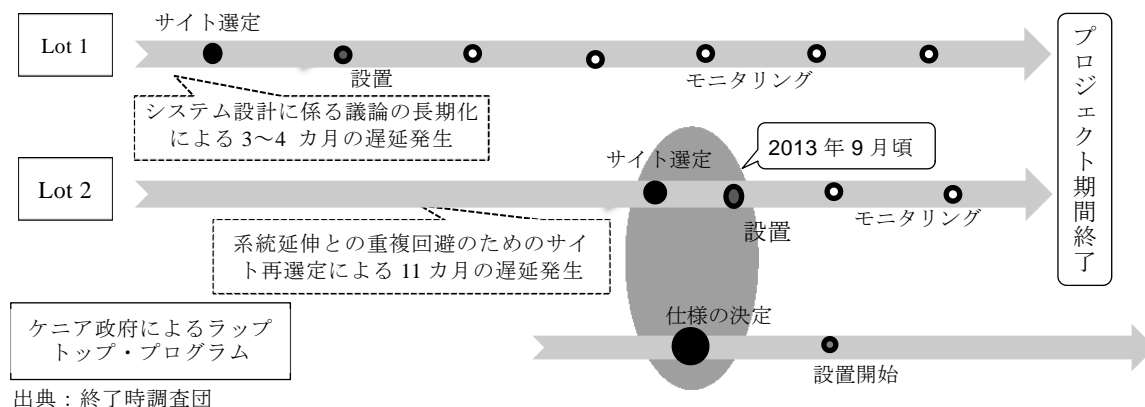


図 4-1 パイロット活動とラップトップ・プログラムの実施タイミング

### (3) 予期しなかった正負のインパクト

予期しなかった負のインパクトは特に確認されなかった。

予期しなかった正のインパクトとしては、太陽光発電設置施設のいくつかは、充電ステーションを利用して、バリカンを使った散髪サービスを始めたことなどである。最近では、女性向けのヘアサロンを開業するアイデアも出ており、そうしたアイデアが実現すれば、地域住民の利便性が更に向上するほか、充電ステーションが女性にとっての社交場的な空間となり、女性間の連帯強化につながっていくことが期待される。

### (4) 上位目標達成のための外部条件

上位目標達成のための外部条件として PDM バージョン 3.1 で挙げられているのは、「(1) REA Annual Renewable Energy Work Programme (Performance Contract) are prepared and implemented」、「(2) Involvement of relevant national and county government is maintained」の 2 点である。

(1)の外部条件は、プロジェクトで構築されたモデルが、REA の部の年間パフォーマンスコントラクトに組み入れられ、今後、REA が行う太陽光発電システム設置業務にモデルが適用されることを組織的に約束するものである。この件については、プロジェクトは現在 REA と協議中であるが、提示するモデルのなかでも特に充電ステーションの採用については、来年度は難しくても、その後の REA のパフォーマンスコントラクトへの反映の可能性があるとの手応えを得ている。しかし、充電ステーションはあくまでもプロジェクトが構築するモデルのごく一部分にすぎないため、モデルの他の要素についても広く REA に採用してもらうよう今後更なる働きかけが必要である。

(2)の外部条件については、太陽光発電モデルの持続性に直接関わるものである。現在、プロジェクトと REA が旗振り役となり、保健省、MoEST、そしてこれらの省のカウンティ事務所と太陽光発電 O&M に関して議論を始めたところである。この件については、[4-1-5 持続性]で述べる。

#### 4-1-5 持続性

##### <要約>

持続性は中程度。REA は国家電化再生エネルギー庁 (National Electrification and Renewable

Energy Authority : NERA) へ組織改編されることが計画されているため、今後の政策的、組織的持続性は判断し難い状況である。ただ、今後提示されるプロジェクトからの提言が再生可能エネルギー関連政策に反映されれば、政策的持続性は高まるだろう。太陽光発電システムの O&M に関する役割や責任については、中央・地方政府等の関係組織間で今後明確化させ、組織的持続性を高めていく必要がある。太陽光、小水力、バイオガス、風力の4つのすべての技術分野について、C/P の実践スキルは理論的な知識に比べて十分でないため、技術的持続性については課題が多い。財務面での持続性については、特に太陽光発電システムの O&M に関して、今後、プロジェクトが提案するモデルを普及して行くための政府予算を獲得していくといった努力が求められる。

#### (1) 政策・組織体制面の持続性

「地方電化マスタープラン (REMP) 2008～2018 年」、及び国家エネルギー政策 (草案) でうたわれているように、REA や MoE&P は、今後も再生可能エネルギー政策を実施していく計画である。今後提示されるプロジェクトからの提言がこうした再生可能エネルギー関連政策に反映されれば、政策的持続性は高まるだろう。

国家エネルギー政策では、REA は NERA へ組織改編され、再生可能エネルギー開発の主管庁になると示されている<sup>15</sup>。NERA が設立された際には、NERA が中央・カウンティ政府と調整しながら地方電化や再生可能エネルギー施策を実施する責任をもつことになる。そのため、プロジェクトの成果は、NERA に引き継がれることになるはずだが、REA から NERA への組織移行については、基本的に大きな変化は生じないと見込まれているものの、具体的な絵姿はまだ見えてきていない。

プロジェクトは今後、REA、MoE&P、保健省、MoEST、カウンティ政府の協力を得て太陽光発電モデルの O&M への取り組みを進めていく予定である。ハイレベルの協議を経て合意形成し、MOU の締結が実現するといった一連の調整作業が円滑に進めば、組織的持続性は高まるであろう。

#### (2) 技術面での持続性

成果 1、2、3 の達成状況を説明した際にも記載したように、バイオガスの技術移転を受けた 1 人の C/P を除くその他の C/P は、専門家からの技術移転を受ける時間を十分確保することができなかった。C/P は理論的な知識を向上させることができたものの、現場での活動参加が限られていたことから、実践力の向上は限定的である。プロジェクトは現在現場で活用可能なガイドラインを作成中であるので、REA 及び MoE&P はプロジェクトの残り期間中及びプロジェクト終了後にガイドラインを活用した実践力の向上に努めるべきである。

中央・地方両方の技術的持続性を高めためには、REA は今後も JKUAT、その他関連機関と協力して研修や会議に継続的に参加するとよいだろう。保健省・MoEST のカウンティの関係者についても、太陽光発電に関する研修に継続して参加し、施設の太陽光発電システムの日常的な運用管理が滞りなく行えるようにするべきである。

<sup>15</sup> ただし、NERA の業務範囲には、地熱発電や大規模水力発電は含まれない。



### (3) 財務面での持続性

財務面での持続性は 2 つのレベルで見ていく必要がある。ひとつは中央レベルであり、MoE&P 及び REA が、プロジェクト終了後にプロジェクト効果をどのように財政的に維持していけるかという視点である。もうひとつは、開発されたモデルに従い、太陽光発電システムがいかに現場で財務的に健全な状況で運用されていくかという視点である。

中央レベルの財政的持続性についてであるが、MoE&P/REA は、再生可能エネルギーを用いた地方電化については、さまざまな資金源を得ながら実施している。太陽光発電については、REA は世界銀行、スペイン、フランス開発局 (French Agency for Development : AFD) といった国際ドナーからの無償・有償資金協力に大きく依存している。そのため、プロジェクトで開発した太陽光発電モデルの普及に関しても、将来の他ドナーによるプロジェクト実施状況に左右されるといってよいだろう。今後のモデル普及に関しては、プロジェクト終了前に国際ワークショップを開催し近隣国関係者に構築モデルの紹介をするとともに、プロジェクト終了後は REA の活動計画にもモデルを活用した事業の実施を盛り込むよう調整を進めている。ただし、モデルの普及・活用そのものには、その性質上、追加的な財政資源はさほど必要としない。今後の REA の事業において、モデルを活用していくことは財政的にはさほど困難ではないといえるものの、計画、住民の啓発、監理、モニタリングといった活動をモデルが示すようにきちんと行っていくためには、追加的な人的資源が必要となるため、そうした面での努力が必要になってくるだろう。

財務面での持続性に関する課題は、むしろ、中央よりも地方にあると考えられる。パイロット活動実施により、REA がこれまで考えてきた以上に太陽光発電には O&M コストが必要であることが明らかになった。プロジェクトは現在「誰が O&M コストを負担すべきか」という点について中央・地方の関係者と協議を続けているところだが、保健省、MoEST、カウンティ政府といった関係者がこの点に関して強く関与することが、O&M の適切な実施に不可欠であろう。さらに、財務省 (国庫) についても、O&M 予算が必要なことを理解し、保健省や MoEST に対して十分な予算を割り当てていく必要がある。このように、関連機関すべてが財政的に O&M にコミットし、プロジェクトが実施した 10 カ所の太陽光発電システムだけではなく、今後 REA が設置するすべての太陽光発電システムの O&M が適切に行われるならば、プロジェクトが開発したモデルは高い財政的持続性をもつことになるだろう。

## 4-2 結 論

現在のところ、プロジェクト目標の達成度は中程度であるが、未完の活動が遅滞なく効果的に実施され、また本報告書の提言にのっとりたアクションが取られれば、プロジェクト終了時の達成度は高まる見込み。

プロジェクトは、種々の効率性の低下という課題を抱えながら活動を続けてきた。今後、O&M 体制について、関係機関の理解を促進し、了解を取り付けるとともに、モデルの定着を確実なものにするよう、実効性の高い提言を提示し、C/P 機関からの承認を得る必要がある。こうした課題が解決されれば、プロジェクト目標の達成見込みは向上するだろう。

プロジェクトは、上で指摘した残された活動を残り期間で確実に実施するとともに、本報告書で示す提言に従ってアクションを取ること。プロジェクトは、予定どおり 2015 年 2 月末をもって

終了するのが妥当である。

## 第5章 提言と教訓

### 5-1 提言

#### 5-1-1 プロジェクトに対する提言（プロジェクト残り期間で取り組むべきこと）

##### (1) 運転・保守管理（O&M）モデルの確立による持続性の担保

保健省、教育科学技術省（MoEST）、カウンティ政府等と協力して、太陽光発電設備のO&Mに関する協議を継続し、体制・仕組みの整備をめざすこと。O&Mモデルへの組織的・財政的コミットメントを得るために、協議の際にはハイレベルの対話を行い、覚書（MOU）の締結をめざすべきである。

MoESTにおけるO&M体制については、例えば、中央政府と学校をリンクさせる強いファシリテーション機能をカウンティの教育事務所にもたせ、学校が太陽光発電システムの営繕に費用が必要となった場合に、即座に中央のMoESTにつないでいけるような体制の導入を提言するのも一案だろう。

また、充電サービスを行う施設では、充電ビジネスから得た現金の取り扱いや管理に関して一部、着服等のリスクが関係者より指摘されていることから、どのような管理方法が望ましいかについても議論をする必要があるだろう。

なお、O&Mモデルはカウンターパート（C/P）機関の正式な承認を得るとともに、モデルの改善を継続的に行っていく責任部署を明確化させること。

##### (2) モデルの適用可能性に関する定量分析の実施とC/Pへの情報提供

将来想定されるモデルの適用範囲、概略数量、そして将来必要となるO&Mコストを試算し、REA/MoE&Pに提供することを推奨する。また、このためには充電ステーションを設置するサイトの選定条件を明示することが必要になるため、パイロット活動で得られた知見を踏まえ、適切な条件設定を行うこと。

##### (3) 実現性の高い提言の策定

成果4を達成するため、構築されたモデルに基づいてC/Pに対して提言を行う際には、関連機関と十分な議論を実施し、実現性の高い提言を行うこと。そして、C/P及び関連機関が提言に従ったアクションを取ることができるよう、十分な理解と支援を働きかけること。今後、REAがモデルを採用した業務を行っていくことが重要である。そのため、業務完了報告書においてモデルの有用性が確認されたら、プロジェクト終了前に、REAの「年間再生エネルギー業務計画（パフォーマンス・コントラクト）」にモデルを適用する旨の記載を促すと同時に、地方電化マスタープラン（REMP）改定時にもモデルを反映させるよう働きかけること。

##### (4) C/Pの十分な参加を得た技術移転の実施

技術移転が不十分な個所を補うため、残り期間で専門家からC/Pへの知識・技術の移転を重点的に実施することが必要である。4つの技術分野すべてにおいて技術移転を推進するためには、C/Pの積極的な参加が不可欠である。例えば、来年2月に開催が予定されている国際ワークショップの準備や発表は、C/Pが中心となって行っていくこと。

(5) 指標達成状況、課題、提言の記録

評価時点では、重要なプロジェクト目標・成果指標のいくつかが未達成で、今後数カ月で達成できる見込みのものが多かった。事業完了報告書作成時（2015年2月）には、すべての指標の達成状況を明確に記載し、プロジェクトの最終的な目標・成果達成度を明示すること。加えて、残された課題に関して、C/P 機関・関連機関と十分に協議したうえで、持続性向上のための提言を行い、事業完了報告書にも同内容を記載すること。

5-1-2 C/P 機関に対する提言（中長期的に取り組むべきこと）

(1) 継続的なモデルの活用と改善

C/P 機関は、プロジェクトが提示したモデルの有効活用とモデルの継続的な改善を行うこと。また、関連省庁との調整を担当する責任者の任命を行うなど、モデルの維持発展のための体制を整備する必要がある。

(2) 継続的なガイドラインの活用と改定

小水力、バイオガス、風力技術に関しては、1年次にパイロット活動が中止になり、C/P は計画、分析、設計、設置、モニタリングといった一連のサイクルを現場で実施する機会を失った。プロジェクトは代わりに C/P に対して集中的な研修を実施し、さらに将来的に役立つガイドラインを作成しているところである。C/P は研修受講経験を生かし、今後、小水力、バイオガス、風力技術の現場でこれまで習得した知識を活用して行くべきである。そのためには、太陽光発電を含めたガイドラインの利用及び継続的な改定を行っていく必要がある。REA は、ガイドライン改定やアップデートを担当すること。

(3) REMP のデータベースの改善

サイト選定の重複等を避けるため、REMP に関するデータベースを地理情報システム (GIS) を活用して整備をし、ドナーを含む関連機関に提供すること。GIS を活用したデータベースが実現すれば、将来の開発計画に係るサイト選定が容易になるだろう。

(4) ジョモケニヤッタ農工大学 (JKUAT) とのナレッジ共有と人的交流

REA 及び MoE&P の、JKUAT とのナレッジ共有や人的交流は有益であることが明らかになった。再生可能エネルギー技術について、JKUAT と継続した交流を行うこと。プロジェクトが作成したガイドライン等の各種文書についても、JKUAT と共有し、JKUAT の研修教材として活用してもらうなどの連携が有効である。また、JKUAT で行われている太陽光発電に関する研修には、保健省、MoEST、カウンティ政府の関係者等を継続的に参加させるようにすること。

(5) 設置工事に関する基礎技術の向上

パイロット・サイトでの太陽光発電設備設置に際し、業者による屋内配線、スイッチ、ブレーカー設置といった基礎的な電気工事技術が低いことが明らかになった。そのため、担当の専門家は、工事の不具合を修正する業務に追われることとなった。専門家が不在で工事が行われた場合、設置後にさまざまな不具合やトラブルが発生する可能性が高い。基

礎的な設置工書の質を高めるためには、REA は入札図書作成の際などに適正な詳細設計を実施し、それに従って業者を監督・検査することが重要である。

## 5-2 教訓

本プロジェクトから得られた教訓は以下のとおり。

### (1) 急速に変化する状況への対応

プロジェクトでは成果の達成に遅れがみられるが、こうした遅延の多くが〔3-4-2 負の影響をもたらした要因〕で記載した理由に拠るところが大きい。内部要因・外部要因を合わせて8つの要因が、プロジェクト期間を通してプロジェクトに負の影響を与えている。プロジェクト実施者は、こうした問題に対し、プロジェクト開始前及び開始後に適切な対応策を講じ、負の影響を最小に抑えるべきだった。内部要因への具体的な対応として、プロジェクト実施中はC/Pとの共同活動時間の確保が極めて重要であり、移動時間のロスをなくすためにもプロジェクト事務所をC/Pと同じ施設内に設置したり、C/Pがプロジェクトに充当可能な時間/週を事前に確認するなど、プロジェクト開始前に最低条件を設けておくべきであった。他方、外部要因に対しては、プロジェクト開始後に始まったカウンティ制への移行やラップトップ・プログラムにおいてC/Pへの頻繁な聞き取りや情報収集を徹底することで、ラップトップ・プログラムへ本プロジェクトのモデルを適応させるなどの対応ができたであろう。また、場合によっては、活動範囲の変更や専門家派遣方法の変更を含む、思い切ったプロジェクトデザインや手法の変更を考えるべきであろう。

## 付 属 資 料

1. 主要面談者リスト
2. 署名済み M/M

## 1. 主要面談者リスト

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- ・ 出井努専門家（総括/風力発電）
- ・ 鮫島義明専門家（副総括/地方電化/小水力）
- ・ ディパック・ビスタ専門家（太陽光発電/パイロット機材調達支援・施工監理）
- ・ 北内陽子専門家（コミュニティ開発/地域社会モニタリング）
- ・ 中川由香専門家（バイオマス・バイオガス発電）
- ・ 五十嵐堅治専門家（環境社会配慮）
- ・ 若林英人専門家（財務管理計画）（質問票調査）
- ・ 下向賢専門家（業務調整/パイロット機材調達支援・施工管理補助）

### <BRIGHT プロジェクト専門家>

- ・ 大竹祐二専門家（チーフアドバイザー）

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- ・ Mr. Samson Kasanga, Assistant Director, Renewable Energy, MoE&P

### <REA>

- ・ Mr. N'gang'a Munyu, Acting Chief Executive Officer, REA
- ・ Eng. Ephantus Kamweru (Project Manager), Chief Manager, Renewable Energy Department, REA
- ・ Mr. James Muriithi, Senior Engineer, Renewable Energy Department, REA
- ・ Ms. Judith Kimeu, Assistant Engineer, Renewable Energy Department, REA (MHP)
- ・ Mr. Hannington Gochi, Senior Technician, Renewable Energy Department, REA (PV, Wind)
- ・ Mr. Anthony Wanjara, Technician, Renewable Energy Department, REA (MHP)
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- ・ Ms. Caroline Kelly, Assistant Officer, Renewable Energy Department, REA (Biogas)
- ・ Ms. Caroline Wambu, Assistant, Corporate Planning Department, REA (Finance)

### <保健省>

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- ・ Dr. Peter Okoth, Director, Narok County Health Office
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- ・ Mr. Robert Mugwery, Deputy Sub-County Public Health Officer, Narok South Sub-County
- ・ Mr. Daniel Tubei, Bio Medical Engineering Technician, Narok North Sub-County

<ナロック・カウンティ教育事務所>

- ・ Mr. Makori Anonym, County Director of Education's Office, Narok County Education Office



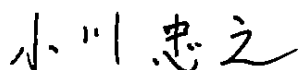
**MINUTES OF MEETINGS  
BETWEEN  
THE JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
RURAL ELECTRIFICATION AUTHORITY AND MINISTRY OF ENERGY AND  
PETROLEUM  
ON  
JAPANESE TECHNICAL COOPERATION  
FOR  
THE PROJECT FOR ESTABLISHMENT OF RURAL ELECTRIFICATION MODEL  
USING RENEWABLE ENERGY**

The Japanese Terminal Evaluation Team (hereinafter referred to as “the Team”), organized by the Japan International Cooperation Agency (hereinafter referred to as “JICA”), headed by Mr. Tadayuki Ogawa, the Senior Advisor in the field of Energy and Mining, JICA, conducted a survey from 1 to 14 October 2014 for THE PROJECT FOR ESTABLISHMENT OF RURAL ELECTRIFICATION MODEL USING RENEWABLE ENERGY (hereinafter referred to as “the Project”).

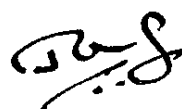
During the survey, the Team had a series of discussions with the concerned parties of the Government of the Republic of Kenya (hereinafter referred to as “the Kenyan side”), jointly evaluated the achievements of the Project, and exchanged views for further improvement of the Project.

As a result of the discussions, both the Kenyan side and the Team agreed upon the matters referred to in the Joint Terminal Evaluation Report attached hereto and agreed on taking necessary action stated under Attachment.

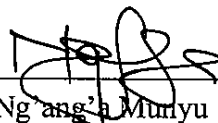
Nairobi, 14 October 2014



\_\_\_\_\_  
Mr. Tadayuki Ogawa  
Team Leader  
Terminal Evaluation Team  
Japan International Cooperation Agency (JICA)



\_\_\_\_\_  
Eng. Joseph Njoroge  
Principal Secretary  
Ministry of Energy and Petroleum (MoE&P)  
The Republic of Kenya



\_\_\_\_\_  
Mr. Ng'ang'a Muriyu  
Chief Executive Officer  
Rural Electrification Authority (REA)  
The Republic of Kenya

## ATTACHMENT

**1. Taking action in accordance with the recommendations made in the Joint Terminal Evaluation Report**

Both sides agreed to take action in accordance with the recommendations made in the Joint Terminal Evaluation Report attached in Appendix 1.

**2. Signing of Memorandum of Understanding (MoU) on Operation and Maintenance (O&M) of solar PV systems (inclusive of the 10 pilot sites of the Project)**

Both sides agreed that the REA/MoE&P shall make the best effort to sign MoU among REA/County Governments and/or MoH and REA/Ministry of Education, Science and Technology (MoEST) respectively by the end of December 2014 in order to clarify responsibilities of each party for securing necessary budget for O&M of solar PV systems.

With regard to MoEST's institutional framework for O&M, an option such as giving a stronger facilitator role to County Education Offices may be considered. The Offices could then effectively link the solar PV-installed schools and MoEST when the schools are in need of financial resources for solar PV O&M.

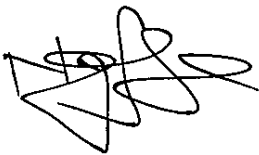
**3. Dissemination of the established models (Financial/O&M/Technical model)**

REA and MoE&P shall be responsible for managing the established models and applying them into future solar PV projects in Kenya. In case of transformation of REA into the National Electrification and Renewable Energy Authority (NERA), REA and MoE&P shall hand over the models to the newly appointed person(s)/department(s) in charge of solar PV electrification.

**4. Application of the models to the Rural Electrification Master Plan (REMP) and other related policies**

Both sides acknowledged that the established models, if deemed effective in the Project Completion Report, shall be incorporated into the Rural Electrification Master Plan (REMP) and other related policies at the time of updating. Potential scope of application of the models, number of prospective project sites and projected annual O&M cost shall also be reflected in the policies.

Appendix 1: Joint Terminal Evaluation Report



JOINT TERMINAL EVALUATION REPORT  
ON  
THE PROJECT FOR ESTABLISHMENT OF  
RURAL ELECTRIFICATION MODEL USING  
RENEWABLE ENERGY

Nairobi, 14 October 2014

Ministry of Energy and Petroleum (MoE&P)  
Rural Electrification Authority (REA)  
and  
Japan International Cooperation Agency (JICA)



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- ANNEX 6: List of Counterpart Personnel (C/P)
- ANNEX 7: List of Provided Machinery and Equipment

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### Abbreviation/ Acronyms

AFD	French Agency for Development
BRIGHT Project	Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy
C/P	Counterpart
DAC	Development Assistance Committee
DC	Direct Current
EAC	East African Community
F/S	Feasibility Study
GIS	Geographical Information System
JICA	Japan International Cooperation Agency
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KSh.	Kenya Shilling
M/M	Man Month
MHP	Micro HydroPower
MoE&P	Ministry of Energy and Petroleum
MoEST	Ministry of Education, Science and Technology
MoH	Ministry of Health
MOU	Memorandum of Understanding
O&M	Operation and Maintenance
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
OJT	On-the-Job Training
PDM	Project Design Matrix
PV	Photovoltaic
R/D	Record of Discussion
REA	Rural Electrification Authority
REMP	Rural Electrification Master Plan
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar
WG	Working Group

### Summary of Evaluation

<b>I. Outline of the Project</b>		
Country: Republic of Kenya		Project title: The Project for Establishment of Rural Electrification Model Using Renewable Energy
Issue/Sector: Energy		Cooperation scheme: Technical Cooperation Project
Division in charge: Industrial Development and Public Policy Department		Total cost: Approx. 290.1 million yen (as of March 2013)
Period of Cooperation	(R/D) October 2011 March 2012 – February 2015 (3 years)	Partner Country's Implementing Organization: Ministry of Energy and Petroleum (MoE&P), Rural Electrification Authority (REA)
		Supporting Organization in Japan: Nippon Koei etc.
Related Cooperation: Capacity Development for Promoting Rural Electrification Using Renewable Energy (BRIGHT Project) (2011-2015)		
<b>1. Background</b>		
<p>The government of Kenya has been actively working on the enhancement of electric power supply aiming for the stable and balanced economic foundation as well as poverty reduction. Ministry of Energy and Petroleum (MoE&amp;P) has been in charge of the energy sector in Kenya and the Rural Electrification Authority (REA) was established under section 66 of the Energy Act No. 12 of 2006 and became operational in July 2007. REA's mandate, vision and mission are aligned with the national development plan such as Vision 2030. Vision 2030 is designed as a vehicle for accelerating the transformation of the country into an industrialized middle income nation. To achieve this goal, electricity has been identified as one of the drivers where it is expected to achieve 100% electrification rate by 2030.</p> <p>Regarding the rural electrification, Rural Electrification Master Plan (REMP) has been prepared and updated to attain its goal; 40% of rural electrification rate by 2020 which was below 10% in 2009. Trading centers, secondary schools, health centers are prioritized as important public facilities under REMP, so the electrification rate of those facilities has improved from 10% (2003) to 89% (June, 2013). As a rolling plan of REMP, REA strategic plan has been prepared and updated every 5 years. The latest plan (REA strategic plan 2013/2014-2017/2018) as well as new energy policy by MoE&amp;P clearly states the focus on the utilization of renewable energy. Additionally, in order to promote the decentralization policy under the new constitution (2010), the function of central government is expected to focus on the national level policy formulation, while the county government will be responsible for the planning and implementation of each project.</p> <p>Therefore, both MoE&amp;P and REA recognized the need for establishment of the rural electrification model by renewable energy to meet these national demands and requested a technical cooperation to Japan International Cooperation Agency (JICA). In response to the request, The Project for Establishment of Rural Electrification Model Using Renewable Energy started in March 2012 for the three-year cooperation period.</p>		

## 2. Project Overview

### (1) Overall Goal

Rural electrification models using renewable energy are disseminated in the country to improve the quality of Kenyan's life.

### (2) Project Purpose

Rural electrification models using renewable energy are established.

### (3) Outputs

- 1) A practical model for photovoltaic (PV) electrification of health service institutions in nonelectrified areas is developed through pilot projects.
- 2) A practical model for PV electrification of schools in nonelectrified areas is developed through pilot projects.
- 3) The Capacity of REA / MoE&P to undertake project using Micro HydroPower (MHP), Biogas and Wind technologies is enhanced.
- 4) Necessary policy and institutional frameworks for rural electrification using renewable energy are recommended.

### (4) Inputs

#### Japanese side:

Short-term Expert: 11 (90.96M/M) Trainee received: 3 trainees (in Japan), 7 trainees (in Third Countries: India and Thailand)	Equipment: 2,119,484 KSh. (2.5 million yen) Local cost: 51,642,688KSh. (62.1 million yen)
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#### Kenyan side:

Counterpart personnel (C/P): 19 Land and facilities: An office space including desks, chairs, a lockable cabinet, electricity, water, drinking water and tea	Local cost: 2,360,404KSh. (2.8 million yen)
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## II. Evaluation Team

Members of Evaluation Team	The Japanese side		
	Mr. Tadayuki Ogawa	Leader/ Rural electrification	Senior Advisor, JICA
	Ms. Yuki Masuya	Evaluation planning	Energy and Mining Group, Industrial Development and Public Policy Department, JICA
	Dr. Kumiko Shuto	Evaluation analysis	Senior Consultant, IMG Inc.
	The Kenyan side		
	Ms. Judith Kimeu	Assistant Engineer, Renewable Energy Department, REA	
	Mr. Hannington Gochi	Senior Technician, Renewable Energy Department, REA	
Period of Evaluation	September 30 – October 14, 2014		Type of Evaluation: Terminal Evaluation



### III. Results of Evaluation

#### 1. Project Performance

##### 1-1. Inputs

Inputs both from the Kenyan and Japanese sides are provided basically as planned. Among the inputs provided, the distance between the project office and REA/MoE&P has caused inefficiency to a high degree. Although the number of the C/Ps increased substantially compared with the situation at the beginning, their limited availability for project activities, due to their other duties, has hampered effective technical transfer from the Experts.

##### 1-2. Outputs

###### (1) Output 1 (solar PV model at dispensaries)

Output 1 is judged to be achieved to some degree at present and many of the activities for achieving this output, such as further monitoring, synthesizing monitoring results, finalizing financial analysis, developing guidelines/user manuals and, finally, completing the models are still ongoing. Furthermore, there is still a certain level of uncertainty with regard to nationwide applicability of O&M of the solar PV systems. More efforts to ensure sustainable O&M models of the solar PV systems, particularly financial and institutional arrangements, need to be made in the remaining implementation period.

###### (2) Output 2 (solar PV model at schools)

The achievement of Output 2 is basically the same as that of Output 1. Output 2, however, has more challenges than Output 1 in terms of institutional and financial arrangements of sustainable O&M of solar PV systems since involvement of Ministry of Education, Science and Technology (MoEST) in establishing the O&M mechanism is still nascent.

###### (3) Output 3 (capacity development on MHP, biogas and wind technologies)

Output 3 is expected to be achieved to some degree if the ongoing activities, such as the preparation of guidelines and documentation/ presentation of Simple Pre- Feasibility Study (F/S), are completed as planned. Since the pilot projects for Output 3 were cancelled toward the end of the first year of the project period, most of the C/Ps had little chance to practice what they have learned in trainings. The C/Ps' more active participation is needed in the ongoing activities for Output 3 so that their practical knowledge will improve in the remaining project period.

###### (3) Output 4 (recommendation on policy and institutional frameworks)

Output 4 is expected to be achieved to a relatively high degree if the remaining activities, such as holding the International Workshop and proposition of recommendations are completed as planned. On the other hand, whether or not the Project can present truly effective and realistic recommendations depends largely on successful production of Output 1 through 3. The Experts are now preparing

recommendations based on findings from the three Outputs. Close discussions with the C/P institutions need to be undertaken in order to produce truly useful recommendations.

#### 1-3. Achievement of Project Purpose

The Project Purpose is achieved to some degree at present. If unfinished activities are conducted successfully, the achievement level is expected to be relatively high at the end of the project period. Successful completion of all the activities for the four Outputs with full participation from the C/Ps is required to attain a high level of achievement.

#### 1-4. Implementation process

##### <Positive factors>

##### (1) Collaboration with JKUAT and the BRIGHT Project

The C/Ps and staff of County Offices of the MoH have been attending and/or making presentations at various seminars and trainings organized by the JKUAT and/or JICA's technical cooperation project "The Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy (the BRIGHT Project)". Such collaboration with JKUAT and the BRIGHT Project is contributing to raising efficiency of the Project.

##### <Challenges>

##### (1) Demanding work volume of the C/Ps

Demanding work volume of the C/Ps outside the Project, such as work for diesel power generation, has been impeding effective and efficient technical transfer from the Experts to C/Ps. In particular, the C/Ps have been having a hard time finding time to go to the pilot sites (for Output 1 and 2) and pre F/S sites (for Output 3). Hence much of the field activities, particularly activities for Output 1 and 2, have been conducted by the Expert Team alone, without much participation from the C/Ps.

##### (2) Inconvenient location of the project office

The project office is located far from REA/ MoE&P, making the Experts and C/Ps difficult to see each other in person. This physical distance inhibits smooth project operation to a significant degree.

##### (3) Effects of rapid grid extension in Kenya

REA has been vigorously extending electrical grids to non-electrified areas in Kenya. The sites extended by grid, by nature, often overlap with the Project's potential and existing solar PV pilot sites. In fact, the Project had to re-select the pilot sites for Lot 2 several times since it became apparent the area would be soon covered by grid extension plans. It took much longer time for the Project to finalize its selection of the pilot sites, particularly for Lot 2.

(4) Time spent for planning collaboration with UNIDO

In the first year of the Project, the Project Team spent about nine months planning the details of collaboration with UNIDO. The collaboration was planned to facilitate pilot activities of MHP, biogas and wind power, which was for Output 3. However, after research, it was realized that such collaboration would not be effective and a decision was made to cancel the plan. The Project had to modify the plan for Output 3 substantially and the time spent for planning since the commencement of the Project was wasted to a large extent.

(5) Transition to the County System in Kenya

Kenya has seen a transition to the County System in the last few years. The roles and responsibilities of the central government and county governments dramatically changed particularly in mid to late 2013 (for Output 1). This change has caused the Project to spend a lot time for coordination with both national and sub-national stakeholders with regard to the O&M of the pilot solar PV systems.

(6) Poor performance of solar PV systems installers contracted by the Project

The level of skills and techniques of local solar PV systems installers contracted by the Project was much lower than anticipated. The solar PV systems at the pilot sites are facing repeated technical and mechanical troubles which need to be rectified frequently by the Project. The Project Team has to spend such a long time shooting troubles in the fields that some of the work that needs to be done in Nairobi is being delayed.

(7) Remoteness of the pilot sites of Lot 2

The Project had to select pilot sites for Lot 2 which were far in the distance from Nairobi because there was no other choice. The selection was appropriate considering typical areas where off-grid electrification systems operate. However, the sites have security issues and require a long travel time. It is not possible for the Experts and C/Ps to visit the sites often within the limited timeframe of the Project, which in turn hampers technical transfer activities for Output 1 and 2.

(8) Heavy workload of the C/Ps for the Laptop Program

The C/Ps' work volume for the Kenyan Government's Laptop Program has become increasingly large since around April 2014. The time they can spend for project activities has become even less than before.

**2. Summary of Evaluation Results**

(I) Relevance

Relevance is relatively high. The project is well aligned with Kenya's development priority as well as with Japan's ODA policy towards Kenya. The project is also appropriately responding to the needs of

the target group, especially the needs of those public facilities in nonelectrified areas by mobilizing Japan's comparative advantage of expertise in renewable energy, community participation, O&M, and business analysis. On the other hand, Kenya has been seeing rapid grid extension in recent years and some of the sites selected for the pilot project have become covered by such an extension. Such a situation could have been avoided if strategic and systematic planning on rural electrification had been in place at REA/MoE&P before the commencement of the Project.

#### (2) Effectiveness

Effectiveness is fair at present. Although the project purpose is expected to be achieved to a relatively high degree by the end of the planned period, there is still uncertainty regarding the achievements of all the Outputs, from Output 1 through 4. If ongoing activities are completed smoothly and effectively and the concerned institutions take action in accordance with the recommendations to the Project specified in this report, effectiveness is expected to be higher at the completion of the Project.

#### (3) Efficiency

Efficiency is fair. Inputs from both Japanese and Kenyan sides are basically provided as planned. However, the C/Ps, having many other duties, are not able to spend sufficient amount of time for project activities especially before the Mid-term Review, hence lowering the level of technical transfer from the Experts to the C/Ps. The plan for pilot projects at industrial facilities was cancelled in the first year and it took time to rearrange the project framework. Various key activities were delayed due to reasons such as solar PV pilot site re-identification to avoid grid extension, system troubles at solar PV systems and Lot 2 being in a remote area. Furthermore, Kenya's transition to the County System around mid-2013 required time to identify stakeholders and their roles and responsibilities regarding O&M of solar PV systems. On the other hand, collaboration with the JKUAT and BRIGHT Project is contributing to raised efficiency to a certain extent.

#### (4) Impact

Impact is fair. The achievement level of the Overall Goal will largely depend on that of the Project Purpose. It will also depend on the practicality and replicability of the electrification models to be finalized in the remaining project period. Since there is a certain level of uncertainty regarding the achievement of the Project Purpose at the moment, the Overall Goal is also subject to uncertainty. Positive impacts of the Project are: (1) Stakeholders of renewable energy technologies increased their awareness regarding the high O&M cost and (2) It is likely that REA will discuss O&M issues with potential facility owners/users in future implementation of systems instalment. There are also impacts at the community-level which improved daily lives of the community members after the installation of solar PV systems at the pilot sites. For instance, personal security of female pupils and staff has

improved with lighting at evening and night time. The community members, particularly women and children, are now enjoying improved public health services such as being provided better care during deliveries at night and getting immunizations at local dispensaries. On the other hand, REA could not adopt some specifications suggested by the Project regarding the solar PV systems design for the Laptop Program due to time constraints, which, if realized, would have been a remarkable impact affecting as many as 3,000 primary schools in Kenya.

**(5) Sustainability**

Sustainability is fair. Presently, the level of policy and institutional sustainability is difficult to judge since REA is planned to be transformed into the National Electrification and Renewable Energy Authority (NERA). However, if the suggestions from the Project are incorporated into the current policies on renewable energy in future, policy sustainability will be high. The roles and responsibilities regarding the O&M of solar PV systems need to be further clarified and ensured among the national and county governments for better institutional sustainability. Technical sustainability is facing challenges because the C/Ps' practical skills have room for improvement compared with their theoretical knowledge in all four renewable energy technologies. Financial sustainability also needs to be improved, particularly for the appropriate O&M of solar PV systems, since the governments' budgets for pushing forward model dissemination is yet to be secured.

**3. Factors that promoted realization of effects**

(1) Factors concerning the planning

N/A

(2) Factors concerning the implementation process

N/A

**4. Factors that impeded realization of effects**

(1) Factors concerning the planning

N/A

(2) Factors concerning the implementation process

All the negative factors listed in "1-4. Implementation process" have impeded realization of effects in some way or other throughout the project period.

**5. Conclusion**

At the time of the Terminal Evaluation, the achievement level of the Project Purpose was fair.

However, the achievement level will be higher if the remaining activities are completed successfully without delay in the remaining project period and appropriate action is taken in accordance with the recommendations proposed in this report.

The Project Team has been conducting planned activities despite the challenges of multiple adversities which contributed to lowering efficiency. There are still many issues to be addressed in the remaining implementation period until the Project can present practical and sustainable models. In particular, presenting optimal O&M mechanisms of solar PV systems requires obtaining understandings and agreement from relevant organizations. The Project will then need to give effective recommendations to C/P organizations, which should be authorized and endorsed, so that the models will take root at the C/P organizations. If these issues are addressed properly, the achievement level of the Project Purpose will be much higher.

The Project is advised to take action explained above as well as to follow recommendations presented in the next section. The Project should be completed in February 2015 as originally planned.

## **6. Recommendations**

### **Recommendation to the Project (To be addressed in the remaining project period)**

#### **(1) Ensuring sustainability by establishing the O&M models**

The Project should continue discussing the O&M models of solar PV systems with relevant institutions including MoH, MoEST, county governments and so forth so as to ensure sustainability of the solar PV systems. Having high-level dialogues and then entering into MOUs with relevant institutions is strongly recommended since it would officially promise institutional and financial commitment to the O&M models. Providing quantitative data on projected annual O&M cost, both total and itemized, by the Project to the prospective signees of the MOUs would facilitate informed decision-making at the signees' sides.

With regard to MoEST's institutional framework for O&M, an option such as giving a stronger facilitator role to County Education Offices is to be considered. The Offices could then effectively link the solar PV-installed schools and MoEST when the schools are in need of financial resources for solar PV O&M.

Furthermore, appropriate management and handling of cash generated from the battery charging business needs to be discussed in order to prevent possible misconduct at the facilities.

The proposed O&M models, on the other hand, should be authorized by the C/P organizations. Departments/persons responsible for continuous improvement of the models should also be identified and appointed.

#### **(2) Conducting and presenting a quantitative analysis on applicability of the models**

A quantitative analysis on applicability of the proposed models is recommended to be conducted and

presented to REA/MoE&P. It is beneficial for the C/P organizations to be equipped with quantitative information on, but not limited to, (1) a projected scope of applicability of the proposed models to their future rural electrification plans, (2) the estimated number of applicable cases, and (3) required O&M costs. When conducting the quantitative analysis, site-selection criteria for battery charging stations need to be clarified also. Thus, the Project is advised to build upon its knowledge acquired through its experience on the pilot activities and propose most appropriate criteria.

(3) Formulating realistic policy recommendations

In order to complete the work for Output 4, which is about proposing recommendations on policy and institutional frameworks for rural electrification using renewable energy, the Project is advised to have close dialogues with relevant institutions regarding the proposed solar PV models. The Project, then, should formulate realistic policy recommendations and garner support for their implementation by the concerned institutions. It is important to facilitate active adoption of the proposed models by REA in future. Therefore, if the models are deemed effective in the Project Completion Report, application of the models is advised to be specified in REA's "Annual Renewable Energy Work Programme (Performance Contract)" as well as in Rural Electrification Master Plan (REMP) at the time of updating. The Project and REA are encouraged to work on this issue before the Project terminates.

(4) Working on intensive technical transfer with strong participation from the C/Ps

In order to fill the knowledge/skills gap, it is advised that the technical transfer from the Experts to C/Ps be undertaken actively during the remaining project period. Strong participation from the C/Ps in such activities is key for attaining satisfactory levels of technical transfer in each field of renewable energy technology. The C/Ps' participation includes, but not limited to, preparation and presentation of papers for the International Workshop to be held in February next year.

(5) Recording the achievements of the Objectively Verifiable Indicators, challenges and recommendations

At the time of the Terminal Evaluation, some of the key Objectively Verifiable Indicators in PDM have not reached their targets. They are expected to be attained in the next few months as the Project progresses. When writing the Project Completion Report to be submitted in February 2015, the achievement levels of those indicators should be clearly written so that an objective judgment of project performance can be made easily. Furthermore, remaining challenges and measures to be taken for raising sustainability should be discussed with the C/P and other related organizations and the results of the discussions should be delineated in the Project Completion Report.

**Recommendation to the C/P institutions (To be addressed as medium- to long-term measures)**

(1) Utilizing and improving the proposed models continuously

The C/P organizations are recommended to continue utilizing and improving the solar PV models proposed by the Project. Assignment of the departments/persons responsible for the coordination with relevant institutions is also recommended to make an institutional effort to improve the models.

(2) Utilizing and revising the guidelines continuously

As for MHP, biogas and wind technologies, pilot project implementation was cancelled in the first year of the project period. Thus, the C/Ps did not have a chance to experience the whole cycle of planning, analysis, system designing, installation and monitoring which are necessary for carrying out activities on the ground. The Project, instead, gave intensive training to the C/Ps and guidelines are being developed for future use. It is strongly recommended that the C/Ps will build on their training experience in the Project and leverage their increased knowledge in actual implementation of MHP, biogas and wind technologies in the field. In doing so, utilizing and revising the guidelines, including one on solar PV systems, should be conducted continuously. REA should be responsible for revising and updating the guidelines.

(3) Improving database on the Rural Electrification Master Plan (REMP)

Current database for the REMP needs to be improved making use of Geographical Information System (GIS). The improvement will help relevant organizations including development partners avoid duplication or overlap of future project sites. It will also facilitate easier decision-making concerning locations of future development.

(4) Exchanging knowledge and human resources with JKUAT

REA's and MoE&P's knowledge sharing and exchange with JKUAT have been proved to be beneficial. Continuous exchange of knowledge and human resources with JKUAT is advisable for strengthening capacity on renewable energy technology at REA and MoE&P. Such knowledge exchange includes, but not limited to, sharing REA's guidelines and other documents produced by the Project so that JKUAT can utilize them in their training courses. With regard to JKUAT's trainings on solar PV systems, regular attendance to such trainings by MoH, MoEST, and County Governments should be ensured.

(5) Improving basic skills for installation work of electrical facilities

It has been observed that the quality of basic installation work for wiring, switches, breakers, etc. was rather low. Thus, the responsible Expert became fully occupied with fixing those poor installations. Without the supervision of the Experts, most solar PV systems installed by local contractors may soon experience faults and malfunctions. In order to improve the quality of basic installation works, it is important for REA to compile detailed appropriate designs and rigorously supervise/ inspect the



contractors' job accordingly.

#### **7. Lessons learnt**

##### **(1) Taking appropriate measures to minimize negative factors before and during the Project**

There is no doubt that the current delay in producing sufficient outputs is largely attributable to many negative factors. There are as many as eight factors, both internal and external, which have been negatively influencing the Project throughout the implementation period. The project implementers should have made more efforts to identify and tackle these critical issues both before and during the project period so that unfavourable ramifications would be minimized. In some cases, drastic modifications on project design and modalities, including revision in project scope and change in the mode of expert dispatch, to name a few, could have been considered so as to best address major issues.



## 1. Introduction

### 1.1. Objective of the evaluation study

Two and a half years have passed since the inception of the Project for Establishment of Rural Electrification Model Using Renewable Energy (hereinafter referred to as "Project"). The Project is scheduled to be completed in six months, i.e. in February 2015. The Project Team has been undertaking a range of activities in order to achieve the project purpose. It is important for the concerned authorities to review its progress made thus far and to examine to what extent the activities have led to producing expected outputs, thereby leading to the attainment of the project purpose. The examination will make it possible to judge the level of Project's success. It will also predict how much the Project is likely to achieve the overall goal several years after the project period.

The purpose of the terminal evaluation is to objectively evaluate the level of success of the Project and to identify the reasons behind it. Based on the results of the evaluation, the study is to give suggestions and recommendations to the concerned organizations with the aim of providing lessons learnt which will be useful for future direction of the Project and also for similar projects.

### 1.2. Members of the evaluation team

The study team is composed of the following personnel.

Japanese side:

Mr. Tadayuki Ogawa	Leader of the Japanese Evaluation Team/ Rural electrification	Senior Advisor, JICA
Ms. Yuki Masuya	Evaluation planning	Energy and Mining Group, Industrial Development and Public Policy Department, JICA
Dr. Kumiko Shuto	Evaluation analysis	Senior consultant, IMG Inc.

Kenyan side:

Ms. Judith Kimeu	Evaluator	Assistant Engineer, Renewable Energy Department, REA
Mr. Hannington Gochi	Evaluator	Senior Technician, Renewable Energy Department, REA

### 1.3. Schedule of the study

The evaluation team started a literature review in September 2014. Subsequently, the field study in Kenya was conducted from October 1 to 15, 2014. For detailed study schedule in Kenya, refer to ANNEX 1

## 2. Outline of the project

### 2.1. Background of the project

The government of Kenya has been actively working on the enhancement of electric power supply

aiming for the stable and balanced economic foundation as well as poverty reduction. Ministry of Energy and Petroleum (MoE&P) has been in charge of the energy sector in Kenya and the Rural Electrification Authority (REA) was established under section 66 of the Energy Act No. 12 of 2006 and became operational in July 2007. REA's mandate, vision and mission are aligned with the national development plan such as Vision 2030. Vision 2030 is designed as a vehicle for accelerating the transformation of the country into an industrialized middle income nation. To achieve this goal, electricity has been identified as one of the drivers where it is expected to achieve 100% electrification rate by 2030.

Regarding the rural electrification, Rural Electrification Master Plan (REMP) has been prepared and updated to attain its goal; 40% of rural electrification rate by 2020 which was below 10% in 2009. Trading centers, secondary schools, health centers are prioritized as important public facilities under REMP, so the electrification rate of those facilities has improved from 10% (2003) to 89% (June, 2013). As a rolling plan of REMP, REA strategic plan has been prepared and updated every 5 years. The latest plan (REA strategic plan 2013/2014-2017/2018) as well as new energy policy by MoE&P clearly states the focus on the utilization of renewable energy. Additionally, in order to promote the decentralization policy under the new constitution (2010), the function of central government is expected to focus on the national level policy formulation, while the county government will be responsible for the planning and implementation of each project.

Therefore, both MoE&P and REA recognized the need for establishment of the rural electrification model by renewable energy to meet these national demands and requested a technical cooperation to Japan International Cooperation Agency (JICA). In response to the request, The Project for Establishment of Rural Electrification Model Using Renewable Energy started in March 2012 for the three-year cooperation period.

## 2.2. Summary of the project

The Project Design Matrix (PDM) Version 3.1 (ANNEX 2), which is used currently by the Project, specifies the narrative summary of the Project as follows:

### (1) Overall Goal

Rural electrification models using renewable energy are disseminated in the country to improve the quality of Kenyan's life.

### (2) Project Purpose

Rural electrification models using renewable energy are established.

### (3) Outputs



- 1) A practical model for photovoltaic (PV) electrification of health service institutions in nonelectrified areas is developed through pilot projects
- 2) A practical model for PV electrification of schools in nonelectrified areas is developed through pilot projects.
- 3) The Capacity of REA / MoE&P to undertake project using MHP, Biogas and Wind technologies is enhanced.
- 4) Necessary policy and institutional frameworks for rural electrification using renewable energy are recommended.

(4) Activities

For Preparation

1. Set up a Working Group (WG) consisting of 3 sub-groups for Outputs 1, 2 and 3, with clarified roles and functions of the counterpart personnel.

For all Outputs

1. A weekly project status report is prepared and shared by both C/Ps and JICA Experts (JEs).
2. Monthly project meeting is held by REA.
3. Progress report is prepared by JEs including the progress summary table according to PDM to monitor and report the progress of indicators to achieve outputs.

For Output 1 (The health service institution model)

1-1 National Level

- 1-1-1 Review policies, studies, surveys and projects related to electrification of health service institutions using Solar PV.
- 1-1-2 Organize a progress and information sharing meetings with REA, MoE&P, and Ministry of Health (MoH) at least twice to discuss on model establishment and dissemination at national level.
- 1-1-3 Prepare policy recommendations with institutional framework to promote the health institution model(s).
- 1-1-4 Prepare a proposal for the disposal of solar panels, batteries and toxic materials according to the current conditions and regulations.

1-2 County/Sub-county Level

- 1-2-1 Account book and cash flow statement are submitted to County Medical Officer(s) of the project sites at least twice for Lot 1 and once for Lot 2.
- 1-2-2 Operation and Maintenance (O&M) reports are submitted to County Medical Officer(s) twice for Lot1 and once for Lot 2.
- 1-2-3 Organize a progress and information sharing meetings with REA, MoE&P (monitoring team members), and County and Sub-county medical officers at least twice to discuss on

model establishment and dissemination at County/Sub-county level.

1-2-4 Conduct the baseline survey at the target facilities and surrounding communities

1-2-5 Conduct capacity & needs assessment of County/Sub-county medical officers in terms of renewable energy utilization and dissemination.

1-3 Local/Institutional Level

1-3-1 Conduct capacity & needs assessment of target communities and other stakeholders.

1-3-2 Sustainable financial plan is prepared.

1-3-3 Sufficient financial trainings for the operator of charging center, staff of health institution, and members of management committee are provided through lectures and on-the-job training (OJT).

1-3-4 The operator of the charging center accurately records daily sale.

1-3-5 Assigned nurse, a treasurer and a chairperson of the management committee accurately records an account book and cash flow statement.

1-3-6 Assigned nurse and a chairperson of the management committee prepare O&M reports.

1-3-7 Identify and manage to obtain agreement with the agencies and/or organization to provide

financial support to sustain the model according to the income by battery charging system.

1-3-8 Prepare detailed plans of the pilot projects including “System design” and “Sustainable O&M” with staff of REA and MoE&P through OJT.

1-3-9 Organize a stakeholder meeting with the members of management committee and owners of facility to discuss on operation and maintenance at least once for each pilot facility.

1-3-10 Organize an information sharing meeting with users of pilot facility and County/Sub-county medical officer(s) at least once for each pilot facility.

1-3-11 Organize an evaluation meeting with the members of management committee and owners and users of facility, County and Sub-county medical officers at the end of the project period at least once for each pilot facility.

For Output 2 (School model)

2-1 National Level

2-1-1 Review policies, studies, surveys and projects related to electrification of schools using Solar PV.

2-1-2 Organize a progress and information sharing meetings with REA, MoE&P, and Ministry of Education, Science and Technology (MoEST) at least twice to discuss on model establishment and dissemination at national level.

2-1-3 Prepare policy recommendations with institutional framework to promote the school model(s).

2-1-4 Prepare a proposal for the disposal of solar panels, batteries and toxic materials according to the current conditions and regulations.

2-2 County/Sub-county Level

2-2-1 Account book and cash flow statement are submitted to County Education Officer(s) of the project sites at least twice for Lot 1 and once for Lot 2.

2-2-2 O&M reports are submitted to County Education Officer(s) twice for Lot1 and once for Lot 2.

2-2-3 Organize a progress and information sharing meetings with REA, MoE&P (monitoring team members), and County and Sub-county education officers at least twice to discuss on model establishment and dissemination at County/Sub-county level.

2-2-4 Conduct the baseline survey at the target facilities and surrounding communities

2-2-5 Conduct capacity & needs assessment of County/Sub-county education officers in terms of renewable energy utilization.

2-3 Local/Institutional Level

2-3-1 Conduct capacity & needs assessment of target communities and stakeholders.

2-3-2 Sustainable financial plan is prepared.

2-3-3 Sufficient financial trainings for the operator of charging center, staff of school, and members of management committee are provided.

2-3-4 The operator of the charging center accurately records daily sale.

2-3-5 Head teacher, a treasurer and a chairperson of the management committee accurately record an account book and cash flow statement.

2-3-6 Head teacher and a chairperson of the management committee prepare O&M reports.

2-3-7 Identify and manage to obtain agreement with the agencies and/or organization to provide financial support to sustain the model according to the income by battery charging system.

2-3-8 Prepare detailed plans of the pilot projects including “System design” and “Sustainable O&M” with staff of REA and MoE&P through OJT.

2-3-9 Organize a stakeholder meeting with the members of management committee and owners of facility to discuss on operation and maintenance at least once for each pilot facility.

2-3-10 Organize an information sharing meeting for the users of the pilot facility and County and Sub-county education officer(s) at least once for each pilot facility.

2-3-11 Organize an evaluation meeting with the members of management committee and owners and users of facility, County and Sub-county education officers at the end of the project period at least once for each pilot facility.

For Output 3 (MHP, Biogas and Wind)



- 3-1. Conduct inventory and review of existing studies on MHP, Biogas and Wind.
- 3-2. Prepare guidelines for rural electrification using renewable energy (MHP, Biogas, Wind) according to the contents of the technical trainings in terms of planning, design, procurement, monitoring and maintenance.
- 3-3. Conduct technical training for REA / MoE&P staff on MHP, Biogas and Wind.
- 3-4. Carry out simple pre-feasibility study focusing on technical examination for MHP, Biogas and Wind.
- 3-5. Prepare technical recommendation for rural electrification using MHP, Biogas and Wind.
- 3-6. Collect necessary data and equipment for technical trainings and development of the guidelines.
- 3-7. Hold workshops for stake holders to validate guidelines on MHP, Biogas and Wind.

For Output 4 (Policy recommendations)

- 4-1 Implement and monitor the preparation activities of policy recommendations of Output 1,2 and 3.
- 4-2 Organize workshop(s) on rural electrification models using renewable energy and/or present the results of the project by C/Ps at the domestic or international conference for information sharing with other stakeholders and donors in the energy sector of Kenya and East Africa.
- 4-3 Compile policy recommendations.
- 4-4 Initiate and strengthen the concept of Academic-Private Sector Platform in collaboration with JICA Experts of “the Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy.”

### **3. Method of evaluation**

#### **3.1. Five evaluation criteria**

The JICA adopted “the Five Evaluation Criteria” for project evaluation. The Five Evaluation Criteria, proposed by the Development Assistance Committee (DAC) at the Organization for Economic Cooperation and Development (OECD) in 1991, are meant to be used for evaluating development assistance activities. The five criteria are namely:

- 1) Relevance: A criterion for considering the validity and necessity of a project regarding whether the expected effects of a project (or project purpose and overall goal) meet with the needs of target beneficiaries; whether a project intervention is appropriate as a solution for problems concerned; whether the contents of a project is consistent with policies; whether project strategies and approaches are relevant, and whether a project is justified to be implemented with public funds of Official Development Assistance (ODA).
- 2) Effectiveness: A criterion for considering whether the implementation of project has benefited (or





will benefit) the intended beneficiaries or the target society.

3) Efficiency: A criterion for considering how economic resource/inputs are converted to results. The main focus is on the relationship between project cost and effects.

4) Impact\*: A criterion for considering the effects of the project with an eye on the longer term effects including direct or indirect, positive or negative, intended or unintended, and

5) Sustainability\*: A criterion for considering whether produced effects continue after the termination of the assistance.

\* Since the terminal evaluation study is conducted before the project has finished, these two criteria, impact and sustainability, are based on prospect rather than actual achievement.

By examining the Project's progress and achievement by using these five criteria, the evaluation study ascertains the value of the project from different viewpoints. It attempts to assess performance, make a value judgment about the project, and make recommendations and draw lessons learnt.

The structure of the report is two-fold: (1) the confirmation of achievements and (2) the evaluation results based on the five evaluation criteria.

### 3.2. Data collection methods and analysis

The study team has collected both quantitative and qualitative data relevant to the Project from a range of information sources by using multiple information-gathering methods (Table 1). This approach enables the study team to undertake triangulation of methods and information sources, thereby ensuring reliability of the study. The focus of the study is on the collection and analysis of both qualitative and quantitative data. Since the main purpose of the study is to make an in-depth analysis of hindering and contributing factors to project implementation, if any, and to understand reasons for having such factors, the analysis of qualitative data was particularly underscored. Thus, research methods adopted for the fieldwork period mainly centered on the qualitative data collection method including in-depth interviews, observation, and questionnaires with many open-ended questions.

The study team formulated the Evaluation Grid (ANNEX 3) based on PDM Version 3.1 to clarify data collection methods, the types of data to be collected and their sources of information. The following table summarizes methods used and information sources the study team accessed during the study period.

Table 1 Data collection methods and source of information

Data collection method	Source of information
Literature/document review	Various project documents and reports written by experts, meeting minutes and other documents



Questionnaires	Project Experts and counterpart personnel (C/P)
Interviews	Project Experts, C/Ps and staff of other related organizations
Observation and interviews	Site Visit to Lot 1 sites: Iltumtum Primary School and Olkinyei Dispensary in Narok County and Irakilinyeti Dispensary in Kajiado County

Review of literature/documents had been undertaken before the Japanese study team visited Kenya. The main purpose of the literature/document review was to understand the level of the project performance and to examine the implementation process. At the same time, questionnaires were prepared for the Project Experts and Kenyan C/Ps. After the Japanese evaluation team arrived in Kenya, in-depth interviews were conducted with key informants such as the C/Ps, Project Experts, and staff of relevant organizations including development partners. The interviews were to supplement information gathered by the literature review and the questionnaire survey.

The evaluation team also observed project activities as they occurred in a natural setting and undertook interviews at several pilot sites: Iltumtum Primary School and Olkinyei Dispensary in Narok County and Irakilinyeti Dispensary in Kajiado County. The information generated by these methods was then analyzed based on the five evaluation criteria.

### 3.3. Limits and constraints of the study

Due to time and resource constraints, it was not possible to interview all the Experts and Kenyan C/Ps who were involved in project implementation. It was not possible to visit all the pilot sites either. Efforts were made, however, to gather the information by literature review or by interviewing other personnel in a similar field so as to reduce possible sample biases. The study team was able to gather data from the majority of the personnel directly and actively involved in project implementation. Therefore, it is reasonably said that the information collected within the evaluation framework maintains a substantial level of reliability and validity.

## 4. Project performance and implementation process

### 4.1. Inputs from Japan

#### 4.1.1. Dispatch of Project Experts

A total of 11 positions of short-term experts such as Team Leader, Rural Electrification, Photovoltaic Power Generation, Wind Power Generation, Micro-Hydropower, Biomass/gas Power Generation, Financial Management, Socio-economic Survey, Community Mobilization, Environment and Social Consideration, etc. have been dispatched since the commencement of the Project. The total Man/Month spent is 90.96.

For more detailed information on the dispatch of the Experts, see "ANNEX 4: List of Project Experts".

#### 4.1.2. Training of C/Ps in Japan and in Third Countries

Three C/Ps participated in the training in Japan and seven C/Ps attended training in third countries, namely, India and Thailand. For the details on the training courses, see “ANNEX 5: List of Counterpart Training in Japan and Third Countries”.

#### 4.1.3. Machinery and equipment provided by Japan

Equipment and machinery including a current meter, satellite phone, computers, photocopiers, etc. which are worth 2,119,484 Kenyan Shillings (approx. 2.5 million yen) in total, has been provided. They are generally in good condition and being used on a daily basis. For the details of the items provided, see “ANNEX 6: List of Provided Machinery and Equipment”.

#### 4.1.4. Local cost borne by Japan

By the end of the third year of project implementation, a total of 51,642,688 Kenyan Shillings (approx. 62.1 million yen) has been disbursed by the Japanese side for daily project operation (Table 2).

Table 2 Local cost borne by Japan

	1 <sup>st</sup> Year (FY 2012)	2 <sup>nd</sup> Year (FY 2013)	3 <sup>rd</sup> Year (FY 2014) <sup>1</sup>	3 <sup>rd</sup> Year (FY 2014) <sup>2</sup>	Total
Salary and Allowances	5,751,215	5,890,252	3,576,895	3,220,000	18,438,362
Vehicle related expenses (fuel, Maintenance, etc.)	3,217,107	6,861,977	4,543,732	3,350,000	17,972,816
Rent-a-car and Taxi	1,510,86	2,483,163	1,710,700	1,150,000	6,854,723
Office Airtime , Internet	354,293	399,470	273,040	150,000	1,176,803
Meeting (Workshop and Seminars)	6,150	87,850	0	580,000	674,000
Consumables	899,425	560,795	60,170	290,000	1,810,390
C/P Travel Expenses	0	0	0	560,000	560,000
Overseas Training	997,000	1,531,760	1,215,000	0	3,743,760
Printing for book Binding Report Making (Outside Office)	1,564	55,000	33,030	132,000	221,594
Equipment Maintenance	0	95,120	95,120	0	190,240
<b>Total</b>	<b>12,737,614</b>	<b>17,965,387</b>	<b>11,507,687</b>	<b>9,432,000</b>	<b>51,642,688</b>

(unit: KSh.)

## 4.2. Inputs from Kenya

### 4.2.1. Assignment of C/Ps

A total of 19 staff members of REA and MoE&P have been working as the C/Ps and receiving technical transfer from the Experts. This number is a substantial increase from nine in April 2012 when the Project started. While all of them are in possession of sufficient ability to undertake project activities, many of the C/Ps are overloaded with various other duties at REA or MoE&P and timely execution of some of the activities are challenging at many occasions.

<sup>1</sup> Up to August.

<sup>2</sup> After September. Planned amount, not actual amount.

For more detail see “ANNEX 7: List of Counterpart Personnel”.

#### 4.2.2. Local cost borne by Kenya

The Kenya Government shares the cost of project implementation, which amounts to 2,360,404 Kenyan Shillings (approx. 2.8 million yen) since the inception of the Project (Table 3).

Table 3 Local cost borne by Kenya

	(unit: KSh.)			
	FY 2012	FY 2013	FY 2014	Total
International Per Diem (Overseas Training)	574,980 <sup>3</sup>	736,690 <sup>4</sup>	962,984 <sup>5</sup>	2,274,654 <sup>6</sup>
Domestic Per Diem	2,250	45,250	38,250	85,750
<b>Total</b>	<b>577,230</b>	<b>781,940</b>	<b>1,001,234</b>	<b>2,360,404</b>

#### 4.2.3. Facilities provided by Kenya

An office space including desks, chairs, a lockable cabinet, electricity, water, drinking water and tea have been provided for the Project Experts. The location of the project office, however, is far from REA/MoE&P and the long distance, coupled with heavy traffic in Nairobi, is preventing easy travel between the project office and C/P offices.

#### 4.3. Achievement of outputs

##### 4.3.1. Output 1

Output 1 is “A practical model for PV electrification of health service institutions in nonelectrified areas is developed through pilot projects.” Table 4 indicates the achievement of each Objectively Verifiable Indicator specified in PDM version 3.1.

Table 4 Achievements of Objectively Verifiable Indicators for Output I

Objectively Verifiable Indicator	Achievement
0. All level	0-0
0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member.	Lot 1: 3 times 2 time, Ilkilnyeti: financial training 1 time, Olkinyeti: monitoring Lot 2: 1 time 1 time to 3 dispensary: baseline survey
0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&P are provided based on their Objective & Achievement Sheet through on-the-job Training (OJT).	0-1 Lot 1: 5 times Lot 2: 1 time
0-2 At least 3 monitoring team members achieve their	0-2.

<sup>3</sup> USD6,845 was the actual expense.

<sup>4</sup> USD8,720 was the actual expense.

<sup>5</sup> USD11,145 was the actual expense.

<sup>6</sup> USD26,710 was the actual expense.

<p>objectives through trainings. Achievements are confirmed by trainee's self-assessment and evaluation by Project Experts (JEs).</p> <p>0-3 PV electrification, operation and maintenance manual for health service institutions with battery charging business is prepared for C/Ps including user manual and accounting manual.</p> <p>0-4 At least 2 people from health institution and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&amp;M of PV facilities including disposal of solar panels, batteries and toxic materials.</p> <p>1. National Level 1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the model.</p> <p>1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.</p> <p>2. County/Sub-county Level 2-1 Collaboration among C/Ps, County and Sub-county medical officers is initiated and maintained to support the establishment, operation and maintenance of the model.</p> <p>3. Local/Institutional Level 3-1. The target health institutions secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</p> <p>3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is conformed through monitoring.</p> <p>3-3. Awareness raising activities on installed solar PV system at target health institutions and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.</p>	<p>Objective &amp; Achievement test are not carryout yet (It will be conducted around November 2014)</p> <p>0-3. Draft Guideline (Manual) and user manual were prepared. It will be finalized in January 2015.</p> <p>0-4. Lot 1: Olkinyei O&amp;M1: 7 people, O&amp;M2: 15 people Ilkilnyeti O&amp;M1: 5 people, O&amp;M2: 10 people, O&amp;M3: 5 people</p> <p>Lot2 : Langata: O&amp;M: 5 people South Horr: O&amp;M: 3people Angata Nanyukie: O&amp;M: 3people</p> <p>1-1. Information sharing meeting was carried out among MoH, REA and MoE&amp;P. (March 11, 2014) The second meeting will be carried out around January 2015.</p> <p>1-2 . Sites for Lot 1 and Lot 2 were selected according to the following criteria.  <ul style="list-style-type: none"> <li>• Not near to the existing grid line</li> <li>• Not belonging to private or mission</li> <li>• Not overlapping with candidate sites of other donors</li> <li>• Confirmed Safe security environment</li> </ul> </p> <p>2-1 . Information sharing meeting was carried out among County health department, REA and MoE&amp;P. (Kajiado County: June 13, 2014, Narok County: June 16, 2014 , Samburu County: June19, 2014)</p> <p>3-1 Memorandum of Understanding (MOU) on O&amp;M will be signed between County health department and REA</p> <p>3-2. Lot 1: 5 times Lot 2: 1 time (31 Aug 2014)</p> <p>3-3. Lot 1: 9 times Lot 2: 6 times</p>
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Conclusion of the achievement level of Output 1

Output 1 is judged to be achieved to some degree at present and many of the activities for achieving this output, such as further monitoring, synthesizing monitoring results, finalizing financial analysis, developing guidelines/user manuals and, finally, completing the models are still ongoing.

Furthermore, there is still a certain level of uncertainty with regard to nationwide applicability of O&M of the solar PV systems. More efforts to ensure sustainable O&M models of the solar PV systems, particularly financial and institutional arrangements, need to be made in the remaining implementation period.

Reasons for the above conclusion

Current status of solar PV systems installation at health service institutions is shown in Table 5.

Table 5 Solar PV systems Installation at health service institutions

Lot No.	Name of facility	County	Installation
Lot 1	Olkinyei Dispensary	Narok	July 2013
Lot 1	Ilkilnyeti Dispensary	Kajiado	July 2013
Lot 2	Latakweny Dispensary	Samburu	April 2014
Lot 2	South Horr Dispensary	Samburu	April 2014
Lot 2	Angata Annyokei Dispensary	Samburu	April 2014

The Project installed two solar PV systems at Olkinyei Dispensary in Narok County and Ilkilnyeti Dispensary in Kajiado County as Lot 1 in July 2013, after four to five months delay from the originally-planned schedule. This delay was caused mainly due to prolonged discussions between the Experts and JICA HQs regarding appropriate system designs. On top of that, solar PV systems installation at Meto Dispensary in Kajiado County which was selected as one of Lot 1 sites was cancelled in July 2013, just before installation, because grid extension work had started in the area. Before the decision on cancellation was made, activities such as the Orientation for Financial Management, Technical Transfer Seminar on Bookkeeping, Stakeholder Meeting and so forth, inviting Community Chief, Head Teacher and Head Nurse and so on had already been conducted in Meto and discussions on details of the plan had started among the community stakeholders. In the same breath, it was revealed, after the completion of solar PV systems installation, that grid extension to Olkinyei Dispensary would start shortly.

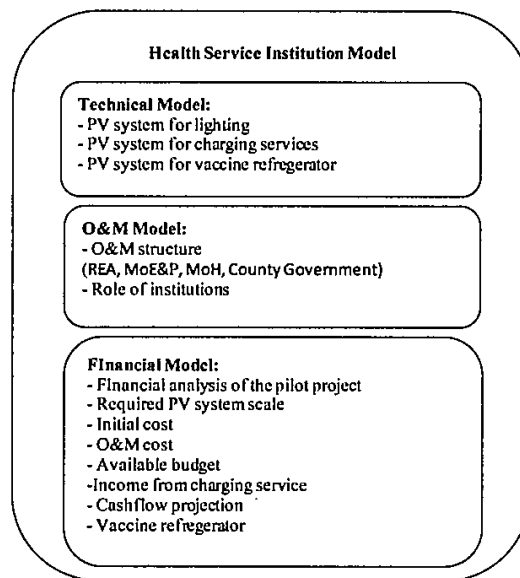
For Lot 2, three dispensaries, namely Latakweny, South Horr, and Angata Annyokei in Samburu County were selected in September 2013 and the systems were installed in April 2014. These three sites were finally selected after repeated re-identification processes because it had been realized later that REA's grid extension plan would cover several planned sites. This problem caused eleven months' delay in finalizing the Lot 2 sites.

Such delays in activities in Lot 1 and 2 gave rise to inefficiency in the production of Output 1 (and Output 2, equally), in that the Project had to spent time and human resources, which were later wasted, and also in that the Project could not have sufficient amount of time for monitoring after

systems installation. Information and data gathered during monitoring activities, therefore, are able to attain only a moderate level of reliability for developing optimal models, which was particularly the case with the Lot 2 facilities.

Despite several system troubles which happened after solar PV systems installation, the Project is now in the process of monitoring these two Lots by involving local stakeholders such as County and Sub-county medical officers. Four of these officers attended a training course held at Jomo Kenyatta University of Agriculture and Technology (JKUAT) and improved their technical capacity in solar PV system O&M.

Through these activities of installation, stakeholder involvement and monitoring, the Project is on the right track of developing practical models which are basically composed of (1) a system design, (2) sustainable O&M, and (3) sustainable financial plans (Figure 1).



Source: JICA Expert Team (2014) Project for Establishment of Rural Electrification Model Using Renewable Energy in the Republic of Kenya (p.29), Progress Report 5

Figure 1 Health Service Institutions Model

The Objectively Verifiable Indicators listed in Table 4 indicate that some of the activities are still ongoing and the achievement levels need to be measured later towards the end of the project period. Such indicators include the sub-group working members conducting monitoring for Lot 2 (Indicator 0-0), the Objective & Achievement Test (Indicator 0-2), the preparation of the operation and maintenance guidelines and user manuals (Indicator 0-3), the signing of the MOU (Indicator 3-1), and periodical monitoring for Lot 2 (Indicator 3-2).

Among these activities in progress, the progresses which merits most attention are the Objective & Achievement Test as it practically measures the level of improved capacity of the monitoring team

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members, the preparation of the guidelines and user manuals, and the last but not least is the signing of the MOU<sup>7</sup>. The successful signing of the MOU and the manifestation of the MoH County Offices' commitment to the O&M of the solar PV systems will be a remarkable milestone for the Project since it will be a significant step towards institutional and financial sustainability to the models developed. The MOU would particularly endorse the sustainable O&M and financial plans proposed by the Project. In this sense, successful signing of the MOU and subsequent action taken by the MoH and REA in accordance with the MOU would significantly alleviate uncertainty associated with O&M of the solar PV systems, both financially and institutionally.

The other important aspect regarding Output 1 is to what extent technical transfer from the Experts to C/Ps has been realized through the process of models development. To answer this question, one needs to wait until the Objective & Achievement Test is conducted in November this year. However, the interviews with the Experts and C/Ps during the evaluation study aptly suggest that the C/Ps' involvement was rather limited to participation in discussions with the Experts as they developed ideas about system design. The C/P participation in discussion on sustainable O&M and financial plans was very much limited mainly due to the reason that there are unclear roles and responsibilities at the REA's side with regard to the O&M issues. Basically speaking, REA is responsible for installing systems and after the handover of solar PV systems, it is the users' responsibility to look after O&M matters. As such, who and what departments should be responsible for developing sustainable O&M and financial plans for the model with the Experts are not so clear. In fact, the Project's latest Progress Report 5 (drafted in September 2014) states the followings.

*"Technical transfer of the so-called soft component issues from JET to REA is one the main purposes of the Project but not enough techniques and knowhow were transferred so far in the soft-component field. REA's mission is up to construction and installation but it does not cover O&M. Thus, they have no personnel, budget and experience for O&M of installed electric systems. This situation is same for MoE&P."(p.96)*

Apart from participation in discussion, the C/Ps' involvement in pilot site visits was also very much limited mainly owing to the C/Ps' unavailability. The C/Ps were always very much occupied with other duties including the Laptop Program and could not find time to visit pilot sites, particularly to go to Lot 2, which was very far from Nairobi. Their limited participation in field visits was a big challenge for the Experts to transfer their technical skills and knowledge to the C/Ps in building

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<sup>7</sup> The MOU asks for the MoH's financial contribution to the major expenses, such as repair and replacement of batteries, inverters and charge controllers, required for sustainable operation and maintenance of the PV systems. It is not financially feasible for each dispensary to bear such costs since the amount is far larger than the income it can generate from its routine battery charging business.



optimal electrification models using solar PV systems.

#### 4.3.2. Output 2

Output 2 is “A practical model for PV electrification of schools in nonelectrified areas is developed through pilot projects.” Table 6 indicates the achievement of each Objectively Verifiable Indicator specified in PDM version 3.1.

Table 6 Achievements of Objectively Verifiable Indicators for Output 2

Objectively Verifiable Indicator	Achievement
0. All level	0-0
0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member.	Lot 1: 2 time Iltumtum, Olemoncho: monitoring and technical monitoring Lot 2: 1 time 3 schools: baseline survey
0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&P are provided based on their Objective & Achievement Sheet through OJT.	0-1 Monitoring Lot 1: 5 times Lot 2: 1 time
0-2 At least 3 monitoring team members achieve their objectives through trainings. Achievements are confirmed by trainee’s self-assessment and evaluation by JEs.	0-2 Objective & Achievement test are not carryout yet (It will be conducted around November 2014)
0-3 PV electrification, operation and maintenance manual for schools with battery charging business is prepared for C/Ps including user manual and accounting manual.	0-3. Draft Guideline (Manual) and user manual were prepared. It will be finalized in January 2015.
0-4 At least 3 people from school and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&M of PV facilities including disposal of solar panels, batteries and toxic materials.	0-4 Iltumtum O&M1: 35 people, O&M2: 4 people Olemoncho O&M1: 30 people, O&M2: 10 people  Marti: O&M: 7 people Tuum: O&M: 10 people Illaut: O&M: 3 people
1. National Level	
1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the model.	1-1. Information sharing meeting was carried out among MoEST, REA and MoE&P. (March 14, 2014) The second meeting will be carried out around Januar 2015.
1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.	1-2 • Not near to the existing grid line • Not belonging to private or mission • Not overlapping with candidate sites of other donors • Confirmed Safe security environment
2. County/Sub-county Level	
2-1 Collaboration among C/Ps, County and Sub-county education officers is initiated and maintained to support the establishment, operation and maintenance of the model.	2-1 Information sharing meeting was carried out among County education department, REA and MoE&P. (Narok County: June 16, 2014 , Samburu County: June 19, 2014)



<p>3. Local/Institutional Level</p> <p>3-1. The target schools secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</p> <p>3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is conformed through monitoring.</p> <p>3-3. Awareness raising activities on installed solar PV system at target schools and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.</p>	<p>3-1 MOU on O&amp;M will be signed between County education department and REA</p> <p>3-2. Lot 1: 5 times Lot 2: 1 time (31 Aug 201)</p> <p>3-3. Lot 1: 9 times Lot 2: 6 times</p>
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Conclusion of the achievement level of Output 2

The achievement of Output 2 is basically the same as that of Output 1. Output 2, however, has more challenges than Output 1 in terms of institutional and financial arrangements of sustainable O&M of solar PV systems since involvement of MoEST in establishing the O&M mechanism is still nascent.

Reasons for the above conclusion

Current status of solar PV systems installation at schools is shown in Table 7.

Table 7 Solar PV systems Installation at schools

Lot No.	Name of facility	County	Installation
Lot 1	Olemoncho Primary Boarding School	Narok	July 2013
Lot 1	Iltumtum Primary Boarding School	Narok	July 2013
Lot 2	Tuum Primary School	Samburu	April 2014
Lot 2	Illaut Primary School	Samburu	April 2014
Lot 2	Marti Primary School	Samburu	April 2014

The reasons for the above conclusion are basically the same as those of Output 1. However, Output 2 faces more challenges than Output 1 in terms of O&M.

Two schools in Narok County, namely Olemoncho Primary Boarding School and Iltumtum Primary Boarding School had solar PV systems installed in July 2013 (Lot 1). Tuum, Illaut and Marti Primary Schools in Samburu County also had their solar PV systems installed in April 2014 (Lot 2). Unlike Lot 1 for Output 1, none of the schools were cancelled for systems installation because of grid extension. However, just like Olkinyei Dispensary, it has become known that grid extension to Iltumtum Primary Boarding School would commence shortly although installation was already completed there.

The schools with solar PV systems are also facing the same financial problem as dispensaries of

Output 1 in that they cannot generate enough income for future repair and replacement of batteries, inverters and charge controllers, etc. through their battery charging businesses. Although the County Offices of MoH are now positively considering bearing the O&M costs on behalf of the dispensaries (Output 1), the MoEST has not started discussing this issue at the institutional level. Since it has already been decided that implementation of the education policy will not be decentralized, it is unlikely that County Offices of MoEST will bear the cost for O&M. Thus, the issue of “Who will bear the O&M cost?” needs to be clarified in future discussions.

On top of that, on the technical side also, none of the staff of MoEST, County Offices and schools have attended solar PV O&M skills training so far. This is mainly due to the fact that institutional frameworks for O&M of school solar PV systems are yet to be clarified due to the initial stage of coordination and dialogues between MoEST and REA/MoE&P. Therefore, compared with the situation of Output 1, Output 2 still has many issues of institutional arrangement for budgeting O&M to be addressed in the remaining project period.

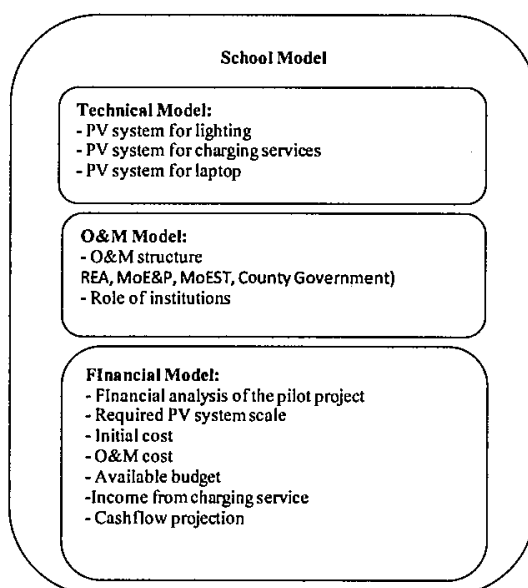
The instalment of solar PV systems at pilot sites for Output 2 was delayed just like Output 1. The delay in Lot 2 activities, in particular, resulted in getting the installation period to coincide with REA’s busy time in deciding solar PV systems specifications for the Kenyan Government’s “Laptop Program to Primary Schools (or simply “Laptop Program” for short)”<sup>8</sup>. The Project, as a result, could not give technical input to REA’s decision at the time, which culminated in the Project’s missing the chance to influence Laptop Program. This issue will be taken up in detail later in “5.4 Impact”.

On the other hand, the positive side is that Kenyan Government’s Laptop Program which aims at supplying one laptop computer per child and electrifying all the primary schools in Kenya is accelerating solar PV installation efforts at REA. If the models consisting of (1) a system design, (2) sustainable O&M and (3) sustainable financial plans (Figure 2), which are to be proposed by the Project, are adopted by this nation-wide initiative, the Project’s impact would be significant. At the moment, however, the Project is giving little impact as will be examined in “5.4 Impact” later in this report.

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<sup>8</sup> The Laptop Program aims at installing 3,000 solar PV systems between March 2014 and June 2015. The completed number of installation at schools is 215 as of 13 August 2014.





Source: JICA Expert Team (2014) Project for Establishment of Rural Electrification Model Using Renewable Energy in the Republic of Kenya (p.42), Progress Report 5

Figure 2 School Model

#### 4.3.3. Output 3

Output 3 is “The capacity of REA/ MoE&P to undertake project using MHP, Biogas and Wind technologies is enhanced.” Table 8 indicates the achievement of each Objectively Verifiable Indicator specified in PDM version 3.1.

Table 8 Achievements of Objectively Verifiable Indicators for Output 3

Objectively Verifiable Indicator	Achievement
3-1. Training is conducted for at least 2 C/Ps for each renewable energy technology.	3-1. MHP: 3 Biogas: 2 Wind: 2
3-2. Guidelines are established for each renewable technology (MHP, Biogas and Wind).	3-2. Draft Manuals (guidelines) were developed in Progress Report 5. Manual Development Committee will be established around October for meetings.
3-3. Guidelines are utilized by relevant ministries, governmental agencies and County/Sub-county offices.	3-3. Manuals (guidelines) will be used by staff of REA and MoE&P.
3-4. Seminar and training for technical transfer are conducted for C/Ps based on their Objective & Achievement sheets.	3-4. MHP: 1time Biogas: 1 time Wind: 1 time
3-5. At least 6 C/Ps achieve their objective through training. Achievements are confirmed by trainee’s self-assessment and evaluation by JEs.	3-5. The Objective & Achievement Test will be carried out in November.

3-6. At least one pre-feasibility study document for future practical model for MHP, Biogas and Wind is prepared.	3-6. Progress of simple pre-F/S: MHP(60%), Biogas (80%), Wind (70%). All simple pre F/S will be completed by the end of November 2014.
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Conclusion of the achievement level of Output 3

Output 3 is expected to be achieved to some degree if the ongoing activities, such as the preparation of guidelines and documentation/ presentation of Simple Pre- Feasibility Study (F/S), are completed as planned. Since the pilot projects for Output 3 were cancelled toward the end of the first year of the project period, most of the C/Ps had little chance to practice in the actual implementation what they have learned in trainings. The C/Ps' more active participation is needed in the ongoing activities for Output 3 so that their practical knowledge will improve in the remaining project period.

Reasons for the above conclusion

The Project spent eight to nine months in the first year discussing its possible collaboration with "Community Power Centres (Energy Kiosks)" undertaken by the United Nations Industrial Development Organization (UNIDO). However, after discussions with REA, MoE&P, JICA, and the UNIDO, it was decided the Project would not collaborate with the UNIDO in implementing pilot projects for MHP, biogas and wind since it was realized that the UNIDO's activities were facing many challenges.

The final decision was made in March 2013 and since then the focus of Output 3 shifted from pilot project implementation to offering trainings to C/Ps for capacity development. Because of this alteration, transferring practical skills and techniques from the Experts to C/Ps became difficult and, as an alternative, the Project gave intensive training through seminars and periodical instruction about study and planning to the C/Ps with occasional practical guidance when the C/Ps had a chance to visit fields and when C/Ps were available in the office. The Experts also embarked upon preparing guidelines for each of the technologies, i.e. MHP, biogas and wind.

As shown in Table 8 (Indicator 3-1), three C/Ps for MHP, two for biogas, and two for wind technologies went through training. Since the level of capacity improvement of these C/Ps will be measured later in November when the Project conducts the Objective & Achievement Test (Indicator 3-5), it was not possible for the evaluation team to objectively measure the Project's effect at the time of evaluation. However, the interviews with the Experts and C/Ps suggest that although the C/Ps were able to increase their theoretical knowledge in each field of technology, they were not fully confident in putting the knowledge into practice since they didn't have such opportunities in the Project. Besides, the time spent for the seminar was relatively short for all the technology fields, ranging from half-day to one and a half day in the whole project period. It is hoped that the C/Ps will utilize the guidelines developed by the Experts for future REA project implementation in the field.

With regard to Indicator 3-6, a pre-F/S document for each of MHP, biogas and wind, was prepared mainly with the initiative of the Experts, except for the paper on biogas which one of the two C/Ps took the initiative to write. The papers are expected to be presented by the C/Ps at the JKUAT's 9<sup>th</sup> Scientific, Technological and Industrialization Conference to be held in November this year.

#### 4.3.4. Output 4

Output 4 is "Necessary policy and institutional frameworks for rural electrification using renewable energy are recommended." Table 9 indicates the achievement of each Objectively Verifiable Indicator specified in PDM version 3.1.

Table 9 Achievements of Objectively Verifiable Indicators for Output 4

Objectively Verifiable Indicator	Achievement
4-1. International workshop is held to share the results of the project (e.g. EAC conference).	4-1. International workshop will be held in February 2015.
4-2. Technical transfer workshops for C/Ps are held 3 times.	4-2. total 3 times Solar PV: 1 time (Sept 27, 2013) MHP/Biogas: 1 time (Oct 25, 2013) Wind: 1 time (Oct 25, 2013)
4-3. Recommendations for C/P to implement the effective electrification by renewable energy are provided to be reflected on their rural electrification policy.	4-3. Recommendation will be finalized in project completion report.

#### Conclusion of the achievement level of Output 4

Output 4 is expected to be achieved to a relatively high degree if the remaining activities, such as holding the International Workshop and proposition of recommendations are completed as planned. On the other hand, whether or not the Project can present effective and realistic recommendations depends largely on successful production of Output 1 through 3. The Experts are now preparing recommendations based on findings from the three Outputs. Close discussions with the C/P institutions need to be undertaken in order to produce truly useful recommendations.

#### Reasons for the above conclusion

The achievement of Output 4 is highly dependent on Indicator 4-3, proposition of recommendations on effective electrification by using renewable energy. The achievement of Indicator 4-3 cannot be realized without successful production of Output 1 through 3. In this sense, the achievement of this output is regarded to be still in half-way.

Nevertheless, the Project is steadily heading its way for making practical recommendations based on its experiences both in the field and in policy analysis. The most significant contribution of the Project to the C/Ps' policy on renewable energy would be its comprehensive and meticulous analysis of the four technologies, solar PV, MHP, biogas and wind, which incorporates elements including

institutional frameworks (policy, regulation and system), financial arrangements, technical arrangements, and consumer benefits.

It was confirmed during the interviews with the C/Ps that before the Project REA was not paying so much attention to such multiple dimensions in applying renewable energy technologies in the field. Now their awareness has increased and the C/Ps have realized the importance of appropriate design, sustainable O&M which involves optimal institutional frameworks, and sustainable financial plans. The Experts are now drafting recommendations based on their findings and learnings from Output 1, 2 and 3. In order to make effective, realistic and useful recommendations for the C/P, close discussions between the Expert team and C/P, both at the working level and high level, need to be conducted before the Project finalizes the recommendations in Project Completion Report.

#### 4.4. Achievement of the project purpose

The project purpose is set as “Rural electrification models using renewable energy are established.” Table 10 indicates the achievement of each Objectively Verifiable Indicator specified in PDM version 3.1.

Table 10 Achievements of Objectively Verifiable Indicators for the Project Purpose

Objectively Verifiable Indicator	Achievement
1. The developed guidelines and manuals are applied to the projects implemented by the REA and MoE&P (C/P).	1. In the solar PV project that REA carries out in 2014/2015 and 2015/2016, guideline and manual prepared in this project are expected to be adopted.
2. The Outputs of the Project are incorporated into implementation of REA Annual Renewable Energy Work Programme (Performance Contract).	2. In 2015/2016 Annual Renewable Energy Work Programme of REA, implementation of the demonstration project using developed model will be written.
3. Renewable energy facilities installed by the Project are operated and maintained properly with sustainability.	3. Ownership of the pilot plants will be transferred to MoEST and MoH through REA around November 2014. MOU on O&M will be signed between REA and Ministries.
4. Implementation structures of national/county governmental agencies and local stakeholders are established.	4. Implementation structures will be established by the MOU on O&M between REA and Ministries.
5. Variety of expertise in renewable energy is increased among members of C/P (C/Ps).	5. Technical transfer on MHP, Biogas and Wind were conducted to the counterpart. Expertise is increased among member of CPs.

#### Conclusion of the achievement level of the Project Purpose

The Project Purpose is achieved to some degree at present. If unfinished activities are conducted successfully, the achievement level is expected to be relatively high at the end of the project period.

Successful completion of all the activities for the four Outputs with full participation from the C/Ps is required to attain a high level of achievement.

Reasons for the above conclusion

The Objectively Verifiable Indicators for the Project Purpose are concerned with the C/P's application of guidelines and manuals the Project develops, adoption of the models proposed, sustainable O&M of the pilot solar PV systems, and increased expertise in a variety of renewable energy technologies.

The achievement level of the Project Purpose depends largely on successful preparation and signing of MOU with MoH/ MoEST and subsequent implementation of O&M of solar PV systems in accordance with the MOU. The C/P's commitment to the utilization and adoption of the guidelines and models proposed by the Project also directly influences the effects of the Project.

The Project needs to complete all the remaining activities identified earlier in this report so that the guidelines, manuals, models and recommendations would be practical, realistic and effective. The Project also needs to continue having close discussions with REA, MoE&P, MoH, MoEST and county governments for establishing optimum institutional and financial frameworks for O&M as well as for the C/P's leveraging the Project's outputs.

**4.5. Implementation process**

The following items are identified as salient factors which influenced the Project, either positively or negatively, during the course of project implementation.

**4.5.1. Factors which influenced the Project positively**

There is one factor which influenced the Project positively, particularly in terms of raising efficiency.

(1) Collaboration with JKUAT and the BRIGHT Project

The C/Ps and staff of County Offices of the MoH have been attending and/or making presentations at various seminars and trainings organized by the JKUAT and/or JICA's technical cooperation project "The Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy (the BRIGHT Project)". Such collaboration with JKUAT and the BRIGHT Project is contributing to raising efficiency of the Project.

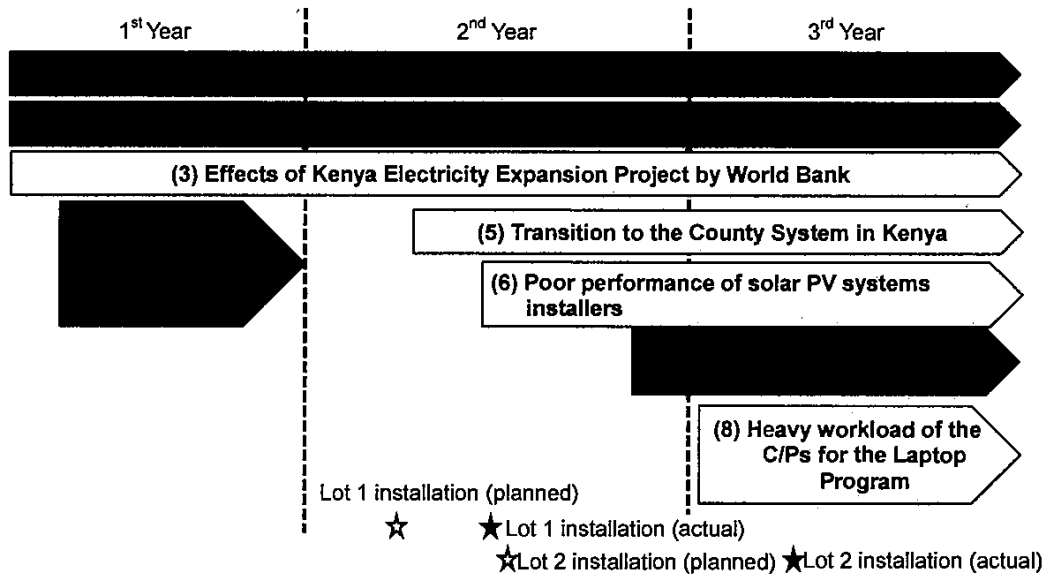
**4.5.2. Factors which stand as challenges to the Project**

One of the most noticeable characteristics is that the Project has been faced with so many factors which stand as challenges to the overall or specific activities in the course of project implementation. Eight factors, from (1) to (8) below, are identified as key challenges which significantly influenced



the Project's efficiency and effectiveness. Figure 3 depicts a timeline of the eight factors as they occurred along the course of the Project's progress.

Figure 3 Timeline of the eight challenges to the Project



(Source: The Evaluation Team)

Among these factors in the figure, the dark shaded arrows (1, 2, 4, and 7) should be considered as endogenous factors which were fairly within the control of the project implementers, i.e. REA, MoE&P and JICA. These factors could have been avoided to a large extent if the implementers took appropriate action beforehand or during the problem.

The light shaded arrows (3, 5, 6, and 8), on the other hand, are more likely to be exogenous factors which were beyond the control of the project implementers. The implementers should have identified these problems before they had happened and took appropriate risk control measures, such as continuous and frequent information sharing among implementers.

Here are more detailed explanations of each factor listed in the figure.

(1) Demanding work volume of the C/Ps

Demanding work volume of the C/Ps outside the Project, such as work for diesel power generation, has been impeding effective and efficient technical transfer from the Experts to C/Ps. In particular, the C/Ps have been having a hard time finding time to go to the pilot sites (for Output 1 and 2) and pre F/S sites (for Output 3). Hence much of the field activities, particularly activities for Output 1 and 2, have been conducted by the Expert Team alone, without much participation from the C/Ps.

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(2) Inconvenient location of the project office

The project office is located far from REA/ MoE&P, making the Experts and C/Ps difficult to see each other in person. This physical distance inhibits smooth project operation to a significant degree.

(3) Effects of rapid grid extension in Kenya

REA has been vigorously extending electrical grids to non-electrified areas in Kenya. The sites extended by grid, by nature, often overlap with the Project's potential and existing solar PV pilot sites. In fact, the Project had to re-select the pilot sites for Lot 2 several times since it became apparent the area would be soon covered by grid extension plans. It took much longer time for the Project to finalize its selection of the pilot sites, particularly for Lot 2.

(4) Time spent for planning collaboration with UNIDO

In the first year of the Project, the Project Team spent about nine months planning the details of collaboration with UNIDO. The collaboration was planned to facilitate pilot activities of MHP, biogas and wind power, which was for Output 3. However, after research, it was realized that such collaboration would not be effective and a decision was made to cancel the plan. The Project had to modify the plan for Output 3 substantially and the time spent for planning since the commencement of the Project was wasted<sup>9</sup> to a large extent except for utilization to Pre-FS and Guidelines.

(5) Transition to the County System in Kenya

Kenya has seen a transition to the County System in the last few years. The roles and responsibilities of the central government and county governments dramatically changed particularly in mid to late 2013 (for Output 1). This change has caused the Project to spend a lot time for coordination with both national and sub-national stakeholders with regard to the O&M of the pilot solar PV systems.

(6) Poor performance of solar PV systems installers contracted by the Project

The level of skills and techniques of local solar PV systems installers contracted by the Project was much lower than anticipated. The solar PV systems at the pilot sites are facing repeated technical and mechanical troubles which need to be rectified frequently by the Project. The Project Team has to spend such a long time shooting troubles in the fields that some of the work that needs to be done in Nairobi is being delayed.

(7) Remoteness of the pilot sites of Lot 2

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<sup>9</sup> It is not appropriate to say the time was completely wasted since part of information gathered by the research conducted during the preparation period was later utilized for developing seminar materials for the revised Output 3. Still, it is clear that the Project had to spend a large amount of resources during the nine months' preparation period.



The Project had to select pilot sites for Lot 2 which were far in the distance from Nairobi because there was no other choice. The selection was appropriate considering typical areas where off-grid electrification systems operate. However, the sites have security issues and require a long travel time. It is not possible for the Experts and C/Ps to visit the sites often within the limited timeframe of the Project, which in turn hampers technical transfer activities for Output 1 and 2.

#### (8) Heavy workload of the C/Ps for the Laptop Program

The C/Ps' work volume for the Kenyan Government's Laptop Program has become increasingly large since around April 2014. The time they can spend for project activities has become even less than before.

### 5. Evaluation results<sup>10</sup>

#### 5.1. Relevance

Summary: Relevance is relatively high. The project is well aligned with Kenya's development priority as well as with Japan's ODA policy towards Kenya. The project is also appropriately responding to the needs of the target group, especially the needs of those public facilities in nonelectrified areas by mobilizing Japan's comparative advantage of expertise in renewable energy, community participation, O&M, and business analysis. On the other hand, Kenya has been seeing rapid grid extension in recent years and some of the sites selected for the pilot project have become covered by such an extension. Such a situation could have been avoided if strategic and systematic planning on rural electrification had been in place at REA/MoE&P before the commencement of the Project.

#### (1) Relevance to the development plan of Kenya

In its VISION 2030, the Republic of Kenya is adamant about all Kenyan citizens having electricity by 2030. VISION 2030 also promises that renewable energy sources will be exploited to increase the supply of energy in Kenya. The Rural Electrification Master Plan (REMP) for 2008-2018 targets electrifying 40% of rural households by 2020. In the REMP, tapping renewable sources of energy, such as solar technologies, wind turbines, hydropower and biogas engines is considered where on-site conditions for resource availability are favourable.

More recently, the National Energy Policy was drafted in 2013, therein the importance of renewable energy in terms of enhanced energy security, climate change mitigation, income generation, job creation and generation of foreign exchange savings is recognized. It also acknowledges Kenya's renewable energy potential including wind, solar and biomass.

These policy directions and development priorities of Kenya concerning rural electrification and the

<sup>10</sup> The levels of the five evaluation criteria are rated based on the scale of "High", "Fair" and "Low".

development of renewable energy are, in no doubt, in alignment with the Project's aim and scope in pushing forward developing a rural electrification model using renewable energy.

**(2) Relevance to Japan's ODA policy towards Kenya**

Japan's Country Assistance Policy to Kenya (2012) set forth Japan's support in improving access to electricity in Kenya. The policy underscores Japan's cooperation to Kenya in promoting stable supply of electricity which is indispensable for maintaining Kenya's economic growth. Japan's Rolling Plan for Kenya (2012) positions the Project as part of Japan's program entitled "Improvement of Generation and Transmission Capacity", which focuses on meeting the increasing demand of electricity in Kenya.

Given this policy context, it is fair to say that the Project is highly consistent with Japan's ODA policy.

**(3) Responsiveness to the needs of the target group**

The Project's target groups are diverse. They range from MoE&P, REA, MoEST, MoH, County/Sub-County Education/Medical Officers in pilot project sites, to members of pilot project school and dispensary management committee and other related persons at pilot project facilities in rural areas.

The Project endeavours to develop the capacity of people and organizations of the target groups, particularly the C/P staff at MoE&P and REA, in developing and establishing rural electrification models using renewable energy. The Project's focus is considered to be appropriate since both the C/P organizations as well as beneficiaries of the Project at sub-national levels recognize the needs for building capacity of establishing and operating electrified public facilities by solar PV in rural areas. MoE&P and REA are also in need to acquiring skills and knowledge for MHP, biogas and wind technologies.

On the other hand, Kenya has been seeing rapid grid extensions in recent years and Meto Dispensary in Kajiaro County selected for the pilot project (Lot 1) has become covered by such an extension. Olkinyei Dispensary and Iltumtum Primary Boarding School in Narok County (Lot 1), where solar PV systems were already installed are scheduled to have grid extension shortly. Such a situation could have been avoided if strategic and systematic planning on rural electrification had been in place at REA/MoE&P.

Therefore, it is reasonable to say that the Project is well addressing the need of the target groups by practically pushing forward the agenda of promoting renewable energy use. A reservation is made, however, since some of the pilot sites are being covered by grid extension plans.

**(4) Appropriateness of Japan's technical knowledge and skills**



The Expert Team is composed of personnel who have rich experience of working in the renewable energy sector, coupled with experts in socio-economic fields including community participation, O&M, environmental assessment and business analysis. The Experts aim at transferring comprehensive technical skills and knowledge to the C/Ps, which are necessary for establishing and sustainably operating facilities in rural settings. Thus, it is fair to say that Japan's expertise in renewable energy is effectively leveraged by the Project.

#### **(5) Appropriateness of the implementation approach**

The Project employs a capacity development approach, rather than a service delivery approach as a technical cooperation project. The former focuses on working with the C/Ps on a daily basis to gradually attain a set goal of improving their skills and knowledge in a certain field, in this case, renewable energy. The latter, on the other hand, tends to concentrate on delivering tangible services (or deliverable) such as facilities, policy documents, operation manuals and so forth, more often than not, without much involvement from the C/Ps. The burning issue the C/P organizations faced before the inception of the Project was, and still is, to acquire knowhow and skills pertaining to establishing models which can be easily replicated. In this respect, sharing and exchanging the knowledge between the Experts and C/Ps through working together to implement pilot projects is considered to be the best capacity development approach.

Therefore, it is fair to say that the Project is appropriately designed in concordance with the needs of the target groups and the Project's implementation approach maintains validity in terms of developing capacity of the C/Ps.

#### **5.2. Effectiveness**

Summary: Effectiveness is fair at present. Although the project purpose is expected to be achieved to a relatively high degree by the end of the planned period, there is still uncertainty regarding the achievements of all the Outputs, from Output 1 through 4. If ongoing activities are completed smoothly and effectively and the concerned institutions take action in accordance with the recommendations to the Project specified in this report, effectiveness is expected to be higher at the completion of the Project.

#### **(1) Prospect of the achievement of the project purpose**

The Project Purpose is "Rural electrification models using renewable energy are established". Judging from the progress of the project activities and the current situation of the achievements of the four Outputs, it is fair to say that the Project Purpose is still halfway to achieving its target. Perhaps the most remarkable achievements the Project have made so far are helping the C/P institutions realize the importance of (1) adopting appropriate designs in response to the particular



situations in which the system would operate, (2) assessing financial feasibility and (3) ensuring practical and functional institutional arrangements for O&M. The achievements also include REA's stronger initiative to carry out appropriate social and environmental responsibilities as guided by the Experts in environmental issues. The Project, furthermore, contributed to the C/Ps' increasing knowledge on a variety of technologies of renewable energy, i.e. PV, MHP, biogas and wind.

Nevertheless, there are still many challenges that need to be tackled in the remaining project period. For Output 1 and 2 (solar PV model development), sustainable models should be completed by the Project Team and the agreement from concerned institutions, particularly from MoH and MoEST, need to be reached in the area of O&M. As for Output 3, the C/Ps need to synthesise the knowledge they gained through the seminars/ Simple Pre-F/S and comprehensive documents need to be prepared. They also need to finalize the guidelines in the upcoming Manual Development Committee. The final output, Output 4, will be culmination of all the outputs produced, where useful policy suggestions are presented for the improvement of Kenya's rural electrification endeavour using renewable energy. The C/P institutions are advised to have constructive discussions with the Project Team to pave the way to institutionally adopting the recommendations made by the Project, which, in turn, will lead to the achievement of the Project Purpose.

#### **(2) Project management system**

Insufficient communication among the Experts and C/Ps was pointed out as a hindering factor to effectiveness during the Mid-term Review. This issue was appropriately addressed by the C/P organizations, particularly by the Project Manager at REA, through means such as holding a monthly meeting to share information and monitor progress. The management of the Project, particularly the communication issue, is judged to be handled appropriately after the Mid-term Review.

However, due to reasons such as C/Ps' demanding work volume and physical distance between the project office and REA/MoE&P explained in "4.5.2 Factors which stand as challenges to the Project", close communication, particularly face-to-face communication between the Experts and C/Ps, has remained as a challenge throughout the project period

#### **(3) Promoting and hindering factors to the achievement of the Project Purpose**

Notable factors which influenced the Project Purpose either positively or negatively are as already explained in "4.5.1 Factors which influenced the Project positively" and "4.5.2 Factors which stand as challenges to the Project". While one item regarding collaboration with the JKUAT and BRIGHT Project was identified as a promoting factor, as many as eight items in 4.5.2 are identified as hindering factors. The negative influence of the eight items on the Project was significant in that the Project's overall efficacy has become reduced throughout the project period. The area which was affected most was the Project's effort to develop the C/Ps' capacity in planning and implementing



rural electrification projects through imparting hands-on information and know-how to them. Not enough participation from the C/Ps was materialized for such activities since the C/Ps were occupied with other duties most of the time. Although tangible outputs such as manuals, guidelines, ideas for models and scientific papers are being produced as planned by the Project, the C/Ps' contribution to producing such deliverables cannot be considered sufficient. In other word, technical transfer from the Experts to the C/Ps has been insufficient as shown in the current situations of Output 1, 2 and 3.

### 5.3. Efficiency

Summary: Efficiency is fair. Inputs from both Japanese and Kenyan sides are basically provided as planned. However, the C/Ps, having many other duties, are not able to spend sufficient amount of time for project activities especially before the Mid-term Review, hence lowering the level of technical transfer from the Experts to the C/Ps. The plan for pilot projects at industrial facilities was cancelled in the first year and it took time to rearrange the project framework. Various key activities were delayed due to reasons such as solar PV pilot site re-identification to avoid grid extension, system troubles at solar PV systems and Lot 2 being in a remote area. Furthermore, Kenya's transition to the County System around mid-2013 required time to identify stakeholders and their roles and responsibilities regarding O&M of solar PV systems. On the other hand, collaboration with the JKUAT and BRIGHT Project is contributing to raised efficiency to a certain extent.

#### (1) Provision of inputs – the Japanese side

The interviews with the C/Ps have confirmed that the areas of expertise of the Experts are well addressing the needs of capacity development of the C/Ps and contributing to the generation of expected Outputs. The Experts have sufficient knowledge and skills not only in the area of systems design but also in the fields of finance, environment and community participation, which are equally important areas of expertise in developing appropriate rural electrification models and guidelines. As for the training for the C/Ps outside Kenya, the designs and contents of the training courses held in India and Thailand were particularly appropriate and appreciated by the C/Ps since they were able to have hands-on experience on a variety of renewable energy facilities in countries whose socio-economic situations and technology levels are quite similar to those of Kenya.

#### (2) Provision of inputs – the Kenyan side

Among the various inputs provided by the Kenyan side, the Project's office space located far from the C/P institutions caused inefficiency. Although the appointment of the C/Ps for each specific technology field was appropriately done, the C/Ps' demanding workload hampered effective technical transfer from the Experts to the C/Ps especially before the Mid-term Review. Timely completion of project activities is difficult from time to time and some activities had to be done



mostly by the Experts, without sufficient participation from the C/Ps.

**(3) Contributing factors to efficiency**

As already explained in “4.5.1 Factors which influenced the Project positively”, collaboration with the JKUAT and Bright Project increased efficiency.

Further collaboration is now being planned where some C/Ps participate in the JKUAT’s 9th Scientific, Technological and Industrialization Conference to be held in November this year.

The Project, on the other hand, accepted participants from the BRIGHT Project to come visit Iltumtum Primary School for training purposes, which facilitated information sharing between the two projects.

**(4) Hindering factors to efficiency**

The hindering factors to efficiency were already identified and explained in “4.5.2 Factors which stand as challenges to the Project”. While each factor itself is giving considerable negative impact to smooth execution of project activities, the combination of these eight factors hindered efficiency as well as production of expected outputs to a considerable degree.

**5.4. Impact**

Summary: Impact is fair. The achievement level of the Overall Goal will largely depend on that of the Project Purpose. It will also depend on the practicality and replicability of the electrification models to be finalized in the remaining project period. Since there is a certain level of uncertainty regarding the achievement of the Project Purpose at the moment, the Overall Goal is also subject to uncertainty. Positive impacts of the Project are: (1) Stakeholders of renewable energy technologies increased their awareness regarding the high O&M cost and (2) It is likely that REA will discuss O&M issues with potential facility owners/users in future implementation of systems instalment. There are also impacts at the community-level which improved daily lives of the community members after the installation of solar PV systems at the pilot sites. For instance, personal security of female pupils and staff has improved with lighting at evening and night time. The community members, particularly women and children, are now enjoying improved public health services such as being provided better care during delivery at night and getting immunizations at local dispensaries. On the other hand, REA could not adopt some specifications suggested by the Project regarding the solar PV systems design for the Laptop Program due to time constraints, which, if realized, would have been a remarkable impact affecting as many as 3,000 primary schools in Kenya.

**(1) Prospect of the achievement of the overall goal**

The overall goal of the Project is “Rural electrification models using renewable energy are

disseminated in the country to improve the quality of Kenyan's life". The numerical targets for the Objectively Verifiable Indicators of the overall goal are "Number of public facilities who apply and follow the model has increased all over the non-electrified areas in Kenya" and "Dissemination structure of national and county governmental agencies is established."

The prospect of the achievement of the first indicator is that if the Project is able to present practical models to REA, there is a fair chance the number of public facilities applying the models will gradually increase throughout rural Kenya. In fact, discussions have started between the Expert team and REA regarding applying the model for the 2015/2016 REA solar PV projects. In particular, possibilities of applying the systems design and battery charging stations are discussed as the most probable "first step" towards utilization of the models.

As for the second indicator, the dissemination structure of national and county governmental agencies is in the process of being established by presenting a draft MOU on O&M of solar PV systems to the C/P organizations and related institutions such as MoH, MoEST and county governments. If these institutions endorse and sign the MOU with institutional commitment, their continuous efforts will lead to the establishment of a model dissemination structure.

It is surmised that if the project purpose is sufficiently achieved at the end of the cooperation period, the overall goal can be achieved likewise as long as the C/P organizations and related institutions continue to facilitate the dissemination of rural electrification models.

## **(2) Intended impact**

The impacts of solar PV systems installation at the community level include improved convenience of the users of the facilities such as that the school children can now study early in the morning or late in the evening. Personal security of the female pupils and staff has improved with lighting at evening and night times. Patients at the dispensaries can have better treatments or deliveries at night. Mothers can easily have their children immunized at local dispensaries where refrigerators for vaccines are kept. Undoubtedly, the Project is giving a positive impact on women and children in particular. On top of that, community people near the facilities can use the services of the battery charging stations and, as a result, their livelihoods are improving by increased convenience.

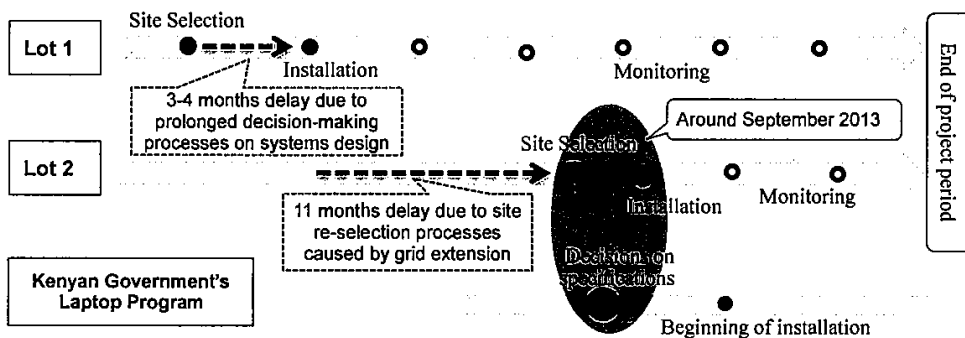
On the other hand, there is something worth mentioning regarding "unrealized" intended impact, so to speak. As has been already explained "4.3.I Output 1", there were delays in installing solar PV systems at both Lot 1 and 2 schools and dispensaries. In retrospect, the eleven months' delay in Lot 2 subsequently led to missing the chance to make a great impact on solar PV systems at primary schools in rural Kenya. The Project team became very much occupied with preparing solar PV systems installation for Lot 2, after having finished selecting the pilot schools and dispensaries in September 2013. It was exactly around that time when REA became also busy deciding detailed specifications for solar PV systems under the Laptop Program. Although REA asked the Experts'





help in deciding the optimum system design, the Experts were too much pressed for time for their Lot 2 activities to respond to REA's request. For instance, the Experts later realized that the power voltage REA adopted as part of the specifications was not appropriate from a technical point of view. Despite REA's and the Experts' effort to modify the specifications from DC12V to DC 48V, it was too late to do so since the contractors, or solar PV systems installers, had already procured some materials based on the DC12V design<sup>11</sup>. The Experts feel that if the peak period of the Lot 2 activities had been several months earlier, they could have been worked together with REA to decide on the optimal specifications. This indicates that the eleven months' delay in selecting Lot 2 sites resulted in a critical negative consequence in that the Project missed the invaluable chance to make a nationwide impact on as many as 3,000 primary schools in terms of solar PV systems design. Figure 4 illustrates critical timings of activities for the Project's Lot 1 and 2 and REA's Laptop Program. The shaded oval shape indicates when the Project was too busy with Lot 2 activities to assist REA in deciding specifications for laptop Program.

Figure 4 Timing of activities for the pilot projects and Laptop Program



(Source: The Evaluation Team)

### (3) Unintended positive/ negative impact

Unintended negative impact was not observed by the evaluation team.

Some facilities began hair cutting services using electric hair clippers for enhancing the functions of the battery charging stations. Starting hair salons for women is also being considered at some facilities, which, if realized, would not only provide extra convenience to the local people but also offer community women a venue for socialization and social cohesion. These innovative ideas regarding the use of battery charging stations are considered to be unintended positive impact.

### (3) The influence of external factors on the achievement of the overall goal

<sup>11</sup> REA, nevertheless, succeeded to have one contractor change their plan to install DC48V at two primary schools.

The identified external factors to influence the achievement of the overall goal in the PDM are: “REA Annual Renewable Energy Work Programme (Performance Contract) are prepared and implemented” and “Involvement of relevant national and county government is maintained”. The former is the assumption that the solar PV models produced by the Project will be incorporated into the REA’s departmental performance contract so that actual application of the models on the ground is made possible. The Project is now having discussions with REA about this incorporation and there is a chance that part of the models, specifically the battery charging system, will be introduced in REA’s self-funded activities in future, if not next year. Since more inclusion of other elements of the models into the performance contract is advisable, the Project and REA are encouraged to continue discussing this issue.

The latter factor is directly linked to the issue of sustainability of the solar PV electrification model the Project is going to propose. At present, there is no solid guarantee that MoH, MoEST, and County Offices of these Ministries will be actively involved in the O&M of solar PV systems. However, constructive discussions have started with the initiative of the Project and REA. This issue will be taken up in “5.5 Sustainability” in detail.

#### **5.5. Sustainability**

Summary: Sustainability is fair. Presently, the level of policy and institutional sustainability is difficult to judge since REA is planned to be transformed into the National Electrification and Renewable Energy Authority (NERA). However, if the suggestions from the Project are incorporated into the current policies on renewable energy in future, policy sustainability will be high. The roles and responsibilities regarding the O&M of solar PV systems need to be further clarified and ensured among the national and county governments for better institutional sustainability. Technical sustainability is facing challenges because the C/Ps’ practical skills has room for improvement compared with their theoretical knowledge in all four renewable energy technologies. Financial sustainability also needs to be improved, particularly for the appropriate O&M of solar PV systems, since the governments’ budgets for pushing forward model dissemination is yet to be secured.

##### **(1) Policy and institutional sustainability**

As promised in REMP (2008-2018) and National Energy Policy (draft), REA and MoE&P will continue implementing policies on renewable energy. If the suggestions from the Project are incorporated into the current policies on renewable energy in future, policy sustainability will be high.

In the National Energy Policy, it is stated that REA will be “transformed into the National Electrification and Renewable Energy Authority (NERA) to become the lead agency in the



development of renewable energy resources<sup>12</sup>. When NERA is established, it will be NERA's responsibility to coordinate with national and county governments for implementation of rural electrification and renewable energy programmes. There is a likelihood that the Project's outputs will be eventually taken over by NERA but institutional arrangements for such transitions are still unclear.

The Project plans to galvanize REA, MoE&P, MoH, MoEST and county governments into their efforts to work on the O&M plans for the solar PV models. If this plan is carried out smoothly, through means such as having high-level dialogues for building a consensus and entering into MOUs, institutional sustainability will be higher.

### **(2) Technical sustainability**

As the achievements of Output 1, 2 and 3 suggest, the C/Ps could not spend sufficient amount of time for receiving technical transfer from the Experts all through the cooperation period, except for one C/P on biogas. Although there is enough testimonials that the C/Ps all increased their theoretical knowledge on a variety of renewable energy technologies, their practical skills to apply the knowledge in actual projects on the ground are still not sufficient mainly due to their limited participation in activities in the field. As the Project is developing various guidelines which can serve as practical reference materials for strengthening the C/Ps' skills required in the field, REA and MoE&P are advised to make most use of such documents and improve the C/Ps skills and knowledge during and after the Project.

In order to raise technical sustainability both at the national and sub-national levels, REA's continuous collaboration with JKUAT and other related organizations with regard to capacity development trainings/ conferences will be beneficial. County-level stakeholders of MoH and MoEST should continue attending trainings on solar PV systems operation so that facility managers and operators will have enough skills and knowledge on solar PV systems.

### **(3) Financial sustainability**

Financial sustainability should be examined at two levels. One is at the central level, i.e. the financial outlook of MoE&P/REA in leveraging the effects of the Project after the cooperation period. The other is at the local level where solar PV systems based on the developed model actually operate on a daily basis.

At the national level, MoE&P/ REA have various sources of funds for electrifying rural areas using renewable energy. For installation of solar PV systems, REA relies heavily on external sources which include loans and grants from international development partners such as the World Bank, Spain and French Agency for Development (AFD). Therefore, the financial prospects in

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<sup>12</sup> Excluding geothermal and large hydros.



disseminating the models developed by the Project are largely dependent on the situations of projects implemented by other development partners. Still, disseminating and utilizing the models inherently do not require much additional financial resources. Application of the models in future REA projects should be financially feasible, though it may not be completely easy as it takes human resources particularly for planning, sensitizing, supervising and monitoring.

Perhaps financial challenges lie more at the local level. The pilot projects have revealed that much larger amount of money is required than previously assumed by REA for the O&M of solar PV systems. The Project is still in the process of discussing the issue about “who should bear such costs?” with both national and local level stakeholders. Strong involvement and commitment of MoH and MoEST as well as their County Offices are prerequisite for the successful O&M. Furthermore, the Ministry of Finance (national treasury) also needs to understand the necessity of O&M expenses and allocate sufficient budgets to the MoH and MoEST as requested. When all these institutions become financially committed to O&M of the solar PV system, not just the ten pilot systems installed by the Project but also all the future systems to be installed by REA, the models established by the Project will have high financial sustainability.

## 6. Conclusions

At the time of the Terminal Evaluation, the achievement level of the Project Purpose was fair. However, the achievement level will be higher if the remaining activities are completed successfully without delay in the remaining project period and appropriate action is taken in accordance with the recommendations proposed in this report.

The Project Team has been conducting planned activities despite the challenges of multiple adversities which contributed to lowering efficiency. There are still many issues to be addressed in the remaining implementation period until the Project can present practical and sustainable models. In particular, presenting optimal O&M mechanisms of solar PV systems requires obtaining understandings and agreement from relevant organizations. The Project will then need to give effective recommendations to C/P organizations, which should be authorized and endorsed, so that the models will take root at the C/P organizations. If these issues are addressed properly, the achievement level of the Project Purpose will be much higher.

The Project is advised to take action explained above as well as to follow recommendations presented in the next section. The Project should be completed in February 2015 as originally planned.

## 7. Recommendations

### Recommendation to the Project (To be addressed in the remaining project period)

#### (1) Ensuring sustainability by establishing the O&M models



The Project should continue discussing the O&M models of solar PV systems with relevant institutions including MoH, MoEST, county governments and so forth so as to ensure sustainability of the solar PV systems. Having high-level dialogues and then entering into MOUs with relevant institutions is strongly recommended since it would officially promise institutional and financial commitment to the O&M models. Providing quantitative data on projected annual O&M cost, both total and itemized, by the Project to the prospective signees of the MOUs would facilitate informed decision-making at the signees' sides.

With regard to MoEST's institutional framework for O&M, an option such as giving a stronger facilitator role to County Education Offices is to be considered. The Offices could then effectively link the solar PV-installed schools and MoEST when the schools are in need of financial resources for solar PV O&M.

Furthermore, appropriate management and handling of cash generated from the battery charging business needs to be discussed in order to prevent possible misconduct at the facilities.

The proposed O&M models, on the other hand, should be authorized by the C/P organizations. Departments/persons responsible for continuous improvement of the models should also be identified and appointed.

### **(2) Conducting and presenting a quantitative analysis on applicability of the models**

A quantitative analysis on applicability of the proposed models is recommended to be conducted and presented to REA/MoE&P. It is beneficial for the C/P organizations to be equipped with quantitative information on, but not limited to, (1) a projected scope of applicability of the proposed models to their future rural electrification plans, (2) the estimated number of applicable cases, and (3) required O&M costs. When conducting the quantitative analysis, site-selection criteria for battery charging stations need to be clarified also. Thus, the Project is advised to build upon its knowledge acquired through its experience on the pilot activities and propose most appropriate criteria.

### **(3) Formulating realistic policy recommendations**

In order to complete the work for Output 4, which is about proposing recommendations on policy and institutional frameworks for rural electrification using renewable energy, the Project is advised to have close dialogues with relevant institutions regarding the proposed solar PV models. The Project, then, should formulate realistic policy recommendations and garner support for their implementation by the concerned institutions. It is important to facilitate active adoption of the proposed models by REA in future. Therefore, if the models are deemed effective in the Project Completion Report, application of the models is advised to be specified in REA's "Annual Renewable Energy Work Programme (Performance Contract)" as well as in the Rural Electrification Master Plan (REMP) at the time of updating. The Project and REA are encouraged to work on this

issue before the Project terminates.

**(4) Working on intensive technical transfer with strong participation from the C/Ps**

In order to fill the knowledge/skills gap, it is advised that the technical transfer from the Experts to C/Ps be undertaken actively during the remaining project period. Strong participation from the C/Ps in such activities is key for attaining satisfactory levels of technical transfer in each field of renewable energy technology. The C/Ps' participation includes, but not limited to, preparation and presentation of papers for the International Workshop to be held in February next year.

**(5) Recording the achievements of the Objectively Verifiable Indicators, challenges and recommendations**

At the time of the Terminal Evaluation, some of the key Objectively Verifiable Indicators in PDM have not reached their targets. They are expected to be attained in the next few months as the Project progresses. When writing the Project Completion Report to be submitted in February 2015, the achievement levels of those indicators should be clearly written so that an objective judgment of project performance can be made easily. Furthermore, remaining challenges and measures to be taken for raising sustainability should be discussed with the C/P and other related organizations and the results of the discussions should be delineated in the Project Completion Report.

**Recommendation to the C/P institutions (To be addressed as medium- to long-term measures)**

**(1) Utilizing and improving the proposed models continuously**

The C/P organizations are recommended to continue utilizing and improving the solar PV models proposed by the Project. Assignment of the departments/persons responsible for the coordination with relevant institutions is also recommended to make an institutional effort to improve the models.

**(2) Utilizing and revising the guidelines continuously**

As for MHP, biogas and wind technologies, pilot project implementation was cancelled in the first year of the project period. Thus, the C/Ps did not have a chance to experience the whole cycle of planning, analysis, system designing, installation and monitoring which are necessary for carrying out activities on the ground. The Project, instead, gave intensive training to the C/Ps and guidelines are being developed for future use. It is strongly recommended that the C/Ps will build on their training experience in the Project and leverage their increased knowledge in actual implementation of MHP, biogas and wind technologies in the field. In doing so, utilizing and revising the guidelines, including one on solar PV systems, should be conducted continuously. REA should be responsible for revising and updating the guidelines.



**(3) Improving database on the Rural Electrification Master Plan (REMP)**

Current database for the REMP needs to be improved making use of Geographical Information System (GIS). The improvement will help relevant organizations including development partners avoid duplication or overlap of future project sites. It will also facilitate easier decision-making concerning locations of future development.

**(4) Exchanging knowledge and human resources with JKUAT**

REA's and MoE&P's knowledge sharing and exchange with JKUAT have been proved to be beneficial. Continuous exchange of knowledge and human resources with JKUAT is advisable for strengthening capacity on renewable energy technology at REA and MoE&P. Such knowledge exchange includes, but not limited to, sharing REA's guidelines and other documents produced by the Project so that JKUAT can utilize them in their training courses. With regard to JKUAT's trainings on solar PV systems, regular attendance to such trainings by MoH, MoEST, and County Governments should be ensured.

**(5) Improving basic skills for installation work of electrical facilities**

It has been observed that the quality of basic installation work for wiring, switches, breakers, etc. was rather low. Thus, the responsible Expert became fully occupied with fixing those poor installations. Without the supervision of the Experts, most solar PV systems installed by local contractors may soon experience faults and malfunctions. In order to improve the quality of basic installation works, it is important for REA to compile detailed appropriate designs and rigorously supervise/ inspect the contractors' job accordingly.

**8. Lessons Learnt**

**(1) Taking appropriate measures to minimize negative factors before and during the Project**

There is no doubt that the current delay in producing sufficient outputs is largely attributable to many negative factors which are identified earlier in this report, "4.5.2 Factors which stand as challenges to the Project". There are as many as eight factors, both internal and external, which have been negatively influencing the Project throughout the implementation period. The project implementers should have made more efforts to identify and tackle these critical issues both before and during the project period so that unfavourable ramifications would be minimized. In some cases, drastic modifications on project design and modalities, including revision in project scope and change in the mode of expert dispatch, to name a few, could have been considered so as to best address major issues.

END



## ANNEX 1: Study Schedule

	Date		Dr. Shuto (Evaluation/ Analysis)	Mr. Ogawa (Team Leader) Ms. Masuya (Cooperation Planning)
1	Sep.30	Tue	Narita 22:30 -	
2	Oct.1	Wed	- 03:20 Doha (OR807) Doha 12:15 - 17:30 Nairobi (QR1337)	
3	Oct.2	Thu	Interview with Eng.Ephantus Kamweru, Chief manager, Renewable Energy Department, REA (Project Manager) Interview with Ms. Judith Kimeu, Assistant Engineer, Renewable Energy Department, REA and Mr. Anthony Wanhara, Technician, Renewable Energy Department, REA (micro hydro power) Interview with Ms. Caroline Kelly, Assitant Officer, Renewable Energy Department, REA (biomass) Interview with Ms. Caroline Wambu, Assistant, Corporate Planning Department, REA (Finance) Interview with Ms. Lucy Muricho, Senior Communications Officer, Communications Department, REA Mr. Hannington Gochi, Senior Technician, Renewable Energy Department, REA (PV, Wind)	
4	Oct.3	Fri	Interview with Dr. Kepha M. Ombacho, Director, Public Health, Ministry of Health Interview with Mr. John K. Temba, Head of ICT for Education, Ministry of Education, Science and Technology Interview with Mr. Samson Kasanga, Assistant Director, Reneable Energy, MOE&P Interview with Mr.Bista Deepak (Project Expert)	
5	Oct.4	Sat	16:00 Interview with Mr. Otake from Bright Project	
6	Oct.5	Sun	Data compilation	
7	Oct.6	Mon	Site visit with a JICA Expert and Joint Evaluator 7:00 Nairobi - 11:30 Narok 13:00-14:00 Olkinyei Dispensary Stay in Narok	
8	Oct.7	Tue	Site visit with a Japanese Expert and Joint Evaluator 9:00-10:00 Interview with Mr. Makori Antonym, County Director of Education's Office, Narok County Education Office 10:20-11:00 Interview with Dr. Peter Okoth , Director, Narok County Health Office, Mr. Daniel Sironga, County Public Health Officer, Narok County Health Office, Mr. Robert Mugwery, Deputy Sub-County Public Health Officer, Narok South Sub-County, Mr. Daniel Tubel,Bio Medical Engineering Technician, Narok North Sub-County 12:00-13:00 Ilumtum Primary School 14:00 Narok-17:00 Nairobi	
9	Oct.8	Wed	Data compilation	
10	Oct.9	Thu	Data compilation	Haneda 00:30-06:45 Dubai (EK313) Dubai 10:45-14:45 Nairobi (EK719) JICA Kenya Office
11	Oct.10	Fri	8:20 Courtesy Call to Mr. N'gang'a Munyu, Acting Chief Exective Officer, REA 10:20 Courtesy Call to Eng. Issac N. Kiva, Director, Renewable Energy, MOE&P PM:Internal meeting	
12	Oct.11	Sat	Internal meeting	
13	Oct.12	Sun	Data compilation	Site visit (Inkinyei from Loit) with JICA experts
14	Oct.13	Mon	9:00 Meeting with JICA experts,JICA Kenya Office and the Evaluation team (at JICA Kenya Office) 16:00 Discussion on Draft Minutes of Meeting (M/M) including draft Joint Evaluation Report(JER) with C/P (Mr.Muriithi) and Joint Evaluator	
15	Oct.14	Tue	14:00 JCC-Sharing the outline of terminal evaluation result at JCC 18:30 Report to Jica Kenya Office	
16	Oct.15	Wed	AM: Signing of MM Nairobi18:30→23:40Doha(QR1338)	Nairobi 16:40→22:40Dubai (EK720)
17	Oct.16	Thu	Doha01:45→17:55Narita(QR806)	Dubai02:50→17:35Narita (EK318)



## ANNEX 2: Project Design Matrix (PDM) Version 3.1

appendix 1  
PDM Version 3.1  
Date:2013/10/15

**Project Title:** The Project for Establishment of Rural Electrification Model Using Renewable Energy

**Implementing Agency:** Rural Electrification Authority (REA) and Ministry of Energy and Petroleum (MoE&P)

**Target Group:** Staff of REA and MoE&P, MoEST, MoH, County/Sub-County Education/Medical Officers in pilot project sites, Members of pilot project school and dispensary management committee, Operators of charging business at pilot project facilities, Local PV suppliers and technicians, Staff and users of public facilities of pilot projects in pilot project sites, power users in rural areas

**Project Site:** Kijado Central (1), Narok North (1), Narok South (2), Samburu Central (1), Samburu North (5)

**Project Period:** 2012– 2015 (3 years)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p><b>Overall Goal:</b> Rural electrification models using renewable energy are disseminated in the country to improve the quality of Kenyan's life.</p>	<ol style="list-style-type: none"> <li>Number of public facilities who apply and follow the model has increased all over the non-electrified areas in Kenya.</li> <li>Dissemination structure of national and county governmental agencies is established.</li> </ol>	<ul style="list-style-type: none"> <li>Official reports of MoE&amp;P/REA</li> </ul>	<p>Promotion measures and policies for rural electrification by renewable energy will be maintained,</p> <p>There will be no major changes in national and county government structures.</p> <p>Recommendations are adopted by relevant organizations.</p>
<p><b>Project Purpose:</b> Rural electrification models using renewable energy are established</p>	<ol style="list-style-type: none"> <li>The developed guidelines and manuals are applied to the projects implemented by the REA and MoE&amp;P (C/P).</li> <li>The Outputs of the Project are incorporated into implementation of REA Annual Renewable Energy Work Programme (Performance Contract).</li> <li>Renewable energy facilities installed by the Project are operated and maintained properly with sustainable.</li> <li>Implementation structures of national/county governmental agencies and local stakeholders are established.</li> <li>Variety of expertise in renewable energy is increased among members of C/P (C/Ps).</li> </ol>	<ul style="list-style-type: none"> <li>Financial reports of the target facilities.</li> <li>O&amp;M records of the target facilities</li> <li>User survey</li> <li>Household survey</li> <li>Numbers of expertise of C/Ps</li> </ul>	<p>REA Annual Renewable Energy Work Programme (Performance Contract) are prepared and implemented</p> <p>Involvement of relevant national and county government is maintained.</p>
<p><b>Outputs:</b> 1. A practical model for PV electrification of health service institutions in non-electrified areas is developed through pilot projects.</p>	<ol style="list-style-type: none"> <li>All level</li> <li>0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member.</li> <li>0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&amp;P are provided based on their Objective &amp; Achievement Sheet through OJT; On the Job Training.</li> <li>0-2 At least 3 monitoring team members achieve their objectives through trainings. Achievements are confirmed by trainee's self-assessment and evaluation by Japanese Experts (JEs).</li> <li>0-3 PV electrification, operation and maintenance manual for health service institutions with battery charging business is prepared for C/Ps including user manual and accounting manual.</li> <li>0-4 At least 2 people from health institution and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&amp;M of PV facilities including disposal of solar panels, batteries and toxic materials.</li> </ol> <ol style="list-style-type: none"> <li>National Level <ol style="list-style-type: none"> <li>1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the model.</li> <li>1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.</li> </ol> </li> <li>County/Sub-county Level <ol style="list-style-type: none"> <li>2-1 Collaboration among C/Ps, County and Sub-county medical officers is initiated and maintained to support the establishment, operation and maintenance of the model.</li> </ol> </li> <li>Local/Institutional Level <ol style="list-style-type: none"> <li>3-1. The target health institutions secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</li> <li>3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is</li> </ol> </li> </ol>	<ul style="list-style-type: none"> <li>Project reports</li> <li>Account book</li> <li>Cash flow statement</li> <li>Financial reports</li> <li>O&amp;M reports</li> <li>Periodical monitoring report prepared by the monitoring team</li> <li>Questionnaire survey</li> <li>Objective &amp; Achievement sheets of monitoring team members</li> <li>PV electrification, operation and maintenance manual for health service institutions</li> <li>Minutes of the meetings with relevant governmental agencies and County/Sub-county Medical officers.</li> </ul>	<p>There will be no major changes in national and county government structures.</p>

ANNEX 2-1

1

	<p>conformed through monitoring.</p> <p>3-3. Awareness raising activities on installed solar PV system at target health institutions and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.</p>	
<p>2. A practical model for PV electrification of schools in non-electrified areas is developed through pilot projects.</p>	<p>0. All level</p> <p>0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member.</p> <p>0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&amp;P are provided based on their Objective &amp; Achievement Sheet through OJT.</p> <p>0-2 At least 3 monitoring team members achieve their objectives through trainings. Achievements are confirmed by trainee's self-assessment and evaluation by JEs.</p> <p>0-3 PV electrification, operation and maintenance manual for schools with battery charging business is prepared for C/Ps including user manual and accounting manual.</p> <p>0-4 At least 3 people from school and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&amp;M of PV facilities including disposal of solar panels, batteries and toxic materials.</p> <p>1. National Level</p> <p>1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the model.</p> <p>1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.</p> <p>2. County/Sub-county Level</p> <p>2-1 Collaboration among C/Ps, County and Sub-county education officers is initiated and maintained to support the establishment, operation and maintenance of the model.</p> <p>3. Local/Institutional Level</p> <p>3-1. The target schools secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</p> <p>3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is conformed through monitoring.</p> <p>3-3. Awareness raising activities on installed solar PV system at target schools and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.</p>	<ul style="list-style-type: none"> <li>• Project reports</li> <li>• Account book</li> <li>• Cash flow statement</li> <li>• Financial reports</li> <li>• O&amp;M reports</li> <li>• Periodical monitoring report prepared by the monitoring team</li> <li>• Questionnaire survey</li> <li>• Objective &amp; Achievement sheets of monitoring team members</li> <li>• PV electrification, operation and maintenance manual for schools</li> <li>• Minutes of the meetings with relevant governmental agencies and County/Sub-county Education officers.</li> </ul>
<p>3. The Capacity of REA / MoE&amp;P to undertake project using MHP, Biogas and Wind technologies is enhanced.</p>	<p>3-1. Training is conducted for at least 2 C/Ps for each renewable energy technology.</p> <p>3-2. Guidelines are established for each renewable technology (MHP, Biogas and Wind).</p> <p>3-3. Guidelines are utilized by relevant ministries, governmental agencies and County/Sub-county offices.</p> <p>3-4. Seminar and training for technical transfer are conducted for C/Ps based on their Objective &amp; Achievement sheets.</p> <p>3-5. At least 6 C/Ps achieve their objective through training. Achievements are confirmed by trainee's self-assessment and evaluation by JEs.</p> <p>3-6. At least one pre-feasibility study document for future practical model for MHP, Biogas and Wind is prepared.</p>	<ul style="list-style-type: none"> <li>• Prepared Guidelines</li> <li>• Project reports</li> <li>• Objective &amp; Achievement sheets of trainees at REA and MoE&amp;P</li> </ul>
<p>4. Necessary policy and institutional frameworks for rural electrification using renewable energy are recommended.</p>	<p>4-1. International workshop is held to share the results of the project (e.g. EAC conference).</p> <p>4-2. Technical transfer workshops for C/Ps are held 3 times.</p> <p>4-3. Recommendations for C/P to implement the effective electrification by renewable energy are provided to be reflected on their rural electrification policy.</p>	<ul style="list-style-type: none"> <li>• Project reports</li> <li>• Presentation materials for International workshop.</li> <li>• Rural electrification policy of REA and MoE&amp;P</li> </ul>

ANNEX 2-2

<b>Activities:</b>	<b>Inputs ( Means and Cost)</b>	
<p><b>For Preparation</b></p> <ol style="list-style-type: none"> <li>1. Set up a Working Group (WG) consisting of 3 sub-groups for Outputs 1, 2 and 3, with clarified roles and functions of the counterpart personnel.</li> </ol> <p><b>For all Outputs</b></p> <ol style="list-style-type: none"> <li>1. A weekly project status report is prepared and shared by both C/Ps and JEs.</li> <li>2. Monthly project meeting is held by REA.</li> <li>3. Progress report is prepared by JEs including the progress summary table according to PDM to monitor and report the progress of indicators to achieve outputs.</li> </ol> <p><b>For Output 1 (The health service institution model)</b></p> <p>1-1 National Level</p> <ol style="list-style-type: none"> <li>1-1-1 Review policies, studies, surveys and projects related to electrification of health service institutions using Solar PV.</li> <li>1-1-2 Organize a progress and information sharing meetings with REA, MoE&amp;P, and MoH at least twice to discuss on model establishment and dissemination at national level.</li> <li>1-1-3 Prepare policy recommendations with institutional framework to promote the health institution model(s).</li> <li>1-1-4 Prepare a proposal for the disposal of solar panels, batteries and toxic materials according to the current conditions and regulations.</li> </ol> <p>1-2 County/Sub-county Level</p> <ol style="list-style-type: none"> <li>1-2-1 Account book and cash flow statement are submitted to County Medical Officer(s) of the project sites at least twice for Lot 1 and once for Lot 2.</li> <li>1-2-2 O&amp;M reports are submitted to County Medical Officer(s) twice for Lot1 and once for Lot 2.</li> <li>1-2-3 Organize a progress and information sharing meetings with REA, MoE&amp;P (monitoring team members), and County and Sub-county medical officers at least twice to discuss on model establishment and dissemination at County/Sub-county level.</li> <li>1-2-4 Conduct the baseline survey at the target facilities and surrounding communities</li> <li>1-2-5 Conduct capacity &amp; needs assessment of County/Sub-county medical officers in terms of renewable energy utilization and dissemination.</li> </ol> <p>1-3 Local/Institutional Level</p> <ol style="list-style-type: none"> <li>1-3-1 Conduct capacity &amp; needs assessment of target communities and other stakeholders.</li> <li>1-3-2 Sustainable financial plan is prepared.</li> <li>1-3-3 Sufficient financial trainings for the operator of charging center, staff of health institution, and members of management committee are provided through lectures and OJT.</li> <li>1-3-4 The operator of the charging center accurately records daily sale.</li> <li>1-3-5 Assigned nurse, a treasurer and a chairperson of the management committee accurately records an account book and cash flow statement.</li> <li>1-3-6 Assigned nurse and a chairperson of the management committee prepare O&amp;M reports.</li> <li>1-3-7 Identify and manage to obtain agreement with the agencies and/or organization to provide financial support to sustain the model according to the income by battery charging system.</li> <li>1-3-8 Prepare detailed plans of the pilot projects including "System design" and "Sustainable O&amp;M" with staff of REA and MoE&amp;P through OJT.</li> <li>1-3-9 Organize a stakeholder meeting with the members of management committee and owners of facility to discuss on operation and maintenance at least once for each pilot facility.</li> <li>1-3-10 Organize an information sharing meeting with users of pilot facility and County/Sub-county medical officer(s) at least once for each pilot facility.</li> <li>1-3-11 Organize an evaluation meeting with the members of management committee and owners and users of facility, County and Sub-county medical officers at the end of the project period at least once for each pilot facility.</li> </ol>	<p><b>Japanese Side</b></p> <p>A. Dispatch of Experts &lt; Short-term Experts &gt;</p> <ul style="list-style-type: none"> <li>• Team leader / Wind power generation</li> <li>• Sub leader / Rural electrification / Micro-hydro power</li> <li>• Photovoltaic power generation</li> <li>• Biomass/gas power generation</li> <li>• Financial management</li> <li>• Community Development and Monitoring</li> <li>• Procurement and supervision of pilot projects</li> <li>• Environmental and Social Considerations</li> </ul> <p>B. Training of Kenyan personnel (in Japan, in the third country)</p> <ul style="list-style-type: none"> <li>• Counterpart Training, and/or</li> <li>• Group Training Course for Rural Electrification by Renewable Energy</li> </ul> <p>C. Provision of Equipment.</p> <ul style="list-style-type: none"> <li>• Equipment for pilot projects of health service institutions</li> <li>• Equipment for pilot projects of schools</li> </ul> <p>Other equipment will be specified depending on the requirement for effective implementation of the Project.</p> <p>D. Local Cost (Seminars, meetings, trainings, local and international consultants, etc.)</p>	<p>MoE&amp;P and REA continue to be responsible for rural electrification in Kenya.</p> <p>Related ministries (MoH, MoEST,) agencies and county governments take part in the Project actively.</p> <p>Target communities, institutions, and private sectors agree the Project Purpose and take part in the Project actively.</p> <p>Security is maintained</p>
<p><b>For Output 2 (School model)</b></p> <p>2-1 National Level</p> <ol style="list-style-type: none"> <li>2-1-1 Review policies, studies, surveys and projects related to electrification of schools using Solar PV.</li> <li>2-1-2 Organize a progress and information sharing meetings with REA, MoE&amp;P, and MoEST at least twice to discuss on model establishment and dissemination at national level.</li> <li>2-1-3 Prepare policy recommendations with institutional framework to promote the school model(s).</li> <li>2-1-4 Prepare a proposal for the disposal of solar panels, batteries and toxic materials according to the current conditions and regulations.</li> </ol> <p>2-2 County/Sub-county Level</p> <ol style="list-style-type: none"> <li>2-2-1 Account book and cash flow statement are submitted to County Education Officer(s) of the project sites at least twice for Lot 1 and once for Lot 2.</li> <li>2-2-2 O&amp;M reports are submitted to County Education Officer(s) twice for Lot1 and once for Lot 2.</li> <li>2-2-3 Organize a progress and information sharing meetings with REA, MoE&amp;P (monitoring team members), and County and Sub-county education officers at least twice to discuss on model establishment and dissemination at County/Sub-county level.</li> <li>2-2-4 Conduct the baseline survey at the target facilities and surrounding communities</li> <li>2-2-5 Conduct capacity &amp; needs assessment of County/Sub-county education officers in terms of renewable energy utilization.</li> </ol> <p>2-3 Local/Institutional Level</p> <ol style="list-style-type: none"> <li>2-3-1 Conduct capacity &amp; needs assessment of target communities and stakeholders.</li> <li>2-3-2 Sustainable financial plan is prepared.</li> <li>2-3-3 Sufficient financial trainings for the operator of charging center, staff of school, and members of management committee are provided.</li> <li>2-3-4 The operator of the charging center accurately records daily sale.</li> <li>2-3-5 Head teacher, a treasurer and a chairperson of the management committee accurately record an</li> </ol>	<p><b>Kenyan Side:</b></p> <p>A. Assignment of counterpart personnel</p> <p>B. Provision of office space and facilities at REA (office for JICA experts and Working group members.)</p> <p>C. Allocation of counterpart budget</p>	<p>Related ministries (MoH, MoEST,) agencies and county governments agree the Project Purpose and accept their roles in the Project implementation.</p> <p>Counterpart, budget, office space and facilities necessary for the Project are allocated</p>

<p>account book and cash flow statement.</p> <p>2-3-6 Head teacher and a chairperson of the management committee prepare O&amp;M reports.</p> <p>2-3-7 Identify and manage to obtain agreement with the agencies and/or organization to provide financial support to sustain the model according to the income by battery charging system.</p> <p>2-3-8 Prepare detailed plans of the pilot projects including "System design" and "Sustainable O&amp;M" with staff of REA and MoE&amp;P through OJT.</p> <p>2-3-9 Organize a stakeholder meeting with the members of management committee and owners of facility to discuss on operation and maintenance at least once for each pilot facility.</p> <p>2-3-10 Organize an information sharing meeting for the users of the pilot facility and County and Sub-county education officer(s) at least once for each pilot facility.</p> <p>2-3-11 Organize an evaluation meeting with the members of management committee and owners and users of facility, County and Sub-county education officers at the end of the project period at least once for each pilot facility.</p> <p><b>For Output 3 (MHP, Biogas and Wind)</b></p> <p>3-1. Conduct inventory and review of existing studies on MHP, Biogas and Wind.</p> <p>3-2. Prepare guidelines for rural electrification using renewable energy (MHP, Biogas, Wind) according to the contents of the technical trainings in terms of planning, design, procurement, monitoring and maintenance.</p> <p>3-3. Conduct technical training for REA / MoE&amp;P staff on MHP, Biogas and Wind.</p> <p>3-4. Carry out simple pre-feasibility study focusing on technical examination for MHP, Biogas and Wind.</p> <p>3-5. Prepare technical recommendation for rural electrification using MHP, Biogas and Wind.</p> <p>3-6. Collect necessary data and equipment for technical trainings and development of the guidelines.</p> <p>3-7. Hold workshops for stake holders to validate guidelines on MHP, Biogas and Wind.</p> <p><b>For Output 4 (Policy recommendations)</b></p> <p>4-1 Implement and monitor the preparation activities of policy recommendations of Output 1,2 and 3.</p> <p>4-2 Organize workshop(s) on rural electrification models using renewable energy and/or present the results of the project by C/Ps at the domestic or international conference for information sharing with other stakeholders and donors in the energy sector of Kenya and East Africa.</p> <p>4-3 Compile policy recommendations.</p> <p>4-4 Initiate and strengthen the concept of Academic-Private Sector Platform in collaboration with JICA Experts of "the Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy."</p>		
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**ANNEX 2-4**

# ANNEX 3: Evaluation Grid

Lit= Literature review, Q= Questionnaire, Int=Interview, Ob= Observation

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
Performance	Achievement of inputs	Japanese side: Dispatch of experts, equipment/machinery, training in Japan and third countries, operation cost Kenyan side: Assignment of C/P, facilities, operation cost	Comparison with the plan	Data regarding inputs, opinions of the experts and CP	Project documents, JCC minutes, data regarding inputs, experts, CP	Lit, Int, Q
	Achievement of output 1: A practical model for PV electrification of health service institutions in nonelectrified areas is developed through pilot projects.	0. All level 0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member. 0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&P are provided based on their Objective & Achievement Sheet through OJT; On the Job Training. 0-2 At least 3 monitoring team members achieve their objectives through trainings. Achievements are confirmed by trainee's self-assessment and evaluation by Japanese Experts (JEs). 0-3 PV electrification, operation and maintenance manual for health service institutions with battery charging business is prepared for C/Ps including user manual and accounting manual. 0-4 At least 2 people from health institution and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&M of PV facilities including disposal of solar panels, batteries and toxic materials. 1. National Level 1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the	Comparison with the indicator	Indicators, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, indicators, experts, CP	Lit, Int, Q

ANNEX 3-1

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
		<p>model.</p> <p>1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.</p> <p>2. County/Sub-county Level</p> <p>2-1 Collaboration among C/Ps, County and Sub-county medical officers is initiated and maintained to support the establishment, operation and maintenance of the model.</p> <p>3. Local/Institutional Level</p> <p>3-1. The target health institutions secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</p> <p>3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is conformed through monitoring.</p> <p>3-3. Awareness raising activities on installed solar PV system at target health institutions and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.</p>				
	Achievement of output 2: A practical model for PV electrification of schools in nonelectrified areas is developed through pilot projects.	<p>0. All level</p> <p>0-0 All sub-group working members for Output 1 participate in monitoring at least twice as a monitoring team member.</p> <p>0-1 Monitoring trainings for the monitoring team members including both technical and environmental/community development staff at REA and MoE&amp;P are provided based on their Objective &amp; Achievement Sheet through OJT.</p> <p>0-2 At least 3 monitoring team members achieve their objectives through trainings. Achievements are confirmed by trainee's self-assessment and evaluation by JEs.</p> <p>0-3 PV electrification, operation and</p>	Comparison with the indicator	Indicators, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, indicators, experts, CP	Lit, Int, Q

ANNEX 3-2

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
		<p>maintenance manual for schools with battery charging business is prepared for C/Ps including user manual and accounting manual.</p> <p>0-4 At least 3 people from school and management committee as well as the operator of charging center are trained to have accurate understanding and to be able to conduct proper O&amp;M of PV facilities including disposal of solar panels, batteries and toxic materials.</p> <p>1. National Level</p> <p>1-1 Collaboration among relevant governmental agencies is started and maintained at national level to support the establishment and dissemination of the model.</p> <p>1-2 Key criteria of the site selection are analyzed and established and sites for Lot 1 and Lot 2 are selected accordingly.</p> <p>2. County/Sub-county Level</p> <p>2-1 Collaboration among C/Ps, County and Sub-county education officers is initiated and maintained to support the establishment, operation and maintenance of the model.</p> <p>3. Local/Institutional Level</p> <p>3-1. The target schools secure the money from battery charging business and other financial source(s) for sufficient maintenance cost such as future purchase of batteries.</p> <p>3-2. Periodical monitoring is carried out by the monitoring team at least 3 times for Lot 1 and twice for Lot 2. Satisfaction for the system is conformed through monitoring.</p> <p>3-3. Awareness raising activities on installed solar PV system at target schools and community are held at least 3 times for each Lot 1 sites and 2 times for Lot 2 sites.</p>				
Achievement of	3-1. Training is conducted	Comparison	Indicators,	Project	Lit, Int, Q	

ANNEX 3-3

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
	output 3: The Capacity of REA / MoE&P to undertake project using MHP, Biogas and Wind technologies is enhanced.	for at least 2 C/Ps for each renewable energy technology. 3-2. Guidelines are established for each renewable technology (MHP, Biogas and Wind). 3-3. Guidelines are utilized by relevant ministries, governmental agencies and County/Sub-county offices. 3-4. Seminar and training for technical transfer are conducted for C/Ps based on their Objective & Achievement sheets. 3-5. At least 6 C/Ps achieve their objective through training. Achievements are confirmed by trainee's self-assessment and evaluation by JEs. 3-6. At least one pre-feasibility study document for future practical model for MHP, Biogas and Wind is prepared.	with the indicator	opinions of the experts and CP	documents, reports by experts, JCC minutes, indicators, experts, CP	
	Achievement of output 4: Necessary policy and institutional frameworks for rural electrification using renewable energy are recommended.	4-1. International workshop is held to share the results of the project (e.g. EAC conference). 4-2. Technical transfer workshops for C/Ps are held 3 times. 4-3. Recommendations for C/P to implement the effective electrification by renewable energy are provided to be reflected on their rural electrification policy.	Comparison with the indicator	Indicators, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, indicators, experts, CP	Lit, Int, Q
Implementation process	Ownership of the CP organization	CP organization's involvement in project management	Activity record	Results of the questionnaire, activity record	Project documents, experts, CP	Lit, Int, Q
	Collaboration and communication with relevant organizations	How collaboration with related organizations is undertaken? Is communication among relevant organizations effective and smoothly undertaken?	Activity record	Results of the questionnaire, activity record	Project documents, experts, CP	Lit, Int, Q
	Methods of transferring technology	Is the method of transferring appropriate?	Activity record	Results of the questionnaire, activity record	Project documents, experts, CP	Lit, Int, Q
	Project management system	Are the systems of project monitoring, decision-making, communication within the project members appropriate?	Confirmation of project monitoring activities	Project documents, JCC minutes, opinions of the experts and CP	R/D, Project documents, reports by experts, JCC minutes, indicators,	Lit, Int

ANNEX 3-4



Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
					experts, CP	
<b>Relevance</b>	Consistency with development policies of Kenya	Are the overall goal and project purpose aligned with the national development policies?	Development plans, priority areas	National and regional development policies	Policy documents, JICA Office, experts, CP	Lit, Int
	Consistency with Japan's foreign aid policy for Kenya	Is the project consistent with Japan's aid policy?	Japan's aid policy at present and at the time of project inception	Japan's aid policies for the target countries	Japan's aid policies, experts	Lit, Int
	Appropriateness of the target group setting	Is the selection of the target groups* appropriate?  * Staff of REA and MoE&P, MoEST, MoH, County/Sub-County Education/Medical Officers in pilot project sites, Members of pilot project school and dispensary management committee, Operators of charging business at pilot project facilities, Local PV suppliers and technicians, Staff and users of public facilities of pilot projects in pilot project sites, power users in rural areas	Target groups' size and characteristics	Ex-ante evaluation, JCC minutes, opinions of the target groups, experts and CP	Ex-ante evaluation, JCC minutes, reports by experts, target groups, experts and CP	Lit. Int
	Congruency with the needs of the target group	Is the Project catering the needs of the target groups?	The extent of the project's matching needs	Existing study results such as questionnaires, needs analysis, opinions of the target groups, experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit. Q, Int,
	Japan's technological advantage	Is Japan's technological advantage well reflected in the services provided by the Project?	Comparison with similar services in the target countries	Training materials, questionnaire study results (on target groups), opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit. Q, Int,
	<b>Effectiveness</b>	Appropriateness of setting the project purpose, objectively verifiable indicators, numerical targets, means of verification	Are the project purpose, indicators, and means of verification appropriate?	Logical relations between the project activities and outputs, quality of data obtained from the means of verification	PDM, indicators, opinions of the experts and CP	PDM, indicators, experts, CP
Achievement of the project purpose: "Rural electrification models using		1. The developed guidelines and manuals are applied to the projects implemented by the REA and MoE&P	Comparison with the indicator	Indicators, opinions of the target groups, experts and CP	R/D, Project documents, reports by experts, JCC minutes, indicators,	Lit, Int

ANNEX 3-5

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
renewable energy are established.”		(C/P). 2. The Outputs of the Project are incorporated into implementation of REA Annual Renewable Energy Work Programme (Performance Contract). 3. Renewable energy facilities installed by the Project are operated and maintained properly with sustainable. 4. Implementation structures of national/county governmental agencies and local stakeholders are established. 5. Variety of expertise in renewable energy is increased among members of C/P (C/Ps).			target groups, experts, CP	
	Promoting and hindering factors to the achievement of the project purpose	What are the promoting factors to the achievement of the project purpose?	Influence of the promoting factors on the achievement of the project purpose	Data on project activities (CP's policy directions, project's operation, decision-making), opinions of the experts and CP	R/D, Project documents, reports by experts, JCC minutes, indicators, target groups, experts, CP	Lit, Q, Int,
		What are the hindering factors to the achievement of the project purpose?	Influence of the hindering factors on the achievement of the project purpose	Data on project activities (CP's policy directions, staff turnover rates, project's finances), opinions of the experts and CP	R/D, Project documents, reports by experts, JCC minutes, indicators, target groups, experts, CP	Lit, Q, Int,
	The influence of external factors (important assumptions) on the achievement of the project purpose	How are the external factors influencing the achievement of the project purpose? How is the project coping with the factors?	The project's reaction to the external factors	Information on external factors (There will be no major changes in national and county government structures.), opinions of the experts and CP	R/D, Project documents, reports by experts, JCC minutes, indicators, target groups, experts, CP	Lit, Q, Int
<b>Efficiency</b>	Appropriateness of inputs	Inputs from Japan: Japanese experts	Quantity, quality, and timing of the inputs in comparison with the plan	Expertise, numbers of experts, dispatch duration, capacity	R/D, Project documents, reports by experts, JCC minutes, records of inputs, indicators, target groups, experts, CP	Lit, Q, Int,

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
		Inputs from Japan: Equipment / machinery	Quantity, quality, and timing of the inputs in comparison with the plan	specifications, quantity, units, value, purpose	R/D, Project documents, reports by experts, JCC minutes, records of inputs, indicators, experts, CP	Lit, Q, Int, Ob
		Inputs from Japan: Training in Japan and the third countries	Quantity, quality, and timing of the inputs in comparison with the plan	Trainees' affiliations, number of trainees, training periods, contents of the training	R/D, Project documents, reports by experts, JCC minutes, records of inputs, target groups, trainees, experts, CP	Lit, Q, Int,
		Inputs from Japan: Operation cost	Quantity, quality, and timing of the inputs in comparison with the plan	Budget, expenses	R/D, Project documents, reports by experts, JCC minutes, records of inputs, experts, CP	Lit, Q, Int
		Inputs from Kenya: Assignment of counterpart personnel	Quantity, quality, and timing of the inputs in comparison with the plan	Number of staff, capacity	R/D, Project documents, reports by experts, JCC minutes, records of inputs, target groups, trainees, experts, CP	Lit, Q, Int,
		Inputs from Kenya: Office, work space and relevant facilities	Quantity, quality, and timing of the inputs in comparison with the plan	Conditions of the facility, opinions of the target groups, experts and CP	R/D, Project documents, reports by experts, JCC minutes, records of inputs, target groups, trainees, experts, CP	Lit, Q, Int, Ob,
		Inputs from Kenya: Operation cost	Quantity, quality, and timing of the inputs in comparison with the plan	Budget, expenses	R/D, Project documents, reports by experts, JCC minutes, records of inputs, experts, CP	Lit, Q, Int
		The level of outputs in relation to the inputs	Are the inputs producing sufficient levels of outputs?	Confirmation of inputs and outputs	Achievement of targets, opinions of the experts and CP	R/D, Project documents, reports by experts, JCC minutes, records of inputs, indicators,

ANNEX 3-7

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
					target groups, experts, CP	
	Progress of the Project	Is the Project implemented as scheduled?	Comparison between the plan and actual project activities	Project documents, opinions of the experts, CP and target groups	R/D, Project documents, reports by experts, JCC minutes, indicators, target groups, experts, CP, site visit	Lit, Q, Int, Ob
	Collaboration with other ODA projects	How does the Project collaborate with other ODA projects including Bridge Project?	Confirmation of collaborations established and/or collaboration possibilities	Information on other projects (esp. Bridge Project)	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Int,
	Promoting and/or hindering factors to efficiency	What are the promoting factors to efficiency?	Influence of the promoting factors on efficiency	Data on project activities, opinions of the experts and CP	R/D, Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int,
		What are the hindering factors to efficiency?	Influence of the hindering factors on efficiency	Data on project activities, opinions of the experts and CP	R/D, Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int,
Impact	Prospect of achieving the overall goal: "Rural electrification models using renewable energy are disseminated in the country to improve the quality of Kenyan's life."	Are the project activities expected to be sustainably implemented?	comparison with the indicator	Indicators, opinions of the experts and CP	Project documents, relevant statistics	Lit, Int,
	Unintended effects	Are there unintended effects (both positive and negative) the project has brought about?	Confirmation of unintended effects	Opinions of the target groups, experts and CP	R/D, Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int,
	The influence of external factors (important assumptions) on the achievement of the overall goal	How are the external factors influencing the achievement of the overall goal? How is the project coping with the factors?	Relations between the project and external factors	Information on external factors (REA Annual Renewable Energy Work Programme (Performance Contract) are prepared and implemented Involvement of	R/D, Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int

ANNEX 3-8

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
				relevant national and county government is maintained.), opinions of the experts and CP		
Sustainability	Institutional sustainability	CP's position in terms of national and regional policies	Confirmation of CP's position in the policy domain	opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
		CP's management and decision-making system	Confirmation of CP's management and decision-making system	Opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
		CP's direction in future	Confirmation of CP's direction in future	Opinions of JICA, Japanese embassy, the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
		CP's assignment of counterpart personnel	Counterpart staff's number, capacity, level of motivation, turnover rate	Opinions of the target groups, experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
		Project management	Confirmation of operational management and monitoring	Opinions of the target groups, experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
	Financial sustainability	CP's Budget for the project	Confirmation of CP's budget	CP's budget, financial data, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
		Transparency of CP's finance	Confirmation of financial data	CP's budget, financial data, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
	Technical sustainability	Counterpart personnel's technical skills	counterpart staff's level of technical skills	CP's activities, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int

Aspects/ five evaluation criteria	Evaluation questions		Criteria & method for judgment	Required data	Information source	Data collection
	Question	Sub-question				
		Operation/ training manuals	Quality of operation/ training manuals and frequency of use	Operation manuals for training and administration, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
		Operation and maintenance of equipment and machinery	Confirmation of procedure of operation and maintenance of equipment and machinery	Information on operation and maintenance of equipment and machinery, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int
		Information management	Confirmation of information management	Confirmation on information management, opinions of the experts and CP	Project documents, reports by experts, JCC minutes, target groups, experts, CP	Lit, Q, Int



## ANNEX 5: List of Counterpart Training in Japan and Third Countries

Overseas trainings for Counterpart members (C/Ps) conducted under the budget of Japanese side are listed below.

### 1. 1<sup>st</sup> Year Overseas training (in Japan) for C/Ps conducted under Japanese budget

Duration: 8/27/2012 – 9/19/2012

Content of Training: Renewable energy technologies  
 Operation and Maintenance of existing system  
 Appropriate technologies for rural electrification using renewable energy

	Name of Trainee	Position	Organization
1	Mr. Antony Wanjara Oredo	Renewable Energy and Generation, Technician	REA
2	Mr. Edwin Owiti	Renewable Energy Department, Engineer (I)	MOE&P
3	Mr. Jacob Chepkwony	Renewable Energy Department, Engineer (I)	MOE&P

### 2. 2<sup>nd</sup> Year Overseas training (in India) for C/Ps conducted under Japanese budget

Duration: 11/9/2013 – 11/22/2013

Main Visiting Institution: The Energy and Resources Institute (TERI)

Content of Training: Renewable energy technologies  
 Operation and Maintenance of existing system  
 Business Models  
 Appropriate technologies for rural electrification using renewable energy

	Name of Trainee	Position	Organization
1	Mr. Semekiah Ongonga	Renewable Energy Department, Assistant Engineer	REA
2	Ms. Caroline Kelly	Renewable Energy Department, Assistant Officer	REA
3	Ms. Peninah Karomoh	Renewable Energy Department, Environmental Scientist	REA
4	Mr. Dickson Musili	Renewable Energy Department, Principal Renewable Energy Assistant	MOE&P

### 3. 3<sup>rd</sup> Year Overseas training (in Thailand) for C/Ps conducted under Japanese budget

Duration: 8/2/2014 – 8/16/2014

Main Visiting Institution: School of Renewable Energy Technology, Naresuan University (SERT)

Content of Training: Renewable energy technologies  
 Operation and Maintenance of existing system  
 Appropriate technologies for rural electrification using renewable energy

	Name of Trainee	Position	Organization
1	Mr. Gilbert Gichunge	Renewable Energy Department, Training Engineer	REA
2	Mr. Hannington Gochi	Renewable Energy Department, Senior Technician	REA
3	Mr. Benson Mwakina	Renewable Energy Department, Senior Principal Superintending Engineer	MOE&P

ANNEX 5-1



## ANNEX 6: List of Counterpart Personnel (C/P)

Project Director			
1	Mr. N'gang'a Munyu	Ag. Chief Executive Officer, REA	Renewable energy in general
Project Manager			
2	Eng. Ephantus Kamweru	Chief Manager, Renewable Energy Department, REA	Renewable energy in general
3	Eng. Isaac N. Kiva	Senior Principal Superintending Engineer (RE), MOE&P	Renewable energy in general
Working Group			
4	Mr. James Muriithi	Senior Engineer, Renewable Energy Department, REA	Renewable energy in general
5	Mr. Hannington Gochi	Senior Technician, Renewable Energy Department, REA	PV, Wind
6	Mr. Anthony Wanjara	Technician, Renewable Energy Department, REA	MHP (PV)
7	Ms. Colleta Koech	Assistant Engineer, Renewable Energy Department, REA	PV, Wind
8	Ms. Caroline Kelly	Assistant Officer, Renewable Energy Department, REA	Biogas
9	Mr. Gilbert Gichunge	Project supervisor, Renewable Energy Department, REA	Biogas
10	Mr. Semekiah Ongong'a	Assistant Engineer, Renewable Energy Department, REA	MHP
11	Ms. Judith Kimeu	Assistant Engineer, Renewable Energy Department, REA	MHP
12	Ms. Peninah Karomoh	Environmental Scientist, Renewable Energy Department, REA	Environment
13	Ms. Eunice Wambui	Economist, Corporate Planning Department, REA	Finance
14	Ms. Lucy Muricho	Senior Communications Officer, Communications Department, REA	Community Development
15	Mr. Samson Kasanga	Assistant Director, Renewable Energy, MOE&P	PV, Renewable energy in general
16	Mr. Jacob Chepkwony	Assistant Engineer, Renewable Energy, MOE&P	PV, Renewable energy in general
17	Mr. Edwin Owiti	Assistant Engineer, Renewable Energy, MOE&P	PV, Wind
18	Mr. Mungai Kihara	Engineer, Renewable Energy, MOE&P	Wind
19	Mr. Dickson Kisoa	Principal Renewable Energy Assistant (RE), MOE&P	PV, Renewable energy in general

ANNEX 6-1

## ANNEX 7: List of Provided Machinery and Equipment

(unit: KSh)

	Item	Specification	Units	Cost
1	Desktops	HP	3	342,000
2	Photocopy Machine	S/NFAJ11641 (2020L)	1	380,000
3	Auto Cad	LT 2013	1	95,000
4	Satellite Phone	Thuraya XT	1	255,351
5	Projector	Epson ES01 2600 Lumens	1	56,000
6	UPS	1500KVA Mercury Smart	3	42,000
7	Printer	HP P 3015DN	1	55,000
8	GPS	Garmin eTrex30	1	35,230
9	Clamp Meter	KEW MATE 2012R	2	32,641
10	Current Meter	UC-200V No. 2329	1	503,553
11	pH Meter	M610T	1	7,068
12	ORP Meter	RM-30P	1	68,913
13	Methane Gas Detector	XP-3140	1	186,595
14	Laser Distance Meter	GLM 80	1	25,163
15	Refractometer	RHA-200ATC	4	34,970
			<b>Total</b>	<b>2,119,484</b>

ANNEX 7-1

供与機材（パイロット活動関連費）

購入年	内容	内訳	費用（円）
2011年	調査用車両	2台	7,337,300
2013年	太陽光発電 パイロット機材	Lot1 関連機材（ソーラ ーバッテリー、ソーラ ーモジュール、LED 照 明、蛍光灯、インバー ター等）	7,380,001
2014年	太陽光発電 パイロット機材	Lot2 関連機材（ソーラ ーバッテリー、ソーラ ーモジュール、LED 照 明、インバーター等）	16,951,212
合計			31,668,513 (26,848,363 KSh)

