Final Evaluation of the European Union Energy Project

"Support the Ministry of Health and Social Welfare of Liberia in Providing Renewable Energy Sources to Rural Primary Health Care Facilities"

Save the Children International- Liberia

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ACRONYMS

AfT	Agenda for Transformation
CHAI	Clinton Health Access Initiative
CHDC	Community Health Development Committee
CHT	County Health Team
CO	Carbon Monoxide
DAC	Development Assistance Committee
DC	Direct Current
DHIS	District Health Information System
DVD	Digital Video Disk
EPI	Expanded Programme on Immunization
EU	European Union
EVD	Ebola Virus Disease
FGD	Focus Group Discussion
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HF	High Frequency
HMIS	Health Management Information System
HQ	Headquarters
IEC	Information, Education and Communication
KII	Key Informant Interview
LDHS	Liberia Demographic and Health Survey
M&E	Monitoring and Evaluation
MCH	Maternal and Child Health
MLME	Ministry of Lands, Mines and Energy
MoH&SW	Ministry of Health & Social Welfare
MoU	Memorandum of Understanding
OECD	Organization for Economic Cooperation and Development
OIC	Officer-in-Charge
PIU	Project Implementation Unit
PRS	Poverty Reduction Strategy
PSA	Preferred Supplier Agreement
PV	Photovoltic
RREA	Rural Renewable Energy Agency
SCI	Save the Children International - Liberia
SMU	Solar Maintenance Unit
ToT	Training of Trainers
TWC	Technical Working Committee
WASH	Water, Sanitation and Hygiene
WCS	West Coast Services

EXECUTIVE SUMMARY

Save the Children - Liberia commissioned final evaluation of the European Union (EU) Energy Project, a 36 months (August 2011 – August 2014) solar energy project aimed at increasing access to reliable health care in Liberia. The project provided modern, affordable and sustainable energy sources to 205 rural and peri-urban health facilities, providing light during the night, and powering communication radios with round-the-clock energy. The project also aimed to train Ministry of Health and Social Welfare (MoH&SW) staff and community members on solar system maintenance. In order to ensure proper maintenance of the solar units, it was planned that a Solar Maintenance Unit (SMU) would be established within the Infrastructure Unit of the MoH&SW. It was envisioned that when these health facilities are provided with reliable energy source, it would strengthen the health referral systems from clinic to health centers, and form health centers to hospitals; support reduction in mortality through ensuring 24 hours supply of energy in health facilities; and also support the Expanded Programme on Immunization (EPI) through 24 hours energy to run solar fridges that store vaccine.

Thus, the final evaluation was undertaken to assess the overall progress made by the project towards fulfilling its objective of increased access to health. The evaluation also sought to examine the degree to which risks and assumptions envisaged at project initiation held true, and identify if there were any factors that facilitated or impeded the achievement of the objectives. Specifically, the evaluation was to re-assess the strategic objectives and implementation mechanisms proposed during the design of the project; gauge the extent to which implementation mechanisms have been effective in delivering results, and to provide recommendations.

The evaluation used a mixed-method, combining both quantitative and qualitative data collection approaches, involving desk reviews; key informant interviews (KIIs), focus group discussions (FGDs), and field observations. The conclusion provided in this report is based on triangulation of data collected through the various approaches. Given the national scope of the project, health facilities were selected from different regions of the country. In total field data were collected from 23 health facilities in six counties: Bomi, Margibi, Grand Bassa, Bong and Grand Gedeh, and Montserrado. Excluding Montserrado, in each county, four health facilities were selected, but one of them did not have a solar energy source. This allowed for comparison of facility utilization data between facilities with solar energy source, and those without. In the end, 15 FDGs and 45 Key KIIs were conducted, sampling 195 persons.

Overall, the evaluation was constrained by the fact that it was conducted nearly one year after the project closed up. Consequently, it was difficult to promptly gather information, as none of the staff who directly worked on the project implementation is in the current employment of Save the Children - Liberia. During the rainy season, travelling in the counties becomes difficult; so, selection of health facilities had to be controlled for their proximity to the provincial capital and their accessibility by road. On account of this consideration, the team had to replace River Cess County with Grand Bassa, as there were increasing concerns about reaching the targeted number of health within the time frame for the evaluation.

Principal Results and Analysis

The project addressed an important human need, which has remained a top development priority for the government – access to health. The provision of reliable energy source for rural and peri-urban health facilities has been acknowledged by all stakeholders, including health care workers and local community members as a viable strategy for increasing access to health care, mainly for women and children. Anecdotes from the field suggested that providing light in rural health facilities has enhanced the quality of service delivery because it creates a safe and conducive environment wherein care-givers provide needed medical services. Furthermore, it is reported to also encourage local community dwellers to seek prompt medical care even at night. Usually, they would choose to wait for daylight before attending the clinics, and such delays have been associated with increased health risks.

The project is relevant because, besides addressing pressing health needs of local communities, it is strategically aligned with the development priorities of the government. Both the Poverty Reduction Strategy (PRS), and the Agenda for Transformation (AFT 2013 - 2017), highlight government's policy for shift towards renewable energy, especially for rural and peri-urban populations.

The project management arrangement instituted by Save the Children - Liberia was adequate, and utilized a proactive and preventative management style. The structures and systems put in place ensured multi-layered supervision and quality control. The management team was far-sighted in anticipating problems, and took the necessary steps to either preclude such problems or mitigate their impacts on the implementation of the project. . The financial reports were of high quality, and were reviewed internally by the finance department on a quarterly basis. The project management team produced annual financial reports for each of the three fiscal years of implementation. Each annual financial report was independently verified by a certified local auditing firm, which asserted that the project financial reporting system was adequate; there was no ineligible expenditure; and that revenues were appropriately allocated by project and presented accordingly in the financial reports.

Various mechanisms were put in place to promote democratic governance at both national and local community levels. To begin with, a Project Implementation Unit (PIU) was organized to provide oversight for the coordination and implementation of the project. Within the PIU, a Technical Working Committee (TWC) was set up to handle technical matters, primarily designing of the solar system. Local communities were actively mobilized, and a Memorandum of Understanding (MoU) was signed between Save the Children - Liberia and each local community.

On the technical side, the design of the solar system utilized in the project is very sound, and followed best practice in solar energy technology, especially in resource constrained environments like rural Liberia. The project opted for top quality inputs, and invested in a system that guarantees a 4-day autonomy (meaning that the system can work for 4 days straight without sunshine). Such a system is particularly suitable to the climatic context in Liberia, because it provides a buffer against power outage, which could be readily provoked by heavy rain fall, a common phenomenon in the country. Moreover, the major components (battery, Photovoltic (PV) panes, and charge controller) would not require any major repairs or service until after several years. So, the investment would be viable for many years.

Broadly speaking, the management of the project was largely successful; the project was completed on schedule and within budget. The project delivered the outputs (installation of solar panels) on schedule,

and the target health facilities were reached. The target number of solar units was satisfactorily installed; the targets for training health staff and community members for solar maintenance were exceeded; but the SMU was not established at the MoH&SW.

Notwithstanding this delivery of outputs, the extent to which the project has achieved its overall result (increased access to health) is indeterminate because of the lack of data to make such analysis. First, the indicators for measuring progress towards health outcomes were inadequate. Second, performance tracking essentially focused on the progress of solar installations, leaving the responsibility for health outcome tracking to an external party, the District Health Information System (DHIS).

The attempt by the evaluation to construct proxies for retrospectively tracking health outcomes was not quite successful. Health facility utilization records for deliveries conducted in facilities where solar energy has been provided were reviewed from five counties. Unfortunately, data from four of the counties do not show evidence of increased access, either. However, data form Margibi County showed a different picture. Evidence showed that there were nearly twice as many night-time deliveries (78 percent) taking place at the Tucker-Ta Clinic three months after the installation of the solar units, compared with same period before the installation (46.2 percent). When the percentage point increase of night-time deliveries at the Tucker-Ta Clinic (31.9 percent) was compared with data from the Schefflin Clinic (15.2 percent), which does not have access to solar energy at night, it was found that there are two times more night-time deliveries being conducted at Tucker-Ta Clinic than at Schefflin Clinic.

The main impact of the project is that all health facilities now have a reduced need for utilizing an unsustainable source of energy (generators), for which they often lack the technical assistance to maintain, and the resources to run. These clinics now have adequate light during the night, as well as security light, to receive and treat patients in the best possible circumstances. Also, patients and their relatives do not have to bear the burden of buying candles, flashlight or gasoline to access night-time treatment.

Failure to establish the SMU at the MoH&SW is the most evident risk to the sustainability of the project. Currently, solar maintenance efforts are fragmented, as the trained pool of staff is uncoordinated. Now that the peak of the EVD emergency has abated there is scope to start developing a road map for the eventual handover of the SMU which has been housed by GIZ since October 2014.

There were three main constraints that remarkably impacted both the project timeline and the achievement of results: 1) lack of a customized M&E system to effectively track progress towards the achievement of higher level results, beyond the installation of the solar units; 2) failure to establish the SMU at the Ministry of Health; and 3) the outbreak of the EVD, which caused a near total collapse of the health sector. Majority of the assumptions made at the initiation held true, except for the following: HF radios were not available at nearly all facilities; DHIS was not capturing data on the project indicators; and the MoH&SW did not accumulate any savings to underwrite the cost of financing and managing the SMU.

The evaluation concludes that while the project management was successful in delivering on the technical outputs, there is no documented evidence to measure the extent to which the project achieved its objective of increased access to health. Notwithstanding these limitations, anecdotes from qualitative field data suggested that the project is having remarkable impact on both target groups (health workers) and the beneficiaries. In all health facilities visited for the evaluation, staff members reported that the

introduction of the solar energy has created a conducive environment for providing quality health care. Because of the solar light, health care workers in the target facilities are no longer using unreliable energy sources such as candles, mobile phone light, "Chinese" light, lantern, etc, which undermine their effectiveness and pose health risks (in case of delivery) for the mother and her child.

Recommendations

In view of these findings, the evaluation recommends the following:

- **Promote broader public sector use of solar energy**: the SMU should closely collaborate with the RREA, and other relevant stakeholders, Ministry of Public Works, Ministry of Lands, Mines and Energy to advocate for wider use of solar energy in the public sector.

- **Facilitate continued training and coordination of trained staff**: GIZ which currently hosts the SMU is perhaps best placed (funds allowing) to undertake training for staff at the three capacity tiers: health facility, CHT, and central (Infrastructure Unit); GIZ are also well placed to support the development of a coordination mechanism for all those involved with solar maintenance.

- **Promote much broader collaboration within the MoH&SW**: In the future, such project should include all relevant structures and departments that have direct bearing on the results of the project.

- **Forge stronger synergy with the Expanded Programme on Immunization:** Increase the role of cold-chain staff in maintaining the solar units, since they regularly visit the health facilities for cold-chain outreach.

- **Design tailored Monitoring and Evaluation System:** M&E for the project should not be delegated to an external party. The project must put in place the structure and resources for internal data collection, analysis and reporting of its established spectrum of results.

- **Allocate appropriate funding for solar maintenance**: the MoH&SW needs to establish a financing facility for solar maintenance by establishing an escrow account for depositing savings from fuel and maintenance costs for the facilities where solar energy has been installed.

- **Develop a road map for the eventual handover of the SMU to the MoH&SW**: a strong working relationship is needed to ensure a smooth eventual handover of the SMU to the Ministry and to help build the in house knowledge and capacity to ensure long term viability.

- **Ensure payment of out-standing co-funding obligation**: The MoH&SW has to settle its debt to Save the Children - Liberia, or it should formally request for waiver of the amount from the EU or Save the Children - Liberia.

- **Enhance the involvement and leadership of women**: the project needs to promote the role of women by putting in place strategies that encourage equal participation of both men and women in the implementation. Women could play more meaningful role in community mobilization.

1.0 INTRODUCTION

From June 16 through July 21, 2015 an independent consultant, contracted by Save the Children - Liberia[1], undertook a final evaluation of the European Union (EU) Energy Project implemented by Save the Children - Liberia. The EU Energy Project is a three-year (2011 – 2014) solar energy project aimed at increasing access to reliable health care in rural and peri-urban health facilities in Liberia through provision of modern, affordable and sustainable energy sources to the facilities. The project featured three results areas:

- Increased access to round-the-clock health care services through the provision of sustainable energy sources at rural and peri-urban health facilities.
- Improved capacity of key health staff and communities in solar maintenance.
- Strengthened institutional capacity within the MoH&SW to utilize and maintain solar energy for rural and peri-urban facilities.

The project was co-funded by the EU Energy Facility II and the Government of Liberia. The project targeted 205 health facilities (HFs) spread across the 15 counties in Liberia, and aimed to provide these facilities with light during dark hours (security lights and delivery room lights), and energy for communications, High Frequency (HF radio) round-the-clock. Another component of the project supported the establishment of a Solar Maintenance Unit (SMU) within the Ministry of Health and Social Welfare (MoH&SW) to ensure sustainability – mainly the maintenance and repair of the solar energy facilities in the long run. The need was realized for equipping rural health facilities with a sustainable source of energy as one of the strategies to assist in reducing infant and maternal mortality. Sustainable energy also strengthens the referral services in rural facilities by powering radio communication equipment apart from ensuring proper vaccine cold chain management. The project was intended to achieve the following health outcomes:

1) **Strengthen the health referral system from clinics to health centers, and health centers to hospitals though providing sustainability energy for powering radio communication equipment.**
2) **Support the reduction in mortality through ensuring a 24 hr supply of energy to health centers for longer health services operations and emergency case management**
3) **Support the regular expanded programme on immunization (EPI) of the government through ensuring availability of 24hr electricity to run solar fridges that store vaccines[2]**

The project targeted health staff for training in basic maintenance (at least one per facility, i.e. minimum 205 staff), as well as 615 community members (3 per facility). In addition, the project aimed to identify and train five technicians to work under the SMU at the MoH&SW. The project aimed to directly benefit the rural population of Liberia, which constitutes 53 percent (1,342,889) of the total population[3]. The project was implemented by Merlin, which later merged with Save the Children - Liberia. Save the Children - Liberia partnered with West Coast Services (WCS), a solar installation company, to design and install the solar units in the target health facilities. These efforts were done in collaboration with the MoH&SW, and other key stakeholders, including Rebuilding Basic Health Services (RBHS), and the Rural Renewable Energy Agency (RREA).

[1] See Annex A: Terms of Reference for Consultancy
[2] Merlin – ACP – EU Energy Facility Full Proposal Final (2010, p.8)
[3] Ibid, p.9

2.0 EVALUATION OBJECTIVES, CRITERIA & CONSTRAINTS

2.1 Objectives

In 2013, Save the Children - Liberia carried out an external, mid-term evaluation to assess the mid-point progress of the project, and provide lessons and recommendations for enhancing achievement of results. Having completed project implementation, the final evaluation was commissioned to assess the overall progress made by the project towards fulfilling its objective, as stipulated in the project log frame. The final evaluation also considered the degree to which risks and assumptions envisaged at project initiation held true, and identified if there were any factors that facilitated or impeded the achievement of the objectives. Specifically, the final evaluation endeavoured to 1) re-assess the strategic objectives and implementation mechanisms proposed during the design of the project; 2) assess the extent to which implementation mechanisms have been effective in delivering results, and 3) provide actionable recommendations for any future extension of the project.

2.2 Criteria

The specific areas for the evaluation were derived based on the Organization for Economic Cooperation and Development–Development Assistance Committee (OECD-DAC) criteria: Relevance, Effectiveness, Efficiency, Impact and Sustainability. The evaluation scope further encompassed quality of inputs, coordination and cooperation, constraints, lessons learned and recommendations. Based on these criteria, the evaluation questions were developed.[4]

2.3 Constraints

The final evaluation was undertaken nearly one year after the close up of the project; this affected the evaluation in different ways. None of the staff who directly implemented the project is currently in the employ of Save of Children. Thus, existing institutional memory for the project is limited to support personnel mostly. As a result, the evaluation was supervised by staff members with essentially little or no information on the project. There were initial delays in gathering relevant project documents for desk review. Secondly, finding information from the box files with hard copies of project document at Save the Children - Liberia Country Office proved tedious as everyone involved seemed unfamiliar with the filing system.

The evaluation was carried out during the rainy season, when travelling to the rural parts of the country is challenging. Although all facilities selected are located in rural and peri-urban areas, the number of health facilities visited in remote communities was limited. On account of these concerns, River Cess County, which was initially selected for the evaluation, was replaced with Grand Bassa County.

[4] See Appendix A for Evaluation Questions

3.0 EVALUATION METHODOLOGY

3.1 Approach

The evaluation adopted a mixed-method, combining both quantitative and qualitative data collection approaches. This involved desk reviews, key informant interviews, focus group discussions, and field observations. The conclusions provided in this report are based on triangulation of data collected through the various approaches.

Given the national scope of the project, a cluster and purposive sampling approach was used to identify health facilities which were the primary target of the project. About ten percent (20 facilities) of the targeted 205 health facilities were selected considering proximity to the provincial capital and accessibility by road. Data collection took place in five counties: Bomi, Margibi, Grand Bassa, Bong and Grand Gedeh. Some supplementary data were collected in Montserrado County, as well. In each county, four health facilities were selected, but one of the facilities did not have a solar energy source. This allowed for comparison of facility utilization data between facilities with and without solar energy source.

3.2 Team preparation

To facilitate the evaluation, a team of ten enumerators was recruited and trained in three days workshop from June 25 – 27, 2015 in Monrovia. The training covered key issues: overview of the project; research ethics and data quality control; review of data collection tools & mock exercises; field-testing of evaluation tools; revision of tools and other administrative matters. Through this process, the evaluation tools (interview schedule, FGD guides, data forms, etc.) were field-tested at the Clara Town Clinic, and finalized for the evaluation[5].

3.3 Data collection

Enumerators were deployed form June 28 - July 3, 2015. Before this time, the lead consultant had conducted KIIs with stakeholders in Montserrado. As shown in Table 1below, by the close of data collection on July 17th, 199[6] persons had been reached by the evaluation team[7].

Table 1: Number of persons reached in data collection

County	FGDs	# of Participants	KIIs
Montserrado	-	-	12
Margibi	3	30	7
Grand Bassa	3	30	7
Bomi	3	30	6
Bong	3	30	5
Grand Gedeh	3	30	7
International	-	-	1
Total	**15**	**150**	**45**

[5] See Annex B: Evaluation Data Collection Framework
[6] See Appendix B: List of KII Participants
[7] See Annex C: Evaluation Data Collection Tools

3.4 Data analysis

Both quantitative and qualitative analysis techniques were employed for the evaluation, as indicated by the nature of data collected from the field. Quantitative data comprised health facility utilization data, based on records reviewed at ten facilities (two per county). Because data on other relevant cases such as # of referrals, # of emergencies, etc. were not disaggregated by day and night, only the delivery records were meaningful to the evaluation. Analysis basically involved compilation of cases from a time interval of three months before the installation of the solar energy, and three months afterwards. From the total of each measure (before and after), the proportion of night-time delivery was calculated and compared. Using similar method, the proportion of night-time deliveries in the facility with energy source was compared with the facilities without solar energy source. The results were presented in a table and a chart, indicating the observed trends.

To aid qualitative analysis, audio files from KIIs and FGDs were transcribed by a team of three transcribers. During analysis, transcripts were carefully reviewed, checking audio files to ensure accuracy. Thereafter, analysis ensued, using a five-step process to organize the data, find and organize ideas, build over-arching themes, cross-check to test reliability and validity by examining within each transcript and across others to determine if issues are corroborated or refuted. Together with information gathered from the desk review, plausible explanations and interpretations were given to findings, on which to base conclusion.

3.5 Limitations

The 20 facilities selected in the evaluation have indeed provided a good insight into the situation with the solar energy project. However, since majority of these selected facilities were located closer to the main roads to prevent hindrance to the evaluation schedule, it might be interesting to assess more facilities located in the remote towns and villages to see if a different picture emerges. Also, data quality issues at the facilities did not allow for broader examination of the facility utilization, except for deliveries.

Given the tight timing and urgency for the completion of the evaluation, no provision was made for the holding of a validation workshop, where stakeholders would have the opportunity to input on the results. It is recommended that Save the Children - Liberia organize a validation workshop to solicit feedback from stakeholders. Even if the workshop is not possible, the draft report could be shared with the stakeholders (at least via email) to gather feedback for finalization.

4.0 PRINCIPAL RESULTS AND ANALYSIS

4.1 Relevance and quality

The project addressed a very important human need, which has remained a top development priority for the government – access to health. The provision of reliable energy source for rural and peri-urban health facilities has been acknowledged by all stakeholders, including health care workers and local community members as a viable strategy for increasing access to health care, mainly for women and children.

Anecdotes from the field suggest that providing light in rural health facilities has enhanced the quality of service delivery because it creates a safe and conducive environment wherein health workers provide needed medical services. Furthermore, it is reported to also encourage local community dwellers to seek prompt medical care even at night. Usually, they would choose to wait for daylight before attending the clinics, and such delays have been associated with increased health risks.

Health workers observed that pregnant women tend to experience labor during the night; so, not having light in the delivery room increases health risks for both the mother and her baby because care-givers would not have the supportive environment in which to provide quality care. Under such circumstances, patients and their relatives must to bring candles, flashlights, lanterns, and in some cases buy gasoline to fuel the facility's generators so they can be treated.

> *"The problem that we were having was that in the night, sometimes, when we go to the clinic, when there is no gasoline in the generator, we will end-up running around borrowing people flash light or borrowing this big light -- that light is 5.00USD. When you don't have some at your house, you will end up borrowing some. That is what we used to do here at that time. But we were suffering for light because there was no light at the clinic at the time. That is why we used to buy flashlight."*
>
> **Male FGD respondent in Bomi County**

This is why the relevance of this project, in a country with one of the world's highest rates of maternal mortality ratios[8] cannot be overemphasized. The project has heralded a new dawn of increased access to quality health care for rural populations, by placing health care workers in a better position to serve the catchment populations. Although not definitively measured, proxies imply that the project has helped to relieve poor rural families from the indirect health care costs associated with buying candles, flashlight, gasoline, etc. when they seek treatment at night.

The project is considered relevant because, besides addressing pressing health needs of local communities, it is strategically aligned with the development priorities of the government. The project was designed against the backdrop of a context in which the 2007 Liberia Demographic and Health Survey (LDHS) reported that only 37 percent of deliveries take place in a health facility (70 percent in Monrovia and 26 percent in rural areas); and 30 percent of women who deliver do not receive any postnatal care. Furthermore, infant mortality was rated at 71 deaths per 1,000 live births.[9]

[8] Liberia Maternal Mortality Ratio was measured at 994 maternal deaths per 100,000 live births (LDHS 2007, p.247)
[9] Liberia National Health and Social Welfare Policy, Ministry of Health and Social Welfare (2011 – 2021, p.6)

In general, owing to reasons commonly attributed to the infamy of the civil war, whereby the nation's infrastructure was vandalized, provision of basic services such as electricity and water has remained a mammoth challenge for the government. Because the lack of reliable energy source seriously undermines the provision of basic services, the government of Liberia has since recognized the need for exploring innovative solutions to the country's energy supply deficits. The shift towards renewable energy has been preferred to continued reliance on the growing use of generators, which are not only very expensive to operate and sustain, but are injurious to the environment. For example, with the solar units, the targeted health facilities eliminate their use of generators and kerosene lamps, reducing carbon monoxide (CO) emissions and benefiting the environment. The elimination of the regular use of generators and kerosene lamps also means there is less indoor air pollution within the health facilities.

Consequently, the government proposed, in its first development agenda (Poverty Reduction Strategy), to "*assess the potential for other renewable energy resources such as hydropower, solar, wind and biomass, and begin to construct small hydropower, biomass, and other renewable energy systems as appropriate*."[10] In furtherance of this goal, the RREA was established in January 2010 through an Executive Order (23). Its mission is to promote the spread of renewable energy technologies, particularly in rural areas. In the current development instrument, the Agenda for Transformation (AFT 2013 - 2017), this commitment is reiterated with a clear objective to arrange the installation of solar lights in at least 10,000 villages[11]. Therefore, the project supports government's efforts to deliver quality social services to all its citizens, and therefore remains relevant to the current socio-economic policy framework and development focus of the government.

Technically, the design of the solar system utilized in the project is very sound, and followed best practice in solar energy technology, especially in resource constrained environments like rural Liberia. The project management team opted for top quality inputs, and invested in a system that guarantees a 4-day autonomy (meaning that the system can work for 4 days straight without sunshine). Such a system is particularly suitable to the climatic context in Liberia, because it provides a buffer against power outage, which could be readily provoked by heavy rain fall, a common phenomenon in the country.

Knitted battery and charge controller: Tucker-Ta Clinic, Margibi County

The batteries used in the project have an average life of 5 years (although in real terms it could very well happen that those heavily overused will not go over 4 years and those highly underused can potentially last from 6 to 7 years)[12]. Hence, it is anticipated that the core components (battery, Photovoltic (PV) panel,

[10] Liberia Poverty Reduction Strategy Paper, (July 2008, p.104),
[11] Republic of Liberia - Agenda for Transformation: Steps Towards Liberia Rising 2030 (2013, p.67)
[12] Save the Children - Liberia EU Solar Energy Project: Mid-term Evaluation Report (Jan 2013, p.15)

charge controller) of the system would not require any major repairs or replacement until after about seven years.

Photovoltic (PV) Panel, Tubmaville Clinic, Grand Bassa

The installed system is user-friendly, requiring very minimum intervention from health facility staff at the periphery, precluding the risk of tampering or damage. The utilization of Direct Current (DC) technology prevents abuse, as appliances such as laptop computers, video players or fans cannot be used on the system. Also, restricting lighting to the compartments most in need of light: delivery rooms, record rooms, etc. promotes efficient discharge of power – helps to ensure that luminous intensity is sufficient to where it is needed to serve the intended medical purposes when the need arises. The batteries require zero-maintenance; and logging of performance monitoring data is a straight-forward process that does not require special skills to perform.

4.2 Effectiveness and Efficiency

4.2.1 Summary of achievements

Generally speaking, the management of the project was largely successful; the project was completed on schedule and within budget. The project delivered the outputs (installation of solar panels) on schedule, and the targeted health facilities were reached. All outputs under specific objective 1 (*sustainable solar energy sources available at health facilities*) were satisfactorily achieved; and outputs under specific objective 2 (*key staff are trained to maintain solar equipment*) were exceeded in view of the original plan. However, outputs under specific objective 3 (*solar energy maintenance unit established at the MOH&SW*) were not achieved[13].

Table 2 below summarizes the extent of achievement of each specific objective.

Table 2: Summary of project achievement of results

Specific objective	Achievement	Comments
Result 1: Sustainable energy sources available at health facilities, enable communities to access round-the-clock health care, and improved referral systems.	Solar energy units have been installed at 204 (99.5 percent) of the 205 health facilities targeted under the project	The solar units utilized in the project are top quality, suitable to the economic, technological and environmental context of the project. The results are thus evaluated as been satisfactory. However, there is no evidence of the extent to which the project achieved its overall objective (access to health) or improved the referral system.
Result 2: Key staff are trained to maintain solar equipment	The project exceeded the targets (1 at each facility, and 5 at MoH&SW central) for human resource capacity. More than 410 health facility staff (at least 2 per facility) were trained; 20 technically inclined staff members trained from 10 of the 15 CHTs; 4 technical staff trained at the Infrastructure Unite of MoH&SW; at least 805 community members trained (at least 4 per catchment community) on solar maintenance.	The staff training achievement exceeded expectation, as the total number of persons trained under the project greatly surpasses initial targets.
Result 3: A solar energy maintenance unit is established at the MoH&SW to support facilities in equipment maintenance	The Solar Maintenance Unit (SMU) was not established at the MoH&SW.	Near the end of the project, MoH&SW declared its incapacity to finance and manage the SMU. An interim arrangement was approved for GIZ to house the SMU for the foreseeable future, and collaborate with the MoH&SW.

Overall, the extent to which the project achieved its overall objective (*increased access to reliable health care in rural and peri-urban health facilities in Liberia*) remains indeterminate because of the lack of effective Monitoring and Evaluation (M&E) system that should have tracked progress towards this objective. This finding corroborates the results of the mid-term evaluation, which also flagged this design weakness[14]. Despite this realization, the project management did not prioritize some important

[13] See Appendix C: Detailed achievement of outputs under each specific objectives

[14] Save the Children - Liberia – EU Solar Energy Midterm Evaluation Report: Recommendation 5.5 (July 2013, p.18)

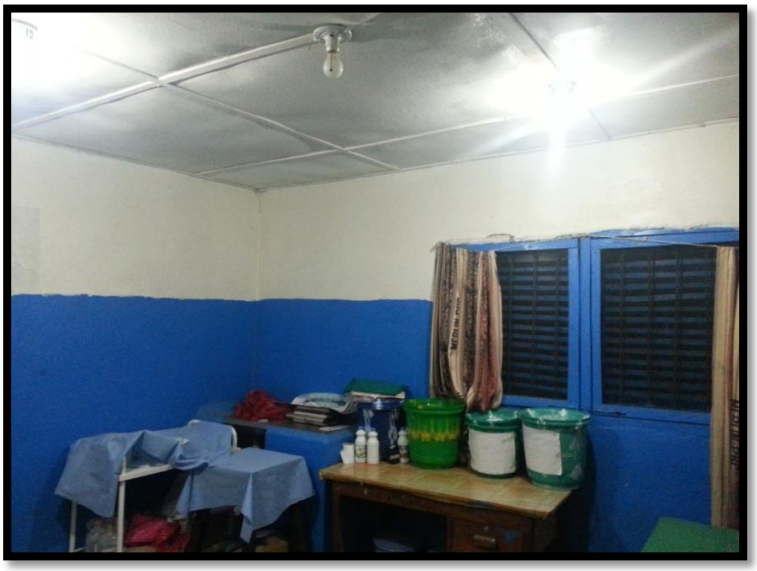
recommendations[15] of the mid-term review on how to retro-fit a tailored M&E system that would have mitigated the situation. Instead, it concentrated on lobbying for the inclusion of the key performance indicators[16] in the Health Management Information System (HMIS) of MoH&SW, which proved futile.

In Table 3 below is a summary of the total solar units installed under the project[17].

Table 3: Summary of installed solar units

	County	Number of Installed Units	Partner
1	Bomi	6	WCS
2	Bong	18	WCS
3	Gbarpolu	6	WCS
4	Grand Bassa	14	Merlin
5	Grand Cape Mount	27	WCS
6	Grand Gedeh	10	Merlin
7	Grand Kru	13	Merlin
8	Lofa	20	WCS
9	Margibi	8	Merlin
10	Maryland	11	Merlin
11	Montserrado	26	Merlin
12	Nimba	22	WCS & Merlin
13	River Cess	6	Merlin
14	River Gee	8	Merlin
15	Sinoe	9	Merlin
	Total	**204**	**Merlin (108) : WCS (96)**

As part of the field work conducted in six counties (including field-testing in Montserrado) to facilitate the evaluation, twenty (20) of the beneficiary health facilities were assessed. At all these health facilities, it was verified that the solar units were installed. This is evidenced by the physical presence of the equipment, which are available at all facilities; a signed installation certificate is displayed on the battery box, with signature of one health facility staff and a community member; and the monitoring log is available for inspection. The Harrisburg solar unit is not yet installed because repair works have not been completed on the roof of the clinic.



MCH, St. John Clinic, Grand Bassa County (night view)

[15] Ibid

[16] The relevant indicators for this project: % of health facility utilization rate at night; # of deliveries at night; # of other emergencies (malaria, accidents, etc.) at night; and # of referrals through the HF system.

[17] See Annex D: Solar Units Installation Tracker

Overall, report of power outage is negligible. The key problem that was reported by many facilities is failed light bulbs. From the evaluation findings, it was evident that there exists disconnect between the health facility staff and some CHT staff who were trained to provide maintenance and repair support. Some facility staff tend to call GIZ for help (using the hotline), instead of first reaching out to the trained staff in the county. Only one of the installed units was not working, the one in Gbecohn, Bong County. With support from the evaluation team, the Officer-in-Charge contacted GIZ, and the problem was solved. The system is now reported to be fully functional.

Although the project exceeded the targets for training, with respect to the initial plan, it is evident that conduct of training does not automatically translate into effective maintenance and servicing of the solar units. The strategy to decentralize capacity for maintenance and repairs is laudable, but a system needs to be set up to link the trained CHT staff with the facilities. Some staff members at facility level are still directly reaching out to GIZ for technical support, instead of the trained personnel available at the CHT. Also, trained CHT staff members interviewed (Bong, Margibi, Bassa and Grand Gedeh) reported that since they completed the training last year, there has not as yet been any follow up. This suggests that there is room for improvement in the manner in which the four people trained at MoH&SW and the 20 people trained at the CHTs are working together. The ongoing maintenance initiatives appear somewhat fragmented, with little coordination or synergy of efforts.

As was well documented in the mid-term evaluation report, the failure to have established a fully functioning and well-staffed solar maintenance unit within the Department of Infrastructure at the MoH&SW is the most evident risk to the sustainability of the project[18]. Housing the SMU at GIZ was intended as a temporary measure; now that the peak of the EVD emergency has abated there is an urgent need to initiate a process of seamless handover of the SMU to the Ministry. However, the onus rests upon the Ministry to reposition itself so that it is able to assume the responsibility of financing and managing the unit. Placing the Ministry in charge may create an incentive for increased institutional support for integration of the relevant performance indicators into the DHIS. With support from the Family Health Division, once the indicators are validated, they may as well be seen more as an institutional priority.

4.2.2 Adequacy of financial reporting

The total cost of 2 million Euros (approximately US$2.6 million) was co-financed by the European Union (75 percent) and the Government of Liberia (25 percent). By the close of the project, 98 percent of appropriated funding had been disbursed[19]. The single partner, West Coast Services (WCS), which participated in the project for 18 months, contributed to the development of the technical design and installed 96 of the 204 solar units (47 percent) in 7 of the 15 counties. WCS reported quarterly to the project management team at Save the Children - Liberia/Merlin. The financial reports were of high quality, and were reviewed internally by the finance department on a quarterly basis, after which subsequent disbursement would take place (based on a detailed forecast of the upcoming period). In addition to thorough financial management undertaken at the Country Office, Save the Children - Liberia/Merlin London based headquarters (HQ) provided a top layer of fiduciary control. This multi-layered financial management system promoted appropriate financial control, and ensured value for money.

[18] Save the Children - Liberia – EU Solar Energy Midterm Evaluation Report: Sustainability 5.5 (July 2013, p.13)
[19] Save the Children - Liberia EU Solar Energy Project Final Financial Report: period (23/08/2013-30/09/2014)

The project management team produced annual financial reports for each of the three fiscal years of implementation. Each annual financial report was independently verified by a certified local auditing firm (MGI-MONBO & COMPANY). On the whole, findings from the expenditure verification exercises determined that the project financial reporting system was adequate; and there was no ineligible expenditure. For example, for Fiscal Year Three (September 1, 2013 to September 30, 2014), wherein a total amount of €538,194.83 was disbursed, 70 percent of the expenditure was subjected to verification. The verification found that there was no ineligible expenditure[20]; expenses were justified by original invoices, duly signed purchase orders, as well as by proofs of purchases such as invoices or external receipts.[21] The verification also found that revenues were appropriately allocated by project and presented accordingly in the financial report.[22]

However, MGI-MONBO & COMPANY notes that the procedures performed for the verification exercises did not constitute either an audit or a review made in accordance with International Standards on Auditing or International Standards on Review Engagements. Hence, the company does not express any assurance on the Financial Report.[23]

4.2.3 Delays to implementation

Throughout the project there were different events and circumstances that impinged the timely delivery of outputs. Nonetheless, these intermittent delays were reworked into the work plan, leaving no room for scope creep as the project was completed on schedule.

The departure of the project manager in April 2012 caused some delays at the start of the project, especially regarding procurement of major components of the solar system. Merlin dispatched a technical expert to expedite implementation, as a new project manager was being recruited. After the installation of the first batch of 61 solar units, some technical problems emerged, when as many as 53 of all the installed breakers malfunctioned. In addition, experience from the field showed that the approved technical design (with a complex wiring scheme) was not installer-friendly, thus inhibiting the effectiveness and efficiency of the installation process. The technical teams had to evaluate the situation and derive a new simplified wiring, and better quality of breakers, provided by the supplier at no additional cost to the project. All subsequent installations were based on the new approved design. As a result of this new learning, the schedules for next two phases of installation were combined to allow for the repair of the existing faulty units before embarking on the new consignment. In the end, none of the above-mentioned limiting factors impacted the project schedule.

On the other hand, there were two key factors that had profound impact on the implementation of the project, and essentially handicapped the achievement of certain results. At the onset of the EVD, about 10 solar units had not been installed at the target facilities in Montserrado (9) and Maryland (1). Because of the obvious health risk of visiting health facilities at the time, the remaining installations were deferred to a later date, and a 'no-cost extension' was solicited from the EU Delegation by the close of the project in September 2014. Ultimately, a deal was agreed between Save the Children - Liberia, MoH&SW, and GIZ, where the latter would house and finance the technical Solar SMU for the foreseeable future,

[20] Save the Children - Liberia EU Solar Energy Project (Grant No. FED: 2011/267-810) Draft Expenditure Verification Report (May 2015, p.4)
[21] Ibid, p.10
[22] Ibid, p.12
[23] Ibid, p.4

working in close collaboration with the MoH&SW. This has proven to be successful, as recently this Unit completed the outstanding installations scheduled under the project, that were delayed due to the EVD with the exception of one which GIZ remain ready to install once repairs to the roof of the clinic are complete. However, the evaluation was unable to obtain a copy of the signed MoU that made this transition possible.

During the project initiation and formulation, it was assumed that with the introduction of solar energy in the targeted health facilities, the Ministry of Health would not need to incur any energy-related expenses for the operations of said health facilities. Consequently, the Ministry would save enough money to finance and manage an SMU within the Infrastructure Unit. This assumption did not hold true because after the agreement was reached the Ministry experienced ensuing budgetary reductions. This situation was further exacerbated by the outbreak of EVD, which overwhelmed the Ministry thereby making it impractical to honor the responsibility of financing and managing the SMU. By June 2014, after relentless efforts and persuasion from the project management team, the Ministry finally registered its unpreparedness. Another issue was the outstanding co-funding obligation of U$150,000.00 that the Ministry failed to fulfill for the implementation of the project. Save the Children - Liberia salvaged the situation by pre-financing the outstanding payment; hence, there was no direct effect on the project result.

4.2.4 Management arrangement and risk mitigation

The project management arrangement instituted by Save the Children - Liberia was adequate, and utilized a proactive and preventative management style. The structures and systems put in place ensured multi-layered supervision and quality assurance – at the field (community) level, at country level, and technical backstopping from headquarters.

Because of the adoption of a proactive and preventative management style, the management team was far-sighted in anticipating problems, and took the necessary steps to either preclude such problems or mitigate their potential impacts on the implementation of the project. When the project manager departed in April 2012, Merlin quickly sent a technical specialist from HQ to complete the logistical procedures and finalize the purchase order, to limit the delays incurred. The project management was also insightful in combining the international procurement of materials for Phases Two and Three, after encountering delay in the procurement for Phase One. There are many other examples that accentuate the exceptional quality of attention to detail and risk mitigation.

In making allocation for the international order of major components of the solar units, a 15 percent risk contingency was budgeted for to arrest any financial uncertainty (such as inflation) that would emerge. After the mapping exercise to verify the health facility listing, it was realized that majority of the targeted health facilities did not have HF radios installed, contrary to what was reported at project initiation. Not having HF radios would prevent the facilities from making maximum use of the installed units, as they had been designed to only provide light and power for these radios. Accordingly, the management repurposed some funding and purchased 45 HF radios, which were provided to the MoH&SW for onward distribution to the health facilities where they were needed the most.

Transporting goods to rural Liberia during the raining season is quite difficult because of the bad road conditions. Fully cognizant of this, the management timed the procurement of supplies so that goods arrived during the dry season. This allowed for safe transport of all solar units. Additionally, safety was reinforced by paddling the PV panels in cushions to prevent breakage. All batteries and charge controllers

were knitted into metal boxes that prevent tampering and theft. As a result of these measures, all units were transported to the 15 counties without a single incident of damage. Furthermore, effective community engagement made it possible to clarify the expectations of the local populations on the limitation of services to be provided by the solar energy – this engendered local community participation and support, thereby preventing potential community backlash.

4.2.5 Institutional cooperation and information sharing

Stakeholder participation and collaboration remained at the heart of the successful implementation of the project. Various mechanisms were put in place to promote democratic governance at both national and local community levels. To begin with, a Project Implementation Unit (PIU) was organized, comprising all relevant stakeholders whose responsibility was to provide oversight for the coordination and implementation of the project. Within the PIU, a TWC[24] was set up to handle technical matters, primarily the design of the solar system for the health facilities.

During the course of the project implementation, four TWC meetings were held to address technical matters regarding the design of the solar units. The TWC customized and approved the design for the installation. When the team learned of the faulty breakers and realized that the initial design was too complex, the TWC designed a new blue print, which was used for all installations henceforth. The first TWC meeting recorded was held on February 1, 2012, and the last meeting was held on June 4, 2013. Apparently, once all the technical issues regarding the design of the solar unit were resolved, TWC meetings were no longer relevant. Nine PIU meetings were held between September 22, 2011 and March 13, 2014. At these meetings key decisions were made to address challenges and constraints to implementation.

Overall, these regular meetings provided the mechanism for keeping all stakeholders adequately informed about implementation progress and other attending issues regarding the health of the project. Moreover, in addition to regular progress updates provided at these meetings, six-monthly interim narrative reports were compiled and shared with stakeholders. Other relevant stakeholders such as the EU Delegation (Project Officer, Giorgio Kirchmayr) were constantly kept in the loop of the implementation progress, and their support solicited as and when needed. One key issue that the EU Delegation provided immense support on was engaging with the Ministry of Health to fulfill its co-funding obligation to the project.

4.2.6 Community participation

At the local community level, community mobilizers engaged with health staff and the local population of the catchment areas for each targeted facility. Initially the mobilizers performed the verification of the health facilities, providing the pioneering opportunity for community entry. Thereafter, for each of the 205 facilities, the mobilizers engaged with the communities through the leadership, and youth and women's groups. These activities commenced about two weeks prior to the arrival of the installation teams. Through this activity, the local population was informed about the project, and a workshop was organized to more formally explain details about the benefits the project will bring to the people, as well as clarify expectations about what the solar units would be used for, and other uses that would not be allowed.

[24] Members of the TWC were Merlin, WCS, and RREA

In order to enhance the effectiveness of communication at the grassroots, language appropriate Information, Education and Communication (IEC) materials[25] were produced (with the technical support of the MoH&SW). The materials contained simplified messages, with accompanying visual aids to help everyone understand. At the end of these activities, Save the Children - Liberia and the communities publicly signed a MoU[26] that outlined the benefits of the project, and the roles and responsibility of the parties to ensure security, maintenance and functional longevity of the solar units.

This level of community involvement and participation has influenced the sense of ownership that local communities feel about the project. Consequently, both the health facility staff and the community leaders are keen on protecting the investment so that the benefits can be long-lasting. All the facilities visited during the evaluation have security guards to prevent theft; public awareness has been created so that people (especially children) do not throw stones at the roof of health facilities where the PV panels are installed. Staff members at the health facilities have been oriented to provide routine maintenance such and cleaning of PV panels, and recording performance ratings in assigned logs.

> *The solar system light there belongs to the community; so, the community has to help to mind it. You can't say it is for the hospital and the hospital has security - one man can't do it. You can't leave it with the hospital. The light is for the community, you don't have to go there as a watchman – but you can keep an eye on it.*
>
> ***Male participant, Community FGD in Salala, Bong County***

4.2.7 Commitment of stakeholders

The project chartered a novel course in public sector investment partnership, with very few examples (if any) that the Ministry of Health has entered into before. Authorities at the Ministry of Health disclosed that the kind of partnership achieved in this project (where the government committed to co-finance 25 percent of the project budget) is perhaps unprecedented. Agreeing to co-fund €500,000.00 was a clear demonstration of ultimate commitment on the part of government – although the government delayed in making good on this commitment. Despite this problem, this level of commitment demonstrated national testament that the project was strategically aligned with government priority. Three key government entities (MoH&SW, Ministry of Lands, Minds and Energy (MLME) and RREA) were involved with the coordination and implementation. At provincial levels, the County Health Teams were quite supportive of the project efforts – regularly giving logistical support; providing updated information that helped to make adjustments in the facility listing, etc.

At the community level, the leadership (both traditional and civil) and the local populations were very supportive, extending social and moral support, including communal hospitality to accommodate strangers. Across the counties, the Community Health Development Committees (CHDC), were keenly involved in the process, with some signing as community counterpart on the installation sheets posted at various health facilities. The signing of the MoUs with these communities is a loud manifestation of the level of community participation and involvement.

[25] See Annex F: Sample of IEC IEC Materials
[26] See Annex G: Sample Community MoU

We pray to God for the people who brought the solar energy to do more. The community provided sleeping place and security during the installation.

Chief Traditional Leader, Zleh Town, Grand Gedeh County

4.2.8 Stakeholders' perception about project

The project addressed a critical barrier to the delivery of quality health care in Liberia, particularly for rural populations. Other stakeholders, including the RREA believed that the project is in the right direction to buttress government's effort to increase access to electricity for rural populations. At community level, the local populations regard the project as a strategic intervention that has not only increased access to health care, but has relieved them from unnecessary socio-economic burdens associated with purchasing candles, flashlight, matches or gasoline in order to receive night-time treatment at the health facilities. They are not shy in expressing their gratitude to Save the Children - Liberia for making it possible for the solar units to be installed at their facilities. This has brought "development" to their communities, as the facility lights up the environment during the night, people feel safe to walk in the vicinity of the clinic, and some students take advantage of this to study around the health facility.

The solar energy has been a great help to the people in this rural part of the Country. It helped to facilitate delivery. You know in the absence of light, the nurses will not be able to carry on these kinds of deliveries. It helps to treat the patients at night, so it has been a great help to us.

Community Leader, Tubmanville, Grand Bassa County

4.2.9 Utilization of project results

Internally, the project results have been used extensively to inform management decision-making in addressing challenges and maximizing the benefits of the project. Verification assessments undertaken by the community mobilizers discovered that some facilities initially targeted by the project had recently received solar energy facility before the start of the project. The learning was used to update the original listing generated at the time of the project initiation. Results from the regular supervision and quality control visits were critical to identifying and troubleshooting technical defects of the initial installations.

The mid-term evaluation undertaken in early 2013, flagged a range of performance issues that informed some decision-making for the remainder of the project. For example, when the mid-term evaluation recognized that the potential risk of failure to establish the SMU at the Ministry was more eminent, it recommended a broad sector maintenance and repair capacity building strategy to empower maintenance staff from each CHT to get involved, instead of relying only on the SMU at the Ministry.
The project management exercised due diligence and tact in persuading the government to fulfill its financial obligation, amidst growing financial constraints facing the Ministry of Health. Total default (of the 25 percent obligation) by the government would have severely crippled the capacity of the project to achieve its results.

There is no evidence that the project results were used externally to inform policy for design of similar projects elsewhere. One key factor that hindered this prospect was the failure of the project to institute a robust system for tracking and communicating higher level results. Because there was no practical arrangement for the systematic collection, analysis and reporting of data on the key health outcome indicators, it was not feasible to demonstrate the desired results of the project. Secondly, the project was tied with the department of infrastructure at the MoH&SW, which was not so effective in escalating achievements and concerns up the management ladder. This weakness was overcome by arranging auxiliary meetings with relevant officials, but it was still not enough to mainstream the project in the Ministry.

Also, there were other fundamental problems of lack of synergy among various structures and departments (Infrastructure Unit, HMIS, Cold Chain, etc.) whose portfolio covered aspects of solar energy utilization – though they all had energy and solar programmes running, they were largely unaware of other departments' activities. Consequently, there was very limited institutional learning and sharing within the Ministry of Health.

4.3 Impact and Sustainability

4.3.1 Achievement of desired outcomes

The overall objective of the project is to increase access to reliable health care in rural and peri-urban health facilities in Liberia through providing modern, affordable and sustainable energy sources to the facilities.[27]Hence, in the grant application it was envisioned that the project would achieve three main outcomes: *1) Strengthen the health referral system from clinics to health centers, and health centers to hospitals though providing sustainability energy for powering High Frequency (HF)radio communication equipment; 2) Support the reduction in mortality through ensuring a 24 hr supply of energy to health centers for longer health services operations and emergency case management; and 3) Support the regular Expanded Programme on Immunization (EPI) of the government through ensuring availability of 24hr electricity to run solar fridges that store vaccines.*[28]

In order to measure progress towards the achievement of these results, the following indicators were adopted for the project: *% of health facility utilization rate at night, # of deliveries at night, # other emergencies at night, and # referrals through the HF radio system*. First, it is worth mentioning that the indicators are inadequate for measuring the results – none of them clearly measure reduction in mortality, and support to EPI. Second, the fact that the indicators could not be incorporated in the District Health Information System (DHIS) brings to question the process used in defining the indicators – how could these indicators have been decided upon without first ascertaining the capacity for data collection? It is, thus, improbable that the planners would delegate this critical aspect of the project to an external party, without making sure everything was in place to deliver on the responsibility. Had the project planners consulted with the HMIS Department, this situation would have been avoided, and the requisite remedial actions taken before finalizing the application. Consequently, the extent to which the project has achieved its overall results remains indeterminate because of the lack of data to make such analysis.

This final evaluation is in agreement with the mid-term evaluation, that the project lacked the requisite

[27] ACP-EU Energy Facility Grant Application (2010, p.7)
[28] Ibid, p.8

M&E system to adequately track progress towards the achievement of higher lever results. Monitoring initiatives undertaken during the project largely focused on the technical side of the project, ensuring technical functionality of the solar units, and tracking progress on the target of installations. The planning for M&E was not thorough enough, and efforts to remedy the situation and follow through were usually haphazard. For example, although the project was to strengthen the referral system, four out of every five (79.4 percent) health facility where solar energy was installed did not have HF radio. After the procurement of the 45 radios, it is unclear how data was collected on the use of the radio to indicate contribution to improving the referral system. Regarding the EPI coverage, it is unclear the extent to which the project forged synergy with the EPI in a systematic, result-oriented way. The solar fridges for freezing vaccines are powered by different solar panels, which do not interface with the systems under this project. There are no concrete reports (emanating from defined work plans) of such collaboration between both systems.

The failure to invest in an effective M&E system was birthed as a result of an incorrect assumption on which the project was designed – that the key outcome indicators were already incorporated into the DHIS. Because of this, no funding was allocated to ensure results synergy and tracking beyond the installation of the solar units. Unfortunately, the DHIS was developed in 2011, and the plan is to make revision after every five years. The system encompasses key performance indicators, agreed upon as national priority for measuring health outcomes. It is not revised to accommodate each new project that is initiated. On this basis, all efforts by the project management team to lobby for the incorporation of the project outcome indicators were fruitless.

4.3.2 Access to health

Owing to the inherent data problems, the evaluation attempted to make "pre" and "post" comparison of the utilization of the health facility since installation solar of the solar panel[29]. Also, the "pre" and "post" utilization data of facility with the solar units was compared with facilities that do not have solar units, using the same time interval.

There are three limitations to this methodology; 1) time interval for data collection was too close for observing any remarkable change, but extending the time interval further would have meant collecting data for times during which Ebola was raging and health facility utilization was at the lowest point; 2) reported facility utilization data for general cases are not disaggregated by day or night, except deliveries conducted; 3) facility utilization is influenced by the population of the catchment (which varies from one facility to another).

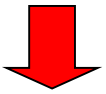
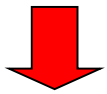
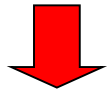
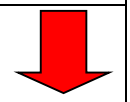
In view of these limitations, the only indicator for which meaningful data was collected was the "proportion of deliveries conducted at night." In each of the five counties, one facility with the solar energy source was compared with another facility that does not have solar energy source.

As shown previously in Table 4 overleaf, health facility utilization data for nighttime delivery in four of the five facilities where solar energy sources have been provided do not show evidence of increased access, as measured by increased proportion of night-time deliveries taking place at these facilities. If taken at face value, the data implies that the proportion of deliveries taking place at the facilities after the

[29] See Annex C: Evaluation Data Collection Tools

installation of the solar energy sources has, in fact, decreased. Moreover, when the data is compared with facilities with no sources of solar energy source to encourage night-time delivery, it seems more nighttime deliveries are taking place at the facilities without sources of reliable energy. It is unclear what impact the EVD outbreak may be having on the situation.

Table 4: Health facility utilization data before and after installation of solar energy (SE)

		3 months before SE		3 months after SE		Results	
County	**Clinics**	**Total deliveries**	**% at night**	**Total deliveries**	**% at night**	**Percent Variance**	**Outcome**
Margibi	Tucker-Ta Clinic	39	46.2%	41	78.0%	31.9%	
	Scheffline Clinic	7	28.6%	16	43.8%	15.2%	
Grand Gedeh	Gboleken Clinic	10	70.0%	11	63.6%	-6.4%	
	Boundary Clinic	0	0.0%	7	14.3%	14.3%	
Bong	Foequelleh Clinic	40	57.5%	45	46.7%	-10.8%	
	Gbecohn Clinic	27	33.3%	39	28.2%	-5.1%	
Bassa	St. John Clinic	51	58.8%	51	58.8%	0.0%	
	Lloydsvile Clinic	41	39.0%	86	46.5%	7.5%	
Bomi	Sass Town Clinic	43	69.8%	39	43.6%	-26.2%	
	Suehn Clinic	46	60.9%	34	55.9%	-5.0%	

However, as portrayed in Figure 1 below, the data from Margibi shows a different picture – the evidence showed that there were nearly twice as many night-time deliveries (78 percent) taking place at the Tucker-Ta Clinic three months after the installation of the solar units, compared with same period before the installation (46.2 percent). When the percentage point increase of nighttime deliveries at the Tucker-Ta Clinic (31.9 percent) is compared with data from the Schefflin Clinic (15.2 percent), which does not have access to a energy at night, it is found that there are two times more night-time deliveries being conducted at Tucker-Ta Clinic than at Schefflin Clinic.

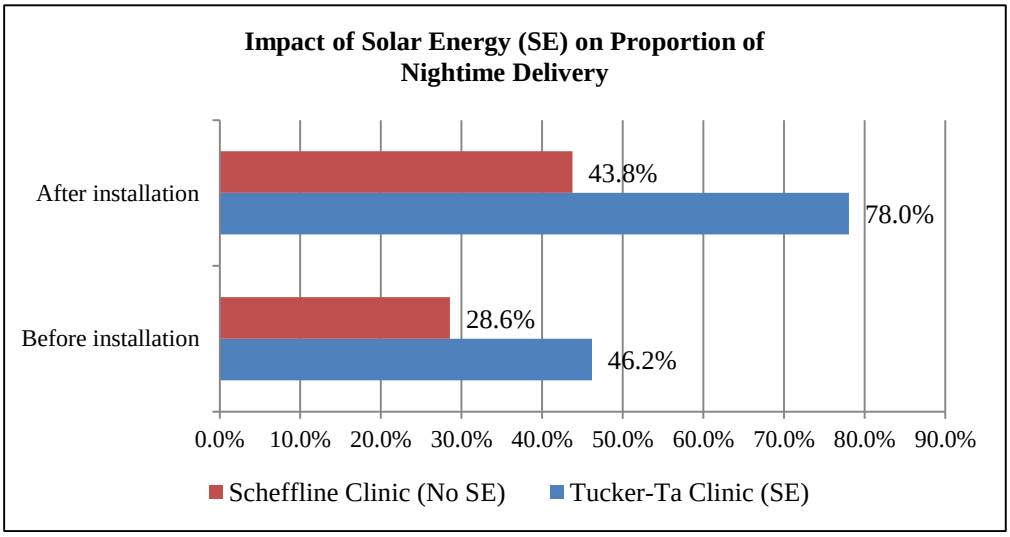


Figure 1: Impact of Solar Energy on Nighttime Delivery

On the whole, the findings from the health facility utilization data could easily fuel an incorrect conclusion that provision of reliable energy source at rural health facilities does not increase access to health care. First of all, the data used for this analysis is quite inadequate as it represents less than 5 percent of the total facilities where the solar units have been installed. Furthermore, data collection at the facility level are usually beset with multiple quality challenges – inconsistencies in gathering data (sometimes cases are recorded, and other times they are not); lack of standardization (some facilities record all nighttime cases for the next day), etc. The most fundamental problem points to the fact that no mechanism was put in place to facilitate accurate data collection for the target outcome indicators for the project. This finding is instructive that there is need to design a tailored M&E system, which would capitalize on establishing a proper baseline to facilitate pre and post comparisons, as well as delineating appropriate control groups to define true counterfactuals for comparing results with facilities that do not have reliable energy source.

As a consequence of the overall M&E deficiencies already discussed, there are no documented evidence to quantitatively demonstrate the extent to which the project achieved its outcomes as articulated in the application and log frame: *increased utilization of health facilities; strengthened referral system for emergency cases; reduced mortality; and enhanced EPI coverage*. Except in Gbecohn where the solar unit had been dysfunctional for a protracted period, all other health facilities visited reported very negligible downtime, far below the 10 percent target. However, there is overwhelming qualitative evidence that the project has remarkably affected the lives of target groups and beneficiaries in very positive ways.

4.3.3 Secondary impacts

The largest impact is that all benefitting clinics and health centers now have a reduced need for utilizing an unsustainable source of energy (generators), for which they often lack the technical assistance to maintain, and the resources to adequately fuel. These clinics now have adequate light during the night, as well as security light, to receive and treat patients in the best possible circumstances. In fact, the light is provided on a 24/7 basis, because unlike other compartments of the facilities, the Maternal and Child Health (MCH) has light also during the day.

Two main outcomes from the installation of the solar units: 1) health workers now enjoy conducive environments in which to perform their work; 2) patients and their relatives do not have to bear the burden of buying candles, flashlight or gasoline. Throughout the sixteen FGDs and eighteen KIIs conducted at the health facilities and within the catchment communities, these themes were communicated in no uncertain terms.

> *The solar panel helps us a lot because sometimes at night we have emergency cases like deliveries or women in labor pain and we will need not to look for flash light like we used to do or patients provided their own light or gas to fuel the generator. Before then we faced difficulties in conducting deliveries at night but with the help of the solar panel, we are able to do our work like emergency cases and deliveries safely.*
>
> ***OIC, Gboleken Clinic, Grand Gedeh County***

> *The solar system is helping us in Gayah Hill Community because like first when a woman goes to the clinic to deliver, they used to carry flash light but right now, no more flash light – the [solar] light can be on for safe delivery. And when somebody was sick at midnight, and they carried them to give them drip in the night, we used to buy gas to put in the generator. But right now it is helping us; so, to see you people coming in this community today, we are very happy we the Gayah Hill Community citizens for the solar system.*
>
> ***Female participant, FGD, Gayah Hill Community, Bomi County***

Health workers have also reported that having the solar light has been helpful in making timely reports. During the night, staff members make use of the light to prepare their progress reports. Additionally, in some communities the residents reported that the light has brought "development;" it beautifies the environment, and creates safe corridor for people to walk at night. There are a few reports of students studying under lights at night. In all FGDs conducted, the communities reported that [pregnant] women and children are the ones who benefit most from the solar light when it comes to receiving treatment at night. Although women are primary beneficiaries, they had limited role in the implementation of the project. For a project that largely benefits women, the participation and involvement of women should have been promoted in the project. For example, of the 15 community mobilizers recruited, only three were females. Besides treating pregnant women and children, there are numerous reports of road traffic accident cases, especially motorcycles, being treated at the facilities at night.

Based on the experiences of health care workers and the local communities, the introduction of solar energy has changed the health care delivery environment, and provided an incentive for people to seek health care round-the-clock – although the health facility utilization data does not readily back this claim. Ideally, the provision of reliable energy source in health facilities ought to be a pull factor for service uptake. However, the presence of solar energy alone is far less than adequate to revolutionize access to health care. Several other factors have to interplay: availability of drugs and supplies; deployment of

skilled human resources; introduction of appropriate technology and equipment for diagnosis and treatment; adequate Water, Sanitation and Hygiene (WASH) facilities; effective communication mechanisms, etc.

The evaluation has taken place at a time when the entire country is just recovering from the most devastating epidemiological tragedy, which has left the health sector in shambles. It is currently unclear what influence the Ebola outbreak has had on the project, as many clinics were left abandoned for a long time due to the collapse of most of the health sector. Similarly, the technical knowledge that was transferred in the technical maintenance training during the installation of the units in the clinics could possibly be in need of a refresher, due to frequent turnovers at the clinic level, which will have been exacerbated by the Ebola outbreak. Therefore, this context has to be taken into consideration in order to make a better judgment on the project overall performance and sustainability.

4.3.4 Sustainability

The establishment of the SMU at the Ministry of Health was the cornerstone for the exit strategy on which sustainability was hinged. It was envisioned that a fully staffed and financed SMU would have been responsible for the infrastructure (maintenance, replacement, expansion). However, due to the financial constraints at the MoH&SW, as well as the Ebola outbreak, this SMU was not established. Rather, an agreement was reached so that GIZ (an organization with requisite technical capacity and experience), would temporarily house the SMU. As part of the agreement, GIZ would collaborate with the Ministry in carrying its functions for maintenance and repair, and at the same time work towards handing over the SMU back to the Ministry. The initial handover of the SMU from Save the Children to GIZ took during the peak of the Ebola outbreak (September 2014); at a time when the main focus of many agencies including Save the Children was the Ebola emergency response activities; as such there was limited support provided to GIZ once the handover was agreed. GIZ have however managed to maintain the integrity of the SMU ensuring the last remaining units were installed and that support for maintenance is still available. Now that the Ebola outbreak has been contained it is hoped that the MoH&SW and GIZ can begin to discuss a road map for the eventual handover of the SMU.

The key condition for this to happen is that the Ministry has to demonstrate its capacity or commitment to finance and manage the SMU. It is assumed that the Ministry could easily finance the unit with the savings from the fuel budget which was allocated yearly to the health sector to run the expensive and frail generators assigned in the targeted health facilities. Currently, it is unclear whether any special study was undertaken by the Ministry of Health to measure the savings accrued as a result of introducing solar energy source at the various health facilities. If such a study had been undertaken to quantify this, it would become an important advocacy tool for mobilizing financial support and promoting policy shift towards utilization of solar energy in the health sector.

Regular updates and progress reports from GIZ will help the Ministry of Health (including the Director for Infrastructure Unit and Former Deputy Ministry for Administration) become more familiar with the work of the unit and prepare for the eventual handover of the unit which in the long run should be housed with the MoH&SW. The outcome however will most likely be decided by political will more than any other factor, but the alternative solution (fuel for generators or no energy at all) is simply more costly than using solar energy and keeping a solar maintenance team.

At the moment, local communities do not have the financial wherewithal to maintain the benefits of the project. However, there is huge public consensus on protecting the infrastructure so that it serves the communities for a long time. Fortunately, the battery component of the system will likely last for up to 7 years. This will therefore require an investment which the MoH&SW should prepare for. This needs to be financed within the budget of the health sector, through savings from amounts allocated to fuel, maintenance and repairs. Solar energy is a cost-intensive investment in the first year, but very cost-effective in the latter years, compared to the gradually increasing fuel/maintenance costs on generators. As such the project has a high economic viability – it saves both the government and the local communities from the daily cost of operating generators or buying candles, flashlights, etc.

However, if the Ministry does not quickly set up the system to start saving this money, and also take charge of the SMU, there is high risk that the benefits of the investment will not be maintained. The Ministry has to factor in the necessary budgetary allocations. For example, since no costly repairs or maintenance activities are expected for the next number of years, the Ministry could begin saving money in an escrow account, which could be accessed when the need arises in the future. If the government fails to undertake such a long-term funding strategy, it would need to keep renewable energy as a top priority for external resource mobilization, which is not the most sustainable option.

The Project has trained over 400 health workers and more than 800 community members on how to use and maintain the solar units. Each facility received a hard copy of the "user package," a reference guide for basic maintenance. Some of those who received the end-user training reported that the training was rather too shallow – basically done *en passant* upon completion of the installation. A second cadre of 20 MoH&SW personnel, with some technical acumen, was trained at the CHT level. Upon completion of the training, each person received a hard copy of the Procedure Manual and the Maintenance/Repair Toolkit. At MoH&SW central level, four staff members from the Infrastructure Unit have been trained in solar panel installation, maintenance and repair. They too received the needed reference materials, but without the toolkits. Due to the Ebola outbreak, the transfer of the SMU to the MoH&SW did not take place; this needs to be rescheduled when the health sector has sufficiently recovered, and infrastructure is back on the agenda. Facilitating the smooth handover of the SMU to the Ministry, ensuring that staff (at all levels) are adequately trained and coordinated is a priority.

Other national partners such as the RREA have the relevant skills and expertise to facilitate the process of capacity building and technical support to enable the Ministry assume the function. The Ministry has expressed interest to start the process of building the relationship with GIZ to enable the transfer of relevant skills and expertise and to pave the way for the transfer of the responsibility of the SMU. Though the SMU ought to remain the linchpin for sustainability, it would need to reach out and build strategic partnerships across the energy sector. This is needed in order to mainstream utilization of renewable energy across the health sector, especially with the EPI. But on a much broader scale, the SMU can build a strong alliance with the RREA to widen the renewable energy discussion in other domains of the public sector such as, education, security sector (lighting police stations, and remote immigration posts), etc. Achieving this level of national synchrony for utilization of renewable energy would require immense political will, as it would bring many government actors together (Health, Education, Public Works, Justice, Lands, Mine and Energy, etc.)

4.4 Constraints

The project started on a slow footing, incurring a couple of administrative delays that presented the initial constraints (departure of the first project manager, complexity of the procurement processes, etc.) to implementation. These impediments were appropriately buffeted throughout the project, without any impact on the project timeline or results.

However, there were three main constraints that remarkably impacted both the project timeline and the achievement of results: 1) lack of a customized M&E system to effectively track progress towards the achievement of higher level results, beyond the installation of the solar units; 2) failure to establish the SMU at the Ministry of Health; and 3) the outbreak of the EVD, which caused a near total collapse of the health sector.

4.4.1 Lack of customized M&E system

The project's performance management strategy was based on an unverified premise that the existing DHIS of the Ministry of Health would capture data for all the relevant health outcome indicators for measuring success. On the basis of this assumption, the requisite resources were not planned for undertaking project specific M&E. Therefore, there was no dedicated M&E staff on the project; no baseline data was collected; and no mechanism was put in place for systematic data collection, analysis and reporting on project health outcome results.

Firstly, it seems the process of selecting the indicators did not utilize broad stakeholder's participation, as it did not include the HMIS Department at the Ministry. Because of this, the indicators were adopted before first determining whether the DHIS is indeed collecting data on them. Since the revision of the DHIS is based upon clearly defined policy, all advocacy efforts by the project management team to incorporate the indicators proved futile. Although, this shortcoming was flagged by the mid-term evaluation, which recommended various approaches to retrofit a tailored M&E system, very little success was achieved in remedying the M&E deficiency of the project. It is the opinion of the evaluation that performance management had not been given the priority valuation that it deserves in project management. As a result, the project management team did not exert itself beyond lobbying for incorporation of the target indicators, when it was apparently clear that the pursuit was a fruitless venture. Moreover, the project management team did not do much to act upon the recommendations of the mid-term evaluation to develop a tailored M&E system, however elementary.

4.4.2 Failure to establish the SMU at the MoH&SW

The project management team encountered a range of cascading problems in collaborating with the Ministry of Health. At first, the level of involvement of the Infrastructure Unit at the Ministry did not meaningfully facilitate the project. The leadership of the Unit was unhappy with the fact that its request for logistical support (vehicles and other equipment) was not eligible under the project financing. As a result, although physically present in all the PIU meetings, staff of the Unit did not participate in any key project activity, including installations of units, monitoring visits, etc. This posture of inaction and low cooperation was a missed opportunity, which inarguably contributed to the failure to establish the SMU. This does not imply an overall fractious working relationship with the Ministry of Health; there was cordial engagement with the senior management (Deputy Ministry for Administration, and the Office of the Minister of Health).

Cognizant of its lack of technical capacity to undertake this project, the MoH&SW discussed with Merlin, which has had experience in installing and running solar systems for facilities, to undertake this project on her behalf[30]. Having considered the project as a strategic priority in achieving Millennium Development Goals (MDG 4 and 5), the MoH&SW agreed to co-fund the project, with an amount covering 25 percent (€500,000.00) of the total cost. After making this commitment in June 2010 (as part of the application to the EU)[31], and confirming in September of the same year, it took the government about three years (mid March 2013)[32] to pay the money. This was made possible after a long process of countless meetings and exchanges of communications, in which the EU also intervened. To date, there is remote possibility that the outstanding amount of US$150,000.00 (equivalent) will be paid. This was the atmosphere building up to the outbreak of EVD, which rendered the Ministry incapacitated to finance and manage the SMU. It is important that the Ministry deliver on its initial commitment, as failure to establish the SMU at the Ministry now poses the greatest risks to the sustainability of the project results.

4.4.3 Outbreak of EVD

At the onset of EVD, the project was well on course in its final six months of implementation, with few outstanding installations mainly in Montserrado; training of key technical staff was underway; and preparation for the establishment of the SMU was in the making. Because of EVD, the installation teams could not visit any health facility; group meetings and long distance travels were discouraged by health experts; so training activities could not be organized for participants from different counties. Also, health facilities were abandoned by both health workers and patients. At the time, the Ministry redirected nearly all its efforts and resources towards responding to the epidemic, leaving infrastructure development outside the parameters of the national health priority. Accordingly, by September 2014, when the epidemic was at its peak, with the Ministry completely overwhelmed by the response, it was agreed that GIZ would house the SMU in the short run. This constraint is an external factor that was unforeseen during the design of the project.

Owing to the inherent M&E shortcomings, the positive results of the project have not been well documented. As such, using the results of the project as an advocacy tool to inform policy formulation or replicate other similar projects is imaginary.

4.5 Risks and assumptions

The majority of risks and assumptions made at the project initiation held true. In most cases the project was proactive in taking steps to mitigate the impacts of identified risks. Nonetheless, some risks and assumptions did not hold true.[33] First, it had been assumed that HF radios were available in the health facilities. Hence, the solar units were designed to supply these radios with solar power for 24-hours operations. However, during the preparatory field work, it was realized that majority of health facilities did not have HF radios. So, the project had to make allocation to purchase 45 HF radios, which were distributed by the MoH&SW. Also, as already discussed, the DHIS did not include the project indicators, as was assumed. Finally, the MoH&SW did not accumulate any savings to underwrite the cost of financing and managing the SMU.

[30] ACP-EU Energy Facility Grant Application (2010, p.11)

[31] Ibid, Annex 10 : Co-donor statement

[32] EU Energy Project: Second Interim Narrative Report (September 1, 2012 – February 28, 2013, p.8)

[33] See Appendix D: Details of Risks and Assumptions

5.0 CONCLUSION, LESSONS LEARNED AND RECOMMENDATIONS

5.1 Conclusion

The evaluation asserts that the project management team was extremely successful in satisfying the technical requirements of the project (installation of high quality solar units, and training of a pool of staff members within the MoH&SW to maintain the units). Save the Children - Liberia put in place management arrangement that took advantage of a multi-layered check and balance systems, which promoted sound quality control and fiduciary management of the project.

However, the degree of success achieved on the technical and management side of the project does not commensurate with documented progress towards the achievements of the project's overall objective – increased access to health. Consequently, the extent to which the project addressed the initial problems it was designed to respond to (*weak referral system, mortality attributed to lack of access to health facility at night; low EPI coverage*) is indeterminate. First, the indicators developed for measuring progress towards success were inadequate, as it did not capture all aspects of the project. Second, there was no effective M&E system for tracking progress beyond the installation of the solar panels.

The project journeyed through a series of extenuating circumstances that impinged achievement of results: difficulty in harnessing the meaningful cooperation and support of the Infrastructure Unit at the Ministry; lack of success in incorporating the project indicators in the HMIS; failure to establish the SMU at the Ministry, etc. The interplay of these limiting factors was compounded by the outbreak of EVD, which impacted the final stage of the project implementation.

Notwithstanding these limitations, anecdotes from qualitative field data suggest that the project is having a remarkable impact on both target groups (health workers) and the beneficiaries. In all the health facilities visited for the evaluation, staff members reported that the introduction of the solar energy has created a conducive environment for providing quality care. Because of the solar light, health care workers in the target facilities are no longer using unreliable energy sources such as candles, mobile phone light, Chinese light, lantern, etc, which undermine their effectiveness and pose health risks (in case of delivery) for the mother and her child. Through FGDs with patients, women, men and community leaders, beneficiaries affirmed that the project is very relevant, as it addresses their priorities. With the health facilities now having light at night, the local populations are inclined to seek prompt treatment during the night, without having to wait until the next day. Such delays have been shown to have consequences of increased health risks. The coming of the light has overcome the need for patients to bring flashlight, candles, and sometimes buy gasoline to fuel the facility's generator. So, it has relieved them of the unnecessary financial burden associated with such indirect health care cost.

5.2 Lessons learned and recommendation

Based on these findings, valuable lessons have been learned that are instructive not only to avoiding some of the problems that affected project's performance, but to replicating a similar project elsewhere. Thus the following lessons and recommendations outline a recipe for replication, scale-up and/or expansion of the project:

5.2.1 Relevance & quality

Promote broader public sector use of solar energy

Essentially, the promotion of renewable energy is at the core of the mandate of the RREA. The establishment of the agency, coupled with the government's expression of interest in exploring and utilizing renewable energy to address the nation's growing energy demand, lays a strong foundation for support in this area. So, the prevailing political will that favours a shift towards use of renewable energy is a catalyst, which needs to be exploited to promote the use of solar energy in Liberia. The government needs to prioritize the use of renewable energy not only in villages, as outlined in the AfT, but particularly in public sector entities.

Expanding the installation of solar energy sources in health facilities may have implications on current efforts to support post-EVD preparedness. It seems improbable for health care workers to practice effective Infection Prevention and Control techniques if they have to work in darkness. As more health care workers have the opportunity to work under conducive conditions, the better the chances for them to practice the necessary IPC measures.

It is thus recommended that the SMU should closely collaborate with the RREA, and other relevant stakeholders, Ministry of Public Works, Ministry of Lands, Mines and Energy to advocate for wider use of solar energy in the public sector. Two areas where the use of solar energy could bring about remarkable change are the education and the security sectors, in addition to the health sector. Hence, in spite of its failure to provide concrete evidence on its successes, introduction of solar energy holds a great potential as a vehicle for service delivery in the public sector, besides the enormous economical and environmental benefits.

Facilitate continued training and coordination of trained staff

In some cases, some staff members at the health facilities and those at the CHTs have queried the quality of training that they received. However, it is clear that the level of training provided to each category of trainees was calibrated to suit the level of responsibility in maintaining the solar infrastructure. Nevertheless, once some trainees have begun to register doubts about their competency, it is imperative that the situation is addressed accordingly.

Therefore and funds allowing, it is recommended that a rapid training needs assessment for staff at the three capacity levels: health facility, CHT, and central (Infrastructure Unit) be conducted (funds allowing). Additionally, a mechanism for coordination and supervision of all those involved with solar maintenance could be established. There is room also to review the current follow up mechanisms as discussions with facility staff suggest they are, for the most part unlikely to seek help for any problems they might encounter.

One way to do this is to create a telephone directory with the contacts of all health facilities where the solar units have been installed. Separate list can be deposited with each CHT staff members, who will be charged with the responsibility to do monthly calls to each target facility in the county, to assess the status of functionality of the units. At the same time, CHT staff numbers could be provided to all facility staff to immediately report any problems they face. To ensure that this activity is a priority, the ToR of the target staff could be revised to include responsibility for solar maintenance. These staff could then report directly report to the SMU, to provide updates of maintenance activities undertaken or to solicit technical support. In cases where remote assistance is inadequate to resolve the problem, the SMU could send a maintenance team. .

5.2.2 Effective & Efficiency

Promote much broader collaboration within the MoH&SW

While there was a strong political will from senior officials of the Ministry of Health, the project did not trickle down to the relevant technocrats who would have given the needed programmatic impetus. This disconnect is reflected in the fact that both the Departments of HMIS and the M&E had little or no role in the design and implementation of the project. Tying the project to only the Infrastructure Unit did not prove to be a viable arrangement. Consequently, the project was not well rooted with the cadre of technicians whose input was vital to success within the Ministry.

From initiation, to planning and implementation, the project would have benefitted from deeper involvement from the entire MoH&SW, with all relevant departments on board, not just the Infrastructure Unit. The HMIS department would have been able to provide baseline info and general health indicator support; M&E would have helped with designing the overall system for data collection, analysis and report; EPI department would have been able to support with info on other locations with solar systems, some of which overlapped with this project.

Forge stronger synergy with the Expanded Programme on Immunization

As resources permit, having the solar fridges and the solar lights being powered by separate PV panels seems to be strategic because it avoids the situation where both services are at risk of shutting down when there is problem with the system. Nonetheless, there is need for synergy in the maintenance of both systems. Already, there are cold-chain officers assigned with the CHTs – these staff members are responsible to maintain and repair the cold-chain solar panels. These staff members conduct routine cold-chain outreach to the health facilities in the counties. So, they could play an increasing role in maintaining the system for the solar lights, under a synchronized solar maintenance plan.

As recommended by the mid-term evaluation, some cold-chain officers at the CHT level have already been trained in solar maintenance under this project. There are reports of their current involvement in providing technical support for maintenance of the solar light. However, these efforts are sporadic and fragmented. The responsibilities for maintenance and repairs of the solar light should be incorporated into the ToR for all cold-chain officers. That way it would be prioritized as part of their official duties and responsibilities.

Design of tailored Monitoring and Evaluation System

The impact of the failed M&E system on the project has been well discussed by both the mid-term and the final evaluation. The mid-term evaluation proposed various strategies that are still relevant, especially if the project would be replicated or expanded to cover more health facilities. This will essentially require certain core elements. Firstly to develop SMART indicators through a participatory and inclusive process that brings on board all relevant stakeholders with the technical competence and responsibility to influence the project. Next, the project has to take greater responsibility for its data management. While closely working together with the M&E Department, the project must hire its own staff with devoted responsibility for data collection, analysis and reporting, even if indicators are captured by HMIS.

Meanwhile, findings from this evaluation indicate that undertaking a more extensive data collection on

health facility utilization is likely to shed better light on the results of the project. This activity could build on the methodology used in the evaluation (before and after comparison). Though not an experimental design, attempts should still be made to compare the results of facilities with the solar light, and those without the solar light.

It is reported that the HIMS will be reviewed this year; this presents an opportunity to include the indicators for tracking the outcomes of this project. Since the indicators seem to fall under the domain of the Family Health Division, they would be mobilized as the champion to lead the advocacy for the inclusion of the project indicators in the HMIS.

5.2.3 Impact and Sustainability

Allocate appropriate funding for solar maintenance

Project ownership remains a key determinant of future performance. Though there is a strong push for decentralization in the health sector, the budget remains managed centrally, causing some disconnect between the Monrovia and the counties. Similarly for this project, the systems are managed locally and regionally, but central Ministry remains in charge of future expansion, maintenance budgets, spare parts supply chain, etc.

For this reason, the central administration needs to establish a financing facility for maintaining the investment that has been made in the solar system. A large investment was done, and the positive impact will only increase if some effort is applied (preventative maintenance, spare parts in stock, supply chain and communications in order). As was envisaged at the project initiation, the Ministry needs to generate concrete evidence that investing in solar energy is smart economics by demonstrating that the project is economically viable and financially sustainable. To this end, the Ministry needs to undertake a pilot study by tracking savings accrued from not having to finance the fuelling and repair of generators at health facilities. These savings can be deposited into an escrow account so that once the systems become in need of major repairs (in the next five years), resources would be available to underwrite such costs. Otherwise, if these systems are ignored and not kept in working conditions, the impact of the investment will have been diminished significantly several years down the line, when the entire system will have to be replaced rather than the odd component.

Improve collaboration between GIZ and MoH&SW

Establishment of the SMU at GIZ was a necessary solution to a major obstacle to the project close up. As noted above, GIZ took over the SMU during a very challenging time in Liberia when the capacity of Save the Children and the Ministry to support the handover was limited given the focus on the efforts to combat Ebola. Over the past few months GIZ have managed to maintain the integrity of the SMU ensuring the valuable technical skills and knowledge of the team remain available not only to the clinics that benefited from this Action but also for any future solar power projects. Now that the peak of the EVD emergency has abated the time is right to plan a way forward between GIZ and the Ministry to ensure a smooth handover of the SMU. The Ministry (Director of the Infrastructure Unit and the Former Deputy Minister of Administration) would benefit from regular interaction with the SMU as well as updates and progress reports to help facilitate the process of knowledge and skills transfer, as well as the transfer of the SMU back to the Ministry.

Even if the Ministry is still not yet ready to assume the management of the SMU discussions on eventual handover should begin. There is scope now for the SMU to engage both with the central leadership and with the CHT staff to build a functional mechanism for capacity building and solar maintenance.

Additionally, routine follow up with health facilities to assess the functionality status of the system at each facility is required. This could be facilitated via the CHT staff. A proactive approach such as this would mitigate the risk of any emerging problems affecting the functionality of the system. As of now, there are cases where staff members at the health facilities are not immediately reporting problems such as faulty charger socket, faulty bulbs, etc. Further training to complete the nationwide capacity building targets under the project is also required – funds allowing.

Expand the use of solar energy in the health sector

With growing emphasis on health systems strengthening, different partners are working on the construction and renovation of health facilities across the country. This presents a unique opportunity for the Ministry to advocate for the installation of solar energy source for these health facilities. To be effective and consistent at achieving this, the Ministry would need to include the solar energy infrastructure as a standard engineering requirement for all target health facilities. UNDP and Jhpiego are two of the leading actors supporting the construction of health care infrastructure. Going forward, the government may need to make new considerations regarding the consumption needs for each target facility. Instead of simply focusing on the MCH rooms, it might be important to consider lighting the short stay (where the mother and child are monitored after delivery), the record rooms, or the maternal waiting rooms, which are being built to keep expectant pregnant women closer to the health facilities.

Maintain the enthusiasm of local communities

There is a high risk for serious frustration to the communities if the lights do not work in the future. At the moment, the local populations have become accustomed to receiving treatment under the light so much so that not having light would dash their hopes and enthusiasm. Because of the solar lights, community members do not have the need to spend their meagre resources to buy candles, torch lights or gasoline to fuel generators at the health facilities. That is why everything needs to be done to maintain the system so that the level of hope and expectation that has been created will not be dashed. These communities simply cannot afford to return to the status quo of darkness.

Ensure payment of the outstanding co-funding amount

The Ministry of Health needs to honour its outstanding co-funding obligation of US$150,000.00. While there may seem to be a remote possibility that the payment would be made, the Ministry is under legal obligation to make good its commitment. Otherwise, the Ministry would need to engage with the EU, and make the appropriate request for waiver so that it sets the record straight, and clear this debt from the books.

Enhance the delivery of quality of care

The provision of solar energy contributes greatly to quality of health care delivery, but it is less than adequate for promoting quality health care delivery. Optimizing the delivery of quality health care is a continuum; as such, other dimensions have to be prioritized similarly: skilled human resource, drugs and medical supplies; diagnostic equipment; effective communication; performance monitoring and evaluation, appropriate WASH facilities, etc. The road to increasing access to quality health care delivery demands optimal balancing of these elements. Therefore, it is imperative that the government exert itself fully to improve the health care environment that supports the delivery of quality health care to everyone.

Enhance the involvement and leadership of women

It was realized that women had very limited role in the implementation of the project. In fact, there was no gender-responsive strategy in place to encourage equal participation of women and men in the implementation of the project. Aside from the technical domain, where a qualified female candidate may be hard to identify, women could have played greater role in community mobilization. It is reported that community events were attended by large populations of women, but that is rather too passive. Going forward, measures should be put in place to promote equal participation of men and women.

APPENDICES

A: Key specific areas for evaluation: (Based on OECD-DAC criteria) & QUESTIONS

1. The consultant shall at least carry out the following activities concerning the relevance and quality of the project:

Study all the documentation and reports from the project

Evaluate the relevance of the project in terms of the socio-economic and environmental context in the project area.

Evaluate the project's relevance regarding the objectives of the Ministry of Health and Social Welfare, the Rural & Renewable Energy Agency, or the country's Poverty Reduction Strategy Papers (PRSP).

Evaluate the project's relevance in terms of needs at the community level

Evaluate the project's identification and initial formulation.

Evaluate whether the project indicators are suitable for measuring performance.

2. Examine the completion of results of the project (project efficiency): Review the completion (status) of project activities towards results (see objectives and activities above). During the evaluation of the efficiency of the project, the Evaluation Consultant shall analyse the implementation of the program emphasising on:

Input delivery, cost control and activity management

The project's achievement of its results in terms of quantity, quality and convenience, according to what had been previously indicated in the Grant Contract.

Balance between the results obtained and those expected. The main constraints and difficulties must be pointed out.

Delays for each activity, as indicated in the original work plan.

3. Assess management arrangements.

To assess the performance of Save the Children - Liberia in Liberia in terms of quality of supervision, efficiency in financial administration, ability to anticipate problems and extend implementation support, adequacy of reporting, recommendations and effectiveness of follow-up on recommendations.

To assess the performance of Save the Children - Liberia in Liberia in terms of project implementation (Including human resources, financial management, internal and external risk factors etc).

4. Assess the quality of cooperation with institutions and effectiveness of coordination mechanisms: This will include the quality of information management and reporting, and the extent to which key stakeholders are kept adequately informed of project activities (including beneficiaries/target groups)

5. Assess the project implementation effectiveness: Assess project performance with respect to effectiveness (delivery of outputs and progress towards achieving the purpose). Assess the extent to which the project remained consistent with, and supportive of, the policy and programme framework within which the project is placed. There must be an emphasis on:

To what extent have the results been used and are they having the desired effect. The evaluation should address technological issues (i.e. solar panels) as we well as other socio-economic/ behavioural/ political issues.

Perception of the results and achievements of the project by the beneficiaries, the local authorities and other stakeholders.

Degree of appropriation and participation of the beneficiaries.

Commitment by the national, provincial and district Authorities in the project's implementation.

6. Impact: The evaluation should assess whether there are any initial indications of the impact being made by the project against the overall objectives as set in the project Log Frame and description of the action.

In those cases where results/ outcome have been delivered/ achieved, is there any indication that the anticipated impact is being achieved (in the project's case, increased access to health care).

If yes to a), based on the fact that the project is introducing an intervention within a government run institution, is the MoHSW able to keep abreast of the increased demand for health care through the provision of medications, health professionals, equipment, etc.

7. Sustainability: Evaluate the extent to which the main actors possess the capacity to retain the results and advantages of the project at the end of the action. Identify the main factors for project success and the conditions required to lead to this success.

The Evaluation Consultant shall evaluate the sustainability of the program results concerning:

The economic feasibility and financial sustainability.

The capacity building of those who will continue the project benefits in terms of training, implementation and monitoring.

Evaluation for the possibility of replication of the positive results in other similar projects.

The extent to which the strategy for maintaining capacity is adequate to address the risk that staff turnover may be high. Suggest strategies for improving this where appropriate.

8. Assess constraints encountered during the project implementation.

a) To analyse the various factors and constraints which have exerted an influence on the project implementation; such as the operational mechanisms, managerial, institutional, socio-economic policy issues and other external factors unforeseen during design.

b) Review of the risks and assumptions included in the Log Frame. Evaluate the extent to which the risks and assumptions have held true during the project implementation to date.

9. Produce a clear set of lessons learned and recommendations that can benefit a future replication, scale-up and/or expansion of the project.

B: List of KII participants

	Name	Sex	County	Town /City	Position	Contact
1	Tamba A.Borbor	M	Bomi	Sass town	OIC	
2	Aminata K.Paykue	F	Bomi	Bonjeh town	OIC	
3	Hector M.Johnson	M	Bomi	Sass town	Community leader	
4	Tamba A.Borbor	M	Bomi	Sass town	OIC	
5	Aminata K.Paykue	F	Bomi	Bonjeh town	OIC	
6	Hector M.Johnson	M	Bomi	Sass town	Community leader	
7	Willie Vokpawuo	M	Bong	Gbarnga	Maintenance Supervisor	0886426783
8	James Mulbah	M	Bong	Sanoyea Town	CHDC Advisor	
9	Edwin Paye	M	Bong	Gbecohn Town	OIC	0886486161
10	Abraham Q. J Kollie Sr.	M	Bong	Foequelleh	OIC	0886951874
11	Sam B. Findley	M	Bong	Gbarnga	Warehouse Supervisor	0777321804
12	Luc Severi	M	Email &	Skype	Fmr. Project Operations Manager	luc.severi@gmail.com
13	Patrick Wonplu	M	Grand Bassa	Tubmanville	Community leader	
14	Levietta Boe	F	Grand Bassa	St.John Clinic	OIC	
15	Featha R.Kolubah	F	Grand Bassa	Lloydsville	OIC	
16	Acha M. Bonwin	M	Grand Bassa	Buchanan	Cold-chain Officer	0770755970
17	Patrick Wonplu	M	Grand Bassa	Tubmanville	Community leader	
18	Levietta Boe	F	Grand Bassa	St.John Clinic	OIC	
19	Featha R.Kolubah	F	Grand Bassa	Lloydsville	OIC	
20	Musu S.Queaneh	F	Grand Gedeh	Gboleken town	OIC	0886485753
21	Grace N.T.Jallayu	F	Grand Gedeh	Boundary town	OIC	
22	James M.S.Kyne	M	Grand Gedeh	Zleh town	Paramount Chief	
23	Anderson V. Gee	M	Grand Gedeh	Zwedru	Cold-chain Officer	0886457335
24	Musu S.Queaneh	F	Grand Gedeh	Gboleken Town	OIC	
25	Grace N.T.Jallayu	F	Grand Gedeh	Boundary Town	OIC	
26	James M.S.Kyne	M	Grand Gedeh	Zleh town	Paramount Chief	
27	Thomas B.Duncan	M	Margibi	Tucker-Ta	OIC	0886596754
28	Lee Gibson	M	Margibi	Schefflin town	OIC	
29	Hon.C.Konah Mccauley	M	Margibi	Marshall City	City Mayor	
30	James Lorwa	M	Margibi	Kakata	Cold-chain Officer	0886594548
31	Thomas B.Duncan	M	Margibi	Tucker-Ta	OIC	0886596754
32	Lee Gibson	M	Margibi	Schefflin town	OIC	
33	Venue M. Gborplay	F	Margibi	Kakata	Community Mobilizer	0886521337
34	Rose K. Mulbah	F	Montserrado	Monrovia	Nurse Aide	0888233894
35	Chippy B. Zoegar	F	Montserrado	Monrovia	Certified Midwife	0886372191
36	Hon. Matthew T.K. Flomo	M	Montserrado	Monrovia	Fmr. Deputy Ministry of Health	0886459130
37	Joseph D.K. Sepeh	M	Montserrado	Monrovia	Architect, Infrastructure Unit	0886491840
38	Dash K. Kwayon	M	Montserrado	Monrovia	EPI worker	0770194187
39	George Koffa	M	Montserrado	Monrovia	Maintenance staff	077 827332
40	Stephen V. Potter	M	Montserrado	Monrovia	Director of Program, RREA	0886525505

41	David Jallah	M	Montserrado	Monrovia	Director, Infrastructure Uni	0886917305
42	Stephen Gbanyan	M	Montserrado	Monrovia	Director, HMIS	0886847915
43	Freeman Godu	M	Montserrado	Monrovia	Coordinator, SMU at GIZ	0886769900
44	C. Emmanuel Davis	M	Montserrado	Monrovia	Community Mobilizer	0886584009
45	Paul Kollie	M	Montserrado	Monrovia	CEO, WCS	0886553263

C: Detailed achievement of outputs under each specific objective

The following tables provide details on the achievement of individual outputs for each result.

Result 1: Sustainable energy sources available at health facilities, enable communities to access round-the-clock health care, and improved referral systems.		
Activity	**Achievement**	**Completion rate**
Activity 1.1 *Investigation Phase*	A team of 15 community mobilizers worked in all 15 counties and verified the Christian Health Access Initiative (CHAI) health facility listings, and produced a final list of 205 facilities. Process completed by July 2012	**1**
Activity 1.2: *Solar system specification design*	Through the Technical Working Committee (TWC), joint decisions were made with inputs from relevant stakeholders. Technical design was finalized by April 2012. The design was later modified after the first phase of installation, when some technical faults were identified.	**1**
Activities 1.3 & 1.8: *Tender and procurement of solar PV systems*	Through a lengthy, comparative bid analysis based on the best combination of price, quality, and availability, the major components (PV panel, battery, charge controller) were ordered internationally, while installation equipment (switches, sockets, etc.) were procured locally. Order of the first 61 solar units (30 percent), allowed time for feedback to correct technical issues before the final batch of 144 units (70 percent) was ordered.	**1**
Activities 1.4 & 1.9: *Transportation of the units*	Aware of the unsafe condition of roads during the rainy season, procurement orders were timed such that the units arrived in the dry season to allow for safe transport. After knitting the batteries and charge controllers in metal boxes, and paddling the PV panels in safety cushions, all 205 units were transported by Merlin and West Coast Services through the 15 counties with no incident of damage to the units.	**1**
Activity 1.5: *Awareness workshops*	Beginning in March 2014 the team of community mobilizers engaged with the catchment communities of each of the 205 facilities that were to receive the solar unit – reaching out to the leaders and members of women's and youth groups. Later a workshop was held to explain the objectives of the project to the people.	**1**
Activities 1.6, 1.10 & 1.11: *Installation and commissioning of solar systems*	By the formal close of the project in August 2014, a total of 202 units had been installed and commissioned. Thereafter, GIZ completed the installation of 2 of the remaining three units (Pleebo Health Center, Gbondoi during 2015); GiZ remain ready to install the unit at Harrisburg Clinic once repairs to the roof are completed.[34]	**1**
Activity 1.7 & 1.12: *Technical evaluation of installations and monitoring and evaluation of system functioning*	Through quality assurance visits both during and after the first round of installations, technical faults in the initial design were rectified and faulty components replaced. Quality control field visits were routinely conducted to monitor performance of the systems, and on average, the functionality of installed units was an impressive 99.99%, with rather negligible reports of power outage. A midterm evaluation was conducted in July 2013. Overall, M&E system focused mainly on progress of technical installation and system functionality, and failed to track progress towards the achievement of higher level results as measured.	**3**
***1** = fully achieved; **2** = largely achieved; **3** = partly achieved; **4** = achieved to a limited extent; **5** = not achieved*		

Result 2: Key staff are trained to maintain solar equipment

[34] This is planned for completion in 2015 – pending funding availability

Activity	Achievement	Completion rate
Activity 2.1: *Train health facility staff in basic solar equipment use and maintenance*	At each of the 204 facilities where the solar units were installed, at least two staff members have been trained in basic maintenance (monitoring charge control, cleaning panels, etc.). Though staff members readily demonstrate skill and knowledge in performing the required tasks, some staff indicated that the end-user training is "not really training," but simply an orientation. Some do not feel they are capable enough to maintain the systems. Unfortunately, staff members at some facilities have failed to utilize the hotline to address problems they face.	1
Activity 2.2: *Develop maintenance schedule for each facility to be conducted by facility staff*	Memorandum of Understanding (MoU) was signed with each community, listing roles and responsibility of system maintenance. Staff members at some facilities are not always recording the charge controller data in a maintenance log. In one case, it was noted that the log sheets have been completely filled out, but no steps have been take to replace the log book.	2
Activity 2.3: *Identifying key members of the community to be trained in basic maintenance of solar equipment*	Targeted community members (at least four per community) have received the same end-user training as the health staff. A representative of the community co-signed the installation certificate, which is displayed on the battery box in each facility. Community members have been instrumental in cutting tree branches that were casting shadow on their panels. They have also played a role in preventing throwing of stones on the panel, as well as keeping mutual vigilance to ensure security of the panel.	1
Activity 2.4: *Annual refresher training*	The planned annual refresher training, intended to reach all facilities has not been conducted. Because of the breaker failure that affected 53 facilities from the first installation of 61 units, the installation teams had to revisit the affected facilities to refresh the concerned staffed. The general refresher was largely disrupted by the outbreak of the Ebola Virus Disease (EVD). GIZ are well placed to conduct a training needs analysis and undertake training (funds allowing).	4
Activity 2.5: *Spare parts*	During the regional Training of Trainers (ToT) for technical staff from the County Health Teams (CHTs) in July 2014, each county received an installation tool box with essential tools for maintenance and repair (digital multi-meter, screw drivers, pliers, safety gears, etc.). GIZ are planning to distribute the 2,000 DC energy bulbs to the County Health Teams (CHTs). As at the reporting time, the light bulbs were still stored in GIZ warehouse in Monrovia	3
1 *= fully achieved;* ***2*** *= largely achieved;* ***3*** *= partly achieved;* ***4*** *= achieved to a limited extent;* ***5*** *= not achieved*		

Result 3: A solar energy maintenance unit is established at the MOH&SW to support facilities in equipment maintenance		
Activity	**Achievement**	**Completion rate**
Activity 3.1: *ToR Maintenance Unit*[35]	Based on the action point of the last PIU meeting in Marcy 2014, the SMU ToR was developed. Unfortunately, by June 2014, the MoH&SW expressed its inability to finance and manage the SMU. Nonetheless, an interim solution was derived when GIZ agreed to house the SMU for an initial 6 months to enable smooth transition to the MoH&SW	**1**
Activity 3.2: *Recruitment of five qualified technicians for the solar maintenance unit*	4 solar technicians who formerly worked for Save the Children - Liberia/Merlin on this project now staff the SMU at GIZ. This does not follow the original plan for five persons (3 from Save the Children - Liberia/Merlin, and 2 from MoH&SW).	**3**
Activity 3.3: *Training for five solar maintenance unit personnel*	4 staff members from the Infrastructure Unit at the MoH&SW received a 5-day solar installation and maintenance. Staff from Merlin and West Coast Services received routine training during the course of the project. CHT staffs from ten counties were trained (two person per county) on solar maintenance and repairs in July 2014. This has created three layers of trained staff: staff at the health facility; CHT members with minimum level of technical background; and staff at the central (MoH&SW) level. The regional ToT for the CHT staff from Gbarpolu, Grand Cape Mount, Bomi, Nimba and Montserrado Counties was postponed on account of the Ebola outbreak	**1**
Activity 3.4: *Procedural manual 'best practice'*	The training manual was produced and used to train the 4 staff members from the MoH&SW, as well as those trained in the regional ToT. All participants who attended the training received copy of the manual as well as the tool kits for maintenance.	**1**
Activity 3.5: *Spare parts manual*	No separate spare parts manual was developed because all the necessary issues on spare parts and repair were covered in the training manual. Hence, the spare part manual was already developed.	**1**
***1** = fully achieved; **2** = largely achieved; **3** = partly achieved; **4** = achieved to a limited extent; **5** = not achieved*		

[35] See Annex E: Solar Maintenance Unit ToR

D: Risks and assumptions

Table 8: Logical Framework for the project[36]			
	Intervention Logic	**Assumptions**	**Extent to which risks and assumptions held true**
Overall Objectives	To increase access to reliable health care in rural and peri-urban health facilities in Liberia through providing modern, affordable and sustainable energy sources to the facilities.	Staffing available, transport to facilities available, facilities equipped with drugs and supplies	**Largely true:** staffing was always available and cooperative; facilities were accessible, but there are reports of stock out of drugs and supplies
Specific Objectives	To provide access to round-the-clock health care services through the provision of sustainable energy sources at rural and peri urban health facilities.	Physical access to the health facility is guaranteed at night (roads)	**True**: although sometime people travel long distances to reach the facilities; it has been possible to reach facilities at night
	To build capacity of key health staff and communities in solar maintenance	Frequent replacement of facility staff	**True:** there are reports of staff replacement, which in some cases affected maintenance
	To build the capacity within the MoH&SW to be able to utilize and maintain solar energy for rural and peri-urban health facilities	MoH&SW will save sufficiently on fuel subsidies & generator repair costs, to finance the Maintenance U	**False**: MoH&SW did not accumulate any savings to underwrite cost of operating the SMU
Expected Results	Sustainable energy sources available at health facilities, enable communities to access round-the-clock health care, and improved referral systems	Availability of HF radios in the health facilities, to ensure increase in referrals;	**False**: there is no HR radio available in about 80 percent of all facilities where the solar units have been installed.
	Key staff are trained to maintain solar equipment	MoH&SW has assigned min 1 staff per facility	**True**: At least two staff members were trained per facility
	A solar energy maintenance unit is established and handed over to the MOH&SW to support facilities in equipment maintenance.	MoH&SW has assigned min 1 staff per facility	**True**: At least two staff members were trained per facility
Activities for Result 1: Sustainable energy sources available at health facilities, enable communities to access round-the-clock health care, and improved referral systems.	1.1 Investigation phase: verifying of the mapping report by CF/MOH&SW on the current situation of energy supplies at all rural health clinics	Support from CHTs will be offered to the Community Mobilizers	**True**: CHTs were very supportive to the works of the community mobilizers, providing updated information and logistical support, where available
	1.4 Transportation of the units	No problems or delays clearing the materials through customs	**True**: Early processing of customs papers helped to overcome anticipated delays
	1.12. Monitoring and evaluation of system functioning	Maintenance logs distributed, staff trained on record keeping, M&E	**Fairly True**: but no M&E flow agreed upon, no any MoU signed with CHTs

[36] Annex H: Revised Log frame (Merlin 2012)

		flow agreed upon, MoU with CHTs	
Activities for Result 2 Key staff are trained to maintain solar equipment	2.1.Train health facility staff (as agreed with MoH&SW (PIU)) in basic solar equipment use and maintenance	MoH&SW has designated min 1 responsible per facility; responsible will be trained in off-peak hours	**True**: At least two staff members were trained per facility
	2.3Identifying key members of the community to be trained in basic maintenance of solar equipment in collaboration PIU	Support from and high motivation in CHTs and community members	**True**: CHTs were very supportive to the works of the community mobilizers, providing updated information and logistical support, where feasible
	2.4 Conduct annual refresher trainings for health facility staff in basic solar maintenance	Availability and commitment of staff; turnover of staff limited	**True**: staff available and committed, and turnover limited. But the EVD situation prevented this level of training.
Activities for Result 3 A solar energy maintenance unit is established and handed over to the MOH&SW to support facilities in equipment maintenance.	3.2 Recruitment of 5 qualified technicians for the solar maintenance unit	Response to job advertisement for qualified technicians might be limited	This activity was not carried out as the SMU was not established. Staff with Merlin were incorporated by GIZ
	3.5 In collaboration with MoH&SW establish supply chain for spare parts	PSA (preferred supplier agreement) in place with component suppliers	This activity was not carried out as the SMU was not established.