SOLAR ENERGY PROGRAMME IN NIGERIA

TERMINAL EVALUATION

FINAL REPORT

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EVALUATION PERIOD: 24 MARCH TO 23 APRIL 2018

DATE OF THE REPORT: 23 APRIL 2018

ABBREVIATIONS & ACRONYMS

ABBREVIATIONS / ACRONYMS	DEFINITION
APG	Advance Payment Guarantees
AtRE	Access to Renewable Energy
BOI	Bank of Industry
CFL	Compact Fluorescent Lamp
CO2	Carbon Dioxide
CPAP	UNDP Country Programme Action Plan
CSA	Cost Sharing Agreement
ECN	Energy Commission of Nigeria
EE	Energy Efficiency
FGN / GoN	Federal Government of Nigeria
GEF	Global Environment Facility
GCF	Green Climate Fund
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation
GVE	Green Village Energy
kW	Kilo watt
kWp	Kilo watt power
LCOE	Levelised Cost of Electricity
LED	Light Emitting Diodes
LFA	Logical Framework Analysis
LGA	Local Government Authority
M&E	Monitoring and Evaluation
NDC	Nationally Determined Contribution
NESP	National Energy Support Programme
RE	Renewable energy
SEP	Solar Energy Programme
S&L	Standards and Labels
SON	Standards Organisation of Nigeria
UNDAF	United Nations Development Action Framework
UNDP	United Nations Development Programme
USD	United States Dollar
USEAP	Universal Sustainable Energy Access Programme
WB	World Bank

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2 EXECUTIVE SUMMARY

2.1 Project Summary Table

Project Summary is shown in **Error! Reference source not found.**.

Table: 1 Project Summary Table

Project Title:	**Solar Energy Programme (SEP)**			
			at endorsement (Million US$)	*at completion (Million US$)*
UNDP Project ID:	00097077	UNDP financing:	600,000	600,000
Donor		Donor funding:	1,400,000	1,400,000
		Total project cost:	2,000,000	2,000,000
Other Partners involved:	Local Government Authorities in Gombe, Niger, Anambra and Kaduna	Project Document Signature (date project began):		16 Sept 2016
		(Operational) Closing Date:	Proposed: 31 Dec 2017	Expected: April 2018

2.2 Project Description

Rural energy is recognised as an important element of rural socio -economic development through the services it makes possible. For the micro business which makes up almost 80 per cent of business in the country especially in the rural areas, energy is as important as the air in which they breathe. The absence of reliable energy supply has reduced productivity in these rural settlements and thereby contributed to the urban migration syndrome which in a sense is depriving the rural areas of its workforce. Most rural settlements are off-grid, and do not have access to energy for their daily basic needs. This means that rural communities have a higher carbon footprint than they need to and are often higher, per person than their urban compatriots mainly because they are forced into choosing high-polluting energy sources, such as coal, heating oil or wood for their daily needs. Having access to a variety of alternative energy sources, inexpensive and supported by government will go a long way in helping these communities bring themselves out of energy poverty to be able to maximize their potential. The objective of this project – Solar Energy Programme – seeks to demonstrate the sustainability and commercial viability of solar energy solutions via a suitable business model, for rural electrification, especially for off-grid communities which are completely underserved, thereby being the worst hit and most vulnerable communities in Nigeria. Successful deployment of the projects is also aimed at attracting the necessary funding to facilitate replication and upscaling of these projects to serve the energy needs of MSMEs in Nigeria

2.3 Evaluation Rating Table

The summary of the evaluation ratings is given in Table 2.

Table 2: Summary of Evaluation Ratings

Evaluation Ratings:			
1. Monitoring and Evaluation	***Rating***	**2. IA & EA Execution**	***Rating***
M&E design at entry	Moderately Satisfactory	Quality of UNDP Implementation – Implementing Agency (IA)	Satisfactory
M&E Plan Implementation	Moderately Satisfactory	Quality of Execution - Executing Agency (EA)	Satisfactory
Overall quality of M&E	Moderately Satisfactory	Overall quality of Implementation / Execution	Satisfactory
3. Assessment of Outcomes	**Rating**	**4. Sustainability**	**Rating**
Relevance	Highly Relevant	Financial resources	Moderately Likely
Effectiveness	Satisfactory	Socio-political	Moderately Likely
Efficiency	Moderately Satisfactory	Institutional framework and governance	Likely
Overall Project Output Rating	Satisfactory	Environmental	Likely
		Overall likelihood of sustainability	Moderately Likely

2.4 Summary of Conclusions and Recommendations

2.4.1 Key Conclusions

- **Background:** Following the success of the Phase 1 solar pilot, BOI and UNDP signed a Cost Sharing Agreement (CSA) of USD2 million for the replication of the projects that commenced in States where UNDP had active partnerships in. Under the CSA, BOI contributed USD1.4 million as Debt and UNDP contributed USD 600,000 as Grant.
- Two project developers (GVE Project Ltd and Arnergy Solar Ltd) were selected from a long list of 80 initial open bidders to implement the project based on their past track records, financial soundness and technical competence.
- The funding were structured as 68% concessional loan with 7% interest rate over 15 years repayment term, 10% equity from the developers (GVE & Arnergy) and 22% grant to support baseline surveys, stakeholder engagement and capacity development.

- **Relevance:** The project is deemed as **highly relevant** and **well aligned** with i) national development (Vision 20:2020, Transformation Agenda) and climate policy and strategies (NDA, RE Masteplan); ii) BOI's aspirations to promote industrialisation through improved access to clean energy; and iii) UNDP's country programme for Nigeria to scale up RE technologies and businesses.
- As such there is **strong country ownership** of the project at the national and local levels.
- **Efficiency:** The project has been deemed as **moderately efficient** in the disbursement of fund as there were delays in the final release of fund from Zenith Bank to GVE's suppliers that had caused delay in project execution and completion.
- To date a total of **Naira 381,539,353 (USD 1,090,112[1])** has been disbursed (84.8%) for the installation and services of stand alone solar home systems (SHS) and off-grid mini grid (MG) systems in 8 communities in Gombe, Niger, Anambra and Kaduna states (see Table 3).
- It is apparent that funding constraints have significantly slowed down the pace of project implementation. It may be necessary to explore alternate means of securing funds to be disbursed such as APGs from the local vendors with more capacities, as utilizing an Advance Payment Guarantee (APG) from developers directly with the associated terms, appeared not to be suitable for this project.
- BOI has submitted inspection reports and issued confirmation letter to Zenith Bank Plc, to enable it to disburse the requested funds immediately to GVE Projects Limited, to prevent project delivery timelines from extending into moratorium period.
- Due to the delays in the final release of the fund, all outstanding outputs are expected to be completed in April 2018, some 4 months later than expected (Dec 2017).
- **Effectiveness:** The effectiveness of the project has been deemed as **satisfactory** in achieving the objective and outputs of the project (see Table 3):
    - **Total Installed capacity: 246.8 kW**
    - **No of households connected: 1,424**
    - **No of businesses connected: 870**
    - **No of jobs created: 29 direct jobs (as technicians, security guards) and over 41 indirect jobs from micro-business**
    - **Installation cost: USD 4,125/kW for mini grid and USD 4,863/kW for SHS**
    - **Beneficiary cost: USD 521/household or businesses**
- **M and E plan and execution:** The M and E plan and implementation has been deemed as **moderately satisfactory**. The indicators and targets provided in the project document were not SMART (not Specific, Measureable, Achievable, Realistic or Time bound). No indicators or targets were included at the medium term outcome (5 years after project has ended) and impact levels (10 years after project has ended) thus making it difficult to assess the medium and long term impact of the project.
- Despite BOI advising GVE and Arnergy to use the UNDP M&E templates, this was not adhered to.
- Furthermore, the project developers were not given the project document and do not fully understood the design, M and E plan and the Theory of Change principles.

[1] Based on exchange rate of Naira 350/USD.

- Hence ad hoc indicators and targets were added as the project progresses rather than at the outset of the project.
- **Sustainability:** The project has taken steps to mitigate the risks that could threaten the sustainability of the SHS and MG businesses in Nigeria:
    - Policy and institutional risk: the positive evidence generated by this project will help to convince and generate strong buy in from policymakers and lawmakers to continue to support BOI to fund solar solutions, lawmakers will need to support and protect the private sector value chain actors to ensure the import tax waiver are enforced effectively and efficiently and imported equipment are released at custom without delays and adding extra cost.
    - Technical risk: the capacity of all value chain actors will need to be enhanced and improved with the latest solar technologies to improve delivery and quality services.
    - Financial risk: The financial model to blend and sequence public concessional loan (68%) with grant (22%) and equity (10%) has generated positive results. Future programme will need to explore if grant portion could be reduced whilst increasing loan and equity portions. But the challenge will be in how to continue to reduce the tariff from Naira 150/180 to Naira 70/kWh to make solar as viable business (see Table 4 below).
    - Business risk: Developers will continue to lobby and convince lawmakers and policymakers to improve the ease of doing solar businesses in Nigeria.
    - Social risk: developers will need to support end users to improve their livelihoods and income in order to secure their affordability and ability to pay for the services, positive testimonies from beneficiaries has already stimulated interest and demand from neighbouring communities.
- **Impact:** As there were no outcome and impact indicators and targets provided in the project document it is difficult to measure the real impact of the project. Future programme to need to estimate the volume of GHG emission avoided through the switch from diesel to clean solar alternative energy.

Table 3: Summary of results (extracted from Table 9).

Project Developer	Total disbursed funding		% fund disbursed	Total Installed kW	Power delivery cost (USD/kW)	No. of community benefitted	Total households and businesses	Beneficiary delivery cost (USD/beneficiary)
	Naira	USD (@N350/USD)						
GVE (mini grid)	214,745,561	613,559	90.2%	148.8	4,125	6	1,242	494
Arnergy (SHS)	166,793,792	476,554	79.5%	98.0	4,863	2	870	548
Total	**381,539,353**	**1,090,112**	**84.8%**	**246.8**	**Ave= 4,494**	**8**	**2,112**	**Ave = 521**

2.4.2 Key Recommendations

1. The Government of Nigeria will need to continue to support BOI and provide necessary funding over the next 5 years in order to transform the nascent solar sector by creating a demand 'pull' for solar RE to reduce supply risk, thus causing a tipping point whereby solar solutions could be mainstreamed, scaled up and replicated as commercial viable businesses.
2. BOI and UNDP could also leverage international public funding such as the Green Climate Fund.
3. Project developers must work closely with local authority and local community to conduct detail due diligence to understand the real needs, ability and willingness of the end users to pay for the services in order to avoid unnecessary delays.
4. BOI will need to work closely with project developers and guaranteeing bank (e.g. GVE and Zenith Bank) to ensure that funds are disbursed efficiently to the project developer's suppliers in order to avoid delays in the execution and completion of the project. BOI will need to explore alternative options to ensure components are delivered timely, while also ensuring security of the funds disbursement to suppliers (e.g. provision of Advance Payment Guarantees (APG) in favour of the suppliers (local) instead of the Project Developer, Letters of comfort from BOI to suppliers, etc). Also, in the event that an APG is issued on behalf of the Project Developer, the terms of disbursements would have to be structured in such a way that doesn't hamper the project execution.
5. For future BOI and UNDP projects, the Logical Framework needs to be designed to capture the full Theory of Change principles so that all indicators and targets are clearly defined at the short term output, medium term outcome and long term impact levels and suitable and realistic means of verification are chosen and detailed.
6. A monitoring / project reporting template for future projects run by BOI and UNDP must be developed and used to identify challenges and shortcomings in the project as well as reporting positive progress.
7. Project developers must have access to the project document and have a good understand of the design, expected outputs and the M and plan before the start of the project.
8. A stakeholders meeting could be organised by BOI after the terminal evaluation to discuss the way forward for future activities.
9. BOI and UNDP could carry out a post-evaluation study in 2020 to quantify and detail the impacts of the project.
10. Current electricity tariff rates in Nigeria are subsidised at: Naira 25/kWh for residential, Naira 40/kWh for commercial and Naira 5/kWh for community. The remaining challenges will be how to close these wide gaps from the Naira 150-180/kWh that are imposed on current end users to a competitive Naira 70/kWh.
11. Hence, future solar programme should contribute to the discussion and seek to answer the questions as raised in Table 4 to reduce the LCOE from Naira 180/kWh to Naira 70/kWh (Figure 1).
12. Key priority areas for future solar programme to address will be:

- **A. How to manage load profiles to save on hardware and operating cost?**

    - How do mini grid companies sustainably offer consumer financing for demand stimulation?
    - Can load curves be optimally shaped through selective distribution, a kiosk model, or energy as a service?

- **Service-based demand:** Increase capacity utilization through a targeted service based approach. Offer financed appliances with service based pricing to primarily commercial/productive customers to stimulate demand, shape load, increase savings, and improve revenue for businesses stimulation.

- **System flexibility to address dynamic demand:** Design flexible mini grids that can meet dynamic demand. This approach includes under-sizing systems with planned modular upgrades (e.g. 120 kWp grid in modules of 30kWp for a cluster of 5 to 10 communities). Centralised or standalone Community Enterprise Centre could be powered with solar to provide workshop, agro-processing, marketing and packaging. At portfolio scale this allows for low cost, quick-to-deploy, and bankable ways to meet increased demand, backed by on-going, clear data collection and analysis.

- **B. How to provide effective and cost-efficient customer engagement and services through a digitalised platform?**
  - How to achieve energy access goals while prioritizing the best customers and customer services?
  - How to collaborate and partner with One Acre Fund[2] who are already working with farmers in Niger state to utilise their efficient digitalised solutions and platform?
  - **Growing productive load:** Engage with customers in a way that drives maximum capacity utilization and revenue. To this end, establish a set of productive use categories and a set of load curves that correspond with each category. Identify ways to serve these customers and drive demand growth.
- **C. Increasing scale, localized expertise, and remote monitoring can save transaction cost**
  - How can transaction costs stay low as the number of parties involved grows?
  - Establish clear and reasonable quality standards for mini grid components and performance with an allowance for some local variation.
- **D. Reducing the cost of capital by 4% to enable more rapid scaling**
  - What should a successful blended finance facility look like?
  - Who are the key actors to ensure success?
  - Are there effective ways to aggregate dozens, hundreds of mini grids and assess risk?
- How can OPEX grants (e.g. Green Climate Fund)[3] be applied, implemented and monitored to achieve desired results?

Table 4: Six hypotheses on how to reduce the levelised cost of electricity from Naira 150-180 to Naira 70/kwH. ***Extracted from Rock Mountain Institute (Mar 2018). 20 by 20: A Design Charette to Achieve $0.20/kWh.***

Six hypothesis to achieve USD 0.20/kWh	Current situation	Proposed solutions	Outstanding questions	Key next steps	Priority areas for future solar programme in Nigeria

[2] One Acre Fund in Nigeria: https://oneacrefund.org/work-with-us/job-openings/g/?gh_jid=868765

[3] GCF proposal for Nigeria: GCF's USD 230 million Universal Green Energy Access Program ("UGEAP") to be managed by Deutsche Bank group entities to fund solar home system and mini grids investments for SMEs and households located in Sub-Saharan Africa with an initial focus on Benin, Kenya, Namibia, Nigeria, and Tanzania. BOI should work with Deutsche Bank to acces this fund.

(Naira70/kWh)					
1. A standardized modular hardware system applied at scale can save $0.11/kWh	• High system cost at low volume • Custom engineering and complex install in the field for small batch of projects • Global cost reduction trends for many components, especially PV and some batteries	Standard, modular, and containerized mini grid solution can reduce cost of service by 20% • Expecting hardware cost reduction of 18% due to global trends over the next 3 years • Bulk purchasing and higher volume for logistics/overhead into Africa saves additional 15% • Standardized modular solution reduces engineering time by a third and install by 80% • Standardized modular solution with integrated M&V also improves reliability and reduces O&M • Further savings possible from simplified or local pre-assembly of PV and racking	- What sizes should be standardized around? - Would batteries be included with standardized solution? - Would racking and PV be standardized and preassembled as well? - Should these units be designed for potential future grid integration? - Bulk purchased lithium-ion cells have been reported as low as $90/kWh, what technical barriers still exist (e.g. weather, cycling, BOS)?	- Establish or build on existing mini grid industry consortiums to pursue the standardization and scale described above. - Use the consortiums to build relationships across value chain and to work toward ready-to-install systems.	Create industry consortium: Create a consortium including mini grid developers, hardware suppliers, and service providers focused on reduction of hardware costs through scale and joint industry work streams.
2. Actively managing load profiles can save $0.08/kWh on hardware and operating cost	- Many off-grid sites lack productive use loads - Agrarian and domestic loads exacerbate morning and evening peaks - Latent public (e.g. water pumping) and private (e.g. productive use) demand for energy exists	Encourage daytime use through load management programs to reduce LCOE by 13% • Site selection: Target sites with higher existing daytime load • Energy efficiency: Reduce night-time lighting loads by 50% by using LED lighting • Demand stimulation: Double daytime use by financing flexible, productive uses (e.g. water purification, pumping) • Tariffs: Simple tariff structure to encourage daytime use can shift 20% of nighttime load (e.g. time of use)	**- How do mini grid companies sustainably offer consumer financing for demand stimulation?** **- Can load curves be optimally shaped through selective distribution, a kiosk model, or energy as a service?**	- Use an industry consortium to establish a common communications protocol as a key step toward data collection and system flexibility. - Use "innovation labs" or other pilot project programs to test scaling technologies and demand stimulation program designs.	**Service-based demand: Increase capacity utilization through a targeted service based approach. Offer financed appliances with service based pricing to primarily commercial/productive customers to stimulate demand, shape load, increase savings, and improve revenue for businesses. stimulation**
3. Effective and efficient customer engagement can save $0.06/kWh despite being 3% of total cost	Customer engagement is critical for demand stimulation and managing load profile (slide 30) • Slow/uncertain customer acquisition leads to underutilized system capacity in early years • Revenue lost from non-collection or poor customer retention issues. Payment is often inefficient	Focus first on productive-use and largest customers • Partner with organizations like ag. coops and telcos that have existing customer relationships to: – Provide better understanding of willingness and ability to pay – Gain insight into productive use and demand stimulation needs • Use mobile money and/or transparent and intuitive customer interface (e.g. USSD) • Track metrics on customer acquisition and retention to improves sales and offerings	**- How can we achieve energy access goals while prioritizing the best customers and customer services?** **- How to collaborate with One Acre Fund who are already working with farmers in Niger state to utilise their digital solutions?**	- Share knowledge around productive uses, load curves, and demand growth trajectories. - Work with mini grid developers and operators and One Acre Fund to build the playbook described that could be used across multiple markets.	**Growing productive load: Engage with customers in a way that drives maximum capacity utilization and revenue. To this end, establish a set of productive use categories and a set of load. curves that correspond with each category. Identify ways to serve these customers and drive demand growth.**

	because of a nascent mobile money framework.				
4. Increasing scale, localized expertise, and remote monitoring can save $0.05/kWh	Developers and operators serve sites far from major cities across multiple states and regions • International companies have high labour costs • Long project delays lead to idle labour and low productivity	**Increase scale to serve 100+ sites efficiently by targeting labour and logistics through clustering and partnership** **• Select and serve clusters of sites within 2-3 hour travel from each other** **• Form strategic partnerships along the value chain to take advantage of economies of scale, local labour and knowledge, and specialization** **• Engage with communities to reduce land costs through donation while increasing site security** **• Reduce overhead costs by 60% through rapid scaling-up number of sites served**	**- How can transaction costs stay low as the number of parties involved grows?** **- Establish clear and reasonable quality standards for mini grid components and performance with an allowance for some local variation.**	- Use industry associations to propose standards. - Use industry associations, government or donor partners to encourage a shared data platform.	Standards and local exemptions: Establish clear and reasonable quality standards for mini grid components and performance with an allowance for some local variation.
5. Reducing the cost of capital by 4% to enable more rapid scaling can save $0.03/kWh	Most projects are funded by grant, equity, or with greatly subsidized interest rates • Commercial loan rates in sub-Saharan Africa are typically between 15% and 20% • USD or EU-denominated loans offer alternatives but also come with high cost (15-20%), FOREX risk and currency mismatch for local developers	Use blended finance facilities to aggregate mini grid sites, manage risk, and apply equity, debt financing • Use credit enhancement tools, such as FOREX risk hedging, customer payment backstops, and collateral guarantees to leverage other capital • Invest in quality assurance frameworks and consistent robust data collection to give investors clarity and confidence	**- What should a successful blended finance facility look like? Who are the key actors to ensure success?** **- Are there effective ways to aggregate dozens, hundreds of mini grids and assess risk?** **- How can OPEX grants be applied, implemented and monitored to achieve desired results?**	- Third-party led finance consortium to bring together an array of mini grid financiers to act on first priority. - Identify ways for government, donor partners, financiers to expand mini grid finance of power to additional services.	Global mini grid finance consortium: Standardize different parts of mini grid financing, including the supply chain, project finance, and consumer finance. The consortium would enable funding from ideation, pilot demonstration, and through to scaling, through a pre-agreement between funders who traditionally fund those stages.
6. Supportive regulation and policy can increase ease of doing business and save $0.03/kWh	Fees can add almost 50% to hardware cost, including customs, VAT, and local taxes (e.g., 20%, 19%, and 9%, respectively) • Delays at port	Waive customs/duties and VAT for all mini grid components (not just PV) • Reduce port delays for mini grid components • Clarify grid interconnection procedures, both technical and financial • Publish grid extension plans • Allow cost-reflective tariffs (at least for pilots	How should tariffs be set? • What happens, technically and financially, when the grid arrives? • If necessary, how can subsidies be used in a way drives growth, connects customers,	Ensure clear policies support flexible tariffs and interconnection standards and procedures. • Identify ways for regional bodies such as ECREEE or the East African Community to encourage best-practice policies	Reduce risk to developers and investors: Policymakers can help reduce private sector risk through clear off-grid energy planning, allowing for

	and in licensing slow growth and tie-up working capital • In Nigeria, mini grid regulations are in place but enforcement remains a challenge	and within some limits) • Reduce licensing/permitting requirements where appropriate	and does not distorting the market?	among members.	tariff flexibility, promoting local assembly (complete knock down), and supporting financing strategy.

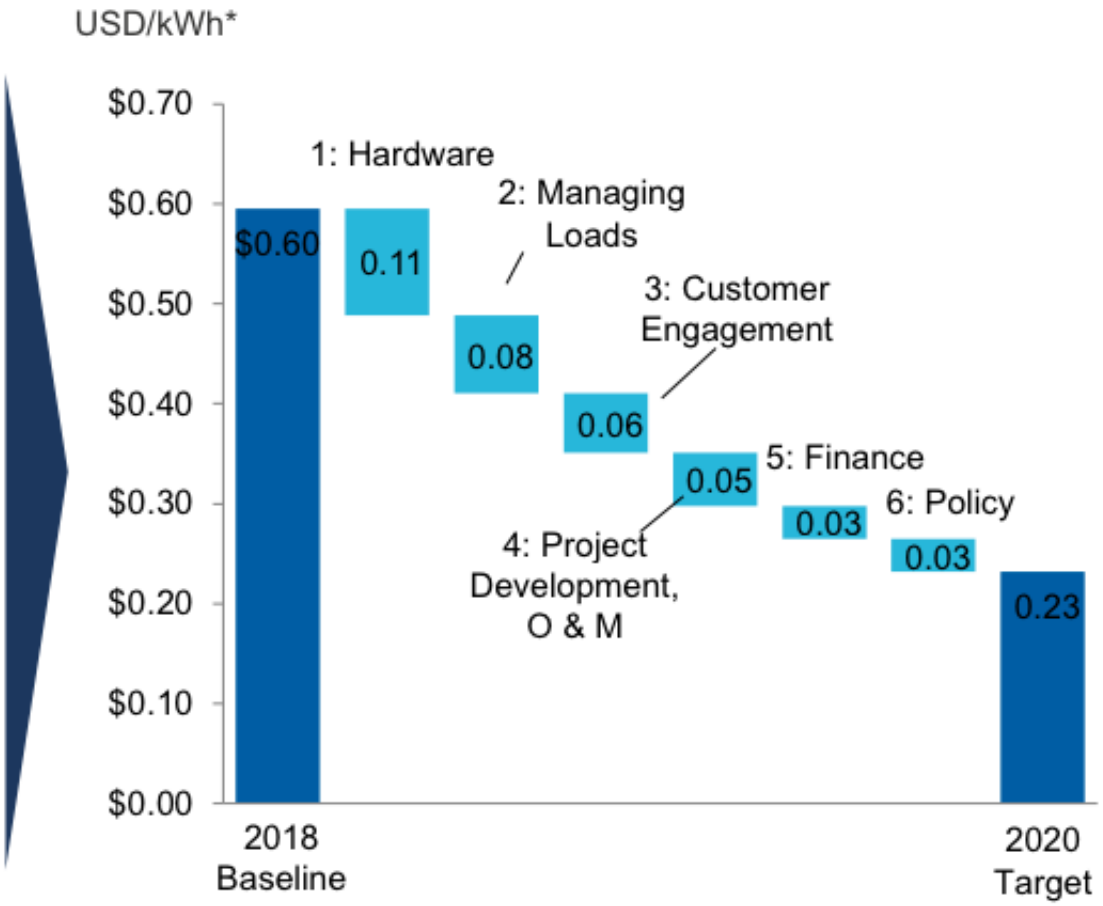

Figure 1: Opportunities to reduce levelised cost of electricity under six categories (RMI, 2018).

3 INTRODUCTION

3.1 Purposes, Objectives and Scope of the evaluation

The purposes of the Terminal Evaluation of the project "Solar Energy Programme" are many folds:

- to promote accountability and transparency, and to assess and disclose the extent of project accomplishments.
- synthesize lessons that can help to improve the selection, design and implementation of future BOI and UNDP funded activities.
- provide feedback on issues that are recurrent across the BOI and UNDP portfolio and need attention, and on improvements regarding previously identified issues.
- contribute to the overall assessment of results in achieving UNDP and BOI strategic objectives aimed at national and global environmental benefits.
- gauge the extent of project convergence with other UN and UNDP priorities, including harmonization with other UN Development Assistance Framework (UNDAF) and UNDP Country Programme Action Plan (CPAP) outcomes and outputs.

The main **objective** of the terminal evaluation (TE) is to assess whether the project has achieved or is likely to achieve the project objectives. The evaluation is required to assess the project performance against the five evaluation criteria: **relevance, effectiveness, efficiency, sustainability and impact**.

The definitions of the evaluation criteria to be assessed are given below:

Criteria	**Definition**[4]
Relevance	The extent to which the objectives of a development intervention are consistent with beneficiaries' requirements, country needs, global priorities and partners' and donors' policies.
Effectiveness	The extent to which the development intervention's objectives were achieved, or are expected to be achieved
Efficiency	A measure of how economically the resources and inputs (funds, expertise, time) are converted to results
Sustainability	The likelihood of continued benefits after the project ends.
Impact	Verifiable improvements in livelihoods, access to energy, livelihoods, green employment and verifiable reductions in stress on ecological systems

[4] Mostly based on the UNDP-GEF TE Guidelines

The TE is also expected to draw lessons and develop recommendations that may help in improving the selection, enhancing the design and implementation of similar future projects and activities in the country, improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

The scope of the evaluation covers an assessment and analysis of the relevance, effectiveness, efficiency, sustainability, and impact of the project, covering areas such as project design, monitoring and evaluation, attainment of outcomes, implementing partner and executing agency execution, management arrangements, work planning, finance and co-finance, stakeholder engagement, reporting, communications, etc.

3.2 Approach and Methodology

The Terminal Evaluation was undertaken in a participatory manner in which the key stakeholders were consulted throughout the evaluation process. The evaluation was guided by the key evaluation criteria based on the "Guidance for Conducting Terminal Evaluations of UNDP-supported GEF-financed Projects."

The TE assessed if the corresponding programmed activities were carried out for the outputs contemplated in the logical framework for the project. The evaluation used a variety of methods to ensure an evaluation based on qualitative and quantitative information and on sources such as desk studies, literature review, individual interviews and direct observation.

The interviews included BOI and UNDP members, relevant project staff, focal points, government officials and institutional partners. This constituted most of the key stakeholders. The visits included all the field and project sites and no sampling was necessary. The list of stakeholders consulted and the project sites visited are provided in Annex in Section 7.

3.2.1 Evaluation Questions

The key questions used during the evaluation served as the basis for conversations, discussions and observations, and were not necessarily asked in their form as presented below. The detailed Evaluation Question Matrix is presented in Annex in Section 7.

GENERAL Questions:

1. What is your responsibility area with respect to the SEP project?
2. What activities have you and your organization been directly involved with?
3. How long have you been working for or cooperating with the project?
4. Who are your primary counterparts and/or colleagues in the project?

PROJECT IMPLEMENTATION (Effectiveness):

To what extent have the expected outcomes and objectives of the project been achieved?

1. Were the project objectives achieved?
2. Did the project make a positive impact on the community - what?
3. Has the institutional capacity and awareness, and information on off grid solar PV for houeshold and commercial uses increased?

4. Have there been improvements made by the Government in the National RE policy and regulatory framework to improve the scaling up of RE technologies and businesses?

PROJECT IMPLEMENTATION (Efficiency):

Was the project implemented efficiently, in line with international and national norms and standards?

1. Do you think the money that went into the effort was worth it? Do the ends justify the means?

2. Were the project funds well managed?

3. Was there good coordination and cooperation among the participants involved in the community project?

4. Did the project implementation team remain the same or was there a lot of staff turnover?

5. Were the activities carried out timely and according to work plans?

6. Are you aware of any financial, legal or other project implementation concerns with respect to the activities?

7. If you could start over again, would you implement the project differently? How?

PROJECT IMPACT (Impact):

Are there indications that the project has contributed to, or enabled progress toward, reduced environmental stress and/or improved ecological status?

1. What has happened as a consequence of the project?

2. What practical improvements have there been as a result?

3. Can the project impacts be quantified (e.g. green job created, improved in income, social eco-entrepreneurs and trade association created)?

4. How many people have directly benefited from the project activities?

5. Did the pilot project help to influence environmental and development policies programmes and plans in the country?

PROJECT IMPACT (Sustainability):

To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?

1. Is the project effort continuing after the end of UNDP funding / end of the project?

2. Who will take a lead in continuing this work? Is there an enough commitment from them?

3. Have any of the project efforts been replicated (or starting to replicate) in other communities?

4. Are there efforts under way to find new sources of public and private funding to continue and expand the activities that were started under this project and not yet finished?

5. Were there public awareness and outreach efforts? And how effective was the project in attracting public attention?

The evaluation team have used ratings for each of the criteria for the project based on the findings of the analysis.

3.3 Project Summary Table

Table: 5 Project Summary Table

Project Title:	**Solar Energy Programme (SEP)**			
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Other Partners involved:	Local Government Authority	Project Document Signature (date project began):		16 Sept 2016
		(Operational) Closing Date:	Proposed: 31 Dec 2017	Actual: April 2018

3.4 Limitations of the Evaluation

Even though many key stakeholders were visited, it was not possible to meet some of the stakeholders due to availability and logistic issues and hence their perspectives could not be incorporated in the report.

4 PROJECT DESCRIPTION AND DEVELOPMENT CONTEXT

4.1 Project Start and Duration

The Project Document was endorsed in Sept 2016 and the project was to be implemented for a durations of 15 months to end in Dec 2017. But the agreements between BOI and the project developers (e.g. GVE Projects Ltd and Arnergy Solar Ltd) were only signed in Feb 2017 and the project was to be completed within 12 month. The project has encountered several delays caused by: i) the late signing of the agreements (5 months late); ii) late disbursement of funds by Zenith Bank to GVE's suppliers; and iii) changed in the project sites from Delta to Kaduna. So the project is anticipated to be completed in April 2018, some 4 months later than stated in the project document.

4.2 Problems that the Project Sought to Address

Rural energy is recognised as an important element of rural socio-economic development through the services it makes possible. For the micro business which makes up almost 80 per cent of business in the country especially in the rural areas, access to reliable energy is very critical. The absence of reliable energy supply has reduced productivity in these rural settlements and thereby contributed to the urban migration syndrome which in a sense is depriving the rural areas of its

workforce. Most rural settlements are off-grid, and do not have access to energy for their daily basic needs. This means that rural communities have a higher carbon footprint than they need to and are often higher, per person than their urban compatriots mainly because they are forced into choosing high-polluting energy sources, such as coal, heating oil or wood for their daily needs. Having access to a variety of alternative energy sources, inexpensive and supported by government will go a long way in helping these communities bring themselves out of energy poverty to be able to maximize their potential.

The objective of this project – Solar Energy Programme – seeks to demonstrate the sustainability and commercial viability of solar energy solutions via a suitable business model, for rural electrification, especially for off-grid communities which are completely underserved, thereby being the worst hit and most vulnerable communities in Nigeria. Successful deployment of the projects is also aimed at attracting the necessary funding to facilitate replication and upscaling of these projects to serve the energy needs of MSMEs in Nigeria

However, many key barriers still hinder the uptake and scaling of off grid mini grid (MG) and Solar home system (SHS) businesses to improve energy access and security to achieve the SDGs:

- **Policy and institutional barriers:** Policy can still be unpredictable or unsupportive. Key considerations include tariff-setting, licensing, taxes, import duties and delays, subsidies, and grid-extension and inter connection e.g. effective enforcement of Parliament-approved fiscal policy to waive the 25% import tariff for solar equipment and accessories.
- **Technical barriers:** Poor M and E plan and execution leading to project delays, high delivery costs and poor planning in logistic operations, sub-standard solar panels with low efficiency and durability, poor awareness and understanding on the solar system.
- **Economic barriers:** Cost can remain high. Overall cost of service is determined by both upfront and on going cost, and can be measured by calculating the overall levelized cost of electricity (LCOE): i) Upfront cost includes hardware, project development, and construction; ii) Ongoing cost includes O&M, fuel, customer engagement, and system losses; and Policy and finance also affect cost. Lack of access to competitive and viable financial products and services, lack of business skills, low efficiency in the timely disbursement of fund from BOI to vendors and suppliers.
- **Financial barrier:** Financing remains expensive or often unavailable. Increased access to finance is required for scaling successful business models, but current rates are high (20 to 25 % commercial interest rate with short repayment term) and increase further with foreign exchange risk.
- **Business barrier:** Capacity utilization is still poor with uneven load. Cost of service increases further for mini grids with poor utilization, including systems that are oversized with slow customer acquisition and/or low peaks loads in the morning and high peak loads in the evening.
- **Social barriers:** Lack of sound baseline data to understand the needs, aspirations, ability and willingness of the targeted beneficiaries to pay for the electricity services, acceptance and scepticism of the end users on the new technology.

This project seeks to address the above barriers to scale up the off grid mini grid solutions and businesses by improving the supply and demand side management of viable solar businesses.

4.3 Immediate and Development Objectives of the Project

The objective of the project is to catalyse on the successes of the Phase 1 pilot - Access to Renewable Energy Project (AtRE) and use that to remove barriers to the widespread application of decentralized renewable energy-based power generation in Nigeria (Figure 1). Complementary indirect mitigation benefits are expected from sustained market growth of decentralized renewable energy generation after the project ends and from paving the way for larger renewable energy (RE) power plants – for example, by clarifying the technical and institutional aspects of connecting RE-based intermittent power generation sources into the grid and leveraging financing for RE investments from new sources such as carbon finance and NAMAs.

At the consumer level, RE cannot yet compete with the costs of grid electricity, at the initial stage, but subsequently, it has proved to be worth the investment in the long run. For the private back-up electricity supply, however, the situation is different. Despite the Government's efforts to restore regular power supply, the need for private backup generators for meeting demand and securing adequate operating reserve is still likely to continue for several years to come. Therefore, the initial focus of the project will be on promoting renewable energy as an alternative – or complementary – energy source to private petrol/diesel generators, which currently dominate the back-up power generation market. Once the regular power supply and grid stability are restored, and in the course of further developing the net-metering scheme and the related tariffs, the already-installed RE systems can continue to operate and the market can further develop on the basis of a fully grid-integrated approach

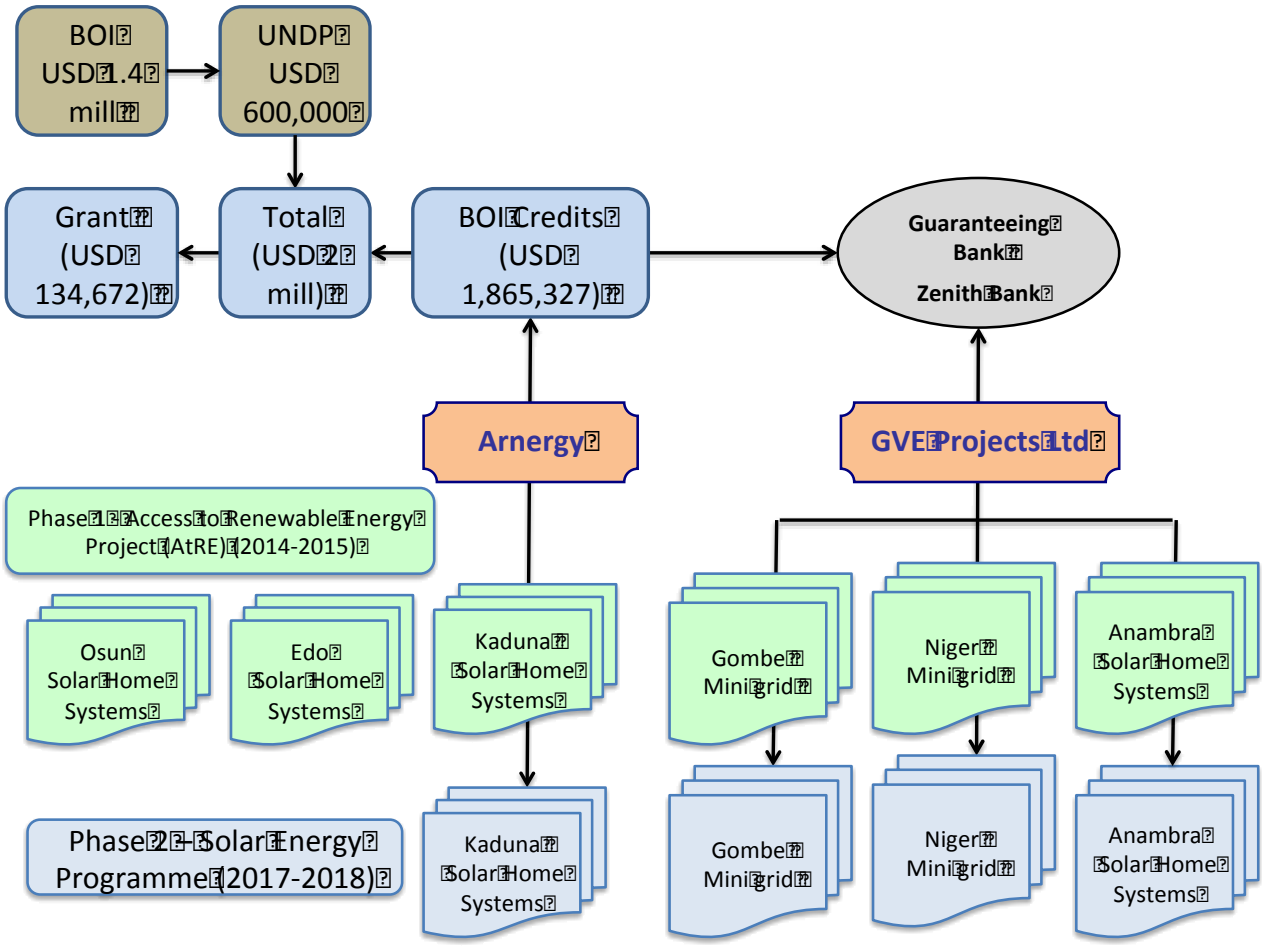

Figure 1: Solar Energy Programme. Phase 1 AtRE pilot project is added to show the progression from Phase 1 to Phase 2 with the states involved.

Project Rationale and Policy Conformity

The Bank of Industry (BOI) and the UNDP have in the past put together a Renewable Energy Project (2010 – 2012) with the objective to build the capacity in the business and financial sectors to incorporate renewable energy in business planning and development. The programme had assisted in building the capacity of MSMEs to incorporate renewable energy either as a business in and of itself or as a service provider for business development. It had also assisted financial institutions to better understand and assess the credit and financing risks of renewable energy policies and regulatory frameworks.

Project Goal, Objective and Outputs/activities

Rural energy is recognised as an important element of rural socio-economic development through the services it makes possible. In this way, using solar systems can have a significant impact on the lives of rural users. Energy can provide services such as the extension of daytime activities through lighting, entertainment by means of radios and televisions and pumping of potable water, increase in productivity of small and medium scale enterprises, etc. In the past, solar energy projects in Nigeria have always been implemented to provide social and communal services (e.g., powering health centres, schools and communal centres). These social and communal services can spark the provision of income-generating activities. For example, small solar systems may help promote productive activities (e.g. restaurants, rural cinemas, tailor, telephone and barber shops and technical artisan workshops), powering small tools and appliances (drills, soldering irons and blenders), lighting and radio/TV. In this way, the provision of solar energy would help contribute to rural employment creation, albeit on a small scale. The proposed initiative will take pro-active measures to promote productive uses such as these both in households and communal enterprises. UNDP's contribution is to be utilized as Grant while BOI's contribution is to be utilized as long term debt for the implementation of solar electrification projects.

Global objective: To reduce Nigeria's energy related CO_2 emissions by substituting fossil fuels (petrol / diesel, wood fuel, paraffin and coal) with solar powered energy supplied, for the purpose of providing basic energy services to rural homes and community users.

Development Objective: To improve people's livelihoods by improving their access to and affordability of modern energy services and assist the communities with the initiation of a renewable energy programme for the rural areas, thus reducing the dependency on fossil fuel.

The BOI/UNDP Solar Energy Programme is aimed at promoting and supporting an expansion of renewable energy services to support households and Micro, Small & Medium Enterprises (MSMEs). The project explores the public private partnership that advances the implementation of Renewable Energy Solutions. It also provides linkages for enterprise development, especially for underserved and underserved rural communities. The Renewable Energy Programme initially focused on awareness creation and capacity building of the relevant stakeholders in the renewable energy space, in order to encourage them to invest in the sector.

A pilot phase has been completed in six (6) selected States of Niger, Osun, Gombe, Anambra, Edo and Kaduna States (Figure 1). The aim of the pilot project was to demonstrate the sustainability and commercial viability of solar energy solutions via a suitable business model, for rural electrification, especially for off-grid communities which are completely underserved, thereby being the worst hit and most vulnerable communities in Nigeria. Successful deployment of the pilot projects is also aimed at attracting the necessary funding to facilitate replication and upscaling of these projects to serve the energy needs of MSMEs in Nigeria.

The project has now entered into the replication and expansion phase with a focus on deployment of low-cost, off-grid Solar Energy Solutions for rural communities and other user categories, either as a stand-alone (i.e. Solar Home System) or micro-grid system.

4.4 Baseline Indicators and Expected results

Table 6 shows the expected results at the end of the project, according to the Results Logical Framework provided in the Project Document. Ideally the project objective should be added in the logframe and assumptions and risks should be in more detail for each output. Likewise, the indicators and targets included should be Specific, Measureable, Achievable, Realistic and Time bound. Project developers must be trained to understand the Theory of Change principles and on how to deliver the outputs in the logframe.

Table 6: Results logical framework with baseline indicators and targets							
Intended Outcome as stated in the UNDAF/Country [or Global/Regional] Programme Results and Resource Framework: To promote an equitable enabling environment for policy dialogue; promote strategies for enhanced value added production, driven by private sector engagement							
Outcome indicators as stated in the Country Programme [or Global/Regional] Results and Resources Framework, including baseline and targets: : By 2017, Nigeria's economic growth is driven by increased and diversified use of renewable energy sources that promote technology transfer and local capacity building; characterized by affordable and equitable access for domestic and productive uses							
Applicable Output(s) from the UNDP Strategic Plan: Sustainable access to energy and improved energy efficiency							
Project title and Atlas Project Number: Solar Energy Programme							
EXPECTED OUTPUTS	**OUTPUT INDICATORS[5]**	**DATA SOURCE**	**BASELINE**		***Targets***		***Data collection methods and risks***
			Value	***Year***	***Year 1***	***Final***	

[5] It is recommended that projects use output indicators from the Strategic Plan IRRF, as relevant, in addition to project-specific results indicators. Indicators should be disaggregated by sex or for other targeted groups where relevant.

Output 1 *Deployment of Off – grid solutions to household and businesses*	***1.1** No of communities off-grid replications provided*	*Project final reports*	0	*2016*	*At least one off-grid community in Gombe, Anambra and Delta States*	*3*	*Acceptance by the community*
Output 2 *Project Management + M & E Costs*	***2.1** Audits carried out*	*Audit Report*	0	2016	*1*	*1*	
	***2.2** Terminal Evaluation done*	*TE report*	0	2017	*1*	*1*	
	***2.3** No of site Visits carried out.*	*M&E Site Reports*	0	2017	*2*	*2*	

4.5 Main stakeholders

Stakeholder engagement: This project seeks to build a strong public private partnership where the main solar value chain actors were government and technological stakeholders. The identified community stakeholders played a key role as well in the project implementation. This project built on the success of the previous project – the Access to Renewable Energy Project and some of the stakeholders in Phase I were part of the Phase 2 - Solar Energy Programme. However, the scope has now been expanded to include more states and more engagement with the respective state governments (see Figure 1 above). The primary target groups include but not limited to households, micro, small & medium enterprises (MSMEs) with support from the government.

Local authority and local community: The BOI and the UNDP were partnering with selected states (Niger, Anambra, Gombe, Delta (replaced by Kaduna) to implement the Solar Energy Project in these states. The partnership is expected to assist the off-grid rural communities, and small and medium scale enterprises in the state in accessing renewable energy for sustainable domestic and productive uses.

BOI/UNDP Staff assigned to the project: For BOI, project staff have been specifically assigned to the Solar Energy Programme. More staff were assigned to the project as the need arises. A project team was already in place at the BOI office.

5 FINDINGS

5.1 Project Design / Formulation

5.1.1 Analysis of Logical Framework Analysis (LFA)/Results Framework

The project document stated that the **Objective of the SEP** seeks to catalyse on the successes of the Phase 1 project (Access to Renewable Energy Project [AtRE]) and to use the lessons learned to overcome the barriers to scale up decentralized renewable energy-based power generation to improve access to clean energy for households and Micro, Small & Medium Enterprises (MSMEs) in Nigeria.

The SEP objective hopes to contribute to; i) the **global objective** by reducing Nigeria's energy related CO_2 emissions by substituting fossil fuels (petrol / diesel, wood fuel, paraffin and coal) with solar powered energy supplied, for the purpose of providing basic energy services to rural homes, community and commercial users; and ii) to the **development objective** by improving people's livelihoods through improved access to clean and competitive modern energy services and reduce the dependency on fossil fuel in the rural areas.

The objective of the SEP will be achieved through two main outputs:

- Output 1 - Deployment of Off – grid solutions to household and businesses: At least one off-grid community in Gombe, Anambra and Delta States.
- Output 2 - Project Management + M & E Costs.

Assessment: The title and objective statement of the project were rather too generic and could be more specific. For example, the title could be 'Scaling up of solar home system (SHS) and mini grid (MG) technologies and businesses for households and MSMEs in Nigeria.' Because the title and objective were too generic, the Output 1 statement was also too generic. As shown in the results logical framework (Logframe) in Table 6 above, indicators and targets presented were not SMART (not Specific, Measureable, Achievable, Realistic and Time-bound), thus making it difficult to monitor and evaluate the expected results. It seems the new indicators were added as the project progresses rather then at the outset of the project. Furthermore the project developers were not given the project document and hence do not understand the design, Theory of Change principles and M & E plan of the project.

Recommendations for improvement:

- Avoid project title and objective statement that are too vague and generic and choose project title and objective statement that are specific and reflective of the solutions to be promoted or scaled up
- The project objective should be included in the logframe.

- Output statement should also be more specific and the indicators and targets to measure the outputs should be SMART.

5.1.2 Assumptions and Risks

"Guidance for Conducting Terminal Evaluations of UNDP-supported GEF-financed Projects" indicates that the evaluation should provide an assessment of the project assumptions and risks as set out in the project document and Log Frame/Results Framework.

Assessment: The critical assumptions and most of the risks (financial [default/cash flow], security/vandalism, regulatory/policy, technical, environmental) were clearly identified in the project document but were not laid out logically or included in the LFA (see Table XY). The risks that were overlooked, not well managed or mitigated in the project were:

- **Willingness to pay:** Due to incomplete baseline survey assessment and insufficient due diligence, Arnergy Solar Ltd. has to move all the SHS equipment from Iyede-Ame, Lagos Iyede and Igeh communities in Delta to the Kaduna state. The targeted community in the Delta were not willing to pay for the SHS system because Niger Delta Development Company were offering free SHS to households. There were also issue of security and restlessness in Iyede–Ame, that has led to lost of some lives, and post as security threat to the project implementation. This has caused delays in project completion and extra logistic costs were incurred.
- **Non viable project:** Arnergy was supposed to install the SHS for the Garin Dawakin community in Gombe. But this has not been implemented because Arnergy felt that implementing only one small project in Gombe may not be economical enough.
- **Land access and title:** Due to incomplete land access and title checking, GVE has sited the grid power house and solar panels on land that belonged to a neighbouring community in Niger state. That community insisted that they must be connected with power before Swasun community could access the power. GVE had to install 35 extra poles to connect the grid to that community.
- **Bank guarantee:** The delays in the disbursement of payments to GVE's suppliers by Zenith Bank have delayed the release of equipment and the completion of the SHS in Gombe and Niger states. Project implementation had stalled due to lack of funds, as the Guaranteeing Bank, Zenith Bank Plc, has requested that BOI issues a confirmation letter before it disburses additional funds to GVE. Inspection visits were conducted by BOI to verify the equipment that have been procured, in order to confirm that funds disbursed have been utilized appropriately, to justify the release of more funds (see inspection reports by BOI in Annex in Section 7).
- **Enforcement of 10% import tax waiver:** GVE complained that 10% import tax were imposed on some solar panel consignments.

Recommendation for improvement:

- Baseline survey and due diligence must be conducted thoroughly to avoid delays and extra cost.
- Land title and rights must be conducted with due diligence
- Payment disbursement must be efficient to avoid project delays
- Public sector must support private sector to ensure that 10% import tax waiver is enforced efficiently and professionally by Custom Department and MoF.

5.1.3 Lessons from other Relevant Projects

The SEP seeks to build on the success of the Phase 1 solar pilot and the current BOI solar delivery system is presented in Table 7. An assessment is made on the current delivery system as presented in Table 7.

Table 7: Evaluation of the BOI's and developer's delivery and business model to scale up solar businesses

BOI Solar delivery system	Evaluation assessment	Future recommendations
i. A needs assessment was carried out in each community to determine their capacity to pay for the power supply as well as to ensure the sustainability of the project.	**There were inconsistency in how the community needs assessment were conducted:** **- Unwillingness to pay for the service:** The project was supposed to develop SHS for a community in the Delta State. But upon learning that they have to pay for the electricity, the community had decided to pull out of the project. This was exacerbated by the fact that State Development Programme was offering the SHS free of charge. Furthermore, the community leadership questioned as to why they should pay for the electricity given that Delta state is key producer of the nation's oil and gas. - Arnergy had to transfer all the SHS equipment from the Delta sites to a new site in Kaduna that has caused a delay to the completion of the project. **- Overlooking the issues of land access, rights and title to site the power house and solar panels:** GVE had installed a 40.95 kWp grid to serve the 200 households and businesses for the Swasun community in Niger State. But it was found out later that the land where the power house and solar panels were located happened to belong to a nearby community that is 800 m away. The community insisted that GVE must extend and connect the grid and electricity to their community before Swasun could make use of the electricity.	All key stakeholders especially the project developer must conduct a thorough baseline survey to have a deep understanding with regards to: real needs and concerns of all the value chain actors, ability and willingness to pay for the services, competing or conflicting project, access to land with proof of land title and rights. Ability to identify and mitigate such risks will help to avoid unnecessary delay on project start, implementation and completion and unforeseen transaction and project cost.

	GVE had installed 35 extra poles to connect the community at GVE's own expenses. This has further delay the project by 3 months.	
ii. Partnerships with the local community Head/Leaders were forged so as to ensure community ownership, engagement and active participation in the project. This ensures community buy-in so that the project is perceived as theirs.	- There were strong community ownership and beneficiaries are very appreciative of the SHS and mini grid services to improve access to clean and reliable and competitive electricity. - Nearby communities have heard of the benefits of the solar system and are requesting for access to the grid.	It is important to manage the expectations so that community will not be disappointed.
iii. Either a 24kW micro-grid or stand-alone SHS solution powered by photovoltaic solar components was installed in the communities depending on the nature of the settlements or other determining factors.	- No issues were encountered here.	
iv. The solutions were deployed with an appropriate metering, payment and collection system. Pre-paid meters using a Pay-As-You- Go (PAYG) model were installed in each house. The model allows for pre-payment and flexibility of payment, which solves the challenges of unpaid bills and cash-flow for subscribers, respectively.	- No issues were encountered except the complaints by end users on the 5% VAT charge on the tariff. - They have requested for this 5% VAT to be waived.	- To avoid any misunderstanding and confusion perhaps the 5% VAT charge on the tariff bill should not be shown on the bill. - Need to explain that the 5% VAT is a government tax that apply to all services in Nigeria.
v. Typically, the clients purchase recharge tokens generated from a central server which is tied to their meter numbers. An agent, appointed to serve the community will bulk buy the power units and tokens from the power producer. On purchase of the token from the agent, the customer enters the pin code using a secured pin pad on their individual meters to get the value of energy purchased (as per agreed tariff which is currently between N150-180/kWh for each user). In the event that the electricity is not utilized, the meter will not read, and the client will not be charged.	- The challenge will be in how to continue to reduce the tariff of N150-180/kWp to N70 to close the gaps with the government's subsidised tariffs: N25/kWp for residential; N40/kWp for commercial and N5/kWp for community (see Table 4 above). -	- Please refer to Table 4 above.
vi. Each metered household is provided with basic energy efficient lighting, mobile phone	- Businesses were able to displace the use of diesel and generator to power their businesses. - End users are more aware and conscious on the	- Please refer to Table 4 above.

charging port, and low consuming AC appliances (TV, radio, hair clipper, table and ceiling fans, entertainment system, etc). However, micro-businesses such as barber salons, provision/sundry stores with refrigerators/freezers, millers, etc, could also be powered by the solar systems. Certified energy efficient LED light bulbs (5W) which use at least 75% less energy, and last 25 times longer, than incandescent lighting (60W, 100W) will be introduced to the communities, as utilization of these with Renewable Energy systems makes it more efficient on the whole.	benefits of saving energy through the use of energy efficient appliances and turning off appliances when not in use. -	
vi. To ensure sustainability of the projects, the Project Developers were advanced long-term loans of fifteen (15) years with a concessional interest rate of 7%, typical of such developmental projects which require patient capital.	- Access to competitive financial products and services are very critical to create demand for solar to create a tipping point for the nascent solar market. - Compared to commercial rate of 20-25%.	- Please refer to Table 4 above.

5.1.4 Replication Approach

Knowledge capture, management and sharing: The project intended to identify, analyse, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identifying and analysing lessons learned is an on - going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP and BOI were supposed to provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. But this is yet to be done.

Sustainability, scaling up and exit strategy: One of the strategies of the Phase 1 pilot project implemented by Bank of Industry was to demonstrate the viability of utilizing renewable energy solutions in addressing the rural electrification deficit. The demonstration projects in the pilot scheme were gaining traction for solar electrification as there have been several indications of interest to replicate similar projects across Nigeria.

The positive testimonies from beneficiaries in Gombe, Niger, Kaduna and Anambra have generated keen interest and demand from neighbouring communities. Other States such as

Jigawa, Ebonyi, Akwa Ibom have also indicated a keen interest in partnering with BOI to deploy solar solutions for their rural communities.

The capacity of solar solutions deployed in the Solar Energy Programme's pilot phase serve mostly residential users for basic load and a few micro-businesses using small inductive loads. In order to achieve universal access to energy for inclusive growth in Africa, it is imperative that clean energy solutions are deployed for both residential and productive uses. In view of Bank of Industry's mandate to transform Nigeria's Industrial sector, and the significant role that the availability of reliable power supply for MSMEs plays to actualize this mandate, the Solar Energy Programme (SEP) has an outlook to achieve the following, going forward:

1. Provision of solar electricity to serve various industrial clusters of micro and small businesses at the bottom of the pyramid, as well as for medium scale enterprises which can power their business operations with clean energy in a profitable manner. This would serve to boost economic activities both in the off-grid and grid-connected areas as electricity supply from the national grid is very limited. Solar power therefore provides a more reliable solution to meet their energy requirements. To achieve this, higher capacities than what was deployed in the pilot phase will need to be deployed.
2. Replication and scale up of rural off-grid projects in at least one (1) off-grid community in each of the thirty-six (36) states of Nigeria with a focus to also providing solar electricity for more MSMEs apart from the households within these target communities.

   Most rural areas in Nigeria are agrarian in nature but do not have storage or processing facilities for their farm produce, which leads to very low bargaining power for their commodities or/and wastage of perishable commodities. The provision of electricity in these rural areas, especially those that have no access to the National grid will drive commodity based industrialization as there will be value-chain addition through the processing of the agro based products. This will in turn add more value to the products of the farmers.
3. Mitigation project with Adaptation benefits: Apart from the Climate change mitigation projects such as the Solar Energy Projects, BOI also seeks to implement Adaptation Projects especially as a prerequisite to accreditation as the National Implementing Entity (NIE) of the Adaptation Fund (and a precursor to application for the larger Green Climate Fund).

In light of above, the replication approach as an exit strategy during the design and formulation of the project was well considered and planned.

5.1.5 UNDP Comparative Advantage

UNDP has a clear comparative advantage as the grant provider of this project as UNDP has many years of experience in the region and in the country. As also highlighted in the Project Document, this project is relevant to the UNDP Country Program Action Plan II (2009-2012) mandate through its strong emphasis on environmental governance, capacity development and technical training for the private sector in order to provide professionals with the necessary know-how and technical skills to advise developers and other decision makers about RE standards and to integrate them into national policies and legislations. It also fits the UNDP's mandate by helping improve the capabilities of municipal enforcement agencies leading to better governance through sustained technical and institutional support.

5.1.6 Linkages between Project and other Interventions within the Sector

GVE and Arnergy are experienced and leader as solar project developers and brought with them vast experiences learned from other national and regional solar initiatives.

The project also seek to link and learn from lessons learned from other solar initiatives: GIZ's National Energy and Strategic Programme and UNDP's GEF funded Energy Efficiency programme to pilot solar:

i. Roguwa Community: As part of the GEF project, a 4.0 kWp Solar Photovoltaic Micro off-grid system was installed which generates a minimum of 14.0 kWh daily. The energy generated from the solar system supplies power to pump water into a 13,000 litre water tank in the community and also used for lights and other appliance. Fifty households, a health centre, a drugstore, and about 10 small scales privately owned businesses benefit from the solar power system.

ii. **Uke Hospital:** A stand-alone photovoltaic (PV) system was installed in the Uke hospital under the GEF project. The hospital was provided with high quality LED lamps for lighting. The capacity of the PV system installed is 1.5 kVA with a back-up battery bank of about 7 kWh, to power the lighting system including in the hospital theatre, a refrigerator and several fans in the doctor's office. Hospital staff revealed that the PV system has been very beneficial to the hospital in that they were able to undertake surgery at the hospital. In the past, they couldn't undertake surgeries and had to send patients to other hospitals. In addition, the LED lights provide illumination in various areas of the hospital.

5.1.7 Management Arrangements

The Project was executed under the National Implementation Modality (NIM), as opposed to Direct Implementation Modality DIM). The project governance and oversight structure (Project Management Committee, Project Management Unit and implementation arrangement) are presented in Figure 3. BOI has provided overall project management whilst UNDP Country Office provided the implementation support. BOI was also responsible for the facilitation of all project activities such as international consultant missions, trainings for respective staff, ensuring appropriate access to project sites, relevant data, records, agencies and authorities. Upon request by BOI, UNDP has provided procurement and contracting services in accordance with the relevant

UNDP rules and regulations, policies and procedures for procurement, human resources management and guidelines. Direct project costs were charged against the BOI-financed project budget for these services.

A Project Manager, and a Technical Officer were tasked with the day-to-day management of project activities, as well as with financial and administrative reporting. The Project Team, has leveraged on other relevant human resources within BOI, and was responsible for project implementation and were guided by Annual and Quarterly Work Plans

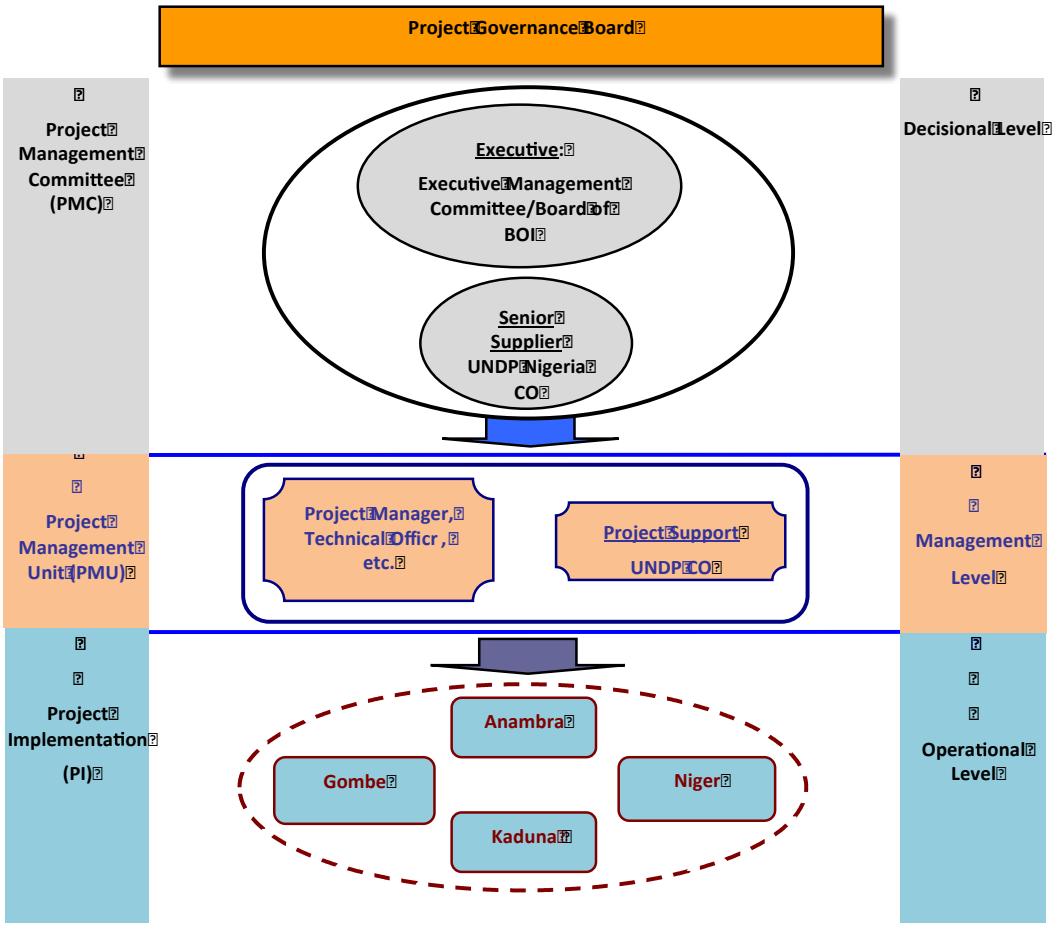

Figure 3: Project management and oversight structures

5.2 Project Implementation

This section of the document reviews the M&E, Adaptive Management (changes in project management according to the feedback), partnership arrangement with stakeholders and project finance.

5.2.1 Adaptive Management and Feedback from M&E activities used for Adaptive Management

The project's management has been adaptive and was able to demonstrate flexibility in making changes if and when necessary to do so in order to keep the project up to date and keep it capable of producing the desired outputs as envisaged originally. One such example was the need to change the project site in Delta to Kaduna state, though not without delays and extra logistic costs. Upon learning that Zenith Bank needed confirmation letters from BOI, BOI was able to dispatch a team to inspect the sites and verify the equipment and issued verification reports for Zenith to release the funding.

5.2.2 Partnership Arrangements (with relevant stakeholders involved in the country/region)

The BOI/UNDP Solar Energy Programme is aimed at promoting and supporting an expansion of renewable energy services to support households and Micro, Small & Medium Enterprises (MSMEs). The project explores the public private partnership that advances the implementation of Renewable Energy Solutions. It also provides linkages for enterprise development, especially for underserved rural communities. The Renewable Energy Programme initially focused on awareness creation and capacity building of the relevant stakeholders in the renewable energy space, in order to encourage them to invest in the sector.

A pilot phase has been completed in six (6) selected States of Niger, Osun, Gombe, Anambra, Edo and Kaduna States. The aim of the pilot project was to demonstrate the sustainability and commercial viability of solar energy solutions via a suitable business model, for rural electrification, especially for off-grid communities which are completely underserved, thereby being the worst hit and most vulnerable communities in Nigeria. Successful deployment of the pilot projects is also aimed at attracting the necessary funding to facilitate replication and upscaling of these projects to serve the energy needs of MSMEs in Nigeria.

GVE Projects Ltd: GVE is the fastest growing renewable energy solutions provider in Nigeria. Over the years, in collaboration with their partners have made tremendous contributions in the renewable energy deployment industry globally through our major business activities which includes; the design, sales, installation and maintenance of renewable energy solutions for residential houses, commercial outfits and rural off-grid communities in line with our clients' needs. GVE Projects Ltd. was founded in 2012 by then young undergraduate students out of the passion to contribute to solving Nigeria's energy poverty crises especially in rural off-grid communities. Currently, GVE has become the fastest growing renewable energy solutions provider in the country. As a result of the large market size (over 90 million people), our business is segmented in phases with the first phase intended to run for ten years. This phase will provide modular, reliable and very affordable PV Solar based mini-grid electricity plants (24kW-100kW capacities each) to impact over 1 million people in 524 off-grid communities in the South-Southern and South-Eastern (Niger Delta) regions of Nigeria with a cumulative peak energy generating capacity of 17.8MW using Pay-As-You-Go prepayment metering platform.

The number of sites will increase progressively at an average growth rate of 27% over a six year period.

Arnergy Solar Ltd: ARNERGY is a distributed utility technology company that leverage Internet of Things (IoT) to deploy affordable, reliable distributed solar energy solutions to rural and urban consumers and SMEs across Nigeria on a monthly subscription model. Arnergy custom design solar energy systems for commercial and residential clients using tried and tested, intelligent solar energy system ensuring Africans have 24/7 power in their homes while reducing operating expenses of African businesses saving them huge costs otherwise spent on diesel/petrol generator maintenance and increased revenue otherwise lost to cut in production.

5.2.3 Project Finance

The total project cost was USD 2,000,000 with USD 600,000 contribution as grant from UNDP and match funded by BOI for a loan sum of USD 1,400,000 as presented in Table 8.

Table 8: Budget by output

EXPECTED OUTPUTS	PLANNED ACTIVITIES	Planned Budget by Year (USD)			RESPONSIBLE PARTY	Actual Expenditures (USD)		
		Y1	Y2	Y3		Funding Source	Actual expenditure	
Output 1 *Deployment of Off – grid solutions to household and businesses*	*Stakeholder Engagement*	80,000	0	0	BOI	CS	80,000	
	Project Procurement/ *Installation and Commissioning*	1,860,000	0	0	BOI	CS/UNDP	1,860,000	
	Sub-Total for Output 1							
Output 2 *Project Management & Implementation*	Field Visits	20,000	0	0	BOI/UNDP	UNDP	20,000	
	Audits	20,000	0	0	BOI/UNDP	UNDP	20,000	
	Terminal Evaluation	20,000	0	0	UNDP	UNDP	20,000	
	Sub-Total for Output 2	60,000					60,000	

TOTAL		2,000,000					2,000,000	

5.2.4 Monitoring and evaluation: design at entry (*), implementation (*), and overall assessment (*)

M and E design at entry: Overall the M and E plan was well designed but could be improved significantly. Although the Theory of Change was mentioned in the project document, the full concept was poorly understood. For example, no SMART indicators (specific, measureable, achievable, realistic and time-bound) and targets were included at the outcome and impact levels in the results logical framework (see Table 6). The output indicators included was very general and not specific enough. The impact, outcome and output statements given below as extracted from the project document has no specific and related indicators and targets attached to them, thus making it difficult to monitor and evaluate the project. Ad hoc indicators were only added as the project progresses rather than at the outset.

Impact	Increase rural electrification through deployment of low-cost, off-grid Solar Energy Solutions for rural communities, replacing fossil and traditional alternatives and improving livelihoods

Remaining questions: How will the increased in rural electrification be measured to assess the impact? How will fossil fuel replacement and improvement in livelihood be measured? Who will conduct these measurements to measure the impact after 10 years the project has ended?

Outcome	Renewable, clean and affordable electricity access for rural communities	Enabled market for MSMEs and stakeholders

Remaining questions: How will electricity access and affordability be measured? How to measure the success of the MSMES and value chain actors? Who will conduct these measurements to measure the expected outcomes after 5 years the project has ended?

Outputs	• Successful pilots • Replication framework	• Identify suitable business models • Knowledge dissemination	• Overarching policy • Clear regulations

Remaining questions: How will these outputs be measured to indicate the success of the project? Should SMART indicators and targets for these output statements above be included at the outset in the results logical framework to guide the solar project developers?

Activities	• Develop replication	• Analyse and tailor	• Design national

framework • Replicate and scale-up projects in different States.	business models • Capacity building • Knowledge sharing	project for scale • Develop specific policy and regulations

Remaining questions: How will each activity contribute to deliver on each individual output? Should each activity be linked specifically to each output rather than

Global objective: The project document stated that the global objective was "To reduce Nigeria's energy related CO_2 emissions by substituting fossil fuels (petrol / diesel, wood fuel, paraffin and coal) with solar powered energy supplied, for the purpose of providing basic energy services to rural homes and community users." Yet again there was no indicators and targets included to track the achievement of this objective. Future project design could include indicators to estimate annual total project GHG emissions avoided by multiplying annual total RE electricity generated with Nigeria's power emission factors.

Development Objective: The project document stated that the development objective was "To improve people's livelihoods by improving their access to and affordability of modern energy services and assist the communities with the initiation of a renewable energy programme for the rural areas, thus reducing the dependency on fossil fuel." Future project design could included indicators to measure improvement in education due to improve lighting for study, improve income due to business opportunities and savings from displaced diesel for generator.

At Implementation: Ad hoc indicators and targets were improvised and added as the project progresses rather than at the outset.

Overall assessment: Overall the M and E plan was well designed but could be improved significantly. Project developers must have a good grasp of the M and E plan and the Theory of Change approach.

Ratings:

M&E: Design at Entry:	HIGHLY SATISFACTORY (HS), SATISFACTORY (S), MODERATELY SATISFACTORY (MS), MODERATELY UNSATISFACTORY (MU), UNSATISFACTORY (U), HIGHLY UNSATISFACTORY (HU)
M&E: Implementation	HIGHLY SATISFACTORY (HS), SATISFACTORY (S), MODERATELY SATISFACTORY (MS), MODERATELY UNSATISFACTORY (MU), UNSATISFACTORY (U), HIGHLY

	UNSATISFACTORY (HU)
M&E: Overall Assessment	HIGHLY SATISFACTORY (HS), SATISFACTORY (S), MODERATELY SATISFACTORY (MS), MODERATELY UNSATISFACTORY (MU), UNSATISFACTORY (U), HIGHLY UNSATISFACTORY (HU)

Recommendations:

- There is a need for project designer to have a good understanding of the Theory of Change: project activities should deliver short term outputs at the end of the project, the aggregation of the outputs should contribute to medium outcomes (say 5 years after project has ended) which in turn should lead to long term and sustainable impact (10 to 20 years after project has ended) of the solutions on offered.
- Robust exit strategy should be built into the project design so that the outputs delivered are sustainable institutionally, financially and socially beyond the funding of the on off project.
- SMART indicators and targets at the output, outcome and impact levels should be included in the results logical framework to monitor and evaluate the project.
- There is a need for BOI to develop a specific M and E template for the solar project developers to use to report on quarterly progress and problems encountered that could include: Overall status; BOI Review; UNDP Review; Output results; Financial statement (expenditures); Risks management (risk identified and actions to be taken).
- Project developers must be provided with a copy of the project document and have a good understanding of the design, Theory of Change, expected outputs, M and E plan of the project document before the star t of the project.

5.2.5 Implementing Agency (UNDP) execution (*) and Executing Agency execution (*), overall project implementation/ execution (*)

UNDP Execution: UNDP was instrumental in the project design and writing of the project documents. The project was executed jointly with UNDP and BOI as the implementing partner.

Implementing Partner (BOI) Execution: A project team was set at BOI to supervise all the activities conducted by GVE and Arnergy to deliver on the expected outputs.

Overall Project Execution

Based on the analysis above, in the author's opinion, the Overall Project Implementation and Execution is Satisfactory (S).

Summary of Ratings:

Implementing Agency Execution:	***SATISFACTORY (S)***
EXECUTING AGENCY Execution:	***SATISFACTORY (S)***

Overall Project Implementation/Execution:	***SATISFACTORY (S)***

5.3 Project Results

The current chapter includes overall project achievement in terms of attainment of the global objectives and some of the key indicators of success or otherwise of the project such as relevance, effectiveness, efficiency, sustainability and impact.

5.3.1 Overall Project Output Rating (*)

The overall project output as stated in the results logical framework seek to establish **"At least one off-grid community in Gombe, Anambra and Delta States."**

The overall project output of the project has been deemed as **satisfactory** in achieving the objective and outputs of the project (Table 9):

- **Total Installed capacity: 246.8 kW**
- **No of households connected: 1,424**
- **No of businesses connected: 870**
- **No of jobs created: 29 direct jobs (as technicians, security guards) and over 41 indirect jobs from micro-business**
- **Installation cost: USD 4,125/kW for mini grid and USD 4,863/kW for SHS**
- **Beneficiary cost: USD 521/household or businesses**

Table 9: Evaluation of the project results implemented by GVE Project Ltd and Arnergy Solar Ltd.

States	Project sites	Project cost (Naira)	Disbursed as at Mar 2018	% disbursed	Installed capacity (kWp)	Status	No. of Households connected	No. of businesses connected	No. of jobs created	
A. GVE Projects Ltd									**Direct**	**Indirect**
1. Gombe (mini grid)	**i. Ayaba community, Biliri LGA – 24kW**	**30,796,885**	**27,857,984**	**90.5%**	**24.0**	**Power house and distribution lines completed. Final solar panels and system connection to be completed in April 2018 as the final funding has been released in April**	**150**	**20**	**3**	**0**

						2018)				
	ii. Kolaku community, Balanga LGA	111,086,987	100,642,372	90.6%	46.0	Power house and solar panels are connected. Connection to the houses and businesses to be completed in April 2018	350	0	5	0
2. Niger (mini grid)	3. Grid extension from Bisanti community to Mantutu (700m away)	85,186,796	76,668,117	90.0%	37.8	Completed	100	7	5	5
	4. Swasun community, Katcha LGA	10,641,210	9,577,089	90.0%	41.0	Completed	200	15	1	9
3. Anambra (SHS)	v. Onono, Anambra West LGA	115,242,303	103,718,073	90.0%	0.0	Waiting for final disbursement of fund from Zenith Bank	300	0	4	0
	vi. Okpechalla, Anmabra Wesr LGA	37,914,850	34,123,365	90.0%	0.0	Waiting for final disbursement of fund from Zenith Bank	100	0	2	0
Sub-total		390,869,031	352,586,999	90.2%	148.8		1200	42	20	14
States	Project sites	Project cost in Naira	Disbursed as at Mar 2018	% disbursed	Installed capacity (kW)	Installed capacity (kW)	No. of Households installed	No. of businesses installed	No. of jobs created	
B. Arnergy Solar Ltd									Direct	Indirect
4. Kaduna (SHS)	i. Soba and ikara community, Tasanyari	209,914,169	166,793,792	79.5%	98.0	Completed	804	66	9	27

	LGA									
5. Gombe (SHS)	ii. Garin Dawaki, Kwawi LGA	48,530,180	Nil (To be incorporated into next phase)			Not installed because Arnergy is not operating in Gombe and reported that the loan provided is too small to make it viable.	250			
Sub-Total		258,444,349	166,793,792	64.5%	98.0		804	66	9	27
Grand Total		649,313,380	519,380,791	80.0%	246.8		2004	108	29	41

Based on the above, the rating under this category of project results is Satisfactory (S).

Rating:

Satisfactory (S)

5.3.2 Relevance (*)

The project is well aligned with national development (e.g. Transformation Agenda 2020) and climate policies (e.g. NDC, RE Masterplan), strategies and action plans to improve access to clean energy and improved livelihoods.

The project is well aligned with BOI's aspirations "To be Africa's leading Development Finance Institution operating under global best practices" to transforming Nigeria's industrial sector by providing financial assistance for the establishment of large, medium and small projects as well as the expansion, diversification and modernisation of existing enterprises; and rehabilitation of existing ones. Its development objectives seek: to support quality projects with high developmental impact such as job creation and poverty alleviation to enhance the socia-economic standard of Nigerians; provide strategic positioning to manage foreign grants and aids that are given to facilitate attainment of the nation's developmental aspirations. To achieve universal access to energy for inclusive growth in Nigeria, it is imperative that clean energy solutions are deployed for both residential and productive uses. It is therefore important to support the provision of sustainable and reliable energy for MSMEs in view of Bank of Industry's mandate to transform Nigeria's Industrial sector, and the significant role that the availability of reliable power for MSMEs plays in actualizing this mandate. The provision of solar electricity to serve various industrial clusters of MSMEs can power their business

operations with clean energy in a profitable manner. This would boost economic activities both in the off-grid and grid-connected areas, as electricity supply from the national grid is still very limited. Solar power therefore provides a more reliable solution to meet their energy requirements.

As stated in the logframe, the project was also well aligned with the UNDP's strategies and programmes: i) intended outcome of the UNDAF/Country [or Global/Regional] Programme Results and Resource Framework that seeks "To promote an equitable enabling environment for policy dialogue; promote strategies for enhanced value added production, driven by private sector engagement"; ii) Outcome indicators as stated in the Country Programme [or Global/Regional] Results and Resources Framework, including baseline and targets: By 2017, Nigeria's economic growth is driven by increased and diversified use of renewable energy sources that promote technology transfer and local capacity building; characterized by affordable and equitable access for domestic and productive uses and iii) Applicable Output(s) from the UNDP Strategic Plan: Sustainable access to energy and improved energy efficiency

As shown above, this project is coherent with the relevant national, BOI and UNDP strategies and plans and national development (Transformation Agenda 2020) and climate policy goals (NDC, RE Masterplan), and assists Nigeria in achieving those targets set for scaling up renewable energy businesses and opportunities and hence is highly relevant.

Rating:

Highly Relevant

5.3.3 Effectiveness (*)

According to the "Guidance for Conducting Terminal Evaluations of UNDP-Supported GEF-financed Projects", the Effectiveness is defined as "the extent to which an objective has been achieved or how likely it is to be achieved."

The effectiveness and other criteria for that matter are affected by, among other things, internal and external factors, sometimes beyond the control of the project implementation team and the implementing partner. Clearly, these aspects that are beyond the control of the project team need to be identified as much as possible and the risks associated with these need to be assessed at the beginning of the project and indicated in the Logical Framework analysis.

As shown in Table 9, the project has been effective in delivering the objective and outputs of the project despite: i) the delays in the execution and completion of the project; ii) the failure of Arnergy to install the SHS in Garin Dakin community in Gombe and to postpone the output to the next phase; and iii) the project sites have to be changed from Delta to Kaduna state.

Rating:

Satisfactory

5.3.4 Efficiency (*)

About 84.8% of the fund has been disbursed (see Table 3 above). The serious delays in the signing of the agreement between BOI and project developers disbursement of fund from Zenith Bank to GVE's suppliers has delayed the completion of the project.

Rating:

Moderately Satisfactory

5.3.5 Country ownership

There is strong country ownership of the project as demonstrated by the active participation at the local community level.

*5.3.6 Sustainability**

The GEF Guidelines stipulate that all terminal evaluations should at a minimum assess "the likelihood of sustainability of outputs at project termination, and provide a rating for this".

In this context, Sustainability is defined as the likelihood of continued services and benefits after the project ends i.e. is there an exit strategy built into the project to ensure continuation beyond the one-off project. Consequently, the assessment of sustainability is expected to consider the risks that are likely to affect the continuation of project outputs and outcomes. The GEF Guidelines establish four areas for considering risks to sustainability, and requires the evaluators to evaluate and rate them individually. The following sections present the evaluator's assessment of sustainability for each category.

Financial sustainability

Key aspects to be considered in relation to financial sustainability are summarised in Table 10.

Table 10: Evaluation of the financial sustainability of the SEP

Managing financial risks	Evaluation assessment	Future recommendations
i. Could the operation and maintenance costs of the SHS and MG be sustained financially by the project developers after the project has ended?	- Yes there is strong likelihood that the O and M costs of the MG and SHS will be covered and sustained by the GVE and Arnergy as long as end users are able to pay for the services.	- Project developers will need to find creative means to increase their revenues and profits to improve their cash flow by improving generation efficiency and optimise daytime demand. -
ii. Will there be continual	- Having tasted the multi-	- Where possible, project

ability and willingness of the end users to pay for the services?	benefits of access to clean and reliable electricity, there is strong likelihood that the end users and community will continue to pay for the services.	developers will need to explore avenues to help improve the livelihoods and income of the end users so that they could continue to pay for and enjoy the services and benefits.
iii. Will national and international public grant still be needed to subsidise future solar programme in Nigeria by supporting and complimenting private sector investment?	- It is very likely that public climate finance as non-reimbursable and reimbursable grants or concessional loans will still be needed over the next 5 years to allow private sector actors to invest, innovate and reduce the transaction, installation, O and M costs and tariff rate in the nascent solar market	- Project developers will need to continue to innovate to reduce the tariff rate by crating demand to reduce the supply risks.

Rating:

Moderately Likely (ML)

Socio-economic Sustainability

Table 11: Evaluation of the socio-economic sustainability of the SEP		
Managing socio-economic risks	**Evaluation assessment**	**Future recommendations**
i. Will the SHS and MG services and benefits continue and be sustained socio-economically after the project has ended?	- As mentioned above, as long as end users can enjoy the benefits of clean and reliable electricity, the services will be valued, protected, improved and sustained. - There are strong evidences that neighbouring communities who have heard of the solar benefits are requesting for the solar	- It is critical for the project developers to continue to provide high quality products and timely and professional customer services in order to manage expectations well and improve the willingness of the end users to pay for the services.

	services to be extended to their community.	

In the Evaluator's opinion, the Socio-economic Sustainability is Moderately Likely (ML).

Rating:

Moderately Likely (ML)

Institutional Framework and Governance

Table 12: Evaluation of the institutional and governance sustainability of the SEP		
Institutional and governance risks	**Evaluation assessment**	**Future recommendations**
i. Has a strong public private partnership been developed to sustain the services and benefits of the solar businesses beyond the life of the SEP?	- There are strong evidences of strong buy in from the public sector at the national and local levels to support private sector to scale up the solar services and benefits.	
ii. Has the import waiver of 25% tax for green products e.g. solar panels and accessories been enforced effectively by Custom and MoF?	- GVE complained that some recent solar panel consignments have been imposed a 10% import tax by Custom and MoF.	- GVE as members of the RE Association are lobbying the government to make sure the import waiver are being enforced effectively and efficiency.

In summary, the rating assigned for Institutional Framework and Governance sustainability is Likely (L).

Rating:

Likely (L)

Environmental Sustainability

There are no major issues regarding Environmental Sustainability of the project and hence Environmental Sustainability is Likely (L).

Rating:

Likely (L)

Overall Likelihood

Based on the above analysis, the overall rating for sustainability is rated as Moderately Likely (ML).

Rating:

Moderately Likely (ML)

5.3.7 Impact

The project document stated the communities are typically agrarian in nature with the presence of very few petty/micro-businesses such as petty trading (including cold stores), barber salon, grain millers, etc. The evaluation of the expected impacts as stated in the product document are summarised in Table 13.

Table 13: Evaluation of the expected impacts as stated in the project document

Expected impacts	Evaluation assessments	Future recommendations
i. **Employment generation**: The implemented projects is expected to create between 6-8 direct jobs (Local Agents & Security personnel) and several indirect jobs from the new micro-businesses that would emerge due to the presence of electricity within these communities. Some of these new businesses will include barber salons, TV viewing centres, and cold stores. This is expected to improve the standard of living for the inhabitants of these communities.	- The direct and indirect jobs created from the SEP for the various sites are summarised in Table 9. Stakeholders interviewed have testified of the economic, environmental and social benefits of being able to access clean and reliable electricity. - But it remains to be seen if there are any negative effect on family's time and students' education because of excessive TV viewing time.	- As a means to create demand to reduce supply risks and to lower supply cost and lower tariff cost, future solar programme will need to optimise daytime electricity generated for scalable productive uses e.g. scale up the use of the electricity for productive uses increase and wider the increase power supply for MSMEs to use the electricity generated for more wider productive uses like agro-processing or solar irrigation. - See Table 4 above.

ii. Improved Standard of living: The project is expected to provide constant supply of electricity for primary health centres and schools in these communities, which will improve their operational efficiency. The provision of electricity is considered one of the most fundamental inputs for social and economic development as it fulfils basic human requirements by promoting improved healthcare, education, employment generation and infrastructural development.	- As there were no indicators and targets to measure the improvement in living standard, it is difficult to evaluate the impact of the solar programme.	- Future solar programme will need to include indicators and targets to measure how access to clean solar electricity could help to achieve the SDGs especially in well being, green jobs, education, health and safety.
iii. **Encouragement of Rural MSMEs:** The provision of reliable and more affordable electricity will stimulate development and encourage productivity of micro/small businesses within the community by extending work hours and reducing the burden of high operational costs (from the use of generators). This is evident in the cost savings from the use of solar solutions in comparison with the use of generators, as well as the emergence of more micro-businesses within the communities where this project was piloted. For example, a user who has a provision store and sells cold drinks confirmed that she used to spend between N5,000-N6,000 to fuel and maintain her generator monthly, but now spends only	- One household has opened the first and only petty shop in Matutu once she was able to connect the electricity to her freezer. - Several shop owners in Swasun have testified on cost saving from the switch from diesel generators that are noisy, smelly and polluting to clean electricity.	- The main challenge remains in how to reduce the tariff from N150 to N70/kWp and to minimise the need for project grant subsidy (see Table 4 bove). - This could be achieved by minimising the risks through supply and demand side management: - 1. Scale up the supply side: One way to improve supply and to spread the supply risk is to scale up to a larger grid to cater for a larger number of end users and communities - For example, a 120 kWp grid could be installed to cater for several cluster of communities based on a modular system (30kwp x 4 neighbouring community clusters). - 2. Optimise and balance the demand side: One way to reduce tariff cost is to spread

about N4,000 monthly using the solar solution, without the worries of maintenance costs. This story is similar for the micro-businesses that operate within these communities.		the load by optimising the daytime usage of the electricity generated e.g. a centralised Community Enterprise Center could be established near the power house to provide milling, agro-processing and packing, workshop, meeting hall and clinic.
iv. **Reduction in rural-urban drift**: The generation of jobs and viable businesses within the rural communities will also reduce rural-urban migration by boosting the local economy. Some of the youths who had hitherto considered relocating to the cities in the pilot communities are now considering means of gainful employment due to the provision of electricity in their communities.	- This has not been tracked.	- Future solar programme will need to explore the feasibility to extend the growing season in the semi-arid areas from rain fed (April to Sept) to the whole year through access to solar-powered irrigation and climate friendly agriculture systems. - Furthermore, solar powered community enterprise centre (CEC) could help to add value to the products through downstream agro-processing and branding e.g. milling, packaging. - Future solar programme could then monitor the movement of people using the survey data as the baseline.
v. **Technology Transfer:** The project is expected to create the need for persons to be trained as Solar Technicians (Local Agent) responsible for installation, first-level maintenance, and recharge voucher distribution. The project may also give rise to the proprietary designs and manufacture of an integrated solar home systems as was done by Arnergy Solar Limited	- There are strong evidences of technology transfer demonstrated by GVE and Arnergy Solar Ltd.	- But future solar programme will need to transfer not only technical skills but also basic financial, business, marketing and accounting skills for developing wholesome well rounded eco-entrepreneurs.

(one of the two project developers), which is the first of its kind designed by Nigerians.		

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on the evaluation conducted and presented above, the following conclusions are drawn.

6.1.1 General Conclusions

- The project "Solar Energy Programme" has achieved satisfactory results even though there were some aspects of the project that could be further improved.
- Overall the project has been effective on overcoming some of the technical, financial, business and social barriers for the scaling up of SHS and mini grid to improve access to clean energy for households and MSMEs in Niger, Gombe, Anambra and Kaduna states.
-

6.1.2 Project Design / Formulation

- Overall the project was well designed but the M and E plan could be improved significantly.
- Although the Theory of Change was mentioned in the project document but its principles were not fully applied.
- In the results logical framework, indicators and targets were only given at the output level and not outcome or impact indicators were included making it difficult to assess the true impact of the project.
- The M and E plan were not well designed in that the indicators provided were not SMART and not specific enough.
- There was no clear M and E template for project developers to record progress so indicators were added as the project progresses rather than established at the outset of the project.
- **Relevance:** The project is deemed as **highly relevant** and **well aligned** with i) national development (Vision 20:2020, Transformation Agenda) and climate policy and strategies (NDA, RE Masteplan); ii) BOI's aspirations to promote industrialisation through

improved access to clean energy; and iii) UNDP's country programme for Nigeria to scale up RE technologies and businesses.

- As such there is **strong country ownership** of the project at the national and local levels.

6.1.3 Project Implementation

- The project management unit at BOI has shown flexibility and exercise adaptive management in making changes if and when necessary to do so in order to keep the project up to date and capable of producing the desired outputs as envisaged originally.
- Partnership arrangements have been defined reasonably well in the project document and these arrangements were executed well within the project.
- However, there was inefficiency in the disbursement of fund from Zenith Bank to GVE's suppliers that has caused a delay in the supply of equipment and delayed the completion of the project by 7 months.
- **M and E plan and execution:** The M and E plan and implementation has been deemed as moderately satisfactory. The indicators and targets provided in the project document were not SMART (not Specific, Measureable, Achievable, Realistic or Time bound). No indicators or targets were included at the medium term outcome (5 years after project has ended) and impact levels (10 years after project has ended) thus making it difficult to assess the medium and long term impact of the project.
- Furthermore, the project developers were not given the project document and do not fully understood the design, M and E plan and the Theory of Change principles.
- Ad hoc indicators and targets were added as the project progresses rather than at the outset of the project.
- One of the strongest aspects of the project is its implementation. Both project developers and BOI as implementing partner execution have been satisfactory despite the some delays encountered. The overall execution of the project has been satisfactory.
- It appears that the lessons learned under Phase 1 were not fully captured and internalised in that they were poor baseline survey to truly understand the needs, ability and willingness of the end users to pay for the services.
- There is great national and local ownership and active participation of the project.
- UNDP in Nigeria has a clear comparative advantage to allow BOI to match fund the contribution from UNDP. The project is very relevant to the UNDP Country Program Action Plan II (2009-2012) and the project is an element of UNDP's Strategic approach – strengthening capacity for the integration of renewable energy and improve access to clean energy.

6.1.4 Project results

- Two project developers (GVE Project Ltd and Arnergy Solar Ltd) were selected from a long list of 80 initial open bidders to implement the project based on their past track records, financial soundness and technical competence.
- The funding were structured as 68% concessional loan with 7% interest rate over 15 years repayment term, 10% equity from BOI and 22% grant to support baseline surveys, stakeholder engagement and capacity development.
- **Efficiency:** The project has been deemed as **moderately efficient** in the disbursement of fund as there were delays in the final release of fund from Zenith Bank to GVE's suppliers that had caused delay in project execution and completion.
- To date a total of **Naira 381,539,353 (USD 1,090,112[6])** has been disbursed (84.8%) for the installation of stand alone solar home systems (SHS) and off-grid mini grid (MG) systems in 8 communities in Gombe, Niger, Anambra and Kaduna states (see Table 1).
- It is apparent that funding constraints have significantly slowed down the pace of project implementation. It may be necessary to find alternate means of securing funds disbursed, as utilizing an Advance Payment Guarantee (APG) with the associated terms, issued on behalf of the project developer, was not suitable for these projects.
- BOI has submitted inspection reports and issued confirmation letter to Zenith Bank Plc, to enable it to disburse additional funds immediately to GVE Projects Limited, to prevent project delivery timelines from extending into moratorium period.
- Due to the delays in the final release of the fund, all outstanding outputs are expected to be completed in April 2018, some 4 months later than expected (Dec 2017).
- **Effectiveness:** The effectiveness of the project has been deemed as **satisfactory** in achieving the objective and outputs of the project (see Table 3):
    - **Total Installed capacity: 246.8 kW**
    - **No of households connected: 1,424**
    - **No of businesses connected: 870**
    - **No of jobs created: 29 direct jobs (as technicians, security guards) and over 41 indirect jobs from micro-business**
    - **Installation cost: USD 4,125/kW for mini grid and USD 4,863/kW for SHS**
    - **Beneficiary cost: USD 521/household or businesses**
- **Sustainability:** The project has taken steps to mitigate the risks that could threaten the sustainability of the SHS and MG businesses in Nigeria:
    - Policy and institutional risk: the positive evidence generated by this project will help to convince and generate strong buy in from policymakers and lawmakers to continue to support BOI to fund solar solutions, lawmakers will need to support and protect the private sector value chain actors to ensure the import tax waiver are enforced effectively and efficiently and imported equipment are released at custom without delays and adding extra cost.

[6] Based on exchange rate of Naira 350/USD.

- Technical risk: the capacity of all value chain actors will need to be enhanced and improved with the latest solar technologies to improve delivery and quality services.

- Financial risk: The financial model to blend and sequence public concessional loan (68%) with grant (22%) and equity (10%) has generated positive results. Future programme will need to explore if grant portion could be reduced whilst increasing loan and equity portions. But the challenge will be in how to continue to reduce the tariff from Naira 150/180 to Naira 70/kWh to make solar as viable business (see Table 4 below).

- Business risk: Developers will continue to lobby and convince lawmakers and policymakers to improve the ease of doing solar businesses in Nigeria.

- Social risk: developers will need to support end users to improve their livelihoods and income in order to secure their affordability and ability to pay for the services, positive testimonies from beneficiaries has already stimulated interest and demand from neighbouring communities.

- **Impact:** As there were no outcome and impact indicators and targets provided in the project document it is difficult to measure the real impact of the project. Future programme to need to estimate the volume of GHG emission avoided through the switch from diesel to clean solar alternative energy.

6.2 Recommendations

Based on the above conclusions and lessons learned, the following recommendations are provided in order of priority, though all recommendations are regarded as important.

1. The Government of Nigeria will need to continue to support BOI and provide necessary funding over the next 5 years in order to transform the nascent solar sector by creating a demand 'pull' for solar RE to reduce supply risk, thus causing a tipping point whereby solar solutions could be mainstreamed, scaled up and replicated as commercial viable businesses.
2. BOI and UNDP could also leverage international public funding such as the Green Climate Fund.
3. Project developers must work closely with local authority and local community to conduct detail due diligence to understand the real needs, ability and willingness of the end users to pay for the services in order to avoid unnecessary delays.
4. BOI will need to work closely with project developers and guaranteeing bank (e.g. GVE and Zenith Bank) to ensure that funds are disbursed efficiently to the project developer's suppliers in order to avoid delays in the execution and completion of the project. BOI will need to explore alternative options to ensure components are delivered timely, while also ensuring security of the funds disbursement to suppliers (e.g. provision of Advance Payment Guarantees (APG) in favour of the suppliers (local) instead of the Project Developer, Letters of comfort from BOI to suppliers, etc). Also, in

the event that an APG is issued on behalf of the Project Developer, the terms of disbursements would have to be structured in such a way that doesn't hamper the project execution.

5. For future BOI and UNDP projects, the Logical Framework needs to be designed to capture the full Theory of Change principles so that all indicators and targets are clearly defined at the short term output, medium term outcome and long term impact levels and suitable and realistic means of verification are chosen and detailed.
6. A monitoring / project reporting template for future projects run by BOI and UNDP must be developed and used to identify challenges and shortcomings in the project as well as reporting positive progress.
7. Project developers must have access to the project document and have a good understand of the design, expected outputs and the M and plan before the start of the project.
8. A stakeholders meeting could be organised by BOI after the terminal evaluation to discuss the way forward for future activities.
9. BOI and UNDP could carry out a post-evaluation study in 2020 to quantify and detail the impacts of the project.
10. Current electricity tariff rates in Nigeria are subsidised at: Naira 25/kWh for residential, Naira 40/kWh for commercial and Naira 5/kWh for community. The remaining challenges will be how to close these wide gaps from the Naira 150-180/kWh that are imposed on current end users to a competitive Naira 70/kWh.
11. Hence, future solar programme should contribute to the discussion and seek to answer the questions as raised in Table 14 to reduce the LCOE from Naira 180/kWh to Naira 70/kWh.
12. Key priority areas for future solar programme to address will be:

- **A. How to manage load profiles to save on hardware and operating cost?**

    - How do mini grid companies sustainably offer consumer financing for demand stimulation?
    - Can load curves be optimally shaped through selective distribution, a kiosk model, or energy as a service?
    - **Service-based demand:** Increase capacity utilization through a targeted service based approach. Offer financed appliances with service based pricing to primarily commercial/productive customers to stimulate demand, shape load, increase savings, and improve revenue for businesses stimulation.
    - **System flexibility to address dynamic demand:** Design flexible mini grids that can meet dynamic demand. This approach includes under-sizing systems with planned modular upgrades (e.g. 120 kWp grid in modules of 30kWp for a cluster of 5 to 10 communities). Centralised or standalone Community Enterprise Centre could be powered with solar to provide workshop, agro-processing, marketing and packaging. At

portfolio scale this allows for low cost, quick-to-deploy, and bankable ways to meet increased demand, backed by on-going, clear data collection and analysis.

- **B. How to provide effective and cost-efficient customer engagement and services through a digitalised platform?**
  - How to achieve energy access goals while prioritizing the best customers and customer services?
  - How to collaborate and partner with One Acre Fund[7] who are already working with farmers in Niger state to utilise their efficient digitalised solutions and platform?
  - **Growing productive load:** Engage with customers in a way that drives maximum capacity utilization and revenue. To this end, establish a set of productive use categories and a set of load curves that correspond with each category. Identify ways to serve these customers and drive demand growth.
- **C. Increasing scale, localized expertise, and remote monitoring can save transaction cost**
  - How can transaction costs stay low as the number of parties involved grows?
  - Establish clear and reasonable quality standards for mini grid components and performance with an allowance for some local variation.
- **D. Reducing the cost of capital by 4% to enable more rapid scaling**
  - What should a successful blended finance facility look like?
  - Who are the key actors to ensure success?
  - Are there effective ways to aggregate dozens, hundreds of mini grids and assess risk?
- How can OPEX grants (e.g. Green Climate Fund)[8] be applied, implemented and monitored to achieve desired results?

Table 14: Six hypotheses on how to reduce the levelised cost of electricity from Naira 150-180 to Naira 70/kwH. ***Extracted from Rock Mountain Institute (Mar 2018). 20 by 20: A Design Charrette to Achieve $0.20/kWh.***

Six hypothesis to achieve USD 0.20/kWh (Naira70/kWh)	Current situation	Proposed solutions	Outstanding questions	Key next steps	Priority areas for future solar programme in Nigeria

[7] One Acre Fund in Nigeria: https://oneacrefund.org/work-with-us/job-openings/g/?gh_jid=868765

[8] GCF proposal for Nigeria: GCF's USD 230 million Universal Green Energy Access Program ("UGEAP") to be managed by Deutsche Bank group entities to fund solar home system and mini grids investments for SMEs and households located in Sub-Saharan Africa with an initial focus on Benin, Kenya, Namibia, Nigeria, and Tanzania. BOI should work with Deutsche Bank to acces this fund.

1. A standardized modular hardware system applied at scale can save $0.11/kWh	• High system cost at low volume • Custom engineering and complex install in the field for small batch of projects • Global cost reduction trends for many components, especially PV and some batteries	Standard, modular, and containerized mini grid solution can reduce cost of service by 20% • Expecting hardware cost reduction of 18% due to global trends over the next 3 years • Bulk purchasing and higher volume for logistics/overhead into Africa saves additional 15% • Standardized modular solution reduces engineering time by a third and install by 80% • Standardized modular solution with integrated M&V also improves reliability and reduces O&M • Further savings possible from simplified or local pre-assembly of PV and racking	- What sizes should be standardized around? - Would batteries be included with standardized solution? - Would racking and PV be standardized and preassembled as well? - Should these units be designed for potential future grid integration? - Bulk purchased lithium-ion cells have been reported as low as $90/kWh, what technical barriers still exist (e.g. weather, cycling, BOS)?	- Establish or build on existing mini grid industry consortiums to pursue the standardization and scale described above. - Use the consortiums to build relationships across value chain and to work toward ready-to-install systems.	Create industry consortium: Create a consortium including mini grid developers, hardware suppliers, and service providers focused on reduction of hardware costs through scale and joint industry work streams.
2. Actively managing load profiles can save $0.08/kWh on hardware and operating cost	- Many off-grid sites lack productive use loads - Agrarian and domestic loads exacerbate morning and evening peaks - Latent public (e.g. water pumping) and private (e.g. productive use) demand for energy exists	Encourage daytime use through load management programs to reduce LCOE by 13% • Site selection: Target sites with higher existing daytime load • Energy efficiency: Reduce night-time lighting loads by 50% by using LED lighting • Demand stimulation: Double daytime use by financing flexible, productive uses (e.g. water purification, pumping) • Tariffs: Simple tariff structure to encourage daytime use can shift 20% of nighttime load (e.g. time of use)	**- How do mini grid companies sustainably offer consumer financing for demand stimulation?** **- Can load curves be optimally shaped through selective distribution, a kiosk model, or energy as a service?**	- Use an industry consortium to establish a common communications protocol as a key step toward data collection and system flexibility. - Use "innovation labs" or other pilot project programs to test scaling technologies and demand stimulation program designs.	**Service-based demand: Increase capacity utilization through a targeted service based approach. Offer financed appliances with service based pricing to primarily commercial/ productive customers to stimulate demand, shape load, increase savings, and improve revenue for businesses. stimulatio**n

3. Effective and efficient customer engagement can save $0.06/kWh despite being 3% of total cost	Customer engagement is critical for demand stimulation and managing load profile (slide 30) • Slow/uncertain customer acquisition leads to underutilized system capacity in early years • Revenue lost from non-collection or poor customer retention issues. Payment is often inefficient because of a nascent mobile money framework.	Focus first on productive-use and largest customers • Partner with organizations like ag. coops and telcos that have existing customer relationships to: – Provide better understanding of willingness and ability to pay – Gain insight into productive use and demand stimulation needs • Use mobile money and/or transparent and intuitive customer interface (e.g. USSD) • Track metrics on customer acquisition and retention to improves sales and offerings	**- How can we achieve energy access goals while prioritizing the best customers and customer services?** **- How to collaborate with One Acre Fund who are already working with farmers in Niger state to utilise their digital solutions?**	- Share knowledge around productive uses, load curves, and demand growth trajectories. - Work with mini grid developers and operators and One Acre Fund to build the playbook described that could be used across multiple markets.	**Growing productive load: Engage with customers in a way that drives maximum capacity utilization and revenue. To this end, establish a set of productive use categories and a set of load. curves that correspond with each category. Identify ways to serve these customers and drive demand growth.**
4. Increasing scale, localized expertise, and remote monitoring can save $0.05/kWh	Developers and operators serve sites far from major cities across multiple states and regions • International companies have high labour costs • Long project delays lead to idle labour and low productivity	**Increase scale to serve 100+ sites efficiently by targeting labour and logistics through clustering and partnership** **• Select and serve clusters of sites within 2-3 hour travel from each other** **• Form strategic partnerships along the value chain to take advantage of economies of scale, local labour and knowledge, and specialization** **• Engage with communities to reduce land costs through donation while increasing site security** **• Reduce overhead costs by 60% through rapid scaling-up number of sites served**	**- How can transaction costs stay low as the number of parties involved grows?** **- Establish clear and reasonable quality standards for mini grid components and performance with an allowance for some local variation.**	- Use industry associations to propose standards. - Use industry associations, government or donor partners to encourage a shared data platform.	Standards and local exemptions: Establish clear and reasonable quality standards for mini grid components and performance with an allowance for some local variation.
5. Reducing the cost of capital by 4% to enable more rapid scaling can save $0.03/kWh	Most projects are funded by grant, equity, or with greatly subsidized interest rates • Commercial loan rates in sub-Saharan Africa are typically between 15% and 20% • USD or EU-denominated	Use blended finance facilities to aggregate mini grid sites, manage risk, and apply equity, debt financing • Use credit enhancement tools, such as FOREX risk hedging, customer payment backstops, and collateral guarantees to leverage other capital • Invest in quality assurance frameworks and consistent robust data collection to give investors clarity and	**- What should a successful blended finance facility look like? Who are the key actors to ensure success?** **- Are there effective ways to aggregate dozens, hundreds of mini grids and assess risk?** **- How can OPEX grants be applied, implemented and monitored to achieve**	- Third-party led finance consortium to bring together an array of mini grid financiers to act on first priority. - Identify ways for government, donor partners, financiers to expand mini grid finance of power to additional services.	Global mini grid finance consortium: Standardize different parts of mini grid financing, including the supply chain, project finance, and consumer finance.

	loans offer alternatives but also come with high cost (15-20%), FOREX risk and currency mismatch for local developers	confidence	**desired results?**		The consortium would enable funding from ideation, pilot demonstration, and through to scaling, through a pre-agreement between funders who traditionally fund those stages.
6. Supportive regulation and policy can increase ease of doing business and save $0.03/kWh	Fees can add almost 50% to hardware cost, including customs, VAT, and local taxes (e.g., 20%, 19%, and 9%, respectively) • Delays at port and in licensing slow growth and tie-up working capital • In Nigeria, mini grid regulations are in place but enforcement remains a challenge	Waive customs/duties and VAT for all mini grid components (not just PV) • Reduce port delays for mini grid components • Clarify grid interconnection procedures, both technical and financial • Publish grid extension plans • Allow cost-reflective tariffs (at least for pilots and within some limits) • Reduce licensing/permitting requirements where appropriate	How should tariffs be set? • What happens, technically and financially, when the grid arrives? • If necessary, how can subsidies be used in a way drives growth, connects customers, and does not distorting the market?	Ensure clear policies support flexible tariffs and interconnection standards and procedures. • Identify ways for regional bodies such as ECREEE or the East African Community to encourage best-practice policies among members.	Reduce risk to developers and investors: Policymakers can help reduce private sector risk through clear off-grid energy planning, allowing for tariff flexibility, promoting local assembly (complete knock down), and supporting financing strategy.

7 ANNEXES

7.1.1 Itinerary

The itinerary of the visit to Nigeria is shown below.

Date	Activities
24 Mar 2018	Consultant arrived in Lagos
25 Mar 2018	• Skype interview with Etiosa Uyigue, solar project developer
26 Mar 2018	• Meeting with Project team at BOI: Austin Egwuche (Project Manager), Ruseh Oghenekaro (Technical Officer) and Idris Ibrahim (Project officer)
27 Mar 2018	• Leave for Abuja • Meeting with Ifeanyi Orajaka of GVE Projects Ltd. • Meeting with UNDP Project Team: Muyiwa Odele and Oladipo Osibo
28 Mar 2018	• Visit to Field sites of Niger state • Interviews with mini grid beneficiaries
29 Mar 2018	• Interviews with mini grid beneficiaries • Leave for Abuja
30 Mar 2018	• Skype Interview with Femi Adeyemo of Arnergy Solar Ltd • Debriefing meeting with UNDP: Muyiwa Odele
31 Mar 2018	Leave Nigeria

7.1.2 Evaluation Question Matrix

This Evaluation Question/Criteria Matrix as referred to in Section 2 was used during the evaluation.

Evaluative Criteria Questions	Indicators	Sources	Methodology
Relevance: How does the project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels?			
• How would you describe the project objectives? • How do the project objectives and purpose match your organisation's objectives? • Are the project objectives and purpose in line with UNDP, National and regional priorities and objectives in the sector?	• Project Design (e.g. ProDoc) incorporates the wider priorities and objectives in the sector • Existence of clear link between UNDP and Government of Nigeria priorities and the project objectives	• ProDoc	• Review of documents
Effectiveness: To what extent have the expected outcomes and objectives of the project been achieved?			
• Were the project objectives achieved? • Did the project make a positive impact? • Have there been improvements made by the Government in the National RE policy and regulatory framework? • Has the institutional capacity and awareness, and information on RE increased?	• Record of Achievement of project outcomes and outputs • Improvement in Government Policy • Change in institutional Capacity	• PIRs • BOI and project developers' progress reports • Government Policy documents • Training Records	• Review of documents • Interviews

		• Workshop Proceedings	
Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards?			
• Do you think the money that went into the effort was worth it? Do the ends justify the means? • Were the project funds well managed? • Was there good coordination and cooperation among the participants involved in the community project? • Did the project implementation team remain the same or was there a lot of staff turnover? • Were the activities carried out timely and according to work plans? • Are you aware of any financial, legal or other project implementation concerns with respect to the activities? • If you could start over again, would you implement the project differently? How?	• Availability of financial reports • Timeline of the project • Delays of implementation • Planned vs actual expenditure and funding	• ProDoc • Meeting minutes • Budget vs Actual analysis	• Document review • interviews
Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?			
• Is the project effort continuing after the end of UNDP/BOI funding / end of the project? • Who will take a lead in continuing this work? Is there an enough commitment from them? • Have any of the project efforts been replicated (or starting to replicate) in other communities?	• New projects • Firm commitment from agencies • New funding availability	• New Project Document • Project websites • Meeting Notes • Other websites	• Review of documents • Interviews

• Are there efforts under way to find new sources of funding to continue and expand the activities that were started under this project and not yet finished? • Were there public awareness and outreach efforts? And how effective was the project in attracting public attention?			
Impact: Are there indications that the project has contributed to, or enabled progress toward, reduced environmental stress and/or improved ecological status?			
• What has happened as a consequence of the project? • What practical improvements have there been as a result? • Can the project impacts be quantified? • How many people have directly benefited from the project activities? • Did the pilot project help to influence environmental and development policies programmes and plans in the country?	• Reduction in GHG	• Project Tracking	• Review of documents

7.1.3 List of documents reviewed by the evaluator

Project Document, and Log Frame Analysis (LFA)

Project Implementation Plan

Implementing/Executing partner arrangements

List and contact details for BOI and UNDP project staff, key project stakeholders

Project sites in Niger state

Quarterly Progress Reports

Project budget and financial data

NDC (2015)

Transformation Agenda 2050

UNDP Development Assistance Framework (UNDAF)

UNDP Country Programme Document (CPD)

UNDP Country Programme Action Plan (CPAP)

Rocky Mountain Institute (2018): 20 by 20:

Site inspection reports

Useful website consulted:

GVE Projects Ltd website:

Arnergy Solar Ltd website: http://arnergy.com/

BOI website and solar loans: https://www.boi.ng/

Once Acre Fund for Nigeria website: https://oneacrefund.org/what-we-do/farmers-first/

GCF website: https://www.greenclimate.fund/-/

GCF's USEAP proposal: https://www.greenclimate.fund/-/universal-green-energy-access-programme?inheritRedirect=true&redirect=%2Fwhat-we-do%2Fprojects-

programmes%3Fp_p_id%3D101_INSTANCE_Hreg2cAkDEHL%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3D_118_INSTANCE_4ZRnUzRWpEqO__column-2%26p_p_col_pos%3D1%26p_p_col_count%3D2%26_101_INSTANCE_Hreg2cAkDEHL_delta%3D30%26_101_INSTANCE_Hreg2cAkDEHL_keywords%3D%26_101_INSTANCE_Hreg2cAkDEHL_advancedSearch%3Dfalse%26_101_INSTANCE_Hreg2cAkDEHL_andOperator%3Dtrue%26p_r_p_564233524_resetCur%3Dfalse%26_101_INSTANCE_Hreg2cAkDEHL_cur%3D2

7.1.4 Rating scales

Ratings for Effectiveness, Efficiency, Overall Project Outcome Rating, M&E, IA & EA Execution	***Sustainability ratings:***	***Relevance ratings***
6. Highly Satisfactory (HS): no shortcomings	4. Likely (L): negligible risks to sustainability	2. Relevant (R)
5. Satisfactory (S): minor shortcomings	3. Moderately Likely (ML): moderate risks	1. Not relevant (NR)
4. Moderately Satisfactory (MS): moderate shortcomings	2. Moderately Unlikely (MU): significant risks	
3. Moderately Unsatisfactory (MU): significant shortcomings	1. Unlikely (U): severe risks	
2. Unsatisfactory (U): major shortcomings		
1. Highly Unsatisfactory (HU): severe shortcomings		
Additional ratings where relevant:		
Not Applicable (N/A)		
Unable to Assess (U/A)		

7.1.5 BOI's Solar Energy Loan Website

	Source: Solar Energy Portal at BOI's website: https://www.boi.ng/solar-energy/ MSMEs play a dynamic role as the engine through which developing countries thrive. The performance and growth of MSMEs is a major driver and indices for the level of industrialization, modernization, urbanization, gainful and meaningful employment, income per capital, equitable distribution of income, welfare and quality of life enjoyed by the citizenry. • Consequently, the performance of MSME sector is closely associated with the performance of a nation. However, there is a major gap in Nigeria's industrial development due to the energy crisis in Nigeria that has largely contributed to the incidence of poverty by slowing down industrial and commercial activities. • Many Nigerians and Nigerian businesses who can afford other sources of alternative electricity have resorted to the use of electric generators at great expense. • Therefore, for Nigeria to achieve its objective of sustainable development, there is an urgent need to substantially increase the supply of modern and affordable energy services, while maintaining environmental integrity and social cohesion. • Renewable Energy provides a healthy and sustainable alternative to the use of fossil fuels, with long term cost saving advantages, especially in the absence of reliable power supply that has led to the slow growth of MSMES in the country. • The provision of alternative energy for MSMEs is in tandem with one of the Africa Development's Bank's (AfDB) high 5 priority areas to 'Light up and Power Africa' that is to be implemented via the Bank's climate finance initiative tagged 'New Deal on Energy'. The initiative aims to bridge the financing gap needed to address the energy deficit in Africa, thereby achieving universal access to energy by 2025.
RATIONALE	• The cost of electricity accounts for about 40% of operational costs for most MSME businesses, resulting in very little profit margins, uncompetitive products and generally unsustainable ventures. Therefore, future economic growth crucially depends on the long-term availability of energy from

	sources that are affordable, accessible and environmentally friendly. • To achieve universal access to energy for inclusive growth in Nigeria, it is imperative that clean energy solutions are deployed for both residential and productive uses. It is therefore important to support the provision of sustainable and reliable energy for MSMEs in view of Bank of Industry's mandate to transform Nigeria's Industrial sector, and the significant role that the availability of reliable power for MSMEs plays in actualizing this mandate. • The provision of solar electricity to serve various industrial clusters of MSMEs can power their business operations with clean energy in a profitable manner. This would boost economic activities both in the off-grid and grid-connected areas, as electricity supply from the national grid is still very limited. Solar power therefore provides a more reliable solution to meet their energy requirements.
TARGET MARKET	The target market (end users) include Micro, Small and Medium Enterprises involved in activities which include but not limited to: i. Value addition along all value chains in sectors like Agriculture, solid minerals, etc; ii. Cottage Industries; iii. Artisans; iv. Service industry (Barbers, Hair dressers, tailors, welders, etc) Rural elelc = offgrid = undp = private = MDB = direct offer = grant – CSR =
CRITERIA	• The cost of power supply must be a minimum of between 20%-40% of total production cost. • The end users must utilize the solar power for productive uses and not just lighting. • There must be clear demonstration of viability for business operations vis-à-vis cost-savings, profitability, etc (e.g. business plan).
PROJECTED IMPACT	The Fund shall be used to provide cheap, sustainable and reliable energy source for existing and new businesses with the attendant reduction in greenhouse gas emissions from utilizing fossil fuels. This is expected to boost inclusive economic growth and development, especially in view of the current economic situation in the country, leading to job creation, poverty alleviation and improvement in the general welfare of the citizenry.
PROGRAM LIMIT	N1.0 billion

SINGLE OBLIGOR LIMIT	Maximum of N50.0 Million per end-user (for a 100kVA system)
FUNDING SRUCTURE	The funds may also be disbursed through Deposit Money Banks (DMBs)/Micro Finance Banks (MFBs) for on-lending in view of the partnership between BOI and Commercial Banks. There will be two (2) structures in place to fund the proposed categories of end users: **1. Micro-businesses**: For individual loans less than or equal to the cost of a 5kVA system, the projects would be funded as cluster/group arrangement via a Project Developer or DMB/MFB as the Obligor. In the case where the Project Developer (Solar Solution Provider) is the Obligor, it will be responsible for deploying the solutions as well as monitoring and collection of revenue from end users. In the case where the DMB/MFB is the obligor (via the on-lending arrangement), solutions will be deployed by the Project Developer, while the DMB/MFB will be responsible for monitoring and collection of revenue from end users. **2. Small and Medium Enterprises:** For individual loans greater than N5 million, the projects will be funded via the following means: i. Through direct lending to the Small and Medium Enterprises (end users) as the Obligor since they are more structured businesses; or ii. Through the Project Developer as the Obligor. For both structures (i.e. 1&2 above), the Debt shall not exceed 80% of the total project cost, while the Equity contribution shall be a minimum of 20% of the project cost (i.e. Debt: Equity ratio of 80:20).
OBLIGOR TYPE	i. Project Developers ii. Small and Medium Enterprises iii. DMBs/ MFBs

	For on-lending to Microfinance Banks, There are three (3) categories of licenses issued to MFBs by the CBN as follows: S/N TYPE AREA OF COVERAGE 1 Unit License Permits the MFB to own and operate a single o location. 2 State License Permits the MFB to own several branches but o single State. 3 National License Permits the MFB to operate several branches i the country. The target market will be Unit, State and National licensed MFBs that are able to satisfy the following criteria: • Minimum of 10% Capital Adequacy Ratio. • Non-Performing Loans Ratio of ≤10%. • Liquidity Ratio of 20% minimum. • Ratio of shareholders' fund unimpaired by losses to net credits of not more than 1:10. • Year of commencement of operation of not less than 3 years. • Microcredit to other loans: Minimum of 80:20. • Evidence of financial membership of the National Association of Microfinance Banks (NAMB). Regardless of the Obligor, the Project Developers that are eligible to deploy the solutions shall be selected from an accredited list of Solar energy entrepreneurs shortlisted through a transparent process. This is to avoid fund diversion, either wholly or in part and to ensure quality delivery of the solar installations.
PRICING	**Interest rate:** · 7% per annum payable at the end of every month. **Fees:** · 1% Appraisal Fee · 1% Commitment Fee · 0.125% Monitoring Fee (to be paid quarterly)
TENOR	· Maximum of Five (5) years commencing at the end of the moratorium period.

MORATORIUM	· Twelve (12) months (from date of loan disbursement) for new businesses. · Six (6) months (from date of loan disbursement) for existing businesses.
SECURITY ARRANGEMENT/ **COLLATERAL SUPPORT**	**For Facilities less than or equal to the cost for a 5KVA system (micro facilities):** i. Credit Insurance Guarantee ii. Personal Guarantee of the Managing Director/Notarized Statement of net worth. iii. All Assets Debenture on the equipment to be financed as well as existing equipment. iv. Credit life insurance of the Chief Promoter. v. Insurance of the financed items against burglary and theft, fire and any other hazards. **For Facilities higher than N5 million:** i. Bank Guarantee or Legal mortgage ii. Personal Guarantee of the Managing Director/Notarized Statement of net worth. iii. All Asset Debenture on the equipment to be financed as well as existing equipment. iv. Credit life Insurance of the Chief Promoter. v. Insurance of the financed items against burglary and theft, fire and any other hazards. For On-lending Facilities with DMBs/ MFBs as Obligor: i. Bank Guarantee from a Commercial Bank acceptable to BOI.
DISBURSEMENT	In accordance with agreed milestones.
REPAYMENT SOURCE	From the proceeds of business financed (either directly from the SMEs or indirectly from the Project Developers and Commercial/MFBs).
REPAYMENT MODE	Monthly payment of interest and repayment of principal
OTHER CONDITIONS	i. Provision of not less than two (2) years warranties on all components by the Developer/Supplier.

	ii. Strong and reliable monthly net cash flow that can support monthly loan repayment at the ratio 3 to 1 (i.e. net cash flow to loan principal repayment).

7.1.6 Project site inspection and M and E reports prepared by BOI

1. REPORT OF INSPECTION AND VERIFICATION OF EQUIPMENTS AT KOLAKU AND AYABA COMMUNITIES, GOMBE STATE

DATE:	Wednesday-Thursday, January 24-25, 2018.
COMPANY NAME: **COMPANY REPRESENTATIVE:**	**GVE Projects Limited** Christopher Nwachukwu Project Engineer
BOI REPRESENTATIVE (S):	Ruseh Oghenekaro Technical Officer
PROJECT SITES VISITED	Ayaba community, Biliri LGA and Kolaku community, Balanga LGA, Gombe State.
PURPOSE:	To carry out an inspection and verification of equipment at Kolaku and Ayaba communities Gombe State currently being implemented by GVE Projects Limited, under the Cost Sharing Agreement (CSA) between BOI and UNDP. Project implementation has stalled due to lack of funds, as the Guaranteeing Bank, Zenith Bank Plc, has requested that BOI issues a confirmation letter before it disburses additional funds to GVE Projects Limited. The visit is therefore to verify the equipment that have been procured so far, in order to confirm that funds disbursed have been utilized appropriately, to justify the release of more funds.

COMMENTS/OBSERVATIONS	**Equipment Inspection** **Ayaba community, Biliri LGA** • At the time of the last visit in July 2017, some of the equipment for Ayaba were being stored at the house of the Seriki of Kolaku community for safe keeping, while the meters were securely kept at the State's Ministry of Rural Development. The outstanding equipment were the Solar panels, Charge Controllers and Thunder Arrestors, while the construction of the Power House was also outstanding. • Most of the equipment have now been delivered to Ayaba and were sighted. The Solar Panels, Inverters, LED bulbs for street lights, Flood lights, poles for street lights, Converter Boxes, Cables, Barbed fencing for the Power house, and other balance of system, were sighted at the Head of the community's house, where they are being kept for safe-keeping. • The Distribution poles and Cables, Meters, materials for the PV Array mounting structure, were sighted at a store within the community, where they are also being kept securely. • Construction of the Power House just commenced and work is currently at the Damp Proof Course (DPC) level. There was a challenge with the topography of the area, and several soil tests had to be carried out before eventually selecting a suitable site. • The Village Head, Mr David Lejo (JP), mentioned that the owner of the Land has been requesting for compensation, especially as construction has begun on the site. Mr Chris of GVE explained that the process involved the State Ministry of Land to come to the site to carry out an assessment and provide a land rate, and the necessary documentation. The process would require financial mobilization, but due to the paucity of funds, there has been a hold on it. I assured the Village Head about the availability of funds soon, which was part of what BOI's current mission to the community would aid. • The outstanding equipment to be delivered to site include 36 Batteries which are to be decommissioned from Kolwa and redeployed to Ayaba community, as approved, and eight (8) Charge Controllers to be supplied by Schneider Electric Nig. Ltd. The outstanding work to complete the project in Ayaba includes the completion of the Power House, Casting of the PV Array mounting structure, setting up the micro-grid and Conversion Equipment and Street lights, as well as other logisitics. Mr Chris assured that these would be completed timely once more funds are made available. **Kolaku community, Balanga LGA** • At Kolaku community, the site Engineer, Engr. Edu was on ground to supervise the ongoing work being carried out. The Power House is under construction, and has reached roofing level, the Distribution poles are currently being erected, and the PV Array mounting structure is being put together (casted). • The available equipment are being stored at the Seriki's compound for safe keeping. At the time of the last visit in July 2017, the outstanding equipment were the Solar

	panels, Charge Controllers, Meter Vending Unit and Thunder Arrestors, and Power House construction. Since then, Solar Panels, Meter Vending Unit (software) Thunder Arrestors, and materials for the construction of the Power House have been delivered to site. • The Equipment sighted at the Seriki's compound include The Solar Panels, Batteries, Inverters, LED bulbs for street lights, Flood lights, poles for street lights, Converter Boxes, Cables, Barbed fencing for the Power house, Cables, Meters, materials for the PV Array mounting structure and other balance of system (details attached in delivery schedule). • The design of the Power House has changed from what was used in the pilot projects. Separate rooms are to be used to house the batteries and the Inverters. This is to cater for the cooling requirements needed for the batteries. Also, additional reinforcement is being used for the inverter hanger, to prevent the recurrence of an incident in Kolwa, where the hanger collapsed. It is good to note that Lessons being learned from previous projects are constantly being put into new projects for continuous improvement. • Funding is needed for the completion of the Power House (Roofing, Fittings and Painting), Casting of the PV Array mounting structure, setting up the micro-grid and Conversion Equipment and Street lights, and purchase of the Charge Controllers and Thunder Arrestors, as well as other logistics.
CONCLUSION/ ACTION POINTS	▪ It is apparent that funding constraints have significantly slowed down the pace of project implementation. It may be necessary to find alternate means of securing funds disbursed, as utilizing an Advance Payment Guarantee (APG) with the associated terms, issued on behalf of the Developer, may not be suitable for these projects. ▪ SEP to submit inspection report and request for approval to issue confirmation letter to Zenith Bank Plc, to enable it disburse additional funds immediately to GVE Projects Limited, to prevent project delivery timelines from extending into moratorium period.

2. REPORT OF MONITORING AND EVALUATION VISIT TO BISANTI COMMUNITY AND INSPECTION OF EQUIPMENTS DELIVERED TO SWASUN AND MANTUTU COMMUNITIES, NIGER STATE

DATE:	Wednesday, January 24, 2018.
COMPANY NAME: **COMPANY REPRESENTATIVE:**	**GVE Projects Limited** Ifeanyi Orajaka Managing Director
UNDP REPRESENTATIVES:	Mohammed A Shaba Director, Niger State Planning Commission
BOI REPRESENTATIVE (S):	Idris K Ibrahim Project Officer
PROJECT SITES VISITED	Mantutu community, Swasun community & Bisanti community, Katcha LGA, Niger State.
PURPOSE:	To carry out an inspection and verification of equipment at Swansun and Mantutu communities Niger State currently being implemented by GVE Projects Limited, under the Cost Sharing Agreement (CSA) between BOI and UNDP. Project implementation had stalled due to lack of funds, as the Guaranteeing Bank, Zenith Bank Plc, has requested that BOI issues a confirmation letter before it disburses additional funds to GVE Projects Limited. The visit is therefore to verify the equipment that have been procured so far, in order to confirm that funds disbursed have been utilized appropriately, to justify the release of more funds. To also carry out the periodic monitoring and evaluation visit of the 24kW micro-grid project implemented under the pilot phase of the low-cost, off-grid solar electrification projects in Bisanti community in Niger State. This is to ensure that the project is meeting its desired objective of positively impacting the lives of the indigenes of the community.
COMMENTS/OBSERVATIONS	**i) Equipment Inspection** ▪ The solar equipment for the implementation of the replication projects in Swasun and extension to Mantutu communities have been delivered, installed and are operational. ▪ A schedule of the status of equipment delivery and relevant pictures are

attached as Appendix 1.

Mantutu

- As a result of underutilization of the implemented 24kW solar electricity at Bisanti (the pilot site at Niger State), extension of the grid to Mantutu community, which is about 700 metres from the Power house in Bisanti, was implemented as approved by Management, which resulted to full utilization of the 24kW at the site.
- As at the time of the last visit in June 2017, the equipment for the implementation of the grid extension had arrived Niger State and were being stored in the classrooms at the primary school in Mantutu, while the pre-paid meters were kept securely at the power house in Bisanti community in view of its sensitive nature.
- Currently, all the poles have been erected and some houses in the community have been connected and metered and are currently enjoying power supply from the Bisanti system.
- Of the proposed 100 off taker in Mantutu 44 have been registered and are connected. More villagers are indicating interest and intend to register in the coming weeks. Interested parties include 5 new microbusinesses (barbing, tailoring, phone charging and 2 cold beverage shops) would soon commence operation in Mantutu as a result of the grid extension to the community.

Swansun

- As at the time of the last visit to the community in June 2017, the batteries, inverters and balance of system for the implementation of the replication projects in Swasun were delivered and kept in one of the classrooms at the primary school in Mantutu, while the pre-paid meters were also being kept securely at the power house in Bisanti community.
- As at the time of the visit, the solar panels have been delivered and mounted, the power house in Swansun has also been completed, and is up and running. The Power House design has been modified from the ones used during the pilot phase, this is to cater for the cooling requirements needed for the batteries and inverters as they are now placed in separate rooms to avoid overheating.
- All poles within the community have been delivered and erected, most of the registered households have been connected and metered. However, there is a section of the community which was not captured in the initial design, about 800m away from the Power House which the company proposed will be connected to the system. Distribution poles have been erected in this section of Swansun community and as at time of inspection, 40 additional poles were enroute to the community, which will be used to link this section of the uncaptured community to the power house.
- According to GVE's MD, connection should be completed by Wednesday January

31, 2018 and test run is expected to commence immediately.

- Engagement with some of the villagers indicated that they are happy that they will be able to enjoy uninterrupted power supply from the mini-grid system.

ii) Monitoring Visit

<u>Bisanti.</u>

- The rural electrification project in Bisanti is one of the pilot projects. To achieve full utilization of the implemented 24kW solar electricity, extension of the grid to Mantutu, a community of about 100 households, was implemented.
- Mr. Bala Wyatako, who is the Local Agent responsible for securing the power house, as well as the sale of recharge vouchers to the subscribers, confirmed that there hasn't been any issues with the solar solution in Bisanti and that the community enjoys uninterrupted power supply. He stated that some neighboring communities have shown interest in the solar solution.
- A new commercial user Mr. Salisu Ibrahim has expressed joy in having electricity in the community. He runs a tailoring outfit and added that he started business with 4 machines including one electric sewing machine and he has purchased 3 new machines to expand his business. He stated further that he intends to open a shop in Mantutu following the grid extension to the community.
- A local trader Hajiya Asaja was quite happy with the solar project in Bisanti, as the uninterrupted power supply has improved her business and she has purchased a new refrigerator which allows her sell cold local made drinks in the community and neighboring villages, especially on market days.
- A provisions store owner stated that business is quite good as a result of steady electricity. She said that she has been able to buy 2 additional refrigerators which she uses in the store to sell cold beverages to her clients. She added that people come from far communities to buy cold drinks from her especially during the period of power outages in these communities.
- Engagement with the Agro millers revealed that they are in talks with the project developer to have their milling machines which are diesel engines converted to an engine compatible to the solar grid.
- Hon. Abdullahi A Hassan a former councilor in Bisanti expressed happiness and satisfaction with the project. One of the initial off-takers of the project, he stated that since the project commenced in 2015, he has been enjoying uninterrupted power supply and that the project has brought empowerment and

	enlightenment to the village as a whole. He also appreciated the Bank for its role in the project.
CONCLUSION/ ACTION POINTS	▪ SEP to request a formal report on the status of completion of Swansun community project and the commissioning dates from GVE. ▪ SEP to visit the communities quarterly for adequate monitoring and evaluation of the performance of the solar solution vis-à-vis achieving the goal of the project.

3. REPORT OF MONITORING AND EVALUATION VISIT TO BISANTI COMMUNITY AND INSPECTION OF EQUIPMENTS DELIVERED TO SWASUN AND MANTUTU COMMUNITIES, NIGER STATE

DATE:	Monday, June 20, 2017.
COMPANY NAME: **COMPANY REPRESENTATIVE:**	**GVE Projects Limited** Ifeanyi Orajaka Managing Director
UNDP REPRESENTATIVES:	Anthony Omata Programme Associate, M&E Josephine Edwards Programme Associate, (Programme Finance Team)
BOI REPRESENTATIVE (S):	Ruseh Oghenekaro Technical Officer
PROJECT SITES VISITED	Bisanti community, Mantutu community & Swasun community, Katcha LGA, Niger State.
PURPOSE:	To carry out the periodic monitoring and evaluation visit of the 24kW micro-grid project implemented under the pilot phase of the low-cost, off-grid solar electrification projects. This is to ensure that the project is meeting its desired objective of positively impacting the lives of the indigenes of the community. To also carry out an inspection visit with UNDP team to the new communities (Mantutu and Swasun) in Niger State being currently implemented under the Cost Sharing Agreement (CSA) between BOI and UNDP.

COMMENTS/OBSERVATIONS	▪ The rural electrification project in Bisanti is one of the pilot projects requiring remedial action due to the underutilization of the available 24kW solar electricity. Full utilization is to be achieved by extension of the grid to Mantutu community, which is about 700 metres from the Power house in Bisanti, and is to be implemented under the replication phase. About 163 households and 23 businesses are connected to the solar micro-grid facility, generating an average monthly revenue of about N455,000.00. ▪ The utilization of the solar electricity has however increased from about 60% to 80 % in the last quarter as three (3) micro-businesses have been connected to the grid. The balance will be taken up by Mantutu community which has about 50 households, when the grid extension project is implemented. ▪ Mr. Bala Wyatako is the Local Agent responsible for securing the power house, as well as the sale of recharge vouchers to the subscribers. He confirmed that there has been no technical issues with the solar solution as they community enjoys uninterrupted power supply. He presented a request from three (3) neighboring communities that are appealing for solar solutions to be deployed in their communities too. The Senator responsible for the District had promised to extend the national grid and provide a transformer to the communities, but the indigenes prefer solar electricity as supply from the national grid is very epileptic. ▪ Also a user of the solar solution, Mr Bala added that he spends about N500 monthly for lights and mobile phone charging. Alhaji Umar, another residential user spends N1,000 monthly for basically lights, TV, radio, and mobile phone charging. ▪ Mr. Lami is one of the new commercial users and confirmed a great satisfaction with the solar system. He has a provision store business where he sells cold drinks and other provisions. He spends N20,000.00 monthly on electricity, and confirmed that his business is profitable. ▪ Mr. Suleiman Zibrin is a Public Health Worker in charge of the Primary Health Center in the community. He confirmed the availability of power 24 hours in the day and spends N1,000.00 monthly. He however complained that despite his several requests to the Government to provide a fridge for storage of vaccinations and other drugs requiring cold storage, as well as energy savings bulbs, there has been no response. He had informed the relevant State Government Agency immediately solar electricity was deployed to the community in 2015, and several attempts to get a response has proved

	abortive. Children still have to be taken to other Primary Health Centers for vaccination. ▪ Another new commercial user, Hassan Baba, a barber expressed happiness at the empowerment the presence of solar electricity in the community has provided. He spends about N5,000.00 monthly on electricity. ▪ The Agro millers have not been able to utilize the solar electricity for their operations and still rely on diesel engines as the cost for conversion of the existing engines is in the high side (about N90,000.00 each). GVE is however considering providing a micro finance facility to enable them buy the new engines. **Equipment Inspection** • The solar equipment for the implementation of the replication projects in Swasun and Mantutu communities have arrived at Niger State and are being stored in one of the classrooms at the primary school in Mantutu. The classroom is secure with an armed vigilante keeping guard. • The pre-paid meters are also being kept securely at the power house in Bisanti community in view of its sensitive nature, and it being the last item to be installed. • While most of the equipment have been delivered to site, the solar panels which are to be imported from South Africa are to arrive Nigeria at the end of July. Construction of the Power house is expected to commence in early July, and Mr Ifeanyi Orajaka, MD of GVE Projects Limited proposed a tentative commissioning date at the end of August 2017. • A schedule of the status of equipment delivery is attached as Appendix 1. • The UNDP team provided an M&E template for use by GVE Projects Limited to capture some information for every household, business or public service that would be connected to the micro-grid facility. The form captures indicators such as number of persons in each household, Head of each household, Gender segregation, Nature of business, etc. The template is to be used by all Project Developers as part of UNP's reporting requirements, and would also serve as useful data for BOI's records.
CONCLUSION/ ACTION POINTS	▪ SEP to request a formal revised implementation schedule from GVE Projects Limited, for the projects to be deployed in Swasun and Mantutu communities. ▪ SEP to ensure that utilization of the UNDP M&E templates is adhered to and information duly obtained from GVE Projects Limited and other Developers, going forward.

	▪ SEP to visit the community quarterly for adequate monitoring and evaluation of the performance of the solar solution vis-à-vis achieving the goal of the project.

4. REPORT OF MONITORING AND EVALUATION VISIT TO KOLWA COMMUNITY AND INSPECTION OF EQUIPMENTS DELIVERED TO KOLAKU AND AYABA COMMUNITIES, GOMBE STATE

DATE:	Wednesday-Thursday, June 21-22, 2017.
COMPANY NAME: **COMPANY REPRESENTATIVE:**	**GVE Projects Limited** Christopher Nwachukwu Project Engineer
UNDP REPRESENTATIVES:	Anthony Omata Programme Associate, M&E Josephine Edwards Programme Associate, (Programme Finance Team)
BOI REPRESENTATIVE (S):	Ruseh Oghenekaro Technical Officer
PROJECT SITES VISITED	Kolwa community, Kaltungo LGA, Ayaba community, Biliri LGA and Kolaku community, Balanga LGA, Gombe State.
PURPOSE:	To carry out the periodic monitoring and evaluation visit of the 24kW micro-grid project implemented under the pilot phase of the low-cost, off-grid solar electrification projects. This is to ensure that the project is meeting its desired objective of positively impacting the lives of the indigenes of the community. To also carry out an inspection visit with UNDP team to the new communities (Kolaku and Ayaba) in Gombe State being currently implemented under the Cost Sharing Agreement (CSA) between BOI and UNDP.
COMMENTS/OBSERVATIONS	▪ The rural electrification project in Kolwa is one of the pilot projects requiring remedial action due to the underutilization of the available 24kW solar electricity. The remedial action being implemented involves the

	decommissioning of 60% of the generating assets to Ayaba, Billiri LGA, where an upgrade to 24kW will also be carried out in order to meet the community's power requirements. The balance of 14kW generated in Kolwa is expected to meet the present and projected near future needs of the community. ▪ The utilization of the solar electricity is about 46%, and only increased by 1% in the last quarter due to the establishment of a grain milling and crushing business. About 91 households and 6 businesses are connected to the solar micro-grid facility, generating an average monthly revenue of about N135,000.00. ▪ Mr. Richard Yakubu Bello aka Honourable is the Local Agent responsible for securing the power house, as well as the sale of recharge vouchers to the subscribers. He confirmed that there has been no technical issues with the solar solution as they community enjoys uninterrupted power supply. Also a user of the solar solution, Mr. Richard added that he spends about N1000.00 monthly for lights, TV, Radio, and Mobile phone charging. ▪ He however complained that about 3 new subscribers who paid the subscription fees between February and March, and whose meters have also been installed are yet to be connected to the grid as the Activation code generated and sent by GVE did not work. GVE has been notified but the issue is yet to be resolved. ▪ He also pointed out that some of the street lights were not working, as only about 4 out of 13 units were working and the issue has been reported to GVE. ▪ Mr. Jauro, the community leader, expressed a general satisfaction with the solar solution but noted that the only complaint was the ease of recharging their meters which takes about 2-3 days between request and supply of tokens. When asked if he is aware about the plan to decommission some of the generating assets in the community due to a lack of full utilization, he replied in the negative. Apparently, the engagement that was carried out by GVE was done at the State and Local Government levels. We therefore used the opportunity to enlighten him about the plans as well as explain that the decommissioning would not affect the quality of the electricity that would be available for use in the community, and that there would also be enough to meet the anticipated future power needs of the community. ▪ He mentioned that the Senator representing Gombe South Senatorial District, who is also an indigene of the community promised in Christmas 2016, to power the community school by paying the subscription fee to connect the school, as well as purchase recharge vouchers from time to time. The Senator is however

	yet to fulfil his promise. We advised that he sends a reminder message to the Senator also informing him on the visit by BOI and UNDP team to the site with enquiries made about the primary school. It is intended that the message will prompt him to faster action on the fulfillment of his promise. ▪ Mr. Saleh owns the Agro-milling business where he has 2 machines for Crushing and Grinding of different grains such as corn, rice, millet, etc. He mentioned that on good business days, he spends about N10,000.00 weekly recharging his pre-paid electricity meter. During such busy periods, he is able to mill up to fifty 25kg bags of grains at N150.00 per bag, and is also able to crush the same quantity of grains at N100.00 per bag. Mr. Saleh has another meter which he uses for his household and spends between N500-N1,000 monthly on electricity. ▪ Kolwa has had a slow pace of growth in terms of growth of micro businesses in view of the availability of electricity. Presently, there are still only two micro-businesses with cold stores and both business owners spend about N2,000.00 monthly on solar electricity. When asked about the lack of growth, the Community leader said he was optimistic that economic activity will gradually pick up in the community. He cited the example of another proposed Agro-miller is building a mini complex where he intends to run three stores (for milling, provision store and a TV viewing center. The building which is under construction, was sighted. ▪ In response to the complaints, the representative of GVE projects Limited gave an assurance that in view of the new projects being implemented in Gombe, the GVE team will be available to ensure that the new bulbs are provided for the street lights, though the Local Agent had been notified to buy the bulbs and replace them a month earlier. The issue with the activation code for the new users will be sorted out within the week. ▪ The company is also finalizing the configuration of a technology platform that will ease the recharging process and make vouchers available as and when needed. ▪ As regards the lack of awareness on the plans to decommission some of the generating assets in the community, Mr. Ifeanyi Orajaka confirmed that the Former Permanent Secretary, Gombe State Ministry of Commerce & Industry, Alh Kaltungo as well as the Local Government Chairman have informed the community about the plans. He will however ensure that the information is properly cascaded within the community.

	Equipment Inspection • The solar equipment for the implementation of the replication projects in Kolaku and Ayaba communities have arrived at Gombe State and are being stored at the house of the Seriki of Kolaku community for safe keeping. The meters are being securely kept at the State's Ministry of Rural Development, and will be transported to the sites as and when due. • While most of the equipment have been delivered to sites, the solar panels which are to be imported from South Africa are to arrive Nigeria at the end of July. Mr. Ifeanyi Orajaka, MD of GVE Projects Limited has proposed that both projects in Ayaba and Kolaku would be ready for commissioning by mid-September, 2017. • A schedule of the status of equipment delivery is attached as Appendix 1.
CONCLUSION/ ACTION POINTS	▪ SEP to request a formal revised implementation schedule for the projects to be deployed in Kolaku and Ayaba communities. ▪ SEP to ensure that utilization of the UNDP M&E templates is adhered to and information duly obtained from GVE Projects Limited and other Developers, going forward. ▪ SEP to visit the community quarterly for adequate monitoring and evaluation of the performance of the solar solution vis-à-vis achieving the goal of the project.

5. M and E Report for project site in Delta state

DATE:	Wednesday, March 08, 2017.
COMPANY NAME:	**Arnergy Solar Limited**
COMPANY ADDRESS:	No. 7A, Akinola Cole Crescent, Off Adeniyi Jones Avenue, Ikeja
COMPANY BUSINESS:	Solar Energy Project Developers
BOI REPRESENTATIVE (S):	Ruseh Oghenekaro Technical Officer
COMPANY REPRESEN	Femi Adeyemo MD/CEO

TATIVE	
ADDRESS/ SITE VISITED	Lagos-Iyede Community, Ndokwa East LGA. Delta State
PURPOSE OF VISIT:	Arnergy Solar Limited is implementing the replication phase of the low-cost, off-grid solar electrification projects in i) Iyede Ame, Lagos-Iyede and Igeh communities in Ndokwa East LGA, Delta State and ii) Garin Dawaki community in Kwami LGA, Gombe State. Arnergy has utilized its funds to procure about 71% of the integrated solar home systems to be deployed in the communities. A visit was made to physically confirm delivery and condition of the Solar home systems at the site in Lagos-Iyede, where all the systems are being currently warehoused prior to deployment in the three communities in Delta State.
COMMENTS:	▪ The Solar Home Systems (SHS) were sighted by the visiting staff of SEP (Ms Ruseh Oghenekaro) at the Chairman of Lagos Iyede community's house, where they are being safely warehoused. The Chairman, Mr Appolus Egwenu was on ground to allow access into his house to inspect the solar systems. ▪ A total of 155 units of Arnergy 500, 295 units of Arnergy 300, 400 units of Arnergy 60, 10 units of Arnergy 1500 and 10 units of Arnergy 3000 were confirmed on site and in good condition. ▪ The Chairman of the community, Mr. Appolus Egwenu, and the community's Secretary, who also doubles as the Chairman of the Vigilante group, Mr Akwerigbe Abednego, gave an assurance of the security of the solar systems. They expressed excitement and stated that the members of the community were delighted at the prospect of getting reliable electricity sooner than expected. ▪ During the course of the visit, we met with five (5) solar technicians of Arnergy Solar Limited, who will be responsible for installing the systems in the three (3) communities. The MD, Mr. Femi Adeyemo, confirmed that registration of subscribers will commence effective March 14, 2017, after which actual installation will follow (though subject to the loan disbursement by BOI). ▪ The total number of the various systems approved for deployment to the three (3) communities is 1,000 units. However, as at the time of visit, a total of 870 units of the solar systems have been confirmed delivered to site, leaving a balance of 130 units to be procured. This represents 87% of the total systems to be deployed at the three (3) sites in Delta State. ▪ The systems will be deployed from Lagos Iyede where they are currently being secured, which is about 3km and 5km from Iyede Ame and Igeh communities,

	respectively.

Latest update on Mar 2018: Due to unwillingness of the end users in the community to pay for the services, decisions were made to transfer the project site from Delta to Kaduna state where all the SHS units has been installed by Arnergy.