SOLAR ENERGY AND THE FEDERAL BUDGET: 2012-2016

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CSJ

Centre for Social Justice (CSJ)

(Mainstreaming Social Justice in Public Life)

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ACRONYMS

CC	Climate Change
CDCF	Community Development Carbon Fund
CER	Carbon Emission Reduction
CO_2	Carbon Dioxide
CSO	Civil Society Organisation
DNA	Designated National Authority
FGN	Federal Government of Nigeria
GCF	Green Climate Fund
IRENA	International Renewable Energy Agency
KVA	KiloVolt Ampere
KW	Kilowatt
LED	Low Emission Development
LGA	Local Government Area
MDAs	Ministries, Departments and Agencies of Government
MRV	Monitoring, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
NREEEP	National Renewable Energy and Energy Efficiency Policy
PV	Photovoltaic
REAN	Renewable Energy Association of Nigeria
SEPAN	Sustainable Energy Practitioners Association of Nigeria
SON	Standards Organisation of Nigeria
UNFCCC	United Nations Framework Convention on Climate Change

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EXECUTIVE SUMMARY

Section 1 deals with the introduction of solar energy and its benefits, observations on government awarded solar contracts and the need for value for money. It also deals with the study methodology and the limitations of the study. In section 2, the report of the field assessment is detailed; the number, year, functionality and status of projects assessed. It enumerates the projects that could not be located; the efficiency of the investments and how challenges associated with the projects could be turned into opportunities and gains.

Section 3 deals with planning, budgeting, location of projects and community engagement. It shows the delinking of solar projects from policy and plan positions. Project locations were not empirically selected whilst budget resources were too thinly spread across so many projects. Community engagement by project promoters was minimal leading to a lot of non-functional solar solutions.

Section 4 is the conclusions and recommendations. The key recommendations arising from this study are detailed below.

For Federal MDAs

- Full observance of the provisions of the Public Procurement Act 2007 has become imperative. This should start with procurement planning, the entire bidding process which ensures competition, prevents bid rigging and ensures value for money.

- Provisions should be made for maintenance of these solutions by the contractor for a guaranteed length of time and not just based on an “install and abandon” basis. This is because some components require replacement after certain period of time and just installing and abandoning would reduce their full lifespan value.

- As a follow up to the above, contractors should be paid fully upon expiration of the standard warranty period of their solutions. Government should also consider giving the contractors retainership contracts after the guarantee period, to ensure maintenance and optimal functioning of the facilities.

- To standardize prices and avoid inflation of contract works, the Bureau of Public Procurement in accordance with its mandate should provide a price database of renewable energy components to all federal MDAs and update same from time to time based on changing macroeconomic indicators.
- Contracting agencies should work closely with reputable bodies in the sector such as the Sustainable Energy Practitioners Association of Nigeria (SEPAN), the Renewable Energy Association of Nigeria (REAN) who have experienced professionals in this sector and can facilitate the vetting of bids on renewable energy projects.

- It is imperative to strengthen the monitoring, inspection and approval units of federal MDAs for proper monitoring of the standard and quality of work done by the contractors, functionality of the projects and ascertain if these projects were actually executed in accordance with specifications.

- Rationalise projects and stop spreading resources too thin. Include in budgets only those projects that can be adequately funded within a reasonable period of time. Complete existing projects before embarking on new ones.

- Executing MDAs in a bid to ensure sustainability should consider training of some capable local hands on basic maintenance of the renewable systems such as cleaning of the panels and changing of LED bulbs.

- Innovative designs of solar solutions should be adopted to prevent the theft of solar components. There now exists integrated solar solutions with all the components merged into one unlike the solutions used for projects which are more like an assemblage of various components. These new products reduce the risk of theft of components, are of better quality and last longer when compared with the usual solutions.

For the Federal Ministry of Works, Power and Housing

- In accordance with section 88 of the Electric Power Sector Reform Act, 2005, the Minister of Power should expedite the preparation (and approval by the President) of the Rural Electrification Strategy and Plan and the setting up of the accompanying Rural Electrification Fund. He should also ensure that the quarterly reports are prepared, presented to the President and disseminated to the public.

For the Federal Ministry of Environment

- The Federal Ministry of Environment as the country's Designated National Authority (DNA) and UNFCCC focal point should nominate a group of non-state actors (i.e. selected CSOs etc.,) to undergo the capacity building exercises being offered free by the climate change body. It will not cost Nigeria anything but will bring her a lot of benefits.

- Nigeria should start the process of measuring, reporting and verification (MRV) and annual verification by Designated Operational Entities; certify emission reduction with a view to earning carbon credits. The country should take steps to access international funds like Green Climate Funds (GCF), Nationally Appropriate Mitigation Action (NAMA) Funds, Climate Change Adaptation Fund's Direct Access Modality, Community Development Carbon Fund of the World Bank (CDCF) etc.

- Nigeria should initiate steps and properly position herself to lead the sub-region in matters pertaining to climate change mitigation and adaptation and become a hub for low-carbon technology transfer for the sub-region (Regional – West African - Emission Trading Scheme).

For the Legislature

- The National Assembly in collaboration with the Federal Ministry of Budget and National Planning should adopt a framework and template for the selection of projects to be included in the federal budget as constituency projects. This framework should take cognisance of the policy, plan and budget continuum which guarantees that the budget is used as a vehicle to implement policies and plans.

For the Ministry of Budget and National Planning

- The Ministry should ensure that estimates that will be included in the federal budget bill are based on existing national plans and policies. This will ensure that renewable energy projects are fitted into the national energy policies and action plans.

For Standard Organization of Nigeria (SON)

- SON should adequately regulate the quality of solar equipment being imported to ensure that only components meeting the required standards are allowed into the country. It should also collaborate with federal MDAs to ensure that the components used for solar and renewable energy installations are of the required quality and standard.

- SON should consider facilitating capacity building in federal MDAs that use renewable energy products to put them in a position to properly monitor and vet the results of the public renewable energy procurements.

For Communities and CSOs

- Communities should take ownership of these renewable energy projects, including being responsible for their security and protection against vandalism. But this requires proper community consultation and engagement by project promoters at the time of initiation of the project.

- Youths can be trained on the basic maintenance of these solutions such as cleaning of the solar panels at intervals. CSOs can intervene to provide appropriate training and capacity building. Under well-defined agreements with MDAs, the proper maintenance of such projects should be used as a pre-requisite for the location of other developmental projects in the communities.

- Communities or their local governments should review FGN budgets to determine which projects have been allocated to their communities and as such, follow up, monitor and ensure that the responsible parties implement the projects according to specifications.

SECTION ONE: INTRODUCTION

1.1 SOLAR ENERGY AND ITS BENEFITS

Solar energy technologies have been around globally for over three decades and operate by converting energy from the sun to electrical energy using solar photovoltaic modules. They are one of the cleanest, cost-effective and sustainable forms of energy compared with other clean energy alternatives and conventional energy solutions.

Recent years have seen an increased adoption of solar technologies in urban and rural communities both in developed and developing countries. In developed nations where conventional alternatives exist, solar solutions are promoted by favourable policies, subsidies and measures that make them not only beneficial and cost-effective, but aimed at mitigating the negative effects of climate change which has become a global threat. In developing countries such as Nigeria, public funded solar solutions have been dominated by solar street lighting and solar water borehole solutions. However, the past two years have seen the growth of public solar solutions in the country to include solar electrification projects and small scale plug and play devices for basic lighting and mobile phone charging provision. Various residential and commercial solutions have also been deployed in the private sector and the growth has slowly but steadily been on the increase especially as it solves a pressing basic need – provision of steady electricity.

The benefits of solar technology cannot be overemphasized in terms of its environmental, social and economic benefits including improvements in the standard of living of a community and other indirect benefits. Increased global awareness and significant decrease in cost have led to massive deployment of solar energy technologies and increased public solar projects in the country, particularly solar street lighting and solar water borehole solutions. However, there still exists a huge lack in skills development, maintenance, measurement and evaluation of the impact of these projects overtime as well as the non-availability of data on the functionality (or not) of installed solar solutions in the country.

1.2 GOVERNMENT AWARDED SOLAR CONTRACTS

In recent years, the Federal Government has increasingly engaged in carrying out social solar projects which comprise mostly of solar street/road lighting and solar water borehole projects. These are usually carried out under various Ministries, Departments and Agencies of Government (MDAs), primarily the Federal Ministry of Power, Works and Housing, the Federal Ministry of Water Resources and the Federal Ministry of Science and Technology. Several billions of naira has been invested in these projects.

Various reasons can be attributed to the huge investment of the government in solar road/street lighting projects. They are designed as a cost-effective alternative in comparison to conventional solutions; leads to improved socio-economic activities in localities where they are deployed, improves security and transportation services. Similarly, solar powered water borehole solutions also serve as a cost-effective measure, allowing for vital water resources to be accessed in remote rural locations both for domestic and commercial use, water transfer and water for livestock and irrigation. A natural relationship exists between the availability of solar power and the need for water. Some solar water borehole applications do not use

batteries; the water is simply pumped when there is enough daylight into a storage tank, enabling access to water whenever needed. Others require energy to continue pumping even during hours when there is no sunlight, depending on the use of water in that area. Furthermore, these solar solutions also tend to serve as pilot schemes to draw attention to new possibilities in energy provision.

Some analysts have argued that most solar projects in rural communities are not economical, and therefore have no value for money. Due to the present state of such projects, the general impression is that most solar projects in rural areas are undertaken with full knowledge that they will not be economically self-sustaining, and motivations for doing them turn on social, political or educational benefits rather than economic considerations. It is further argued that the opportunity costs of such projects have not been properly evaluated - that funds spent on such project could have been used for other pressing needs[1].

These conclusions were based on the lack of relevant data showing whether the investments in solar energy solutions have actually increased electricity access, have helped in alleviating any local economic challenges or provided any benefit.

However, in the context of the benefits, there is a need to view these projects, not just on the basis of solar solutions for providing electricity but on the basis of facilitating the provision of socio-economic benefits and improvement in the overall standard of living. Comparing this with the conventional costs of providing these amenities in terms of using conventional alternatives such as diesel/gasoline generators and constant provision of fuel, the economic benefits can clearly be seen. Some analysts argue for example that solar street lighting projects were not necessary as local communities have no real need for such projects as compared to the cities which are even still struggling to get adequate street lighting. They argue that this is the creation of a solution for an imaginary problem[2]. However, while recognizing the fact that most likely, there would not have been any street lighting solution in rural communities based on conventional electricity sources, it is important to recognize that solar solutions have opened the path to providing basic social amenities to these rural communities that would hitherto not have been provided.

However, while the focus has primarily been with installing these public solar solutions, increased attention should be paid to developing the proper support structure, maintenance culture and trained personnel to run these projects. Installed solar projects comprise of components that would need to be replaced after certain periods of time. This makes solar projects look unsustainable because after some time, they fall into disrepair and disuse if not maintained.

1.3 NEED FOR VALUE FOR MONEY

Over the years, the Federal Government has spent billions of naira in executing solar projects across the Federation. States and Local Governments have also invested in solar energy. A close analysis of solar projects in the Federal Government budget would show disparities in

[1] *Delimiting the use of solar energy in Nigeria*, unpublished discussion article available to the author by Goodluck Nwokedi, a public affairs commentator.
[2] Nwokedi, supra.

budgeted costs even for projects of the same capacity within the same budget year. While it can be argued that these solar solutions vary with the components used for such solutions, by location, contractors and other factors, the difference in costs are very significant. This suggests that contrary to the demands of the Public Procurement Act 2007, there is no standard database or price list which regulates costs across MDAs on solar projects[3]. Furthermore, over 80% of these solutions upon assessment are found to be non-functional.

This foregoing raises the central question of value for money with its three cardinal parametres of economy, efficiency and effectiveness (the three Es). Various dictionaries and Wikipedia have explained the three Es as follows[4]:

> *"Economy is a good business operation that minimizes costs. Efficiency is the (often measurable) ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. In a more general sense, it is the ability to do things well, successfully, and without waste. It signifies a level of performance that describes a process that uses the lowest amount of inputs to create the greatest amount of outputs. Effectiveness is the degree to which something is successful in producing a desired result; success*"

Essentially, the three Es imply:

- *Economy - ensuring that input costs are minimised.*
- *Efficiency - ensuring that maximum useful output is achieved at the minimum level of input cost.*
- *Effectiveness - ensuring that output from any given activity is achieving the desired results*[5]*.*

The posers raised by these articulations of value for money when applied to renewables especially solar projects will include:

- Is the FGN implementing these projects at the least possible price?
- Are the beneficiaries getting the maximum outputs and benefits from the concluded projects?
- Are the project beneficiaries getting the services the projects promised to deliver?
- Are the projects fulfilling governmental energy and developmental objectives?

With the increasing number of government installed solar projects, there has been a lack of relevant data to assess the actual functionality and benefits of these projects to justify the substantial investments in them, and whether the solution has led to improved socio-economic benefits. This creates the need for a comprehensive assessment of the value for money of these projects which is the basis of this study.

[3] The Bureau of Public Procurement is mandated by section 5 (e) of the PPA to monitor the price of tendered items and keep a national database of standard prices.

[4] See https://en.wikipedia.org/wiki/Value_(economics) and https://www.google.com/search?q=economic+opertaion&ie=utf-8&oe=utf-8&client=firefox-b&gfe_rd=cr&ei=TBt_WIXfIeXU8geYjauoBg and various web definitions of efficiency and effectiveness.

[5] Samuel S.O. Afhemike in "*The Pursuit of Value for Money"*, page xiv; Spectrum Books Limited 2003.

1.4 METHODOLOGY OF THE ASSESSMENT OF FEDERAL GOVERNMENT SOLAR PROJECTS

Between 2012 and 2015, the Federal Government of Nigeria awarded over 1700 solar projects across the Federation. In ascertaining the desirability and value for money of these projects, the assessment embarked on desk studies reviewing renewable energy projects especially in solar energy over the four year timeframe. The documents reviewed include approved budgets; budget implementation reports of the Budget Office of the Federation; reports of legislative committees; policies, laws, frameworks and standards in the sector with a view to determining whether there is an empirical link between the standards and the appropriations; publications on the topic by national and international experts and bodies, etc.

Two solar street/road lighting projects and two solar powered borehole projects were chosen from each of the six geo-political zones of the country. The states chosen per geo-political zone were Lagos for South West, Kaduna for North West, Bauchi for North East, Nasarawa for North Central, Rivers for South South and Imo for South East geopolitical zones respectively.

3 days were spent in each state, starting from Kaduna and concluding in Imo. Two monitors were mobilized and deployed to the states. The locations to be visited per state were already pre-determined prior to the journey and upon arrival, the monitors went straight to the locations. The assistance of local leaders and youths were sought in order to carry out a hitch-free assessment. Some local leaders were of great assistance while some others did not permit the monitors to carry out any assessment in their community regardless of the letter of authorization the monitors had. For security and safety reasons, the monitors had to leave such locations. Members of the Citizens Wealth Platform in the states also participated in the exercise[6].

A monitoring and reporting template was designed at the beginning of the exercise as a tool to collect information and data. The facts sought in the template include the name of the project, project's budget code, year of appropriation and name of contractor. Others are project description, location, cost, amount so far spent on the project, project commencement date, date of commissioning if completed. Further details were the state of the project - whether completed, abandoned, working, broken down and not executed at all; the initial project completion date, community relations and usage or reaction to the project, etc. Finally, the monitors with the assistance of solar and renewable energy experts had to form an opinion based on these facts and a current standard price database on the value for money of the projects. Section 2 below provides the details of the results of the field assessment.

1.5 LIMITATIONS OF THE STUDY

The study reviewed only 26 projects due to limited time and resources for the research. Only two projects out the 26 visited had full information on the project, including the name of the contractors. Efforts made to obtain information on the approved contractors for the projects were unsuccessful as the staff in the ministries visited (Federal Ministry of Power, Works and Housing; Federal Ministry of Water Resources and the Federal Ministry of Science and

[6] The Citizens Wealth Platform (CWP) is the umbrella network of associations and groups working to ensure that public resources are made to work and serve the public good. It is a network of over 150 groups.

Technology) seemed reluctant to provide the necessary information despite various attempts made by the monitors. Even a freedom of information request sent by the project has not attracted a good response.

Efforts to access some projects in some communities particularly in Rivers State was met with resistance from some youths in the area who felt disturbed by the unfamiliar faces and issued threats for us to leave. Again, while trying to obtain information on projects in some communities, we found out that the locals or officials in charge seemed to know the contractor(s) responsible for the project but were reluctant to provide the information probably because they feared the information would be used to probe the person.

SECTION 2: FIELD ASSESSMENT REPORT

2.1 NUMBER, YEAR AND STATUS OF PROJECTS ASSESSED

A total of 26 solar project locations were visited in the six pilot states. They are 12 solar powered borehole projects and 14 solar street lighting projects. Some of the projects detailed in the budget in some years could not be located based on the descriptions in the budget leading to majority of the projects assessed coming from fewer numbers of years than previously planned. Figure 1 below summarizes the information on the projects assessed.

Figure 1: Total Projects Assessed

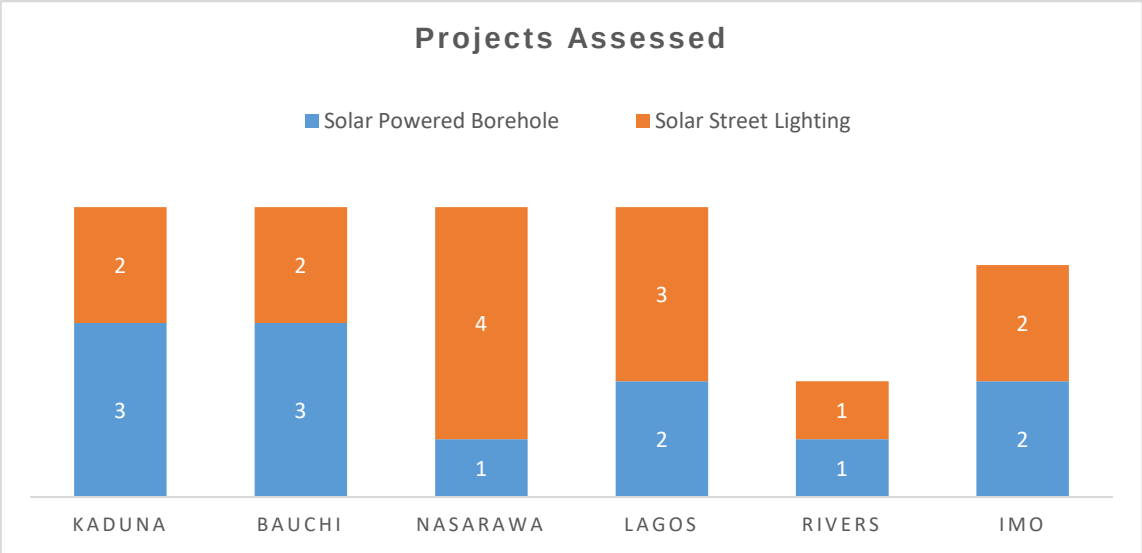


Figure 2 shows the total projects assessed by budget year

Figure 2: Solar Projects Assessed by Budget Year

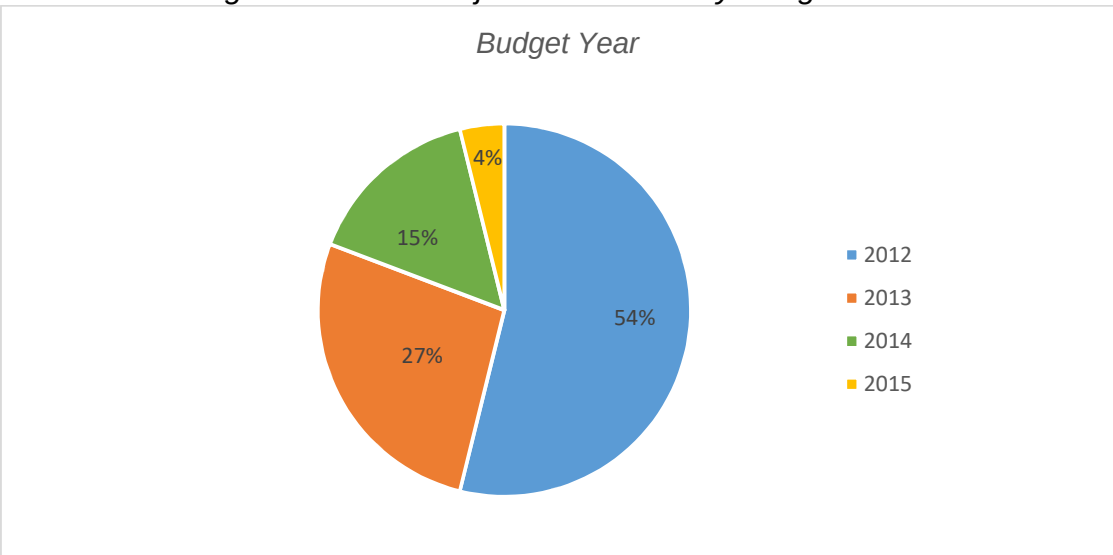
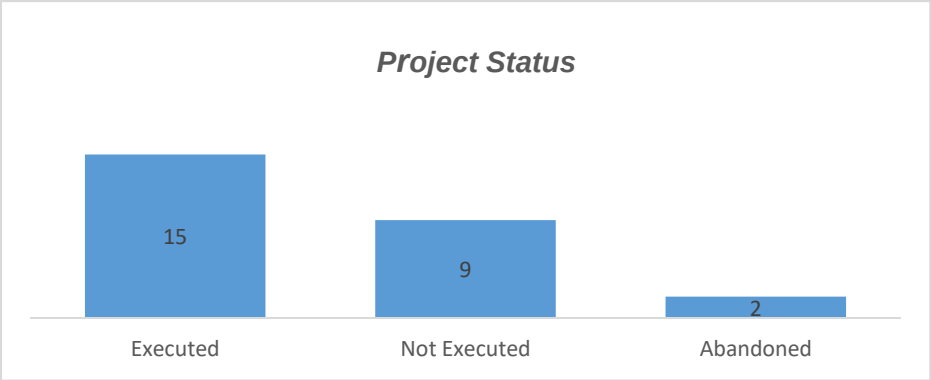


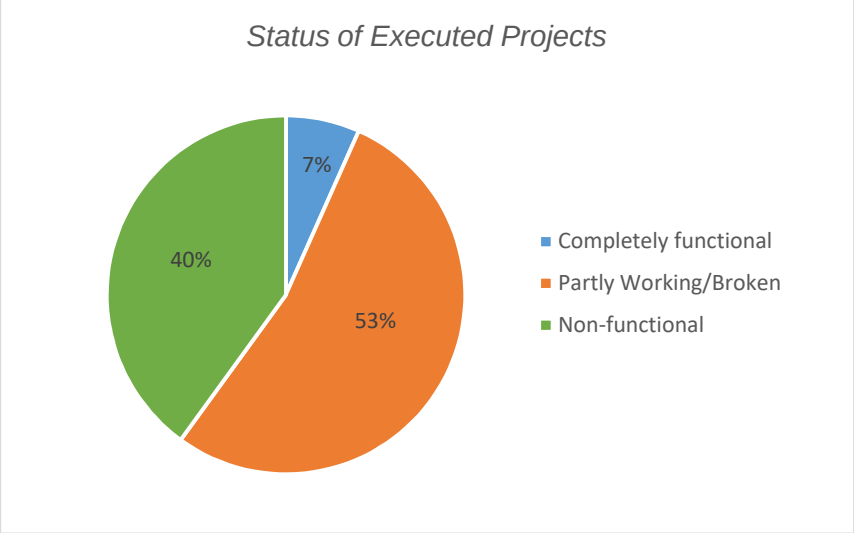
Figure 3 shows the status of the projects assessed.

Figure 3: Status of Assessed Projects



2.2 FUNCTIONALITY OF ASSESSED PROJECTS

Figure 4 below shows the status of the projects assessed in terms of their functionality.



The above Figure shows only a 7% functionality rate which indeed is poor. Partly working/broken down projects is the bulk amounting to 53% whilst the completely non-functional ones are the next big pie of 40%. In Figure 5, the status of executed solar powered borehole projects is shown. This indicates that only 1 out of four is completely functional. There was no middle position of partly working or broken. The status of executed solar street light projects is shown in Figure 6.

Figure 5: Status of Executed Solar Powered Boreholes Assessed

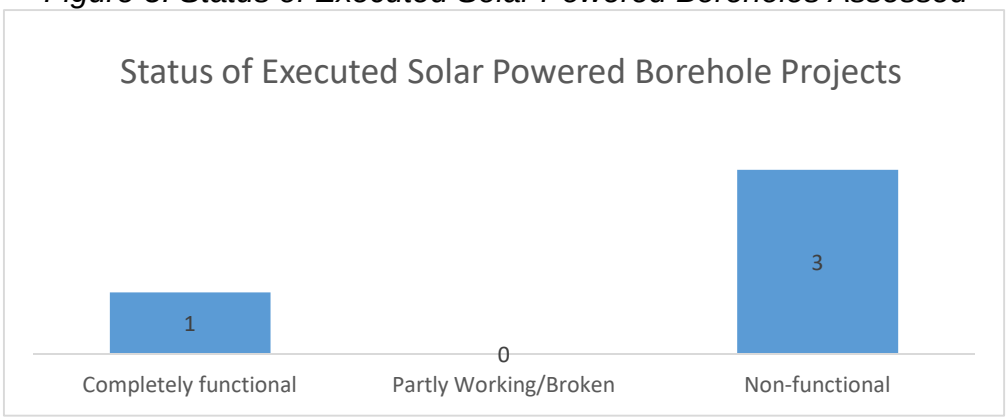


Figure 6: Status of Executed Street Lighting Project

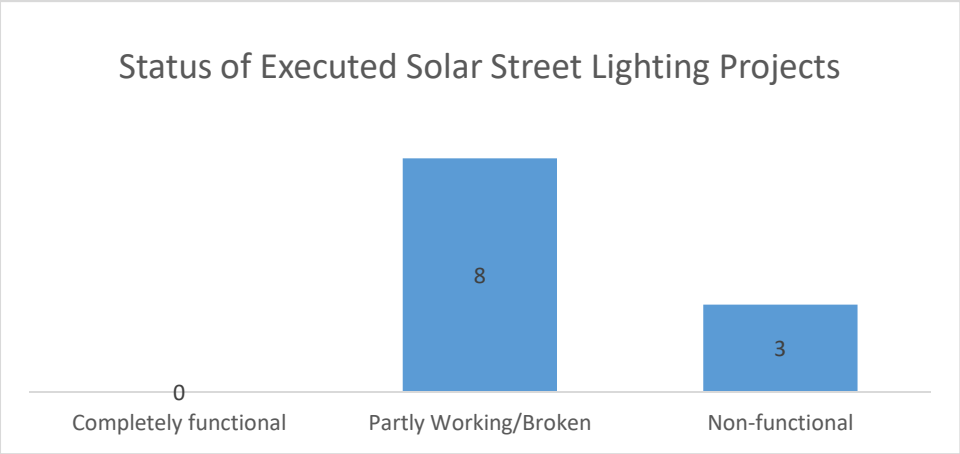


Figure 6 shows that none of the street lighting projects visited was completely functional.

2.3 PROJECTS THAT COULD NOT BE LOCATED

Some projects that were pencilled down for monitoring could not be located. The monitors visited the sites detailed in the budget and asked questions from the locals but could not locate the projects. They are as detailed in Table 1 below.

Table1: Projects that could not be Located

PROJECT	YEAR	MINISTRY	AMOUNT	MONITORS COMMENT
Provision of solar powered street lights in Ekkah Wangibi, Nasarawa - Eggon LGA, Nasarawa State	2013	Ministry of Science and Technology	10,000,000	We went round Ekkah Wangibi village and spoke with the indigenes but they said there was no such project there.
Solar street light at Eugene Ndubuisi Close/Osi-Efa Crescent at Lilly Estate, Amuwo Odofin, off Festac Link Road, Lagos State	2014	Federal Ministry of Lands and Housing	30,000,000	Got to the location but no sign of the project.
Solar power street light at Adegunwa Street, Aguda, Surulere, Lagos	2013	Federal Ministry of Lands and Housing	6,000,000	Got to the location but no sign of the project.
Provision of solar borehole at Barnawa, Kaduna South, Kaduna State	2013	Ministry of Water Resources	10,000,000	We went round Barnawa and spoke with the indigenes but they said there was no such project there.
Solar powered boreholes at Ung. Kanawa, Bauchi LGA	2012	Ministry of Water Resources	20,000,000	We went to Ungwan Kanawa and also spoke with the indigenes but they said there was no such project.
Solar boreholes at Akwanga/Nasarawa	2013	Ministry of Water Resources	24,000,000	We went round the LGAs in question and

Eggon and Wamba LGAs				spoke with the people but they were not aware of such a project in their locality.
Solar powered borehole at 22 Road, between J&K Close, Festac Town, Amuwo Odofin LGA, Lagos State	2012	Federal Ministry of Water Resources	7,600,000	Got to the location but no sign of the project.
Construction of solar powered borehole with perimeter fencing at St Mary's Catholic Church, Iho, Dimeze, Ikeduru, Imo State (ongoing)	2012	Ministry of Lands and Housing	20,000,000	We went to the church and spoke with the parish priest who had been there for some years but he said there was no such project there.
Provision of solar street light in Edeoha in Ahoada East LGA, Rivers State	2013	Federal Ministry of Science and Technology	50,000,000	We could not access the project for security reasons.
Solar powered borehole at Omoku Ogba Egbene Udoni LGA, Rivers State	2014	Federal Ministry of Water Resources	7,500,000	It is a riverine community and transport to go there is by use of boats. The project was not inspected.

It is possible that the contracts for these projects were not awarded or that money was not released by the Ministry of Finance. It is also possible they were awarded, not fully paid for and eventually abandoned. Enquiries made at the relevant MDAs did not yield answers even when a freedom of information request was sent. The authorities simply refused to provide information. Thus, it was impossible to arrive at a conclusion about what happened to the projects. But the project in Iho, Dimeze Ikeduru Imo State, which was supposed to be ongoing but could not be located, presents a special case which suggests some level of mischief.

2.4 SUMMARY OF FIELD ASSESSMENT

The summary of the findings in the field is detailed in the following bullet points. The projects that were not executed are not included in this list.

- Two panel solar borehole at Bayan Bata, Bauchi LGA, Bauchi State at the cost of N3.6m awarded by the Federal Ministry of Water Resources in 2012 was abandoned. The only component of the project present at the site was the water tank.

- Two panel solar borehole at Gubi Village, Bauchi LGA, Bauchi State at the cost of N3.6m awarded by the Federal Ministry of Water Resources in 2012 was abandoned. The construction of the project started as a solar powered borehole; only the steel frame and tank were present. Instead, a motorised borehole was constructed. No reason was given for abandoning the initial solar project.

- 55 poles of solar street light at Tilden Fulani, Toro LGA, Bauchi State at the cost of N22m awarded by the Federal Ministry of Water Resources in 2012; the status shows that it is partly working and partly broken. Each pole had two 80W solar panel making 160W per pole and a total installed capacity of 8.8kW. There were two 12V100AH batteries, a charge controller of 12V15A capacity and a 30W LED bulb. The orientation of the panels was not uniform. Some of the components, primarily the batteries and charge controller had been removed from the non-functional poles. The pole was of average quality. No provision for maintenance was made both in terms of cleaning the panels and replacing any faulty or missing components.

- Provision of solar panel street light systems (American model-California) at Bayan Bata, Ungwan Jaki, Kobi, Sinia all in Bauchi LGA, Bauchi State at the cost of N25.120m awarded by the Federal Ministry of Science and Technology in 2012; the status shows that they are partly working and partly broken. Each pole had two 100W solar panels making 200W per pole and a total installed capacity of 4.8kW. There was one 12V150AH battery, a charge controller of 12V15A capacity and a 36W LED bulb. The orientation of the panel was not uniform. Some of the components primarily the batteries and charge controller had been removed from the non-functional poles. The pole was of average quality and 6m in height. No provision for maintenance was made either in terms of cleaning the panels and replacing any faulty, missing components or against theft and vandalism.

- Solar powered street light in Afor Ibeme Market at Ibeme Ugiri Mbano, Isiala Mbano LGA, Imo North Senatorial District at the cost of N35m awarded by the Federal Ministry of Lands and Housing in 2013 to Henochim Investments Limited, Abuja was executed but non-functional. 23 solar street lighting poles were identified, all irregularly spaced and installed non-uniformly. Each pole had two 100W solar panel making 200W per pole and a total installed capacity of 4.6kW. The capacity of the two batteries could not be determined during the assessment. The orientation of the panel was not uniform. Most of the components, primarily the batteries had been stolen and only very few of the poles were functional. The poles were of average quality. No provision for maintenance was made both in terms of cleaning the panels and replacing any faulty or missing components.

- Installation of solar street lights at Ama Barnax/Umunrmo Road, Ahiazu Mbaise LGA Imo State at the cost of N8m awarded by the Federal Ministry of Science and Technology in 2012 and was commissioned in 2014 is not functional. The six solar street lighting poles are all non-functional. Each pole had two 100W solar panels making 200W per pole and a total installed capacity of 1.2kW. The capacity of the battery could not be determined during the assessment. The orientation of the panel was not uniform. Most of the components primarily the batteries had been stolen and none of the poles were functional. The pole was of average quality. No provision for maintenance was made both in terms of cleaning the panels and replacing any faulty or missing components.

- Provision of solar powered borehole at St. Patrick's Secondary School Ogbe, Ahiazu Mbaise LGA, Imo State at the cost of N10m awarded by the Federal Ministry of Water Resources in 2014 to Befoed Water Engineering Limited was executed and commissioned in 2014 and the status shows that it is working. It is a 1.2kW solar powered borehole. Eight 150W monocrystalline solar panels making a total installed capacity of 1.2kW. The panels were tilted facing south as required for maximum irradiation. Every component was fully operational. However, there was no water filter

unit present as part of the installation. The panels installed were of standard quality. The wiring was of good quality. The steel framework was of good quality. Maintenance provisions were made both in terms of repairing any faulty components or regular cleaning of the panels by the school authorities.

- Provision of solar powered at Bayan Dutse, Narayi Ward, Chikun LGA, Kaduna State at the cost of N12.5m awarded by the Federal Ministry of Water Resources in 2012 and was commissioned in 2012 is non-functional. Eight 40W monocrystalline solar panels making a total installed capacity of 320W. The panels were tilted facing south as required for maximum irradiation in the country. The pump installed had broken down as well as some other components of the borehole such as the tap. The panels installed were of standard quality. The wiring was of low quality. The steel framework was of average quality. No provision was made for maintenance both in terms of repairing any faulty components or regular cleaning of the panels.

- Solar powered borehole at Railway Road by Joji Road, Bakin Masallachi, Hayin Banki Kawo, Kaduna State at the cost of N10m awarded by the Federal Ministry of Water Resources in 2014. The project is non-functional. Every component of the solar powered borehole including the solar panels was not found. The quality of the steel framework was average.

- Construction of solar street light at Badiko, Kurmin Mashi, T/Nupawa, T/Wada, Sabon Gari, Kaduna State at the cost of N20m awarded by the Federal Ministry of Water Resources in 2014 and was commissioned in 2014. The project is partly working and partly broken down. It is made up of 20 solar street lighting poles unevenly spaced at an average of 10 metres. Each pole had a 150W solar panel making a total installed capacity of 3kW. The capacity of the two batteries could not be determined during the assessment. The orientation of the panel varied with the road network. The panels were installed facing off the road and thus varied with the orientation of the road network. Most of the components primarily the batteries had been stolen and only very few of the poles were functional. The galvanized steel pole was of good quality. No provision was made for maintenance both in terms of cleaning the panels and replacing any faulty/missing components.

- Construction of solar street light at Tudun Wada, Kaduna South, Kaduna State at the cost of N10m awarded by the Federal Ministry of Water Resources in 2015 and commissioned in 2015 is partly working and partly non-functional. The project is made up of 48 solar street lighting poles identified. Each pole had two 100W solar panels making a total installed capacity of 9.6kW. The capacity of the two batteries could not be determined during the assessment. The orientation of the panels varied with the road network. The panels were installed facing off the road and thus varied with the orientation of the road network. Most of the components primarily the batteries had been stolen and only very few of the poles were functional. The galvanized steel pole was of good quality. No provision for maintenance was made both in terms of cleaning the panels and replacing any faulty or missing components.

- Solar powered borehole at Ijegun Egba beach, by Celestial Church, Amuwo Odofin LGA, Lagos State at the cost of N7.6m awarded by the Federal Ministry of Water Resources in 2013 and was commissioned in 2013 but it is non-functional. Sixteen 100W polcrystalline solar panels were installed making a total capacity of 1.6kW. The panels were oriented facing West rather than South which is believed to be an effort to show off the panels. The solar panels and steel framework were of standard quality.

Other components including the pump, batteries, charge and pump controller were missing. No provision was made for maintenance both in terms of cleaning the panels and replacing any faulty and missing components.

- Construction of 11 solar street lights at Tudun Kofa to Central Market Road, Keffi LGA at the cost of N6.6m awarded by the Federal Ministry of Lands and Housing in 2012 was commissioned in 2012. The project is partly working and partly broken. Each pole is of 200W capacity making a total installed capacity of 2.2kW. The capacity of the batteries could not be determined during the assessment. The orientation of the panel was not in accordance with best practices. All components of the system from the solar panels to the pole were of low standard. No provision for maintenance was made both in terms of cleaning the panels and replacing any faulty and missing components.

- Construction of 11 solar street lights at Pilot primary school to Abaga Palace, Garaku LGA at the cost of N6.6m awarded by the Federal Ministry of Lands and Housing in 2012 and commissioned in 2012 is partly working and partly broken. Each pole was of 200W capacity making a total installed capacity of 2.2kW. The capacity of the batteries could not be determined during the assessment. The orientation of the panel was inconsistent. All components of the system from the solar panels to the poles were of low standard. No provision for maintenance was made both in terms of cleaning the panels and replacing any faulty or missing components.

- Provision of solar powered street light at Doma Town, Nasarawa State at the cost of N20m awarded by the Federal Ministry of Science and Technology in 2013 and commissioned in 2013. It is partly working and partly broken down. 20 poles of solar street lights were identified. Most of them were non-functional. The capacity of each pole was of 150W making a total installed capacity of 3kW. The capacity of the batteries could not be determined during the assessment. The orientation of the panels was not in accordance with best practices. Most components of the system had been stolen. The solar panels were of standard quality while the pole was of average quality. There was no provision for maintenance both in term of cleaning the panels and replacing any faulty or missing components.

- Solar water borehole (20,000 litres with fetching point) at Palace Road, Oyigbo, Rivers State at the cost of N50m0 awarded by the Federal Ministry of Power in 2012 was not executed. However, there were two taps at the proposed site.

- Solar street light at Hanetu Lane/Orieku Street Orogbum, Port-Harcourt, Rivers State at the cost of N10m awarded by the Federal Ministry of Power in 2012 and was commissioned in 2013 and is partly working and partly broken. 5 street solar light poles were installed along Hanetu lane, and 7 along Orieku Street. Each pole had two 100W solar panels installed, making each pole 200W and the total installed capacity 2400kW. The poles were oriented in a non-uniform manner. The batteries in some of the poles were stolen as well as wires and charge controllers. The metal steelwork was of poor quality with most of the poles and battery cases rusty. No maintenance provision was made for the project. Under some of the poles, we observed that secondary lighting had been installed under the poles by locals for illumination as obviously the solar lighting was non-functional.

2.5 ECONOMY OF THE SOLAR PROJECTS

The value for money in the context of this study is achieved when the assessed projects meet the following criteria:

- The project as assessed meets the standard quality criteria required of such projects.
- The project has measurable socio-economic benefits to the community.
- The project is cost-effective as compared to its conventional alternative.
- The project has environmental benefits.

In ascertaining the value for money of the projects, some key factors were also considered. First, the average market price(s) of the solar street lighting and water borehole solutions from reputable solar firms in the country was compared with the price of the solar solutions as appropriated in the federal budget. Next, the estimated cost during the lifespan of the solar projects using an average of 25 years (the average lifespan of good quality solar panels) was used to ascertain the total value for money of these projects in comparison with their conventional alternatives while considering the properties of both solutions. Lastly, the values of the assessed projects were compared, based on their existing conditions at the time of assessment, against the expected value to ascertain their actual value for money.

Table 2 below compares the average market prices of solar lighting and borehole solutions between 2012-2016 while Table 3 compares the average price of similar conventional lighting and borehole solutions between 2012 – 2016, that is, without the solar components[7].

Table 2: Average Market Prices of Solar Lighting and Borehole Solutions

Lighting Capacity	**Average Price from Solar Firms* (N) 2012**	**Average Price from Solar Firms* (N) 2013**	**Average Price from Solar Firms* (N) 2014**	**Average Price from Solar Firms* (N) 2015**	**Average Price from Solar Firms* (N) 2016**	**Remarks**
36W/40W (single arm)	225,000	220,000	200,000	190,000	340,000	Miscellaneous costs such as transportation costs of components

[7] Information on the market price of the solar solutions used in this Study was obtained from reputable solar firms in Nigeria. For some solutions, the average market price between various solar firms was used whilst for some others, information from one reputable solar firm was used. Solar companies import their components directly from manufacturing companies in various countries primarily China, India, United Kingdom, United States of America, South Korea and Germany. But the majority import from China due to the cheaper prices in that country. Others buy from the authorised agents of manufacturing companies with presence in Nigeria. Therefore, each company would have relatively different costs for various components which could lead to relatively higher costs per solution as compared with other firms even with components that are of the same standard. The average of these solutions was taken to reach the average market value of the solar solutions based on the availability of information from each firm. The information on conventional sources was obtained from reputable solution providers in the country.

						are excluded.
Solar Component of Borehole	**Average Price from Solar Firms* (N) 2012**	**Average Price from Solar Firms* (N) 2013**	**Average Price from Solar Firms* (N) 2014**	**Average Price from Solar Firms* (N) 2015**	**Average Price from Solar Firms* (N) 2016**	**Remarks**
1,000 Litres*	800,000	780,000	750,000	700,000	1,000,000	Miscellaneous costs such as transportation costs of components are excluded

Table 3: Average Market Price of Conventional Lighting and Borehole Solutions

Lighting Capacity	**Average Price from Solar Firms* (N) 2012**	**Average Price from Solar Firms* (N) 2013**	**Average Price from Solar Firms* (N) 2014**	**Average Price from Solar Firms* (N) 2015**	**Average Price from Solar Firms* (N) 2016**	**Remarks**
36W/40W (single arm)	100,000	97,000	93,000	88,000	120,000	Miscellaneous such as transportation costs of components are excluded
Borehole Capacity (minus drilling)	**Average Price from Solar Firms* (N) 2012**	**Average Price from Solar Firms* (N) 2013**	**Average Price from Solar Firms* (N) 2014**	**Average Price from Solar Firms* (N) 2015**	**Average Price from Solar Firms* (N) 2016**	**Remarks**
1,000 Litres	500,000	500,000	550,000	600,000	800,000	Miscellaneous such as transportation costs of components are excluded

Table 4 below shows the comparison between the market prices in Tables 2 with the budgeted cost of the solar projects assessed.

Table 4: Comparison between Budgeted Costs and Average Market Prices

Location	Number of Units	Budgeted Amount	Average Price per unit from Budget	Average Market Price	Percentage of Inflated Cost
Solar Lighting Solutions					
Kaduna					
Construction of solar street light at Badiko, Kurmin Mashi, T/Nupawa, T/Wada, Sabon Gari, Kaduna State	20	20,000,000	1,000,000	200,000	400%
Construction of solar street light at Tudun Wada, Kaduna South, Kaduna State	48	10,000,000	208,333	190,000	9.6%
Bauchi					
55 poles of solar street light at Toro LGA	55	22,000,000	400,000	225,000	77%
Provision of solar panelled street light systems (American model-California), Bayan Bata, Unguwar Jaki, Kobi, Hardo Ward in Bauchi LGA	24	25,120,000	1,046,666	225,000	365%
Nasarawa					
Construction of 11 Solar street lights in Tudun Kofa to Central Market Road in Keffi LGA	11	6,600,000	600,000	225,000	166%
Provision of solar powered street lights in Ekkah Wangibi, Nasarawa - Eggon LGA, Nasarawa State	Unknown	10,000,000	-	220,000	-
Construction of 11 solar street light from Pilot Primary School to Abaga Palace, Garaku	11	6,600,000	600,000	225,000	166%

Provision of solar powered streetlight at Doma town, Nasarawa state	20	20,000,000	1,000,000	220,000	354%
Lagos					
Solar street light at Eugene Ndubuisi Close/Osi-Efa Crescent at Lilly Estate, Amuwo Odofin, Off Festac link road, Lagos state	Unknown	30,000,000	-	200,000	-
Solar street lights at Balogun Elegbata street & Docemo Street, Island 1, Lagos State.	15	15,000,000	1,000,000	220,000	354%
Solar power street light at Adegunwa Street, Aguda, Surulere, Lagos	Unknown	6,000,000	-	220,000	-
Rivers					
Solar street light at Hanetu lane/Orieku street Orogbum, Port-Harcourt, Rivers	12	10,000,000	833,333	225,000	270%
Imo					
Solar powered street light in Afor Ibeme market (Ibeme Ugiri Mbano), Isiala Mbano LGA, Imo North Senatorial District	23	35,000,000	1,521,739	220,000	591%
Installation of solar street lights at Ama Barnax/Umunrmo road, Ahiazu Mbaise LGA	6	8,000,000	1,333,333	200,000	566%
Solar Borehole Solution*					
Kaduna					
Location	**Number of Units**	**Budgeted Amount**	**Average Price per unit from Budget**	**Average Market Price**	**Percentage of Inflated Cost**
Provision of solar borehole at Barnawa, Kaduna South, Kaduna	1	10,000,000	10,000,000	-	-

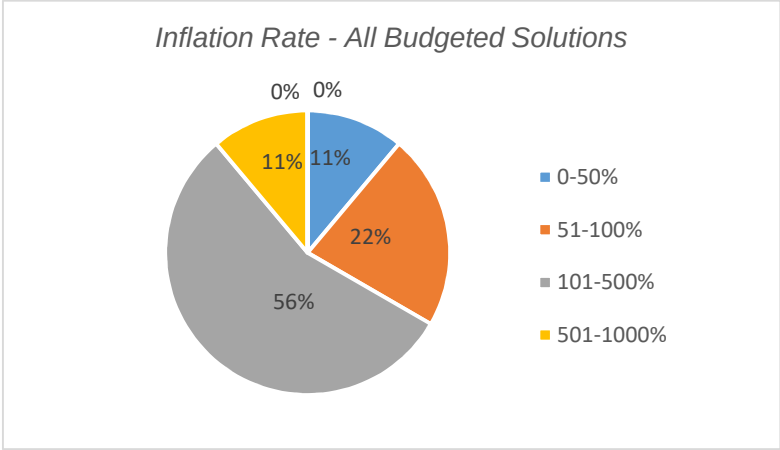
Provision of solar powered borehole in Bayan Dutse, Narayi ward , Chikun LGA, Kaduna state	1	12,500,000	12,500,000	8,000,000	56%
Solar powered borehole at railway road by Joji road, Bakin Masallachi, Hayin Banki Kawo, Kaduna State	1	10,000,000	10,000,000	7,500,000	33%
Bauchi					
Two panel solar borehole at Bayan Bata, Bauchi LGA	1	3,600,000	3,600,000	800,000	350%
Two panel solar borehole at Gubi village, Bauchi LG	1	3,600,000	3,600,000	800,000	350%
Solar powered boreholes at Ungwan Kanawa, Bauchi LGA	1	20,000,000	20,000,000	-	-
Nasarawa					
Solar powered borehole at Akwanga, Nasarawa Eggon, and Wamba LGA, Nasarawa State	1			-	-
Lagos					
Solar powered borehole at 22 Road, between J&K Close, Festac Town, Amuwo Odofin LGA, Lagos State	1	7,600,000	7,600,000	-	-
Solar powered borehole at Ijegun Egba Beach, by Celestial Church, Amuwo Odofin LGA, Lagos State.	1	7,600,000	7,600,000	5,000,000	52%
Rivers					
Solar water borehole (20,000 litres) with fetching point at Palace Road, Oyigbo, Rivers State	1	50,000,000	50,000,000	18,000,000	177%
Imo					
Construction of solar powered borehole in with perimeter fencing at St Mary's Catholic Church, Iho, Dimeze, Ikeduru, Imo State	1	20,000,000	20,000,000	-	-

Provision of solar powered borehole at St. Patrick's Secondary School Ogbe, Ahiazu Mbaise LGA, Imo State	1	10,000,000	10,000,000	5,000,000	100%

It is to be noted that the cost of drilling boreholes varies by location, depth of aquifer, topography of the area, amongst various factors. It is therefore possible that a solution might cost significantly more than the average market price for such solutions in a particular terrain. In terms of capacity; for solar street lighting projects, the average capacity of 36W/40W LED lighting solution is assumed while for the solar powered borehole, the average capacity for community water provision of 20,000 litres is assumed for solutions with no information on installed capacity.

The overall inflation of costs is as detailed in Figure 7 below

Figure 7: Inflation Rate of All Assessed Solar Solutions



This is specifically disaggregated in Figures 8 and 9 below.

Figure 8: Inflation Rate of Solar Lighting Solutions

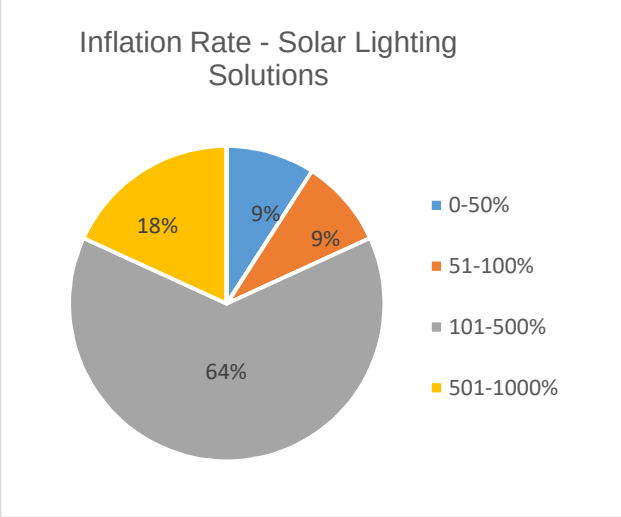
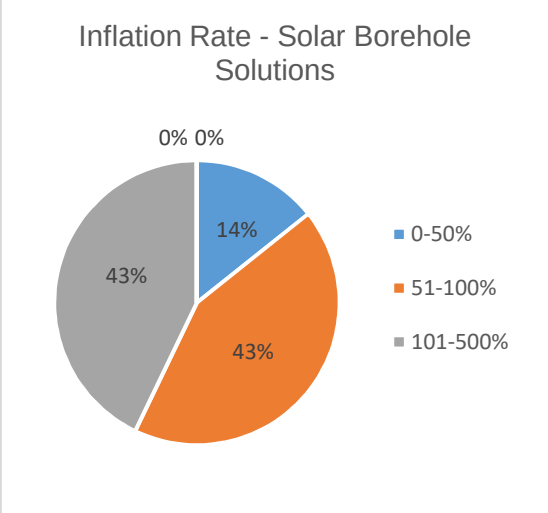


Figure 9: Inflation Rate of Solar Borehole Solutions



From Table 4, there is an average percentage inflated cost of 246% with a maximum of 591% and a minimum of 9.6%. Solar lighting solutions had an average inflation rate of 301% with a maximum of 591% and minimum of 9.6% while solar borehole solutions had an average inflation rate of 159% with a maximum of 350% and minimum of 33%. Out of the 26 projects assessed and 18 projects with their inflation rates determined, 13 had significantly inflated costs (over 100%). From Figures 7 to 9 above, it can be seen that for solar lighting solutions, most of the inflation rate was within 101-500% while for solar powered boreholes, this was between 50-500%.

The inflated costs of these solutions coupled with the fact that most of them are not functional gives the false impression that solar solutions are too expensive and have no value for the amount of money invested. However, solar solutions are designed to be more cost-effective than their conventional alternatives and if installed, secured and maintained properly, it would show significant value for money and savings over conventional fossil energy options. Only one project showed approximate consistency between the budgeted cost and the actual market cost.

2.6 EFFICIENCY OF THE INVESTEMENTS

The first issue on efficiency, which is about *ensuring that maximum useful output is achieved at the minimum level of input cost,*[8] deals also to a good extent, with economy for these solar solutions. It is about the high rate of inflated cost which could be attributed to a lot of possible factors including:

- Flawed procurement process vis, contract bidding and proposal evaluation process.
- Presence of middlemen who have to be “settled” during the contract awarding process from personnel or ministry staff, to the “selected” contract awardee before getting to the actual firm that would execute the contract.
- Poor knowledge of solar solutions by those bidding for the project.
- The false impression that solar solutions are meant to be expensive.
- Inflation of costs for government contracts due to lack of inspection and proper scrutiny of projects.

To ascertain the efficiency of a standard street lighting solution throughout its lifespan, various factors are considered including the technical components of the street lighting solution and the estimated future costs of maintenance in comparison with traditional alternatives. The conventional and traditional alternative is deemed to be the use of generators considering that available grid energy fails to meet 40% of the energy needs of Nigerians connected to it. The study adopts the full life cycle costing approach to determine the actual financial outlays needed to run the two sets of projects over their life time. It did not stop at the initial upfront cost of acquisition. First, the properties of the components for the solar street lighting and borehole solutions are shown in Table 5 and 6 respectively.

[8] Afhemike, supra.

Table 5: Properties of Solar Lighting Solution Components

Component	Average Lifespan	Average Market Price
Solar Panel (200W, 24V)	25 years	2012 – N70,000 2013 – N45,000 2014 – N45,000 2015 – N55,000 2016 – N85,000
Lead Acid Battery (150Ah, 12V)	3 years	2012 – N60,000 2013 – N40,000 2014 – N45,000 2015 – N45,000 2016 – N100,000
Charge Controller (10-20Amps)	5 years	2012 – N26,000 2013 – N22,000 2014 – N18,000 2015 – N18,000 2016 – N36,000
Galvanized Steel Pole Structure (6m)	> 25 years	2012 – 35,000 2013 – 30,000 2014 – 27,000 2015 – 27,000 2016 – 45,000
LED Bulb (36W)	5 years	2012 – N24,000 2013 – N22,000 2014 – N18,000 2015 – N13,000 2016 – N26,000

Table 6: Properties of Solar Borehole Solution Components

Component	Average Lifespan	Average Market Price
Solar Panel (200W, 24V	25 years	2012 – N70,000 2013 – N45,000 2014 – N45,000 2015 – N55,000 2016 – N85,000
Solar Charge Controller (10-20Amps)	5 years	2012 – N26,000 2013 – N22,000 2014 – N18,000 2015 – N18,000 2016 –N36,000
Galvanized Steel Structure	> 25 years	Varies by project

Tank	> 25 years	Varies by project
Treatment Unit (if required)	-	Varies depending on treatment required
Pump (2Hp)	5 years	2012 – 290,000 2013 – 270,000 2014 – 270,000 2015 – 300,000 2016 – 600,000

The properties for a conventional street lighting and water borehole solution are shown in Tables 7 and 8 respectively below.

Table 7: Properties of Conventional Lighting Solution Components

Component	Average Life Span	Average Market Price
Galvanized Steel Pole Structure (6m)	> 25 years	2012 – 35,000 2013 – 30,000 2014 – 27,000 2015 – 27,000 2016 – 45,000
LED Bulb	5 years	2012 – N24,000 2013 – N22,000 2014 – N18,000 2015 – N13,000 2016 – N26,000
Diesel Generator (1KVA)	5 years	2012 – N22,000 2013 – N26,000 2014 – N30,000 2015 – N34,000 2016 – N38,000

Table 8: Properties of Conventional Borehole Solution Components

Component	Average Life Span	Average Market Price
Steel Structure	> 25 years	Varies by project
Treatment Unit (if required)	-	Varies depending on treatment required
Tank	> 25 years	Varies via project
Pump (2Hp)	5 Years	2012 – N50,000 2013 – N40,000 2014 – N70,000 2015 – N70,000

		2016 – N100,000
Diesel Generator (2.2KVA)	5 years	2012 – N40,000 2013 – N45,000 2014 – N55,000 2015 – N65,000 2016 – N73,000

For purposes of fair comparison, it is assumed that the physical structure of the solar solution and conventional solution are the same with the differences being with the fuel component - solar panels, batteries, charge controller for the solar solution; generator and fuel for the conventional solution.

Within the past 10 years, inflation rate in Nigeria has averaged 12.27%[9]. The average price of solar components for the 25 year lifespan, starting from the date of installing the solution was calculated using this average in the context of this study. The actual market price of components that were replaced between 2012 and 2016 were used whilst adding estimated prices on replaceable components after 2016. The estimated maintenance price (cleaning of solar panels, fixing any electrical faults, etc.) was used during the 25 year period based on the average inflation rate. Essentially, the actual prices of any replaceable components between 2012 and 2016 was used and then the estimated market price used for future years.

Projects in 2012

- Solar street lighting solution: **N5,576,281** for the 25 year lifespan = approximately **N18,587** monthly = approximately **N611** daily.
- Solar powered borehole: **N12,266,156** for the 25 year lifespan = approximately **N40,887** monthly = approximately **N1,344** daily.

Projects in 2013

- Solar street lighting solution: **N7,416,855** for the 25 year lifespan = approximately **N24,722** monthly and approximately **N812** daily.
- Solar powered borehole: **N11,334,552** for the 25 year lifespan = approximately **N37,781** monthly and approximately **N1,243** daily.

Projects in 2014

- Solar street lighting solution: **N5,877,263** for the 25 year lifespan = approximately **N19,590** monthly and approximately **N644** daily.
- Solar powered borehole: **N11,176,286** for the 25 year lifespan = approximately **N37,254** monthly and approximately **N1,224** daily.

[9] Trading Economics (2016) *Nigeria Inflation Rate* [online]. Available at: http://www.tradingeconomics.com/nigeria/inflation-cpi [Accessed 29th December 2016].

Projects in 2015

- Solar street lighting solution: **N5,654,359** for the 25 year lifespan = approximately **N18,847** monthly and approximately **N619** daily.
- Solar powered borehole: **N11,645,117** for the 25 year lifespan = approximately **N38,817** monthly and approximately **N1,276** daily.

For the conventional solutions, the average price of components for the 25 year lifespan was calculated using the average inflation rate (12.27%) in the context of this study. Estimates for components with lifespan of 4 years (up until 2016) and below were calculated using exact prices within those years and adding estimated prices on replaceable components and estimated maintenance (fixing any electrical faults, etc.) during the 25 year period while working with the average inflation rate. Estimated generator replacement and fuel costs were also included. Actual prices of any replaceable components between 2012 to 2016 was used and then the estimated inflated market price used for future years.

Projects in 2012

- Street Lighting: **N13,447,058** for the 25 year lifespan = approximately **N44,823** monthly = approximately **N1,473** daily
- Borehole Solution: **N17,725,124** for the 25 year lifespan = approximately **N59,083** monthly = approximately **N1,942** daily

Projects in 2013

- Street Lighting: **N12,671,398** for the 25 year lifespan = approximately **N42,237** monthly = approximately **N1,388** daily
- Borehole Solution: **N17,559,862** for the 25 year lifespan = approximately **N58,532** monthly = approximately **N1,924** daily

Projects in 2014

- Street Lighting: **N12,342,207** for the 25 year lifespan = approximately **N41,140** monthly = approximately **N1,352** daily
- Borehole Solution: **N17,716,607** for the 25 year lifespan = approximately **N59,055** monthly = approximately **N1,882** daily

Projects in 2015

- Street Lighting: **N11,948,930** for the 25 year lifespan = approximately **N39,829** monthly = approximately **N1,309** daily
- Borehole Solution: **N18,250,161** for the 25 year lifespan = approximately **N60,833** monthly = approximately **N2,000** daily

The calculations and figures obtained above show the estimated cost for an ideal solar street lighting solution as compared with an ideal conventional street lighting solution. This shows an average savings of about N6,899,763 in total and about N275,990 annually over a period of 25 years with a solar lighting solution per unit. It shows an average expense of N19,000 monthly and N625 daily for a single unit of solar lighting solution as estimated compared with N42,007

monthly and N1,380 daily of a conventional street lighting solution. The cost-effective benefits and value for money are calculated on the basis that the projects are executed and maintained according to standard practices.

The calculations and figures detailed above also show the estimated cost for an ideal solar water borehole solution as compared to an ideal conventional water borehole solution for 1000 litres tank solution. This shows an average savings of about N6,207,411 in total and N248,296 annually over a period of 25 years for a solar water borehole solution. It shows an average expense of N38,684 monthly and N1,271 daily for a solar borehole solution as compared to N59,375 monthly and N1,937 daily of a conventional water borehole solution.

However, it is very important to note that the estimated cost of the solar solution throughout its lifespan was inflated significantly considering that the cost of solar solutions would be much less, especially as the price of solar components have been reducing significantly over the past 10 years and would continue to reduce as technology matures and advances. The International Renewable Energy Agency (IRENA) has predicted that the average cost of solar PV is expected to decrease by as much as 59% by 2025 compared to 2015 prices[10]. Therefore, it is expected that the costs of solar components would be significantly reduced in coming years. Also, solar solutions entail little or no maintenance, requiring only the cleaning of the panels at intervals and any electrical issues that might arise over time. So, the total cost is expected to be significantly cheaper than estimated and as such, show higher value for money than conventional solutions whose fuel costs alone have rather shown a constant increase in price over the years.

Furthermore, the CO_2 savings from these solar solutions and the accompanying carbon credits, hitherto a neglected important financial component, health benefits, prevention of noise pollution, amongst other positive attributes justify the use of these solutions. There is however a major need to make sure the components are of the right standard and quality and properly installed and operated to achieve optimum efficiency in energy delivery. The certified emission reduction and carbon credit component will make it attractive and imperative to employ staff to maintain the facilities and assure its continuous and sustainable functioning – because of annual verification by Designated Operational Entities.

In order to further review the value for money of the assessed projects, the budgeted amount of each individual solar solution is compared with their estimated value upon assessment. The value of the project was ascertained taking into consideration the cost and quality of components used, estimated constructions costs, period of functionality amongst other factors. To ascertain the cost-effectiveness of the project, the daily cost of the assessed project is multiplied by the number of days the project was fully functional divided by the total number of days the project has been existing and expressed as a percentage. The percentage is graded as follows.

[10] IRENA (2016) *The Power to Change: Solar and Wind Cost Reduction Potential to 2025* [online]. Available at: http://www.irena.org/DocumentDownloads/Publications/IRENA_Power_to_ Change_2016.pdf [Accessed 9th January 2017].

Not Executed/Abandoned	None
0 – 40%	Poor
41 – 60%	Average
61 – 80%	Good
81 – 100%	Very Good

To ascertain the socio-economic benefits, the same method is used. Each day the project is functional, socio-economic value is provided to the locals. The number of functional days is divided by the total number of days the project has existed and then expressed as a percentage to get the socio-economic value. The percentage is graded as follows.

Not Executed/Abandoned	None
0 – 40%	Poor
41 – 60%	Average
61 – 80%	Good
81 – 100%	Very Good

To ascertain the environmental benefit, the number of functional days of the project is multiplied by the estimated daily CO_2 savings and divided by the product of the total number of days the project has been in existence and the estimated CO_2 savings within that period, and expressed as a percentage. In addition, the environmental impacts in terms of abandoned solar components is also considered. The percentage is graded as follows.

Not executed/Abandoned	None
0 – 40%	Poor
41 – 60%	Average
61 – 80%	Good
81 – 100%	Very Good

Table 9: Value for Money of Assessed Projects based on Established Criteria

Location	**Meets Criteria**
Kaduna	
Construction of solar street light at Badiko, Kurmin Mashi, T/Nupawa, T/Wada, Sabon Gari, Kaduna State	Quality: Good Socio-economic value: Average Cost-Effectiveness: Average Environmental Benefit: Average
Construction of solar street light at Tudun Wada, Kaduna South, Kaduna State	Quality: Good Socio-economic value: Average Cost-Effectiveness: Average Environmental Benefit: Average
Provision of solar borehole at Barnawa, Kaduna South, Kaduna	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Provision of solar powered borehole	Quality: Good

in Bayan Dutse, Narayi ward , Chikun LGA, Kaduna State	Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Solar powered borehole at railway road by Joji road, Bakin Masallachi, Hayin Banki Kawo, Kaduna State	Quality: Good Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Bauchi	
55 poles of solar street light at Toro LGA.	Quality: Good Socio-economic value: Average Cost-Effectiveness: Average Environmental Benefit: Average
Provision of solar panelled street light systems (American model-California), Bayan Bata, Unguwar Jaki, Kobi, Hardo ward in Bauchi LGA.	Quality: Good Socio-economic value: Average Cost-Effectiveness: Average Environmental Benefit: Average
Two panel solar borehole at Bayan Bata, Bauchi LGA	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Two panel solar borehole at Gubi village, Bauchi LG	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Solar powered boreholes at Ungwan Kanawa, Bauchi LGA	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Nasarawa	
Construction of 11 Solar street lights in Tudun Kofa to Central Market Road in Keffi LGA	Quality: Poor Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Provision of solar powered street lights in Ekkah Wangibi, Nasarawa - Eggon LGA, Nasarawa state	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Construction of 11 solar street light from Pilot Primary School to Abaga Palace, Garaku	Quality: Poor Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Provision of solar powered streetlight at Doma town, Nasarawa state	Quality: Good Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Solar powered borehole at Akwanga, Nasarawa Eggon, and Wamba LGA, Nasarawa State	Quality: None Socio-economic value: None Cost-Effectiveness: None

	Environmental Benefit: None
Lagos	
Solar street light at Eugene Ndubuisi Close/Osi-Efa Crescent at Lilly estate, Amuwo Odofin, Off Festac link road, Lagos state	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Solar street lights at Balogun Elegbata street & Docemo street, Island 1, Lagos State.	Quality: Poor Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Solar power street light at Adegunwa street, Aguda, Surulere, Lagos State.	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Solar powered borehole at 22 road, between J&K Close, Festac town, Amuwo Odofin LGA, Lagos State	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Solar powered borehole at Ijegun Egba beach, by Celestial church, Amuwo Odofin LGA, Lagos State.	Quality: Good Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Rivers	
Solar street light at Hanetu lane/Orieku street Orogbum, Port-Harcourt, Rivers	Quality: Good Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Solar water borehole (20,000 ltrs) with fetching point at Palace road, Oyigbo, Rivers state	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Imo	
Solar powered street light in Afor Ibeme market (Ibeme Ugiri Mbano), Isiala Mbano LGA, Imo North Senatorial District	Quality: Poor Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Installation of solar street lights at Ama Barnax/Umunrmo road, Ahiazu Mbaise LGA	Quality: Poor Socio-economic value: Poor Cost-Effectiveness: Poor Environmental Benefit: Poor
Construction of solar powered borehole in with perimeter fencing at St Mary's Catholic Church, Iho, Dimeze, Ikeduru, Imo State	Quality: None Socio-economic value: None Cost-Effectiveness: None Environmental Benefit: None
Provision of solar powered borehole at St. Patrick's Secondary School Ogbe, Ahiazu Mbaise LGA, Imo state	Quality: Good Socio-economic value: Good Cost-Effectiveness: Good Environmental Benefit: Good

The results show that 80% of the projects generally had no reasonable value for money especially in terms of their socio-economic, cost-effective and environmental benefits. Most contractors tried to maximize profits in executing the projects and as such, used substandard components and equipment. This suggests that most government contracts are not monitored to check for quality assurance, functionality and standards, etc. Alternatively, the official monitoring and evaluation team either do not have the capacity to properly assess job quality or are compromised to turn a blind eye to their duties.

In the light of the foregoing, the need for maintenance and sustainability, CSOs can be trained and entrusted with the authority to run and ensure the functioning of these facilities as CER (Carbon Credit) generating entities. This will have enormous multiple benefits namely:

- Nationally Determined Contribution targets could be attained through measuring, reporting and verification (MRV).
- It will generate employment for the locals.
- Excess CERs could generate revenue for the community and authority responsible for the project.
- It will provide FGN access to international funds like Green Climate Funds (GCF), Nationally Appropriate Mitigation Action (NAMA) Funds, Climate Change Adaptation Fund's Direct Access Modality, Community Development Carbon Fund of the World Bank (CDCF) etc.
- Lead to establishing and implementing other low-carbon projects, thus enhancing the growth of the green economy which is the future trend and a solution to a lot of economic and social challenges we are now facing in the country.
- Huge benefits at both macro- and micro-economic levels.
- Nigeria will be better positioned to lead the sub-region in matters pertaining to climate change mitigation and adaptation and become a hub for low-carbon technology transfer for the sub-region (Regional – West African - Emission Trading Scheme).

These 80% liabilities can be turned into assets, to the benefit of everybody at the community level all the way to the federal level. CSOs should consider engaging the Federal Ministry of Environment as the country's Designated National Authority (DNA) and UNFCCC focal point for Nigeria to nominate a group of non-state actors (i.e. selected CSOs etc.,) to undergo the capacity building exercises being offered free by the climate change body. It will not cost Nigeria anything but will bring her a lot of benefits.

SECTION 3: PLANNING, BUDGETING, LOCATION OF PROJECTS AND COMMUNITY ENGAGEMENT

3.1 PLANNING AND LOCATION OF PROJECTS

It is pertinent to recall that the Electric Power Sector Reform Act 2005 made provisions for the establishment of a Rural Electrification Agency. The Minister of Power in consultation with the Agency is mandated to prepare a sustainable and coordinated Rural Electrification Strategy and Plan for the President's approval within one year of the commencement of the Act. On a quarterly basis, the Minister in consultation with the Agency is to submit reports to the President on the implementation and achievements of the Rural Electrification Strategy and Plan including information on expansion of the grid, the development of isolated and mini grid power solutions and renewable energy power generation. From all searches, the Minister is yet to prepare the Rural Electrification Strategy and Plan and the accompanying Rural Electrification Fund is yet to be set up[11]. Even if there are drafts of the Strategy and Plan, they have not been approved by the President and in the unlikely event of the Plan and Strategy having received presidential approval, the document has not been activated to inform implementation of rural electrification and renewable energy projects.

Some of the projects monitored turned out to be the constituency projects of federal legislators in the Senate and House of Representatives respectively. They were simply political projects for the legislators to show that they were able to attract federal presence and there was no needs assessment or proper evaluation of their proposed contribution to the communities. From the foregoing, there seems to be a vacuum, the absence of empirical criteria for the determination of the need and location of renewable energy projects especially in street lighting and water. Rather, it seems to depend on the ability of particular political office holders to attract projects to their constituency or location of choice. The implication of the political nature of some of the projects is the high level of abandoned and uncompleted projects. A new legislator will not likely request for funds to complete a pending project started by his predecessor; rather, he will start new projects from the scratch and abandon the uncompleted one. Babatunde Raji Fashola, the current Minister of Works, Power and Housing reports that the Ministry has about 2000 uncompleted power related projects, being the constituency projects of legislators, in need resources for their completion[12]. This is clearly a case of waste and absence of coordination and strategic investment of national resources. Again, it is evident that there are no clear rules to guide legislators on the selection and design of projects that will be included in the Federal Appropriation Act as constituency projects.

The foregoing shows a budgeting process in need of reform especially in the area of proper documentation of existing and on-going projects. MDAs should be placed under budgetary obligation to complete on-going projects before requesting for funds for new ones or in the alternative show cogent, strong and sufficient cause as to the reasons informing the abandonment of an existing project.

[11] This is contained in section 88 of the Electric Power Sector Reform Act of 2005.
[12] Babatunde Fashola speaking at the Nextier Power Dialogue held in Abuja on January 18 2017.

Again, there is no empirical link between these budgetary renewable energy projects and the National Renewable Energy and Energy Efficiency Policy (NREEEP) and the National Energy Efficiency Action Plan (NEEAP)[13]. It should be recalled that these policies show the intention of Nigeria to achieve an electricity vision of attaining 30,000MW of power by the year 2030 with at least 30% renewable energy in the electricity mix (Electricity Vision 30:30:30) pursued in three-pronged stages of attaining stable, then the sustainable and the uninterruptible power supply in Nigeria. The rate at which projects are not executed, abandoned and break down soon after commission is not evidence of a planned and value driven action at mainstreaming renewable energy options.

The monitors discovered that some of the projects were sited at locations and communities that do not need the projects. Also, the location of projects seem not to be based on any master plan which identifies areas in need in an order of prioritisation. For instance, the solar powered borehole which was not executed but planned for 22 Road, between J and K Road of Festac Town in Amuwo Odofin LGA of Lagos State was not necessary and could not have served any useful purpose. The area is already served by the Festac Water Works which had water reticulated around Festac Town. Even if the Water Works had developed fault, all that was needed was to repair same rather than digging isolated boreholes around the town. Also, the budgetary provision of N30m for an un-executed solar project facility at Eugene Ndubuisi Close/Osi-Efa Crescent at Lilly Estate, Amuwo Odofin, off Festac Link Road in Lagos State seems to have been made on the basis of politically connected personalities and not on any empirical fact of its service to the wider community. This is not a major road or estate and the allocation seems arbitrary.

Provision of solar energy is a key strategy to mitigate climate change. Some of the allocations are very poor. For example, only N247,947 was allocated to provision of Solar Farm at Umuoka Community in Udi LGA of Enugu State in 2015 under the Rural Electrification Agency. Some of the projects have been repeatedly provided for over three years indicating that the provisions were either insufficient or monies were not released or utilized. Care must be taken to ensure that full value is derived from the allocations through the deployment of economy, efficiency and effectiveness of spending[14].

The entirety of the whole solar electrification projects (like street lights and mini grids) in the 2015 budget amounts to the sum of N533,900,867, while that of 2016 came up to N4,000,345,838. For the Ministry of Power, their solar related appropriations are as detailed in Table 10.

Table 10: Allocations to Solar Energy in the Ministry of Power

Year	Amount	Year	Amount
2016	7,281,842,618.00	2013	1,647,400,000.00
2015	555,900,876.00	2012	158,250,000.00
2014	1,262,210,000.00		
Total	**10,905,603,494.00**		

[13] National Energy Efficiency Action Plans 2015-2030 adopted by the Inter-Ministerial Committee on Renewable Energy and Energy Efficiency and approved by the National Council on Power in July 2016.
[14] Budgeting for Climate Change in the Energy Sector, Centre for Social Justice, 2016.

Table 11 shows solar related votes in the budgets of three MDAs notably Ministries of Water Resources, Lands and Housing and Science and Technology.

Table 11: Solar Related Votes in the Budgets of 3 MDAs: 2012-2014

Year	Water Resources	Lands and Housing	Science and Technology	Total
2012	3,772,689,409.00	6,145,831,283.00	10,696,921,741.00	**20,615,442,433.00**
2013	8,545,581,814.00	1,484,109,999.00	7,033,601,229.00	**17,063,293,042.00**
2014	3,691,724,198.00	675,900,000.00	3,598,254,750.00	**7,965,878,948.00**
Total	**16,009,995,421.00**	**8,305,841,282.00**	**21,328,777,720.00**	**45,644,614,423.00**

These undulating allocations do not show a trend of consistent allocations to meet set targets. It is recommended that that renewable energy interventions to meet set targets be properly costed and the financing spread across the years so that on a year to year basis, the adequacy or inadequacy of the funds provided will become clear[15].

3.2 COMMUNITY ENGAGEMENT

The community reaction to the project can be grouped into four trends as follows. They were generally positive; generally negative; unconcerned; or unaware.

The graphs below show the local reactions per state.

Figure 10: Community Reaction in Bauchi

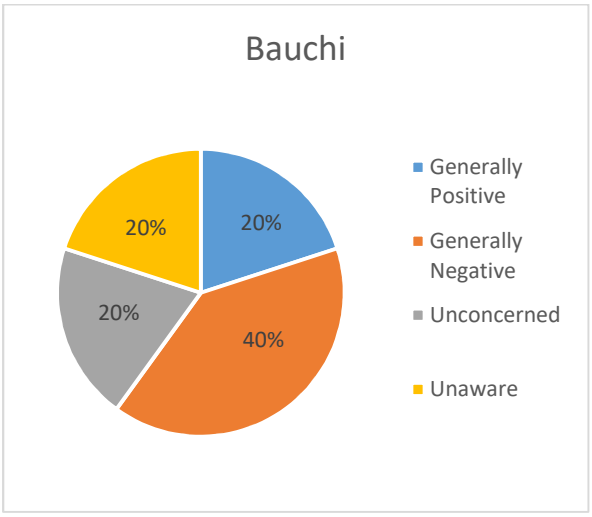
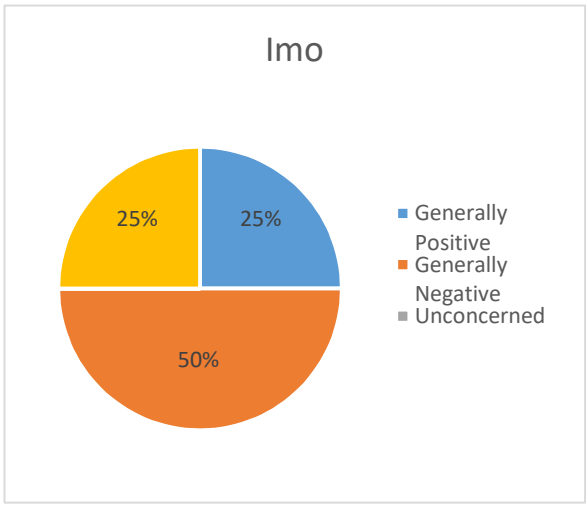


Figure 11: Community Reaction in Imo



[15] Budgeting for Climate Change in the Energy Sector, supra.

Figure 12: Community Reaction in Kaduna

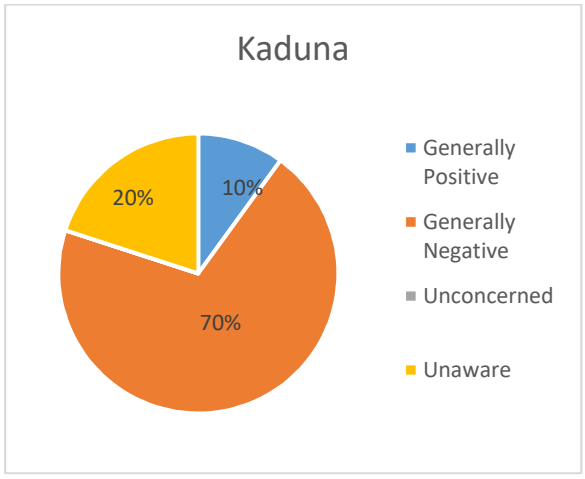


Figure 13: Community Reaction in Lagos

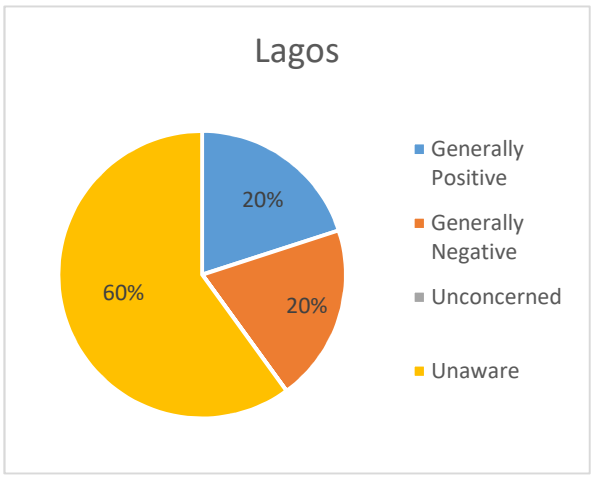


Figure 14: Community Reaction in Nasarawa

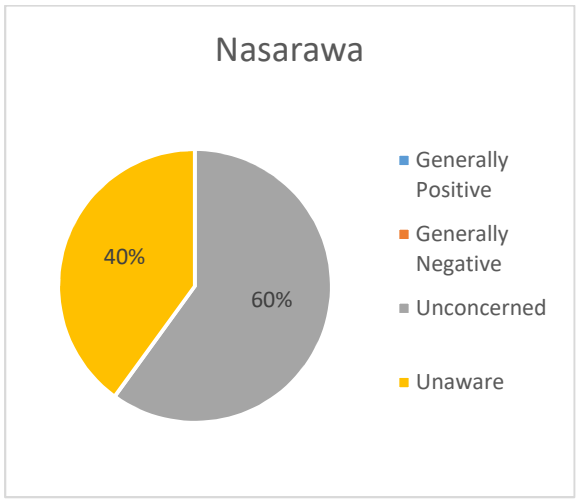


Figure 15: Community Reaction in Rivers

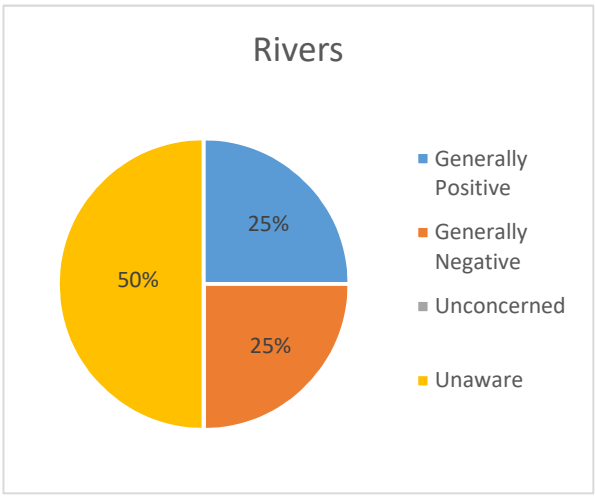
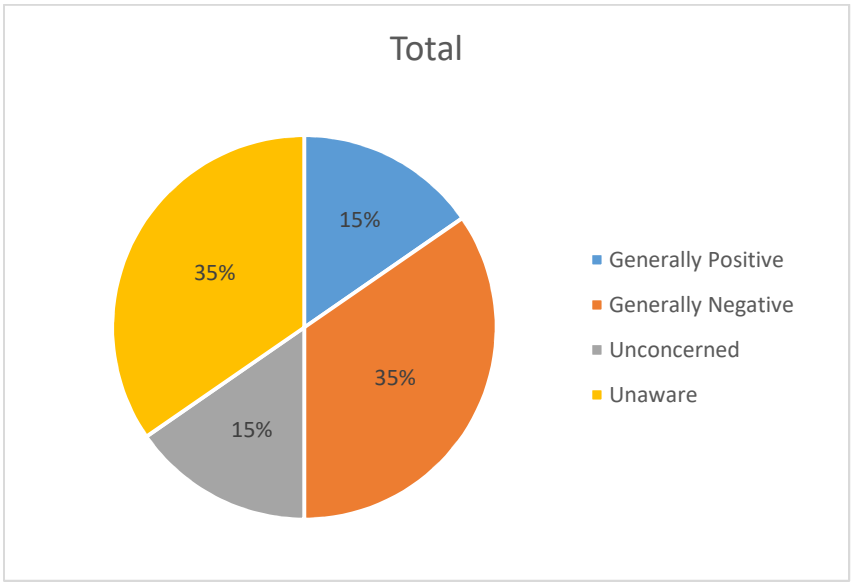


Figure 16: Aggregate Community Reaction in the Six States



In total, the community reaction was either generally negative or generally unaware. The fact that majority were generally negative can be explained by the fact that 53% of the projects

executed were partly working/broken down and 40% were non-functional, leaving just 7% functional. 35% of the total projects were not executed which explains why most locals were unaware of such projects in their communities. The most ridiculous was the fact that in some instances such as the construction of a solar powered borehole with perimeter fencing in St. Mary's Catholic Church in Iho, Dimeze, Ikeduru in Imo state, the church officials who have been there for several years did not even know that such a project was appropriated in the federal budget. How could such a project with a specific site be initiated and approved without the knowledge of the owners of the site? This not only shows a huge disconnect between the project initiators and the community but the total absence of community engagement.

During the assessment including field work and data collection, various observations and challenges were made which are highlighted below. The monitors observed from their discussions with the locals that in most cases, theft of the components began once the solution stopped working even if it was due to a minor fault, or for any other reason probably due to poor quality components used. Most locals were actually concerned and had made personal efforts in fixing the non-functional solutions but were unsuccessful due to their lack of technical expertise in solar technologies.

SECTION FOUR: CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The study reviewed FGN awarded solar projects being carried out across the country. It provided results from the desk study and field assessment exercise carried out and extensively discussed the value for money, quality of the projects assessed, functionality of these projects, community reaction while highlighting the challenges of the project. It also discussed how the projects fitted into the policy, plan budget continuum. It has shown that solar solutions have a greater value for money when compared with alternative conventional solutions. It has lots of benefits which besides its cost-effectiveness and socio-economic benefits, also ensures the functionality of these solutions during for example, periods of fuel scarcity as compared to conventional solutions. Rural and urban residents want certain social amenities such as clean water, security and energy to power day to day social and economic activities. Solar solutions provide a sustainable way of meeting these needs should they be installed and maintained properly and according to specifications.

While the results of the value for money of the assessed projects tend to give the impression that solar projects are a drain on public resources due to their non-functionality after a few years, and in some cases, just months after installation, it is very important to note that this should prompt an inquiry into the procurement process of these solutions. Most of the projects were awarded at highly inflated costs. The inquiry should be on the process of contracting solar projects by federal MDAs to ascertain whether there was the required procurement planning, competition and the quality of materials used by contractors in relation to specifications. There are also issues around monitoring and evaluation of projects by MDAs. It also raises issues about the general lack of maintenance and massive theft of project components which defeats the value and purpose of the projects. In some cases, the projects are not even executed. These solar projects if installed, maintained and secured properly will attract socio-economic development to the communities where they are located.

The study confirms that budgeting for renewable energy solutions is not empirically linked to renewable energy policies and plans such as the Electric Power Sector Reform Act, NREEEP, NEAP, etc. The Rural Electrification Strategy and Plan has not been drawn up and the accompanying Rural Electrification Fund is yet to be set up. The Strategy and Fund would have made adequate provisions for renewable energy. In the event, the Strategy and Plan has been approved, there is no evidence that it informs budgetary decisions. Thus, the links between policies, plans and the budget is very weak.

The budget is suffused with so many solar and renewable energy projects which cannot be adequately funded with available resources. This leads to resources being spread so thin and repetitive appearance of some projects year after year.

Community issues show that sensitisation, awareness creation and knowledge dissemination about renewable energy is low. Members of the communities where renewable energy projects are located have not been engaged and sensitised on the usefulness and relevance of the projects. Again, communities are not engaged through a needs assessment in identification of

the projects. This leads to lack of community ownership, involvement and participation. Thus, projects pack up for minor repairs which could have been paid for by the community; theft of solar components is rampant and the projects actually belong to no one. This creates a sustainability and management challenge for the projects.

Available evidence shows a preponderance of low quality and substandard renewable energy products being used by FGN contractors. There seems to be a lack of standardisation, regulation for solar equipment coming into the country and effective quality control. This has led to the massive inflow of substandard solar components which fall short of required international standards but are used largely especially, in executing public solar projects in the country. The implication is the regulatory agencies like the Standards Organisation of Nigeria have not been doing their regulatory oversight as required by the laws. Most imported solar components lack trademark certificates and compliance with existing standards, with the exception of few solar firms who actually ensure the use of the right components to maintain their professional integrity. As such, the cost of carrying out public solar projects is even more difficult to justify when such substandard components are used. It has therefore become imperative to boost the capacity of the agencies to ensure quality and standards.

Most of the budgetary projects were implemented with an assemblage of various components which makes them amenable to pilfering. However, there are new products which are integrated and reduce the risk of theft of components, are of better quality and last longer when compared with the usual solutions. The need for innovation is therefore crystallizing.

4.2 RECOMMENDATIONS

The key recommendations arising from this study are detailed below.

For Federal MDAs

- Full observance of the provisions of the Public Procurement Act 2007 has become imperative. This should start with procurement planning, the entire bidding process which ensures competition, prevents bid rigging and ensures value for money.

- Provisions should be made for maintenance of these solutions by the contractor for a guaranteed length of time and not just based on an “install and abandon” basis. This is because some components require replacement after certain period of time and just installing and abandoning would reduce their full lifespan value.

- As a follow up to the above, contractors should be paid fully upon expiration of the standard warranty period of their solutions. Government should also consider giving the contractors retainership contracts after the guarantee period, to ensure maintenance and optimal functioning of the facilities.

- To standardize prices and avoid inflation of contract works, the Bureau of Public Procurement in accordance with its mandate should provide a price database of renewable energy components to all federal MDAs and update same from time to time based on changing macroeconomic indicators.

- Contracting agencies should work closely with reputable bodies in the sector such as the Sustainable Energy Practitioners Association of Nigeria (SEPAN), the Renewable Energy Association of Nigeria (REAN) who have experienced professionals in this sector and can facilitate the vetting of bids on renewable energy projects.

- It is imperative to strengthen the monitoring, inspection and approval units of federal MDAs for proper monitoring of the standard and quality of work done by the contractors, functionality of the projects and ascertain if these projects were actually executed in accordance with specifications.

- Rationalise projects and stop spreading resources too thin. Include in budgets only those projects that can be adequately funded within a reasonable period of time. Complete existing projects before embarking on new ones.

- Executing MDAs in a bid to ensure sustainability should consider training of some capable local hands on basic maintenance of the renewable systems such as cleaning of the panels and changing of LED bulbs.

- Innovative designs of solar solutions should be adopted to prevent the theft of solar components. There now exists integrated solar solutions with all the components merged into one unlike the solutions used for projects which are more like an assemblage of various components. These new products reduce the risk of theft of components, are of better quality and last longer when compared with the usual solutions.

For the Federal Ministry of Works, Power and Housing

- In accordance with section 88 of the Electric Power Sector Reform Act, 2005, the Minister of Power should expedite the preparation (and approval by the President) of the Rural Electrification Strategy and Plan and the setting up of the accompanying Rural Electrification Fund. He should also ensure that the quarterly reports are prepared, presented to the President and disseminated to the public.

For the Federal Ministry of Environment

- The Federal Ministry of Environment as the country's Designated National Authority (DNA) and UNFCCC focal point should nominate a group of non-state actors (i.e. selected CSOs etc.,) to undergo the capacity building exercises being offered free by the climate change body. It will not cost Nigeria anything but will bring her a lot of benefits.

- Nigeria should start the process of measuring, reporting and verification (MRV) and annual verification by Designated Operational Entities; certify emission reduction with a view to earning carbon credits. The country should take steps to access international funds like Green Climate Funds (GCF), Nationally Appropriate Mitigation Action (NAMA)

Funds, Climate Change Adaptation Fund's Direct Access Modality, Community Development Carbon Fund of the World Bank (CDCF) etc.

- Nigeria should initiate steps and properly position herself to lead the sub-region in matters pertaining to climate change mitigation and adaptation and become a hub for low-carbon technology transfer for the sub-region (Regional – West African - Emission Trading Scheme).

For the Legislature

- The National Assembly in collaboration with the Federal Ministry of Budget and National Planning should adopt a framework and template for the selection of projects to be included in the federal budget as constituency projects. This framework should take cognisance of the policy, plan and budget continuum which guarantees that the budget is used as a vehicle to implement policies and plans.

For the Ministry of Budget and National Planning

- The Ministry should ensure that estimates that will be included in the federal budget bill are based on existing national plans and policies. This will ensure that renewable energy projects are fitted into the national energy policies and action plans.

For Standard Organization of Nigeria (SON)

- SON should adequately regulate the quality of solar equipment being imported to ensure that only components meeting the required standards are allowed into the country. It should also collaborate with federal MDAs to ensure that the components used for solar and renewable energy installations are of the required quality and standard.

- SON should consider facilitating capacity building in federal MDAs that use renewable energy products to put them in a position to properly monitor and vet the results of the public renewable energy procurements.

For Communities and CSOs

- Communities should take ownership of these renewable energy projects, including being responsible for their security and protection against vandalism. But this requires proper community consultation and engagement by project promoters at the time of initiation of the project.

- Youths can be trained on the basic maintenance of these solutions such as cleaning of the solar panels at intervals. CSOs can intervene to provide appropriate training and capacity building. Under well-defined agreements with MDAs, the proper maintenance of such projects should be used as a pre-requisite for the location of other developmental projects in the communities.

- Communities or their local governments should review FGN budgets to determine which projects have been allocated to their communities and as such, follow up, monitor and ensure that the responsible parties implement the projects according to specifications.