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Reducing Black Carbon Emissions by Transitioning to Clean and Sustainable Lighting (Nigeria)

United For Efficiency Initiatives (U4E)

From Kerosene to Solar - The Economic Impact of An Accelerated Transition to Clean and Sustainable Lighting

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About this Guidance Note

This Guidance Note provides recommendations for the government and other key stakeholders in the Nigerian renewable energy sector towards actualizing the transition to clean modern lighting and energy access for all Nigerians by 2030. Developed by Power For All; on behalf of the United Nations Environment Programme (UNEP) for the "Reducing Black Carbon Emissions by Transitioning to Clean and Sustainable Lighting" project, this Guidance note follows extensive research and consultation with key stakeholders in the Nigerian renewable energy sector cutting across public, private, donor community and civil society. It also considers successful experiences from other African countries adapted to suit the Nigerian context. With the implementation of the

recommendations in this Guidance Note, the enabling environment for driving energy access to all Nigerians will be created with its profound socio-economic benefits.

Section 1 - Introduces the Nigerian energy situation and potentials of modern solar lighting.
Section 2 - Describes the negative impacts of Nigeria's energy poverty and define the socio-economic benefits of increased and sustained energy access.
Section 3 - Provides specific and simple recommendations to be implemented by the government in actualizing energy access for all Nigerians by 2030

1.0 Introduction

Power For All is a global coalition of 200 private and public organizations campaigning to deliver universal energy access before 2030 through decentralized, renewable electricity with presence in four focal countries, Nigeria, India, Sierra-Leone and Zimbabwe. In Nigeria, Power For All works with all key stakeholders in the Nigerian renewable energy sector cutting across government, industry, donor agencies, international organizations, civil society, trade associations and the media to accelerate the renewable energy market in Nigeria. Since commencing its campaign in Nigeria, Power For All has initiated various successful programs and campaigns which has boosted the growth of the renewable energy sector, including contributing to the development of renewable energy policies and organizing the sector for increased market access specifically through incubating the Renewable Energy Association of Nigeria (REAN) and working to create a taskforce that includes representation of all key stakeholders in Nigeria.

Nigeria can eliminate poverty, drive economic growth and development of its citizens through access to clean, modern energy. This reality is sufficient to drive serious efforts in accelerating the provision of clean and modern energy services to the 93 million Nigerians living off-grid[1]. Evidences from various African countries whose governments have taken serious efforts in developing policies and programs to drive clean modern energy access have not only shown an improved standard of living but also significant increase in socio-economic development. Over the past two years, Kenya for example has risen 40 places in the global "Ease of Doing Business" ranking to 92nd position.[2] According to the World Bank, a rise five (5) more places will lead to an increase in foreign direct investment between $250 million and $500 million.[3] Other East African countries such as Ethiopia and Tanzania have also seen significant development, with Tanzania rising from 144th position in 2016 to 132nd position in 2017.[4] Across these countries, these developments have been significantly boosted amongst other factors by significantly increasing access to clean modern solar lighting solutions, with Kenya, Tanzania and Ethiopia accounting for two-thirds of the pico-solar market growth in Africa.[5,6] While various efforts have been made to improve energy access in Nigeria, especially in rural areas, these efforts have not translated to any substantial improvement and can be attributed to the fact they are largely grid extension focused even though the capacity for the country's grid supply is limited.

[1] Global Off Grid Lighting Association GOGLA (2016) Off-Grid Solar Market Trends Report.
[2] The East African (2017) Kenya remains a success story in the region in 'Ease of Doing Business'. Available from: http://www.theeastafrican.co.ke/oped/comment/Kenya-is-a-success-story-in-Ease-of-Doing-Business/434750-3515222-apdhvaz/index.html
[3] ibid
[4] http://www.doingbusiness.org/data/exploreeconomies/tanzania
[5] Global Off Grid Lighting Association (GOGLA) 2016 - Off Grid Market Trend Report
[6] Business Daily (2015) Huduma centres push Kenya up in ease of doing business index. Available from: http://www.businessdailyafrica.com/It-is-easier-to-do-business-in-Kenya-World-Bank/539546-2933230-qimsea/index.html

However, there has been recent focus and increased activities in the decentralized renewable energy (DRE) sector which have shown great potential in driving energy access faster and cheaper than grid extension projects. The Nigerian government has taken positive steps over the past three years in exploring DRE solutions as a better alternative to energy. These include developing favourable policies for the renewable energy sector such as the Mini-Grid Regulation (2017), Sustainable Energy For All Action Agenda (2016), The Nigerian Renewable Energy and Energy Efficiency Policy (2015); The Nigerian Renewable Energy Action Plan (2016), Rural Electrification Strategy and Implementation Plan (2016), The Nigerian Power Sector Investment Opportunities and Guidelines (2016), Nigerian Energy Efficiency Action Plans (2015 – 2030), and Nigerian Renewable Energy and Energy Efficiency Policy (2015). Between July-December 2015 and January-June 2016, the adoption of pico solar lighting solutions in Nigeria almost doubled from 74,000 to 129,000 quality-verified pico-solar products[7] respectively[8]. In its first 3 months, the Solar Nigeria programme provided as many as 49,000 households and business access to clean modern energy.[9]

In January 2017, the Federal Government launched its nationwide solar programme which aims to electrify 20,000 rural off-grid households with the pilot project launched at Wuna community in Abuja.[10] These pico-solar solutions **provide households savings which average $79 per year for the three-year lifespan of the solar product.**[11] There has been an increase in the number of renewable energy companies and successful projects in the past two years despite the country's economic challenges, with various rural communities going off-grid and predominantly adopting solar lighting solutions, which has lead to increased savings for households and improved standard of living.[12] Several government Ministries, Departments and Agencies (MDAs) in the power sector have re-aligned their programs to include and focus on DRE strategies. The Rural Electrification Agency (REA) for example has shifted from grid extension projects to executing off-grid renewable energy projects for rural electrification. However; while the government has taken initial steps in driving this sector, much more is still required to overcome the country's huge energy poverty issue and challenges of the DRE sector.

2.0 The Issues

a) The Price for Inefficient Lighting

Currently 93 million Nigerians live off-grid[13] with majority of them using harmful inefficient fuels primarily biomass and kerosene in providing basic energy services such as lighting to compensate for the modern energy access in the country. At least 30% of Nigeria's population depends on kerosene for their energy needs with 10.8 million households using kerosene for lighting.[14] Thousands of people primarily women and children are maimed each year by kerosene lamp with a 13% fatality

[7] Lighting Global an offshoot of the IFC stes global standards and offers global quality certification for PICO Lighting products. Lighting Global (2017) Quality Assurance Programme. Available from: https://www.lightingglobal.org/quality-assurance-program/our-standards/
[8] Op cit. GOGLA (2016) Off-Grid Solar Market Trends Report.
[9] Energy Mix Report (2016). Nigeria adds 49,000 solar homes in 3 months. Available from http://energymixreport.com/nigeria-adds-49000-solar-homes-3-months/
[10] Vanguard (2017) Osibanjo flags off 20,000 solar powered lighting systems. Available from: https://www.vanguardngr.com/2017/02/osinbajo-flags-off-20000-solar-powered-lighting-systems/
[11] GOGLA (2016) Standardised impact metrics for the off-grid energy sector.
[12] Op cit. Vanguard (2017)
[13] Op cit. GOGLA (2016) Off-Grid Solar Market Trends Report.
[14] UNDP (2012) Kerosene Consumption: An assessment of selected high-impact countries. Draft Report.

rate[15] while to 128,500 deaths occur annually from Household Air Pollution (HAP) of which kerosene is a major contributor.[16]

b) The Economic and Employment Loses

According to the United Nations Environment Programme (UNEP), Nigeria could save over $1.4 billion and the equivalent of 17.3 million barrels of oil annually if it transitions to clean modern lighting from inefficient fuel sources such as kerosene, candles and batteries.[17] Secondly by 2030, Nigeria can eliminate the use of kerosene and all other forms of inefficient fuels for lighting; leading to an estimated $676 million in household savings,[18] especially if the government adopts stronger measures in creating an enabling environment for this transition. This also has the potential to create 30 times more jobs than the kerosene market.[19] Thirdly, Nigeria's import dependency of over 2 billion litres of kerosene per year can be significantly reduced, saving the country about $520 million per annum, and easing pressure on foreign exchange reserves whilst strengtheing the value of the Naira.

c) The Energy Poverty Predicament

Nigeria reportedly ranks in the bottom 25 of countries on power consumption per capita[20] with about 55% Nigerians are said to lack access to electricity[21]. According to the Regulatory Indicators for Sustainable Energy (RISE), a global scorecard for policy makers, which uses a comprehensive set of 21 indicators to compare national policy and regulatory frameworks for sustainable energy, Nigeria ranks a very low 99 out of 111 countries. Using RISE scores across three zones – green zone (67-100) for countries with strong policy framework to support sustainable energy; yellow zone (34-66) for countries with significant opportunities to strengthen the policy framework; and the red zone (0-33) for countries with few or no elements of a supportive policy framework enacted. These indicators show that Nigeria falls squarely in the red zone with a RISE score of 21 - 22 in Energy Access, 11 in Energy Efficiency and 29 in renewable energy - and the country remains among the top 10 countries having the highest electricity access deficit. While the federal government has taken positive steps through the Rural Electrification Agency (REA) in setting up of the Rural Electrification Fund (REF) and implementing the Mini-Grid policy, the need for more programs, policies, and support in driving energy access cannot be over-emphasized.

However, with the move by the Nigerian government at the National level and with states at the sub-national level actively putting certain measures and programs in place, Nigeria can solve its energy access dilemma, improve human development and boost its economy by 2030, whilst attaining energy access for all.

3.0 The Solution

A) Access to Finance

[15] Lighting Africa (2010). Solar Lighting for the Base of the Pyramid – Overview of an Emerging Market.
[16] GACC (2016) Nigeria. Available from: http://cleancookstoves.org/country-profiles/focus-countries/3-nigeria.html
[17] EnviroNews Nigeria (2013). Off-Grid Lighting: How Nigeria can save money, oil - UNEP, February 13, 2013. Retrieved on July 4, 2017
[18] Macroeconomic Model developed as part of this publication series.
[19] UNEP en.lighten
[20] Advisory Power Team (2015) Nigeria Power Baseline Report. Available from: http://www.nesistats.org/uploads/3/6/3/6/3636925/20150916_nigeria_energy_power_report_final.pdf
[21] Ibid. Advisory Power Team – Baseline Power Report (2015). Available at http://www.nesistats.org/uploads/3/6/3/6/3636925/20150916_nigeria_energy_power_report_final.pdf

Access to finance is a huge challenge for the emerging and growing DRE sector– finance is required by the private sector companies to build their businesses and provide consumer financing to customers especially in rural areas. However, these companies struggle to raise finance as investing in off-grid solar energy is still perceived as very high risk. While efforts have been made by the international donor community and private finance institutions to fund proof of concepts and models, implementing pilot programs, and providing finance for the market, government through its federal and state-owned financial institutions can provide the finance required to de-risk the sector, attract investment and catalyze the sector's growth through three key financing instruments described below:

1. **Low Interest Loans:** Single digit interest loans should be provided through the Central Bank and/or Bank of Industry to registered solar companies under the Renewable Energy Association of Nigeria (REAN) providing working capital and finance for expansion. A market finance needs assessment of solar companies in the country have shown that low interest loans between 2% to 6% will be favourable to solar companies and significantly boost their access to working capital and ability to expand their business considerably. With such expansion and more companies entering the market, there will be increased healthy competition leading to more affordable solar solutions for consumers.

2. **Consumer Financing:** Through the Central Bank, the Federal Government should provide consumer finance for modern solar lighting using key microfinance institutions (MFIs) across the country. As most consumers especially in rural communities are price sensitive, this will facilitate easy purchase of modern lighting solutions with households able to spread payments to the MFIs while also saving from forgone expenses on kerosene. To ensure its sustainability and long term impact, a percentage of the federal government's annual budget for solar projects should be channeled towards this consumer financing scheme. This way, such public funds will not only have significantly increased energy access and improved socio-economic benefits, but ensure that these funds are utilized properly.

3. **Credit Guarantees or first-loss facilities:** In order to de-risk the sector and attract investment, the government should provide credit guarantees or first-loss facilities which will enable investors provide new forms of more affordable, patient capital required to drive energy access projects. While building confidence in the sector, these new forms of patient capital will complement government's low interest loan facilities and enable the private sector become more involved in developing finance for the sector. This will open up access to the increasing renewable energy finance portfolio of international investment agencies and donor institutions into the country. Furthermore, with financial institutions primarily risk averse to new markets, the government through these financial instruments can support and incentivize financial institutions in funding the sector. Government can support through cost absorption or de-risking strategies that would encourage investors to invest in the market. For example, government can start with the issue of recovering loans through credit guarantees to encourage the banks and micro finance institutions to finance renewable energy projects.

4. **Grants:** Financing needs of renewable energy companies vary with different stages of growth - companies at seed stage require grants and equity, while those at advanced stage require working capital. With most renewable energy companies in the country at seed stage, grants are particularly critical in catalyzing their growth and the market. Some of these companies only started growing and electrifying communities after receiving grants such as the government YouWin grant and from international donors. Government through the

Central Bank and Bank of Industry (BOI) should provide seed and project development grants to verified renewable energy companies through the Renewable Energy Association of Nigeria (REAN). Through a special grant programme, seed stage renewable energy companies between 1 to 5 years of operation following a well-defined criteria developed in collaboration with key organizations such as Power For All, can be provided grants to fund their operations for growth. The use of these funds by the beneficiary companies will be monitored by the Central Bank or Bank of Industry, and its partner organization such as Power For All to ensure its proper utilization based on an already approved viable business plan in the first 18 months of awarding the grant. This grant programme will provide the required boost to these companies, the unelectrified market and the sector. Secondly, project development grants for projects such as community power projects should also be made available and awarded through REAN to a consortium comprising of selected seed stage and experienced renewable energy companies to collaboratively develop, execute and maintain these projects. This will not only electrify communities or target areas of the government such as industrial clusters, but also provide the required project financing and experience for seed stage companies to scale up.

5. **Crowdfunding:** Crowdfunding has become a successful mechanism for especially seed stage companies to raise capital required to fund their business or specific projects. The success of crowdfunding has not only boosted the economies of various countries estimated at $16.2 billion globally[22] and between $83 million[23] to $127 million[24] in Africa in 2015, but has also develop new and perceived high risk markets where commercial banks are particularly risk averse. Unfortunately inspite of the huge crowdfunding potential in the country, this means of fundraising is currently inhibited by the Securities and Exchange Commission (SEC)[25] with renewable energy companies having to crowdfund on international platforms such as Bettervest, a crowdfunding platform for sustainable energy projects of companies, NGOS and local authorities[26] to execute successful renewable energy projects in the country. However these are prone to forex risks highlighting the need for local crowdfunding. The Government should amend the regulation on crowdfunding to encourage investment/equity crowdfunding while putting measures to prevent its exploitation as done in the US through the Jumpstart Our Business Startups (JOBS) Act and stipulated by the UK's Financial Conduct Authority. The government can select the types of businesses that can be crowdfunded starting with the renewable energy sector. Renewable energy companies through crowdfunding will be able to raise finance for projects, entry into new markets, developing innovative products and solutions, and raise debt finance for business models such as the pay-as-you-go (PAYG) consumer financing. This will also create and increase healthy competition, provide better electricity service and lead to the increasing affordability of products. This will also be an additional significant flow of forex into the country from Nigerians in Diaspora, increasing

[22] Thisday (2016) SEC rules out crowdfunding in Nigeria for now. Available from: https://www.thisdaylive.com/index.php/2016/08/15/sec-rules-out-crowdfunding-in-nigeria-for-now/
[23] The University of Cambridge Judge Business School. The Africa and Middle East Alternative Finance Benchmarking Report. Available from: https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-africa-middle-east-alternative-finance-report.pdf
[24] Afrikstart. Crowdfunding in Africa. Available at: http://afrikstart.com/report/wp-content/uploads/2016/09/Afrikstart-Crowdfunding-In-Africa-Report.pdf
[25] Op Cit. Thisday (2016)
[26] Climate-KIC. Bettervest. Available from: http://www.climate-kic.org/start-ups/bettervest/

forex availability in the country. In Kenya for example, about 35% of funds raised through its M-Changa platform are from the Kenyan Diaspora from 50 countries.[27]

There has been an encouraging inflow of many bilateral and multilateral donors into the country funding and supporting the off-grid energy sector such as the UK Department for International Development (DFID) through the Energy Africa Campaign; the US Government through Power Africa project including the US African Development Foundation (USADF) Fund and USAID Nigeria Renewable Energy And Energy Efficiency Project (REEEP); the World Bank Clean Energy Fund; African Development Bank (AfDB) Sustainable Energy Fund for Africa; GIZ Nigeria Energy Support Programme (NESP); the Japanese International Cooperation Agency (JICA) solar program; and the Heinrich Boell Stiftung Renewable Energy Programme. The AfDB's New Deal on Energy for Africa targets 75 million off-grid connections through AfDB-supported activities by 2025 and the DFID funded Solar Nigeria programme aims to provide €13 million for solar energy companies operating in Nigeria. Government should seize the growing interest in off-grid energy and by implementing the recommendations above, attract and tap into these and future international funding sources.

The implementation of these financing instruments will not only go a long way to supporting the sector, but also enable investors get improved overall market intelligence through the government finance institutions such as the Central Bank. The Federal government should look into its finance initiatives such as the Central Bank MSME Fund program to ensure that the fund is transparently and appropriately disbursed to qualified enterprises as some beneficiaries of the funds have reported being unable to access this fund after selection. Already the government though the Bank of Industry has implemented a N1bn Solar Energy Fund for Micro Small and Medium Enterprises (MSMEs) in the country, in partnership with the United Nations Development Programme (UNDP), providing long terms financing for MSMEs in the country. Similar programmes and initiatives should be developed in partnership with the international donor community and REAN to finance the sector. While companies at all stages of growth would need financing in both international and local currencies to grow and scale, increased local currency financing by the government will help mitigate foreign exchange risks. Government can also mitigate foreign exchange risk through special forex access instruments for solar companies and investors. International investors and companies need to be able to repatriate profits, in order to invest in wider business development, as well as to provide returns to international investors that have taken on risk.

B. Promoting Quality

With a growing recognition of the potential for DRE technologies such as solar lighting solutions in driving energy access across the country, there has been an increase in the inflow of low quality products entering the market and undermining the advances being made in the sector. According to the Global LEAP program[28], the absence of a quality assurance framework negatively affects market growth and adoption of solar lighting solutions.[29] This is evident in the country through various government executed solar projects with over 80% of them breaking down just few months after installation largely due to the use of low quality solar components[30]. Unfortunately, this has

[27] Op Cit. Afrikstart. Crowdfunding in Africa.
[28] The Global LEAP Program is an energy access initiative led by the US Department of Energy as a commitment to the Sustainable Energy for All campaign, and supporting the growth of sustainable commercial clean energy access markets in developing countries.
[29] Hystra (2017) Reaching Scale in Access to Energy: Lessons from Practitioners.
[30] Heinrich Boll Stiftung (2017) Solar Energy and the Federal Budget: 2012-2016.

negatively impacted consumer's confidence in solar solutions and has led to low trust in solar technologies which affects the demand end of the spectrum for DRE products and services.

1. The Nigerian Government (through the standards organization of Nigeria) should adopt the **Minimum Energy Performance Standards** (MEPS) developed as part of this publication series, and importantly adopt the **Lighting Global Quality Standards**[31] for quality assurance of solar products and solar home systems up to 350W which are the most common solar lighting products imported into the country. This Lighting Global standard has been adopted by governments such as in Kenya, Tanzania and Ethiopia, inter-governmental bodies and donor agencies including the UN Framework Convention on Climate Change (UNFCCC) and Clean Development Mechanism for carbon financing, the UN Refugee Agency (UNHCR) and the multi-donor Energizing Development Program.[32] The standard maintains quality and testing methods for basic solar lighting and home solutions up to 350W across five key areas – Truth in Advertising, Durability, System Quality, Lumen Maintenance, and Warranty. This measure would be considered important to promote sustainable development and increase consumer confidence is the introduction of product standards.[33] The Lighting Global Quality Standard and testing methods has been adopted by the International Electrotechnical Commission – a reference point for quality assurance of off-grid lighting products (IEC Technical Specifications 62257-9-5) as a mandatory minimum quality standard for solar portable product.[34] The adoption of the IEC quality standards given the high cost and technical expertise required for product testing would be cheaper and more efficient for the government using IEC accredited test laboratories across the world rather establishment of new testing facilities. Other benefits includes that the IEC standards are kept up to date with new technology and products in the market and makes it cheaper and more conducive for companies and investors to deal with streamlined testing standards and systems rather than design products to meet diverse requirements for regional or national levels in different markets.

2. Government agencies primarily the Customs, Standards Organization of Nigeria (SON), Nigerian Electricity Management Service Agency (NEMSA) and Consumer Protection Council (CPC) should adopt product-verification measures by testing imported solar lighting and solar electrical products into the country, thereby ensuring they meet this standard. NEMSA should adopt the **Lighting Global Quality Standards**[35] as part of their technical standards and certifying imported solar products that meet these standards. Only tested products that meet these standards and registered with SON should be cleared by the Customs. While SON and CPC have the power to impound and destroy sub-standard products, the government should further empower these agencies to prosecute offenders which will go a long way in curtailing the inflow of sub-standard products into the country. These government agencies will work with credible associations such as the Renewable Energy Association of Nigeria (REAN) in regulating the market.

3. There is also the need for the development of quality requirements in the tendering, procurement and execution of solar projects though the Nigerian Electricity Management

[31] https://www.lightingglobal.org/wp-content/uploads/2015/07/LG_QualityAssurance-Roadmap_Sept_2016_v4.pdf
[32] GOGLA (2017) Providing Energy Access through off-grid solar: Guidance for Governments.
[33] Op Cit. Lighting Global (2017)
[34] https://webstore.iec.ch/publication/25275
[35] Op Cit. Lighting Global (2017)

Service Agency (NEMSA) in collaboration with the Renewable Energy Association of Nigeria (REAN). NEMSA recently came up with a pre-qualification certificate for tenders for government required bids for DRE projects, which was test run for some rural electrification tender bids for June/July 2017. This collaboration will when tweaked will set the standard for off-grid projects and involve NEMSA which has primarily been focused on grid related power projects, in playing an active role in the emerging off-grid power sector. This collaboration will ensure quality standards are adhered to and maintained in government and non-government executed solar projects.

4. Government through its information agencies such as the National Orientation Agency and Ministry of Information should engage in public awareness campaigns on the adoption and identification of quality solar products, where they can be obtained, and encourage consumers to report distributors/retailers of sub-standard quality products to the appropriate regulatory agencies such as SON and the CPC.

In summary: Government must begin to prioritize the adoption of harmonized quality standards immediately, since the Nigerian market is still in its nascent stage and the presence and impact of these low-quality products is low. With the growth of the sector, there is the danger of glut of sub-standard goods in the market. Government can start with a preliminary framework to test pilot test these standards starting with a small number of easy to recognize products – like solar home systems verified by Lighting Global – before expanding to other solar components. Low-quality products, replicated to look like the original products and falsely claiming to provide a higher level of service or standard erodes consumer trust and confidence, reduces demand for the products and damages the market. Without standard quality assurance, the emerging renewable energy market in Nigeria will be susceptible to increased influx of low-quality products which unfortunately will benefit from investments in awareness and distribution chain development of quality products, eating into a significant portion of the market share.

As a first step, government can start to promote quality-verification through sector support programs like some of those highlighted above. For example, government can start by adopting the harmonized quality standards in their own procurements procedures, ensuring that companies who benefit from this process are companies that sell quality-verified products. Another way for government to promote quality-verification is through public awareness campaign which promotes quality and features a range of warrantied products that meet Lighting Global Quality Standards.

As a second step Government should collaborate with the Renewable Energy Association of Nigeria (REAN) to develop quality requirements in tendering/procurement. Once standards are fully adopted, they can be implemented and enforced to permit products that only comply with the standards to be brought into the market; for example through a simple importation procedure that enables quality products to be identified at the point of entry into the country. However, before this measure is implemented, it is important that government builds the capacity of the Nigeria Custom Service to be able to effectively implement this measure, so as not to cause disruption, delays or increased costs for businesses that could harm the market.

Lastly, government should also provide a legal framework that makes it easy for companies or public authorities to prosecute those caught in the sales and distribution of low-quality or fake products. To implement this framework, a taskforce comprising the Ministry of Trade and Investment, Ministry of Justice, Ministry of Power, Standards Organization of Nigeria (SON), Nigerian Electricity

Management Service Agency (NEMSA), Consumer Protection Council (CPC) and Trademarks, Patents and Designs Registry should be set up for efficient patent registration, judicial enforcement and criminal persecution of defaulting companies/businesses with fines imposed according to the gravity of the crime.

C. Lower Taxation – Duties and Tariffs

Consumers of solar products especially in rural communities are price sensitive, with their willingness to purchase these products associated with the price. Currently while solar panels attract an import duty of 0% and VAT of 5%, batteries attract 20% import duty while VAT and import tariffs are inconsistently applied on solar products and associated components such as batteries, charge controllers or DC devices, most times at high tariffs. The combined cost of multiple taxes on the batteries which are a key component for storage and other associated components increases the product cost significantly which is usually passed down to the consumers. Significantly reducing or eliminating taxes on solar products and components will drive the market and lead to lower prices of products due to increased and healthy competition, as seen in Kenya which saw an almost twofold increase in pico solar adoption and significant reduction in the price of pico solar products from $7 to $4 with the elimination of VAT and import tariffs on solar products[36]. In 2015, Kenya introduced new renewable energy tax incentives offering exemption from Value Added Tax to several components of renewable energy sources.[37] In four African countries for example - Kenya, Tanzania, Rwanda and Uganda - where governments of those countries have utilized VAT and import exemptions on solar products, these countries currently account for over 25% of worldwide pico-solar market share with huge penetration of these products and associated services in rural communities.[38]

1. Government should implement 0% import duty on solar products and batteries that meet the Lighting Global Quality Standards and IEC 61427-1 and 61427-2 standards respectively imported into the country. This will further encourage quality products and discourage the inflow of substandard products. With a growing market and increased number of businesses in the sector, government can also gain through increased business and employee tax payments from the growing number of renewable energy companies.

2. To ease product introduction and market development, tax incentives such as import duty/excise duty concession, VAT concession, tax credit, production tax concession, and tax holiday on generation income should be considered for the sector. As earlier mentioned, a first step to accomplishing this would be to streamline and enhance the importation process and procedure in Nigeria. A necessary first step would be to identify products eligible for VAT/Tariff exemptions at the borders. The newly released GOGLA guidance note on quality provides a suitable guide and shows that while difficult to do with the normal HS codes, it must be done eventually – possibly with a few pilots to test out different models and procedure for proof of concept.

3. With the above in place and as the market grows, in-country assembly and manufacture of renewable energy components will develop with more companies exploring options and developing local assembly and manufacture. While the National Power Training Institute (NAPTIN); the National Agency for Science and Engineering Infastructure (NASENI), as

[36] Op cit. GOGLA (2016) Off-Grid Solar Market Trends Report.
[37] IEA (2016) Policies and Measures: Kenya.
[38] Op cit. GOGLA (2017)

well some solar companies have already commenced local assembly and manufacture of solar products, their ability to scale significantly will be boosted by first creating a favourable environment which will attract more companies and improve on imported solar technologies adapted to further meet local needs. By creating an enabling environment for the growth of the sector through this recommendation, the sector's contribution to job creation will scale and overall economic growth.

D. Public Awareness & Demand Creation

There is still a comparatively low level awareness of solar solutions in the country despite the electricity and economic benefits they offer. This awareness challenge is compounded further by perception challenges occasioned by badly executed government solar projects in the past decade in Nigeria. This has created some skepticism in the market. Solar companies in an emerging market such as Nigeria, lack their own resources to create considerable awareness or create advocacy to drive demand in this market. Any such efforts end up eating deeply into the already limited finance of these companies which will most likely be passed down to the consumer. With growing inflow of substandard products, it will remain increasingly difficult for most consumers to be well informed about which products are standardized and of good quality and this would lead to reduced confidence in the market should the consumer purchase the wrong or sub-standard product. A Hystra 2017 report[39] assessed levels of consumer awareness and trust in solar products in leading African markets with Nigeria showing just 50% awareness and trust in solar solutions. As an emerging market, the benefits of proper awareness on the benefit of solar solutions as well as obtaining quality products, is very critical for the long term sustainability and growth of the market.

There is an increasing recognition of the role advocacy plays in building and driving demand for this sector by stakeholders, particularly the donor communities and international NGOs. Consumer awareness has further proven to be a spark plug for growth in the early stages of market development for DRE products and services. **Power For All**, a global decentralized renewable energy campaign is addressing this issue through its market activation and awareness building campaign geared at catalyzing market development for the decentralized renewable energy sector. The organization working with a coalition of partners from industry and private sector, government and policy makers, civil society groups and the media is engaged in various advocacy campaigns through multiple initiatives including a "Market Women" initiative; a "Faith-based" initiative and a "Trade Association" initiative which they use to create awareness on quality solar lighting products. By working with women groups, faith based platforms and media institutions across communities the campaign is elevating the awareness of decentralized renewable energy and addressing access problems associated with the demand and supply of product goods and services. Through these campaign activities and working with the Renewable Energy Association of Nigeria (REAN), the organization has not only been able to increase the awareness and adoption of modern lighting solar solutions with positive socio-economic benefits, but these adopters such as the women groups have gone into the solar business as distributors and retailers. Should the government support and adopt such strategies on a national level, the benefits will be profound.

Government should create awareness and the promotion of solar solutions through 'Above the Line' and 'Below the Line' campaign strategies described below.

[39] HYSTRA (2017) Reaching Scale in Access to Energy. Available from: http://hystra.com/a2e

1. '**Above the Line'**: Using the national and state-owned television, radio and digital networks to make public announcements, interviews, discussions as well as newspaper advertisements to promote the electricity access and economic benefits of quality solar products. This should also be embedded in popular television and radio programs having high viewing and can also be structured as part of a behavioural change campaign.

2. '**Below The Line'**: Through local campaigns with local groups, academic institutions, religious institutions, non-governmental organizations, traditional institutions and pressure groups to sensitive, educate and promote solar solutions. This can also be done through product demonstration at public areas such as markets, during community town-hall meetings, and women programs. Rural solar campaigns can be organized around social events such as soccer events, music festivals, trade fairs and political campaigns. These social events can also be planned around these solar campaigns to attract large audiences similar to the "Village Solar Days" campaign adopted in Tanzania which carried out educational campaigns around traditional dances or football matches.[40] Solar enlightenment campaigns should also be embedded in community development activities of government institutions and programs such as the National Youth Service programme and other similar programs.

3. Supporting renewable energy programs and market development organizations, advocacy groups, cooperatives, and associations such as **Power For All** and the Renewable Energy Association of Nigeria (REAN) in their campaign and market development programs in driving solar energy access across the country.

If consumers are not knowledgeable of the quality standards of solar products, they would be susceptible to purchasing low-quality or counterfeits. Support from the government will ensure that consumers are educated and informed of the benefits of solar, how to use it and where to buy credible products.

It is important to note that a lot of developed markets in the world have adopted a "below the line" marketing activity that enables consumers to have direct access to the product before buying the product. Below the line campaigns was first adopted by Lighting Africa and Sunny Monkey in Kenya. Presently, Kenya is one of the most successful markets for solar products in Africa. However, in countries with energy access gaps like Nigeria, above the line public awareness is found to be more effective. An example would be the use of public announcement via radio, newspaper and TV. For example, the Lighting Africa campaign has successful been able to increase public awareness in Kenya, Ethiopia and Uganda using this method. Another measure that has been successfully adopted includes using education networks to increase awareness using school campaigns. Solar Aid owned charity Sunny money is leveraging this method in Malawi, Zambia, Kenya, and Tanzania, which has proven to be successful. Another practical example is through "Village Solar Days" a programme implemented by Tanzania Renewable Energy Association (TAREA). The programed involves educating citizens in the rural areas on the benefits of solar, how to use it and how to recognize sub-standard products.[41]

E. Technical Assistance and Capacity Building

[40] TAREA (2016) Tanzania government grants renewable energy incentives. Available from: http://www.tarea-tz.org/index.php/blog/80-solar-village-day-at-malinyi
[41] http://www.tarea-tz.org/index.php/blog/80-solar-village-day-at-malinyi

As an emerging and growing market, there is an increasing need for technical assistance and capacity building for companies and businesses in the market especially the indigenous small and early stage companies. Poor quality installation or failure of solar products can hinder the growth of the market and provision of clean energy access. Companies have to be trained to be capable not only to develop and install solar solutions, but also provide extended warranties to consumers in order to boost confidence and trust in their products.

1. Government should strengthen, support and sponsor the renewable energy training programs and technician certification schemes developed by its National Power Training Institute of Nigeria (NAPTIN) in partnership with GIZ Nigeria Energy Support Programme (NESP), The Renewable Energy Technology Institute (RETI), and PNN Technology Solutions Limited. Working with the Renewable Energy Association of Nigeria (REAN), government should provide free or significantly discounted training courses for small early stage companies/ businesses in the sector, as well as professionals, technicians and graduates looking to develop skills in the sector. This should also be extended to government's technical and skills acquisition programs such as the industrial training program and youth capacity development initiatives, and university research centres such as the Sokoto Energy Research Centre (SERC),;National Centre for Energy R&D (NCERD), Nsukka; Centre for Renewable Energy Technology (CRET), Akure' UniCal Renewable Energy Centre (UREC), Calabar; and Centre for Renewable Energy, University of Ibadan.

2. For growth of the market and long-term sustainability, it is recommended that government begin to build a qualified workforce and develop local content. First measure is for the government to support through its technical agencies and partnerships with other organizations to develop skills required for the sector on a state-by-state basis. For example, Federal government and State government can collaborate with the National Training Institute (NAPTIN), Energy Commission of Nigeria (ECN) Research Centers and State Electricity Boards to develop technician certification schemes to train technicians, installers and artisans.

3. A few international organizations present in the country are already providing support in developing human and institutional capacity needed to develop the renewable energy sector. Example is the GIZ– Nigerian Energy Support Programme (NESP). The National Power Training Institute of Nigeria (NAPTIN), The National Agency for Science and Engineering Infrastructure (NASENI) as well as other similar research centres are being assisted to deliver a range of relevant training courses on renewable energy and energy efficiency for engineers, architects and technicians. Interventions will also train selected professionals of partner institutions and enhance capacities in the DRE sector as whole.

4. Another measure is for the government to collaborate with REAN to ensure technical expertise is strengthened. Government and REAN can create youth training projects to develop vocational and university-level training to promote local businesses, regulatory capacity, technical skills and innovation. In Kenya, the government created a law making it mandatory for electrical technicians to have minimum qualification to install solar home systems to increase quality assurance. The Kenya Renewable Energy Association (KEREA) is working with local institutions to provide proper training for solar technicians and ensure that the government specification for a technician certification is reflected in their curriculum.

5. Nigeria government can also tap into one of the training supports that are available to the region. An example is the ECOWAS program on Access to Sustainable Energy Services (EPASES) providing direct training events and programme on renewable energy technologies, including off-grid solar, implemented by ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE). 2iE international institute in Burkina Faso has benefited from this program.

F. Simplifying the Policy Environment: Role of MDAs

Several government Ministries, Departments and Agencies in the power sector have different renewable energy mandates and programs which has led to inconsistency and confusion especially to investors. There is need for a focal government renewable energy agency that not only coordinates all renewable energy activities of the government, but also liaises with the private sector and other key stakeholders on behalf of the government in the country's renewable energy industry. It must be noted that some attempts have been made to coordinate the various renewable energy MDAs but the efforts have not been fruitful and no government MDA has a clear leadership mandate to oversee the development of renewable energy. This lack of clear agency amongst the MDAs deprives the sector of a driving force for its growth and development generates a lot of confusion around renewable energy mandates and targets and limits the ability of the government to create a uniform coordinated strategy for the sector. We therefore make a case for two scenarios to address this dichotomy in the sector: The Nigeria Renewable Energy Development Agency while driving the original mandate of the REA will coordinate all government renewable energy departments, agencies, offices.

1. Re-structure the Rural Electrification Agency as the Nigeria Renewable Energy Development Agency. Through the new USAID Scaling Off Grid Energy (SOGE) Taskforce comprising key public and private stakeholders in the renewable energy sector - and with the Rural Electrification Agency (REA) as the focal government agency, the REA could be further empowered to coordinate all renewable energy programs, initiatives and activities of government for the sector. There is a consensus and acknowledgement amongst stakeholders in the sector around the reinvention of the REA under the new leadership appointed in April 2017, as the lead government agency to drive energy access for Nigeria. With its current management, the REA is transitioning from a centrally owned and government-managed project towards a demand-driven, market –based approach organization driving DRE as a path to energy access to meet the un-served and underserved populations across Nigeria.

2. The other alternative to consider is creating a dedicated lead renewable energy government agency to coordinate all renewable energy program of government and liaise with other key stakeholder on behalf of the government. The government alternately could re-structure the various MDAs with renewable energy mandates into one single ove-arching agency called the Nigeria Renewable Energy Development Agency (NREDA), with the remit to oversee all government renewable energy programs in the country.. This will minimize the confusion and risks to investors and the private sector, and encourage renewable energy market development. Government should make sure that NREDA has the sole mandate to oversee to renewable energy sector and backed by adequate legislation.

4.0 Conclusion

The recommendations provided in this guidance notes were specifically developed to accelerate and attain energy access for all Nigerians by 2030. With its implementation, the Nigerian government will

not only solve one of the major challenges facing the country and eliminate energy poverty for its citizens, but also boost the country's socio-economic growth and development. The many intangible benefits of a transition to clean and modern energy access are profound including a healthier population and improved standard of living. Government should work very closely with the Renewable Energy Association of Nigeria, Power For All and key stakeholders in the sector to address the sector's issues and challenges in driving energy access for all Nigerians.