Prospects of Solar Power Generation in Diversifying Nigeria's Energy Mix

A. Introduction

As at July 2016, the total installed power generation capacity in Nigeria, a country of over 187 million people (www.worldometers.info), was 12,522 MW; 85% of which is gas-fired (thermal) and 15% is hydro-generated. The country achieved its highest peak generation output of 5,074 MW in February 2016 (www.power.gov.ng).

In comparison, South Africa, which has a population of 52.9 million has a total installed capacity of 45,000 MW, and achieved peak generation output of 35,819 MW in February 2016 (Reuters, February 27). This shows that Nigeria still has a long way to go in achieving the required generation output to meet the demands of its population.

Analysts have projected that about 50,000 MW is required to adequately light up Nigeria. However, the generation output in Nigeria as at 17th July, 2016 was 2,567 MWh per hour (Nigeria Electricity Hub Weekly Summary of 22nd July, 2016). The poor generation output has mainly been caused by issues ranging from gas supply constraints (arising from the incessant vandalism of gas pipelines and insufficient gas infrastructure); inadequate transmission infrastructure; water management constraints on the hydro power plants; and lack of liquidity across the power sector value chain, amongst other challenges. The foregoing issues have compelled the Federal Ministry of Power to rethink its strategy for bolstering power generation in Nigeria.

The Minister of Power, Works & Housing, Babatunde Fashola, recently revealed the Road Map for Steady, Incremental and Uninterrupted Power Supply. The Roadmap confirms the drive to increase generation capacity by the use of energy sources including solar, wind, hydro and coal. Examples of planned projects under the Roadmap include the 3,050 MW Mambilla hydroelectric power project in Taraba State and the 10 MW Vergnet SA wind power farm project located in Katsina State.

Coal was also referenced as an alternative base load fuel to be explored (the 1200 MW Zuma power project in Kogi State may be one of such projects). The Minister also announced that an energy mix document would be released by the Government with the aim of reducing the cost of electricity and seeking further diversification of its power generation sources. The focus of the yet-to-be-released document would be to spur investment in renewables to encourage rapid economic development.

B. Legal & regulatory framework for renewable energy

From a policy perspective, there have been a number of policies made by the Government relating to renewables. These include the National Electric Power Policy (NEPP), the Electric Power Sector Reform Act (EPSRA), and more recently, the National Renewable Energy and Energy Efficiency Policy (NREEEP). The table below sets out in more detail, the existing policies on the
<table>
<thead>
<tr>
<th>S/N</th>
<th>Name of Policy/Legislation</th>
<th>Date</th>
<th>Issuing Authority</th>
<th>Policy Directives</th>
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<tbody>
<tr>
<td>1.</td>
<td>NEPP</td>
<td>2001</td>
<td>Electric Power Implementation Committee (EPIC)</td>
<td><strong>Approved</strong> by the Government and outlines the framework for power reform agenda in Nigeria. It also sets a target of 10% renewable energy mix for all new connections by 2020.</td>
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<td>2.</td>
<td>Nigerian National Energy Policy</td>
<td>2003</td>
<td>EPIC</td>
<td><strong>Approved</strong> by the Federal Executive Council. Acknowledges the importance of the different renewable energy sources and how they can effectively be utilized. However, no concrete targets for renewables were set.</td>
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<td>3.</td>
<td>Renewable Energy Master Plan (REMP)</td>
<td>2005</td>
<td>Energy Commission of Nigeria (ECN)</td>
<td><strong>Not yet approved.</strong> Encourages the integration of renewables (with particular emphasis on solar energy). The REMP advocates for increased supply of renewable electricity from 13% of electricity generation in 2015 to 23% in 2025 and 36% by 2030. The REMP is yet to be signed off by the government or formulated into a law governing the renewable energy development.</td>
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<td>4.</td>
<td>EPSRA</td>
<td>2005</td>
<td>Federal Legislature</td>
<td><strong>Passed as an Act of the National Assembly.</strong> Mandates the creation of the Rural Electrification Agency (REA) to ensure the development of a rural electrification plan and further encourages the promotion of electricity from all sources of energy including renewables.</td>
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<td>5.</td>
<td>Renewable Energy Policy Guidelines (REPG)</td>
<td>2006</td>
<td>Ministry of Power</td>
<td>Articulates policy goals for the development of off-grid independent renewables systems and setting up a Renewable Electricity Trust Fund as well as cost effective measures to accelerate renewable projects. Also includes incentives for investors by way of a 5-year tax holiday.</td>
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<td>6.</td>
<td>The Renewable Electricity Action Programme (REAP)</td>
<td>2006</td>
<td>Ministry of Power</td>
<td>Sets out a roadmap for implementing the REPG and Renewable Electricity Fund Policy and further sets out development targets per technology and application. There has not been an evident implementation of the REPG and the REAP.</td>
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<td>7.</td>
<td>The National Biofuel Policy and Incentive</td>
<td>2007</td>
<td>Nigerian National Petroleum Company</td>
<td><strong>Approved</strong> by the Federal Government. Aimed at the development of a national fuel ethanol industry and the gradual reduction of the nation’s dependence on imported gasoline, reduction in environmental pollution, while at the same time creating a commercially viable industry that can provide sustainable domestic jobs.</td>
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<td>8.</td>
<td>NREEEP</td>
<td>2015</td>
<td>Ministry of Power</td>
<td><strong>Approved</strong> by the Federal Government with an objective to develop power generation through renewables and energy efficiency capacity by 2020. Note that the NREEEP is a more robust policy document, as it sought to consolidate the objectives of the documents listed in Nos 1-7 above.</td>
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From the above, it can be seen that a good number of policies have been in place in Nigeria for renewables, however they have been largely ineffective. Also, there were various gaps and overlaps in many of the policies. As noted in No. 8 above, the NREEEP sought to consolidate the objectives of the policies listed in Nos. 1-7 above. Below are highlights of the available incentives under NREEEP.

C. Incentives under the NREEEP

1. Free Custom Duties for two (2) years on the importation of equipment and materials used in renewables and energy efficiency projects;

2. Allows for project developers to obtain soft loans and special low-interest loans from the Renewable Electricity Fund for renewable energy supply and energy efficiency projects;

3. Advocates for the Government to ensure that an appropriate economic instrument is put in place to allow generators of renewables to obtain preferred pricing and rates as they sell;

4. Tax incentives to manufacturers of renewable energy and energy efficient equipment and their accessories. Incentives include: (i) five-year tax holiday for manufacturers from date of commencement of manufacturing; (ii) five-year tax holiday on dividend incomes from investments on domestic renewable energy source;

5. Government is to assist in allocation or grant of land to manufacturers of energy efficient products and renewables projects.

D. Tariff framework for renewables (with a focus on solar power generation)

Feed in Tariffs (FITs) are generally applicable to solar power generation (as with other renewables). FITs refer to a minimum guaranteed price per unit of produced electricity to be paid to the renewable power producer or as a premium in addition to general market electricity prices. FITs are designed to enable the producers sell their power to the grid at considerably higher prices than the tariffs obtainable for other power generation sources such as thermal generation. Inducements implied in FITs include (a) guaranteed market; (b) priority grid connection and off-take; (c) facilitated land acquisition process; (d) concessionary tariff rates and (e) simplified licensing/permit process.

The tariff structure for solar power generation (as with other renewables) in Nigeria was originally provided for as FITs under the Multi-Year Tariff Order 2 (effective between June 2012 and March 2015). However, MYTO 2.1, (MTYO 2 amended) and the recently reviewed MYTO 2015 did not make provisions for FITs. Notably, NERC has recently issued a Regulation on Feed in Tariff for Renewable Energy Sourced Electricity in Nigeria (REFIT Regulations) passed in December 2015, which provides for the tariff framework for renewables. The salient highlights of the REFIT Regulation are considered below:

E. Highlights of the REFIT Regulations

i. The REFIT Regulations set a target generation output cap from renewable sources at 2000MW by 2020. The Distribution companies (Discos) and Nigerian Bulk Electricity Trading Plc (NBET) are obligated to purchase the power on a "must buy" basis, thereby providing priority grid access to renewables generators.

ii. Eligible renewable energy sources under the REFIT Regulations are wind, small hydro, biomass and solar.

iii. Eligible renewable projects under the REFIT Regulations are restricted to projects with a capacity between 1-30MW. Off-grid Renewable projects are also excluded from the ambit of the REFIT Regulations. Notwithstanding the exclusion, the REFIT Regulations mandate that NERC and the REA develop technical and operational modalities for off-grid projects.

iv. Power Purchase Agreements (PPAs) under the REFIT are structured to be for 20 years and payments are for energy delivered only.

v. Costs of shallow connections (i.e. installation of facilities required to deliver power at the connection point, excluding any grid upgrade beyond the common point of coupling) are to be borne by the project developers; however, off-takers can fund interconnections and recover the costs from developers. Costs of deep connections (i.e. reinforcement, extension or reconfiguration of the existing
transmission network beyond the point of connection at higher voltage levels connecting the generating unit) are to be borne by the Transmission Service Provider or Disco.

vi. The FITs may be reviewed every three years. However, the prevailing tariff at the time a PPA is signed with a renewables developer shall be fixed for the term of such PPA and the tariff review would only be applicable to new projects.

vii. FITs applicable for solar projects for 2016 as indicated in Schedule 5 of REFIT Regulation consists of Capital Cost $/MWh176.85; Operations and Maintenance $/MWh0.15, making a total of $/MWh177.00 per MWh.

F. Tariff for solar renewables outside the REFIT Regulations

The maximum capacity of solar renewables is 5MW under the REFIT Regulations. This means solar generation projects outside this threshold would not come under the REFIT Regulations. Furthermore, unsolicited bids for solar projects negotiated with NBET, as well as off-grid power projects, are excluded from the REFIT. Tariffs for projects not covered by the REFIT are generally to be agreed between the parties, subject to the approval of NERC.

G. Prospects for solar power generation

The prospects for solar power generation are quite high in Nigeria and are as follows:

(a) The REFIT Regulations indicate that the Government has set an on-grid target for solar renewable generation of 380MW by 2018. This means that there is a deliberate drive by the Government to ramp up electricity generation from solar sources.

(b) Solar is a major energy resource in Nigeria from a geographical perspective. Analysts have projected that Nigeria could generate 600,000MW by deploying Solar PV panels from just 1% of Nigeria’s land mass (www.renewableenergy.gov.ng/harnessing-nigerias-solar-power-potential/).

(c) Given the high level of solar radiation in the northern part of Nigeria (about 5.0-7.0Kw.m2/day) (www.isdr cjournals.com), utilizing solar power generation in the northern part of the country has potential to steadily increase the power generation capacity in Nigeria.

(d) In light of (c) above, there are opportunities for solar power developers to partner with Discos to provide embedded power generation, particularly for the Discos in Northern Nigeria.

(e) There is a ready market for solar power developers to operate in, in view of the huge demand for power supply; high population density; and the fact that solar power projects take less time to reach commercial operations compared to the conventional gas-fired generation. In terms of our natural and topographical features, the total land mass in Nigeria is estimated at 923.97 thousand square kilometers.

(f) The tariff structure for solar generation within and outside the REFIT Regulations is currently higher than many African Countries. For example, the price of 11.5 cents per kWh recently agreed by NBET for large solar on-grid and off grid projects outside the REFIT Regulations compares favorably against the current price of 0.14 cents per Kwh in South Africa (based on the Renewable Energy IPP Program), and 6 cents per Kwh in Zambia (under the Scaling Solar Power Project). This should incentivize local and international investment in solar power projects in Nigeria.

(g) Both the Federal and State Governments are looking to partner with project developers under Public Private Partnership (PPP) structures for the provision of solar power generation. For example, a German company, Nova Solar power, recently agreed a partnership with Katsina State for the development of a 125MW solar plant under a PPP structure (Nigeria Electricity Hub, February 16, 2016).

(h) The Federal Government plans to facilitate the promotion of rural electrification through both on-grid and off-grid power generation by the utilization of energy sources including solar energy.
H. Tariff for solar renewables outside the REFIT Regulations

There are a number of solar PV projects currently being contemplated in the on-grid and off-grid space. In the off-grid space, a number of homes and businesses are opting for solar stand-alone systems. Examples of non-individual off-grid solar projects either operational or in development are the Lagos State Government 5MW Lagos Solar Project (in collaboration with the UK Department for International Development) for electrification of public secondary schools and primary healthcare centres in Lagos State. Also, the Bank of Industry recently commissioned a 24KW off-grid solar project located in Kaduna State.

NBET has recently initialed solar PPAs with 14 developers which are reported to have the potential of adding about 1,125MW to the grid. The fact that there is now an NBET-agreed tariff for large solar on-grid generators outside the REFIT Regulations (11.5 cents per kWh), would encourage an influx of solar power generators willing to invest in the Nigerian electricity sector. Some of the current projects include; Nigeria Solar Capital Partners’ 135MW plant in Bauchi State valued at $200 million; the Pan Africa Solar project for the development of a 75MW solar photovoltaic power project located in Katsina State valued at $146 million; the Nova Scotia power project worth $150 million being undertaken by CDIL for the development of a 80MW plant in Jigawa State estimated to provide power to more than 200,000 homes; and the 382.8KW Solar PV plant hybrid technology being built by General Electric in Kaduna State.

I. Conclusion

Given the huge potential for solar power generation (and other forms of renewables), Nigeria must make efforts to diversify its energy mix (with less emphasis on thermal generation) and invest heavily in research and development on the exploitation of solar and other renewable energy technologies. In terms of a legal, regulatory and tariff framework, a lot has been done in terms of policy and regulation. However, these now need to be implemented and the tariff framework for solar on-grid projects needs to be tested.

It is hoped that in the next couple of years once the tariff framework and the liquidity issues across the electricity value chain are resolved, we will see a lot more solar projects (on-grid and off-grid) come on stream and possibly pave the way for competitive procurement for projects across different renewable energy sources.

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