

## **OPPORTUNITIES AND CONSTRAINTS OF SCALING UP ELECTRICITY ACCESS IN THE GAMBIA**

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**ABSTRACT:** The availability of adequate, reliable, affordable and sustainable energy is a critical milestone in the socio-economic development of any country. In the Gambia less than half of the population (42%) has access to electricity; over 90% are still dependent on solid biomass for cooking and heating. This has significantly hampered development and intensified poverty. Thus, a top priority for the government today is to scale up electricity access in the country especially in the rural areas. To fulfill this objective, the government has taken a number of policies and strategies all gear towards increasing national electricity access in the country. Implementation of these initiatives in a form of projects through Least Cost Power Development Plan (LCPDP) strategy have yield significant opportunities in the attainment of national energy policy target of 2030 by increasing the number of household and businesses with access to electricity. Notwithstanding, this quest is equally face with constraints in the process. These substantial risk constraints include technical, institutional, policy and financial challenges. Therefore, this article conclude that in order to achieve a reliable and effective supply of the total electricity need within the prevailing condition, the Government should encourage Public Private Arrangement of power supply with indigenize energy entities who can met the generation capacity of 50-100MW. The results further suggest that NAWEC and the Government should sign a performance contract in addition to the already signed service contract. Also, the government should look beyond these short to medium-term measures and diversify into the long term energy mix measures to include renewal into the grid system.

**Keywords:** *Scaling Up Electricity Access, Opportunities, Constraints, The Gambia, National Water & Electricity Company.*

### **I. INTRODUCTION**

The Gambia is the smallest country in continental Africa with a total land area of about 11,295 km<sup>2</sup>. It is located in West Africa and is bordered by Senegal on three sides with the Atlantic Ocean coastline on its western edge. The Gambia is one of the smallest in-land countries in Africa with a population of two (2) million. The country experienced an average high annual population growth rate of 3.3 and the consequent increase in domestic demand has been exerting enormous pressure on the country's natural resources which in turn is having an impact on environmental, social and economic conditions [1].

The small Gambian economy relies primarily on tourism, agriculture and remittance inflows. The macro framework continues to be characterized by high debt, crowding out public and private investment. Gambia has moderate external public debt (59% of gross domestic product (GDP) which is primarily in long-dated maturities at concessional rates but it has substantial high-cost, short-term domestic debt currently estimated at 46% of its GDP. The key long-term development challenges facing Gambia are related to its undiversified and highly import driven economy, inadequate modern sustainable energy for all Gambian among a host others [2].

The energy sector encountered its triple challenges of low energy access, insecurity and low efficiency which have an impact on all Gambians. The supply of modern energy services plays a significant role in the development of the Gambian economy. The availability of modern energy provides for greater opportunities in the domestic sectors, which can all contribute to economic growth of the country. Conversely, the absence or limitation in modern energy supply restricts the progress of economic growth. By extension, inadequate supply of energy and its high cost is seriously limiting investment in The Gambia especially the real sectors of the economy [3].

The Gambia government recognizes these problems or challenges of modern reliable and efficiency supply of energy. As a result, the National Development Plan of the Gambia has one of its key objectives, to ensure a reliable and adequate generation, transmission and distribution of electricity at affordable prices to all. In light of these, The Gambia Government is pushing through a series of energy scale up projects and development programmes to improve social and economic development [4]. The crusade of Scaling up electricity access in the

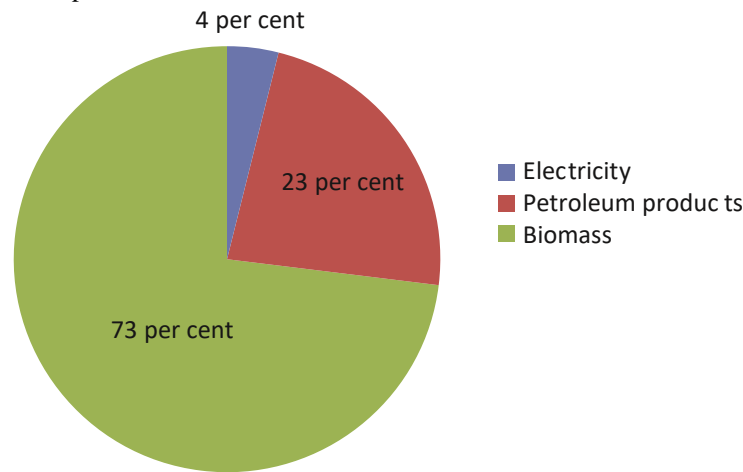
Gambia undoubtedly register significant gains as well as some setbacks, therefore a proper evaluation of this initiative is timely needed in order to establish the magnitude of these opportunities and constraints of this scaling up, thus the motivation of this article.

**II. LITERATURE REVIEW**

**Energy and Electricity in the Gambia**

The main source of energy in The Gambia is wood and other biomass fuels, followed in decreasing order by petroleum products, electricity and a small fraction of renewable energy. The biggest consumers of energy in The Gambia are households and the transport sector with a steady and consistent increase during the past decade in the consumption of petroleum products. Wood fuel consumption is increasing due to increasing energy demand from households for cooking and household-related needs. The dependence on wood fuel means that users are subject to the associated health hazards (such as indoor air pollution) and spend excessive time, effort and money collecting or buying wood fuel. The Government however is committed to providing safer energy services (clean cooking fuel and electricity) at affordable prices [5].

Figure 1: Energy consumption in The Gambia, 2017



Source: Ministry of Petroleum and Energy, 2017

The National Development Plan (NDP) is aimed at fostering cross sectorial socio-economic development; the Government intends to increase electricity generation, enhance access to electricity and improve operational efficiency by focusing on the following four objectives [4]:

- A.** Providing reasonable incentives and facilitation to promote private sector investment in electricity-generation projects;
- B.** Promoting efficient technologies in utility companies to increase their operational efficiency
- C.** Undertaking the replacement and upgrading of ageing transmission and distribution systems; and
- D.** Promoting the use of renewable energy technologies (such as wind, solar and biomass) with emphasis to rural areas.

The current level of electrification in The Gambia is insufficient and the Government is resource constrained to improve the situation, given the huge demand. As at now, The Gambia has an overall electrification rate of 42 per cent, with very high regional variations (from 6 per cent in the North Bank region to 93 per cent in the Banjul region). These electrification rates indicate average electricity access of only 12 per cent in the rural and semi urban regions [6].

Today, the Gambia has an electricity supply of 50 MW indicating a huge gap for improvement. The bulk of the electrification is in urban areas leaving many rural areas without access to electricity [7]. Almost the entire supply of electricity in The Gambia is produced using fossil fuel. The electricity grid comprises of the main Greater Banjul regional grids and six small regional power stations. These six provincial diesel engine power stations were commissioned as part of a Rural Electrification Project in 2006, which raised total installed capacity in rural areas from 4 MW to 11 MW. There are plans to connect these regional grids reducing the number from six to two [8].

**Table 2:** Electrification rates by region, 2018(%)

Regions	Electrification Rate
Banjul	93
Western	22
Upper River	14
Lower River	12
Central River	7
North Bank	6

Source: Ministry of Petroleum and Energy, 2018.

**Electricity Access in the Gambia**

An affordable, reliable and sustainable electricity supply can facilitate the provision of safe water, increased agricultural productivity, the creation of local jobs and functioning of educational and healthcare facilities. Access to a reliable electricity supply is also recognized as a crucial milestone towards the achievement of the Sustainable Development Goal Seven (SDG 7). However, approximately 1.2 billion people around the world are still deprived of access to electricity more predominantly in the rural areas [9].

Presently, in the Gambia only 42% of the population has access to electricity supply leaving a huge gap of 58% of the population without electricity access. Greater percentages of people without electricity access are in the rural areas. Low access to electricity in the rural Gambia is typically characterized by the challenges of limited electricity production and transmission infrastructure. In order to meet energy needs in rural areas, biomass and petroleum products such as kerosene and paraffin wax candles are used as substitutes for electricity. The use of these products often results in environmental degradation, the release of greenhouse gas emissions and health problems [3, 4 & 12]. The high cost of petroleum products is also a significant financial burden which often leads to suppressed demand, that is to say energy needs and target in the Gambia is far from being met[10].

**Electricity Access Challenges in the Gambia**

Several challenges burden The Gambia’s electricity sector such as high tariffs due to its dependence on fossil fuel generation, poor operational efficiency and heavy electricity losses due to its ageing transmission and distribution infrastructure [7].

According to the World Bank Investment Climate Assessment for The Gambia, the lack of a stable and extended electricity system represented the most serious obstacle to business corporations in the country. Considering the continuing instability and fragility state of the energy sector, it is likely that the unreliable provision of electricity remains a major obstacle to economic expansion. Inadequate supply of electricity also hinders social development and constrains the delivery of healthcare and education services in the country[11].

The Gambia is confronted with both infrastructural and financial constraints in providing grid connectivity to rural and remote areas. Electricity in the country is quite expensive, regional benchmarks suggest that electricity tariffs in The Gambia are quite high for both residential and commercial users. In comparison to other regional countries (West Africa), the Gambia has the highest electricity tariffs for domestic (credit metering) customers at US\$0.28 per kWh [8]. During times of high international oil prices and unfavorable foreign exchange rates which are beyond the control of government institutions, the provincial power stations operate for limited hours and on a day to-day basis. The main grids experience constant challenges are in the areas of operation and equipment maintenance power plant machinery[3].

**Table 3:** Tariff Comparison of Select West African Countries

Country	Effective residential tariff (US cents) @ 100kWh/month	Monthly per capita GDP (USD)	% of monthly per capita GDP spent on 100kWh of electricity
The Gambia	28.0	98	21.7
Senegal	23.8	139	17.2
Burkina Faso	20.0	103	19.5

Cote d' Ivoire	11.9	134	8.9
Ghana	8.2	128	6.4

Source: World Bank 2017

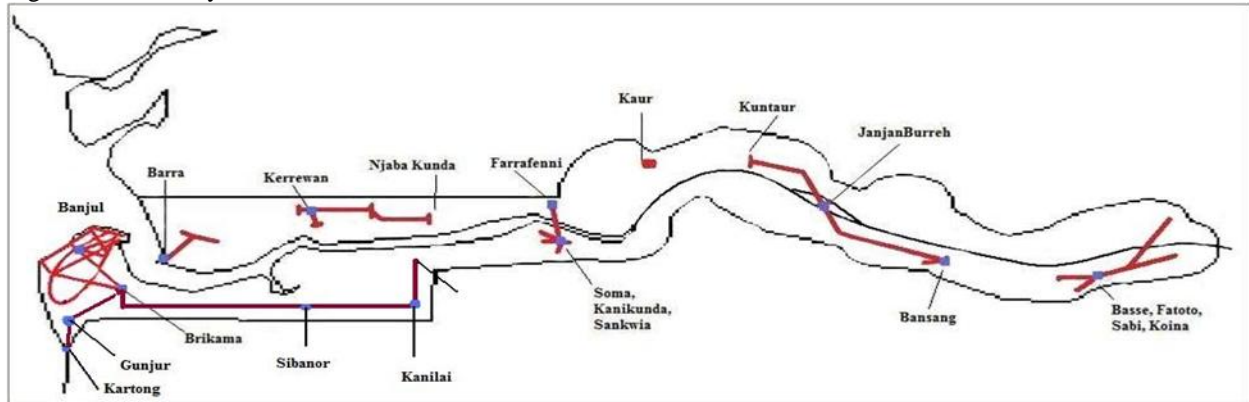
**Strategies of Scaling up Electricity Access in the Gambia**

The Gambia is pushing through a series of energy and development programmes to improve social and economic development. This aims to expand access to energy particularly electricity through a variety of delivery mechanisms and business models. Introducing this policy is not easy in a country heavily reliant on fossil fuel with growing demand for electricity and a weak transmission and distribution infrastructure. The Gambia is taking a strong position in its energy policy and strategy to ensure speedy increase in access to electricity especially in the rural areas. The Least Cost Power Development Plan (LCPDP) strategy is aim at providing guidance to the government on how to expand the electricity sector to meet the needs of customers while minimizing total system cost [12].Some of the key LCPDP strategic projects as are discuss below:

**Restoration and Modernization of HFO Power Plants**

The objectives of the Electricity Restoration and Modernization Project for Gambia are to: (i) improve the operational performance of the Project Implementing entity and (ii) improve the capacity of the entity to dispatch variable renewable electricity. There are three components to the project, the first component being on-grid solar PV with storage. The second component is the Transmission and distribution (T&D) restoration and modernization. This component will finance T&D upgrades necessary to: (a) absorb the additional generation capacity; (b) prepare for future capacity expansion including the OMVG and other pipeline projects;(c) help reduce T&D losses and power cuts; (d) extend the distribution network throughout the country; and (e) enable future grid extension. This component includes four subcomponents: new Kotu-Brikama line, improved service quality, distribution backbone in the provinces and customer connections, demand-side management (DSM) and loss reduction activities. Finally, the third component is the urgent institutional support for sector turnaround. This component will finance key activities such as restore the sector, improve operational performance of NAWEC and support project implementation. This component includes three subcomponents: NAWEC turnaround strategic support for the energy sector and project preparation and implementation support [13].

Figure 2: Electricity Grid Infrastructural in the Gambia



Source: The Gambia Electricity Sector Roadmap, 2017

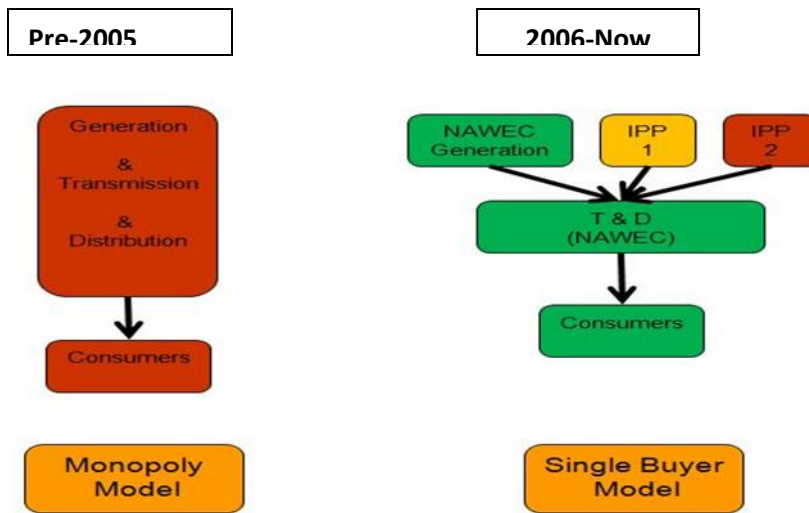
**Increase Generation Capacity through Independent Power Producers (IPPs)**

The regulation of the electricity sector falls under the purview of Public Utility Regulatory Authority (PURA). Following the approval of the National Energy Policy in 2005 and the enactment of the Electricity Act, the electricity sector in The Gambia has seen significant improvements. The monopoly that National Water and Electricity Company (NAWEC) earlier enjoyed in the generation of electricity ended with the opening of the generation market to the private entities. NAWEC however still maintains its monopoly status in the distribution and transmission sectors. NAWEC still maintains its Kotu Power Station as the major generating power house supported by a number of standalone power stations in the major provincial towns. The current maximum available capacity at Kotu Power Station is 25.3 MW at peak load[6].

In 2006, an independent Power producer (IPP) became operational with a new power plant in Brikama with an installed capacity of 26MW. This new injection of privately generated power resulted in major improvements in

the sector. Currently, there are two independent power producers (IPPs) operating in The Gambia supplying approximately half of the power generated in the country [8].

Figure 3: Shift in Electricity Generation, Transmission and Distribution in the Gambia



Source: PURA, 2018

**Rural Electrification projects**

The majority of electrification in The Gambia is in urban areas, leaving many rural areas without access to electricity. As a result, the Gambia government has unveiled a scaling up strategy to increase electricity access to 30% of the rural population in The Gambia by 2030. The Government launched the rural Electrification project in 2007 which built new power plants in all the major provincial towns. All the engines are diesel engines. Another intervention area of the project was the construction of extensive transmission and distribution networks in several villages and towns in the rural areas. Electricity services is much improved now in the rural areas with most localities experiencing excess of 12 hours of electricity per day, 6hrs in the morning and 6hrs in the evenings [6].

**Increase Supply through Regional Interconnection**

Recognizing the problem of electricity access, the Economic Community of West African States (ECOWAS)/West African Economic and Monetary Union (UEMOA) adopted in 2006 the White Paper for a Regional Policy geared towards Increasing Access to Energy Services for Rural and Peri-urban Populations. Two of the regional targets set included: 1) at least 60 per cent of people in rural areas to have access to productive energy services in villages, in particular motive power to boost the productivity of economic activities; and 2) 66 per cent of the population, or 214 million people to have access to an individual electricity supply (ECOWAS/UEMOA, 2016). One of the measures of the success of the regional policy is that at least 20 per cent of new investments in electricity generation should be targeted towards scaling up electricity access to the rural communities in order to achieve energy self-sufficiency, reduced vulnerability and sustainable environmental development in keeping with the regional plan [14].

Currently, in the Gambia a 12 MW of power is supplied from the national electricity utility in Senegal, Société National d'Électricité du Sénégal (SENELEC). This supply is generated from the West Africa Power Pool (WAPP) two sub stations in Senegal. Also, the country's power sector is anxiously waiting for an additional 23MW generation capacity from regional Organization pour la Mise en Valeur du fleuve Gambie, Gambia River Basin Development Organization (OMVG) interconnection. The OMVG interconnection consists of: 1,677 km of power transmission line in 225 kV; 8 15 substations HV / MV for powering loads from national utilities; and two dispatching centers. The project also partly finances the operations and maintenance (O&M) contract costs for the first five years of operations. OMVG represents a strategically critical means for The Gambia to close its supply/demand gap and reduce the average cost of supply [4].

**The Gambia Electricity Access Project (GEAP)**

The Gambia Electricity Access Project's ultimate objective is to increase the Gambian population's access to affordable and reliable electricity services. It will involve the construction of Medium and Low Voltage lines, erection of transformers and connection of customers in Lower River, North Bank, Central River and

West Coast regions to one unified grid system. From the OMVG Energy Project two substations (Brikama and Soma) currently undergoing construction, greater percentage of rural people (men and women) will be provided with modern electricity access as well as improve the performance of the National Water and Electricity Company (NAWEC) by increasing its billing and revenue collection volume and staff capacity. With a total cost of 62.26 million dalasis, the project will be implemented within four years [6].

### **III. METHODOLOGY**

According to [15], “Gap Analysis Model” is a research methodology that premised on the fact that service quality is dependent on the size and direction of the gap between expected service and perceived (actual) service ( $Q = P - E$ ). Later studies on the model [16, 17, 18, 19] revealed that service quality include both “technical quality or outcome quality of a service”; and the “functional quality or process quality of the service”. These studies were based on the modified blended model from the pioneer model. Therefore, this article conduct rapid assessment technique through a comprehensive desk review as well as stakeholder consultation covering government ministries and departments, utilities, private sector and development partners in The Gambia energy sector.

### **IV. ANALYSIS AND DISCUSSION ON THE LITERATURE REVIEW**

From the literature review, it is clearly evidence that the Gambia’s power sector is in a precarious situation. Merely 50MW of generation capacity is available compare to at least 100 MW demand, meaning many part of the country is still not electrified. This is partially due to the fact that NAWEC is not financially viable thus its debt has mushroomed to 9 billion Dalasis (approximately US\$200 million). However, there is real reason for hope [6]. There are potentially game changing developments on the horizon as the Gambia is pushing through a series of scaling up electricity programmes to improve social and economic development. The primary focus of the new electricity roadmap is Least Cost Power Development Plans (LCPDP). This Least Cost Power Development Plan (LCPDP) is aimed at providing guidance to the government on how to expand the electricity sector to meet the needs of customers while minimizing total system cost. It also helps diversify the energy mix to reduce NAWEC’s exposure to oil prices and transition towards cleaner energy sources. The LCPDPs is center on three scenarios, with sensitivity analysis for fuel prices and transmission losses on the preferred scenario. The methodology of LCPDPs follows a linear programming capacity and dispatch optimization model which helps to assess the least-cost generation mix using assumptions. The LCPDP model is currently centered on the following extents:

- a. Minimize total discounted system cost comprising fuel and variable O&M, fixed O&M and annualized capital costs (for new plants) and cost of unserved energy
- b. Repair and upgrade existing power stations to increase power generation through LCPDP
- c. Forecast annual load duration curve to predict annual electricity demand [3, 6 & 12].

*Some of the key Opportunities and Constraints for scaling up electricity access in the Gambia identify by this article are discuss below:*

#### **Opportunities of Scaling Up Electricity Access in the Gambia**

After an extensive literature review, this article identifies and discusses key prospects render by the scaling up electricity access in the Gambia as follows:

**Contribution to increase access to reliable supply of electricity:** The majority of electrification in The Gambia is in urban areas, leaving many rural areas without access to electricity. In 2011, the national electricity access was 35% (Ministry of Energy, 2011) but today with many LCPDP scaling up projects implement as discuss earlier, the national electricity access is increase to 42%.

**Increase household and business access to electricity:** The increase percentage of national electricity access means that the number of households and businesses supply with electricity obviously increase especially in the rural areas. This is mainly due to LCPDP scale up projects that built electrical infrastructures in both rural and per urban areas.

**Liberalization of electricity generation market:** Scaling up electricity access in the Gambia through LCPDP projects has given rise to liberalization of electricity generation component of the market by the introduction of two Independent Power Producers (IPPs) into the power sector. Currently, the two IPPs and cross boarder interconnection from Senegal is generating almost half of the national electricity supply.

**Institutional development and capacity building:** Scale up LCPDP electricity access projects avail NAWEC the opportunity of counterpart engineers on the job training with employees, oversees trainings, study tours and provision of tools, materials & office equipment, construction of Customer Service Centers and sensitization on electricity conversion.

**Expansion of electricity distribution infrastructure:** LCPDP scale up electricity access opportune the construction of electrical infrastructures (MV & LV lines and MV/LV transformers), supply of connection equipment, acceptance tests and commissioning of new stand-alone diesel engine generators with additional new Transmission and Distribution (T&D) line as well as commissioning of T&D lines from IPPs. This have further contributed to the reduction of T&D losses from 40% to 22% since 2011 to date.

#### **Constraints of Scaling Up Electricity Access in the Gambia**

The below discuss points are identify as major constraints in scaling up electricity access in the Gambia.

Substantial investments is still needed in T&D infrastructure to reduce T&D losses and extend the distribution network throughout the country. The Gambia electricity distribution system (below 66 kV) is plagued with inefficiencies at the distribution level while the transmission system (66 kV and above) is nonexistent. These factors lead to high technical losses and unfeasible electricity transport over long distances. Scaling T&D infrastructure to meet growth projections is estimated to require US\$133 million by 2025, which is intend to come from public finance.

In addition, there is lack of single reliable power network which can supply electricity from different sources. The availability of this single network will not only help to extend the distribution network in the provinces but also expand access to quality electricity services.

Furthermore, The Gambia is a country of two million people with only 42% of the population with electricity access, leaving the majority of the population (58%) without access to electricity. This implies that, achieving the entire objectives of scaling up electricity access through LCPDP projects still remains a big challenge for the government in terms of finance, technical and human resources.

Also, NAWEC cost recovery is estimated to be approximately 88 percent. By extension, the cost of electricity supply in The Gambia is estimated at approximately US\$0.32 per kWh in 2017 on a cash-needs basis (that is, cash needed to cover immediate operating costs and debt servicing of the utility), one of the highest in Sub-Saharan Africa. Total cost of supply is estimated to be as high as US\$0.39 per kWh in 2017 including operating costs and all capital expenditure obligations (many of which are serviced by the government not NAWEC). These estimates compared to average tariffs were US\$0.26 per kWh. This shows that NAWEC still have significant challenges in terms of resources for basic operating costs (personnel, maintenance, and so on) not to talk of initiating new scale up LCPDP to increase national electricity access.

Meanwhile, cost and revenue data from NAWEC are rough estimates, as the utility does not have separated accounts for its electricity, water and sewage activities. The separation of accounts (electricity, water and sewerage) to be implemented by the Service Contractor and expected to started in 2018 but did not hold. A review of the tariff structure is also planned with support of the World Bank-funded Integrated Financial Management Information Systems Project but yet to start. This review should assess among other issues the potential for an automatic pass through mechanism for fuel prices and exchange rates plus the allowed T&D losses. The implementation of these plans will ensure more accurate figures on cost recovery and increase transparency on costs and cross-subsidies.

Finally, the turnaround of NAWEC into an efficient, creditworthy, financially viable utility is a critical success factor in achieving the country's electricity road map objectives. To attract reasonably price for IPPs and maximize finance for development, the turnaround of NAWEC is critical to manage high levels of risk presented by the current lack of financial viability. Likewise, to avoid the risk of interruptions in the supply of electricity through imports due to nonpayment, NAWEC needs to be able to meet any contractual commitments in relation to import purchase agreements and have sufficient resources to adequately maintain its assets and implement much-needed investment projects. The main elements of the plan are to achieve NAWEC solvency including Debt restructuring, Competitive fuel supply and reduced technical and commercial losses.

## **V. CONCLUSION AND RECOMMENDATIONS**

The energy sector in The Gambia faces vexing problems. This country has budgetary constraints for the foreseeable future due to its dependence on imported fuel and weak supply infrastructure to support the desired economic and social development. This difficulty is especially pronounced in rural areas, which are generally characterized by widespread poverty, low income, low demand and the inherent disadvantage of being further from the grid. In recognition of this fact, the Gambia government and its energy stakeholders adopt and implement LCPDP scale up electricity access in the country especially in the rural areas. These scales up policies and strategies have contributed in increasing the national electricity access from 35% in 2011 to 42% in 2020. Although, the progress of these scale up projects are still not enough due to several constraints but equally registered a great degree of opportunities. These LCPDP scale up electricity access policies and projects give rise to opportunities such as

increase number of household and business access to electricity, increase reliable supply of electricity to existing customers, liberalization of electricity generation market, institutional development and capacity building and expansion of electricity distribution infrastructure among others. However, the Gambia still have huge constraints in scaling up electricity access in the Gambia. These constraints are inadequate substantial investment in modernizing T&D infrastructure, lack of single reliable power network, rough estimates of cost and revenue data, short fall in cost recovery as well as inadequate institutional finance and technical competence to further scale up national electricity access. This further implies that in the Gambia the problem of low electrification rate is severe. Up to date government LCPDP scale up electrification policies and projects are still based on 'status quo' path of grid extension. Accordingly, the Gambia's electricity progress will likely falls short of attaining the new electricity roadmap and sustainable energy for all objectives by 2030. In this regard, the article recommends the Gambia government and its energy stakeholders to hold on to its LCPDP policies and strategies but be aware and identify substantial constraints of achieving financial viability of meeting energy goals. In addition, the Gambia government should look beyond these short to medium-term measures and think of diversification of the energy mix as currently the Gambia remains 100% dependent on HFO which has a substantial impact on NAWEC's financial position. Generation depends on imported liquid fuel and with no automatic pass through mechanism, which is difficult to implement given the already cost-prohibitive tariffs. As a result, NAWEC remains vulnerable to price and exchange rate shocks plus transition to imports. Finally, NAWEC and the Government should sign a performance contract in addition to the NAWEC service contract. The contract should also include commitments from the Government of The Gambiasuch as an agreement for the settlement of government arrears to NAWEC. Furthermore, energy stakeholders in the Gambia should execute renewable energy plan outlined in the road map. This will help reduce the risk exposure over the medium term. This article is confident that, successful Implementation of these abovementioned recommendations will not only support existing LCPDP scale up policies and strategic projects but also help to attain universal energy target by 2030.

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