

Potentiality and Barriers of Renewable Energy in Tanzania; Electricity Services Access and Policy Perspectives

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Summary

Access to electricity services is still a major challenge to the majority of people living in the rural areas of Tanzania with connection and access still at low level compared to urban areas. Efforts to electrify villages and rural communities is commendable, though more drive to utilize renewable energy (RE) is recommended. There has been more focus on large hydropower and thermal power projects leaving other sources of RE underexploited. Climate change and unpredictable high fossil prices necessitate the shift into RE. Tanzania has great potential of RE which could supply more of the electricity needs at an affordable cost. This policy brief elaborates the potentiality of RE in the context of electricity services access and policy implication in Tanzania and calls for promotion and capacity building on issues of RE in government, financial institutions and communities, Research on RE affordability, mobilization of smaller energy access supplier, setting minimum quality and safety standards, and support the development of bespoke RE installation infrastructure has to be done by the government. involvement of RE issues exploitation in policies, strategies and plans to all levels. Enhancing the role of Public Private Partnership (PPP) could be a solution for RE financing bottleneck.

Introduction

In Tanzania, major sources of power are natural gas, petroleum, and hydropower. Out of the total installed power capacity of 1,264 megawatts (MW), 568 MW is from hydroelectric power, 685.4 MW is from thermal power, and other renewable energy contributes less than 82.4 MW (USAID, 2018). More than 85% of the population uses traditional fuels as household energy sources (Bonjour, 2013). According to Bureau of Statistics and the Rural Energy Agency report 2017 only 32.8% of communities in Tanzania has access to electricity, whereby urban areas have more access to electricity (65.3%) than the rural areas (16.9%). Out of the total electrified households, 74.9% and 24.7% are electrified with national grid and solar power, respectively. The rest (0.3%) are electrified with individual electricity produced from other sources such as small generators.

Tanzania has a lot of renewable energy sources such as biomass, solar, hydropower, geothermal, biogas, wind, tidal, and waves (MEM, 2017) but only a small fraction is harnessed (ESI, 2014). These sources are important for decentralized renewable energy technologies, which nurture the isolated nature of the settlements and are environmental friendly. Despite their necessity, renewable energy sources are given low priority by both government and households. They are important to users in local households in the countryside, where most people depend on the use of charcoal, firewood, and cow dung as their major sources of energy. This affects

their health and contributes to climate change problems, which are alarming in developing countries.

However, since the introduction of the national energy policy (NEP) 2015, the following has been achieved on the energy sector; operationalization of Rural Energy Agency (REA) and Rural Energy Fund (REF); formulation of Small Power Producers Association (SPPA); increased number of players in the petroleum industry; reliable supply of petroleum products; operationalization of the Bulk Procurement System (BPS) for petroleum importation; formulation of Model Power Purchase Agreement (MPPA); formulation of Electricity Act 2008, Power System Master Plan (PSMP) 2009 – 2033; increased power generation installed capacity from 891 Megawatt Electricity (MW) in 2003 to 1,483 MW in 2014; increase in annual electricity consumption per capita from below 80 kilowatt hour (kWh) in 2003 to 105 kWh in 2014; increased electricity connection levels from below 10 percent in 2003 to 30 percent in 2015; formulation of the Electricity Supply Industry Reform Strategy and Roadmap 2014 – 2025; increased natural gas discovery from 8 Trillion Cubic Feet (TCF) in 2003 to 57.6 TCF in March 2018 as well as completion of Natural Gas transportation pipeline from Mtwara to Dar es Salaam and the associated facilities.

Despite the achievements, the Energy Sector faces a number of bottlenecks including: low private sector participation in large scale power generation; over-reliance on few big electric generation sources, unreliable and expensive energy supply; overdependence on Government subsidies; low access to modern energy services; inadequate human resource with

requisite skills and knowledge; low participation of Government and Tanzanians in the petroleum value and supply chain; inadequate financial resources to develop the sector; and inadequate research and development (NEP, 2015).

Energy Profile of Tanzania

Energy Consumption

The main source of energy for rural Tanzanian households is traditional biomass standing at 90% whereby other modern sectors are dependent on imported petroleum products. The country has abundant RE resources but hydro is only source currently being exploited adequately in a renewable manner at a capacity of 10 MW per year (NEP, 2015). The ESI indicates that about 67.5% of the total population has access to electricity services of which 49.3% is in rural areas. According to the rural electrification program, Tanzania has targeted to have an electrification rate of 50% by 2020, 64% in 2025, 76% in 2030, and 90% in 2035. Consequently, the country faces a lot of challenges on energy access which are caused by an unpredicted level of use of firewood and charcoal as well as high connection costs, followed by a high and frequently unstable price of petroleum.

Electricity Access and Generation Capacity

The demand for new electricity connections has increased due to the improved energy policy 2015, that led the Government lowering the connection and monthly fixed charges. The 2016 Energy Access Situation Survey results show a significant improvement of electricity connection at household level in both rural and urban areas of the Tanzania Mainland since 2011. Up to 2016, about 32.8 percent of all households in Tanzania Mainland were connected to electricity of any form with rural and urban areas recorded 16.9 and 65.3 percent respectively. According to the power system master plan (2016), for large and medium-scale hydro power projects, twenty-three (23) projects with a total installed capacity of 4,765MW are identified as power development options. Four (4) planned projects out of those, i.e. Rumakali, Rusumo, Ruhudji and Malagarasi Stage III, were committed projects in the PSMP2012 Update.

In general, Tanzania electric energy supply is depending on fossil prone to world market price variability and hydropower which is prone to climate variability. According to the Tanzanian official generation expansion plan, in 2025 the fossil fuel fired power plants will represent 75% of the total installed capacity compared to 20% from hydropower plants and 5% from other renewables (ESI, 2014), after 2025 the power mix is expected to still be dominated by fossil fuel based technologies (especially the newly introduced coal-fired power plants which are expected to represent more the 40% of the installed capacity in 2035) and large hydropower. In the year 2017, the power installed capacity was 15492 MW, comprises of Hydro 562 MW, Natural gas 610 MW, Liquid fuel 420 MW (ESI, 2014). NEP (2015) added that, another Gas fueled power plant, Kinyerezi I with 150MW capacity was commissioned, thereby increasing the total generating capacity to 1,633MW with a 10,000MW target by 2025.

Renewable energy will make up almost half of sub-Saharan Africa's power generation growth by 2040. According to Renewables Global Status Report, 2018, at present, renewable sources account for nearly 80 per cent of Kenya's energy supply and Ethiopia is planning for a carbon-neutral status by 2025. The application of RE technologies has the potential to alleviate poverty to big percentage of the rural population of Tanzania. On top of that RE technologies is a viable option because it can easily be decentralized thus providing energy in areas far from the national grid.

Renewable Energy Vs Fossil Fuels

Renewable energy comes from natural resources that can be replenished during an average human lifetime and includes solar, wind, hydro, geothermal, and biomass. Fossil fuels, on the other hand, can take thousands or even millions of years to naturally replenish and include, natural gas, coal, and oil. Fossil fuels dominate energy generation in the country, however, it's reasonable to assume the percentage of renewables will continue to outgrow fossil fuels for the foreseeable future. These days, the energy produced by renewables is just as affordable as energy produced by fossil fuels. RE generation is cleaner, easier to sustain over time, expanding more rapidly, and sometimes even cheaper than fossil fuels. Teske et al, (2017) noted that, a variety of technologies can provide electric services in different capacities, with corresponding variances in performance and cost. These RE technologies have multiple proven benefits such as improved health through the displacement of indoor air pollution, reduced greenhouse gas emissions, enabling small business activities, increased security, for example via street lighting at night and enhanced communications and facilitation of greater quality and availability of education through access to affordable lighting.

Electricity Supply Reform Strategy 2014-2025

This Strategy recommends for gradual unbundling of the state owned utility company into independent generation, transmission and distribution companies with much emphasis of private sector participation in the entire supply chain with exception of transmission segment. To create an environment conducive to attracting investment in the ESI which will support the country's economic development goals. The ESI infrastructure is reported to be one of the major constraints in the Government of Tanzania (GoT) efforts to achieve the desired socio-economic goals articulated in the Tanzania Development Vision 2025.

Energy Policy 2015

The first National Energy Policy (NEP) for the Country was formulated in 1992 and it got replaced in 2003. After a strengthening of the Energy policy in 2015, it can be said that RE has only been a small part of the policy and that it should be reviewed. Among the outcome associated with the attainment of the objectives of the 2015 NEP will;

- i. Create a conducive environment for private capital investment in the Energy Sector;

- ii. Expedite access to modern energy services through development and expansion of energy infrastructure;
- iii. Develop energy resources to adequately meet domestic energy demand and facilitation of energy trading;
- iv. Promote energy alternatives including renewable energies to enhance diversification of energy mix;
- v. Enhance energy efficiency and conservation in all sectors;
- vi. Optimize benefits to the Government and the people of Tanzania through strategic participation, interventions and equitable benefit sharing;
- vii. Ensure prudent management of petroleum resources and accrued revenue for the lasting benefits to the society;
- viii. Promote usage of locally produced goods and services in the petroleum industry;
- ix. Strengthen institutional, legal and regulatory frameworks and developing human resource to ensure development of a sustainable Energy Sector; and
- x. Promote compliance with environmental, health and safety standards in the Energy Sector.

Related Renewable Energy (RE) Policies and Practice

The Government intended to develop RE sources to minimize production costs. Tanzania has continued to improve its energy policy and regulations in order to encourage and motivate Independent Power Producers (IPP). According to the national power master plan 2016, the government aimed to contribute to at least 260MW of new renewable power generation being connected to the national grid by 2018. This goal should be achieved through a wind project of up to 200 MW per year from Singida, Njombe, and Dodoma.

Barriers to RE initiatives in Tanzania

Among the identified barriers are;

a) Institutional Barriers

- i. **Uncertainty around the government's commitment towards large-scale RE power.** According to the official Power System Master Plan (2016) The current government approach is to proceed with government-owned power generation projects. As the government's financial are limited, some priority projects have to be identified large-scale RE projects are not on the government agenda at the moment (Aly et al., 2019). Further, the unpredictability on the government's priorities related to the Energy sector imposes significant uncertainty about the future investment planning for large-scale RE power projects (Nesamalar et al., 2017).
- ii. **Decision makers' perception that RE power cannot be used for large-scale generation.** High-profile decision makers in Tanzania don't believe that RE technologies can generate reliable electricity in large

amount (e.g. tens of MW scale) to contribute to the country's industrialization vision. Further, the general perception, within public institutions, is that RE power technologies can only provide intermittent non-reliable electricity on small-scale (e.g. Solar Home System or mini-grid).

- iii. **Discouraging business environment for private investors.** The new legislation on the natural resources which reinforces the sovereignty of the Tanzanian state on business contracts is perceived by most of the stakeholders a very discouraging measure for private investment in RE. though, the new legislation is seen by the Tanzanian government as necessary measures to avoid and fight corruption based on the country previous experience in this regard.

- iv. **Tariff cap suggested by the government.** Deciding the utilities tariff in Tanzania has a political dimension as the government does not want the people to suffer from a higher electricity tariff. Some of the private investors development partners and financial institutions consider that RE power projects will not be feasible under the 9 US¢/kWh tariff cap.

- v. **Political interference in the decisions of the utility and the regulator.** The Energy and Water Utilities Regulatory Authority (EWURA) is a highly professional regulator and it used to have a high level of integrity and professionalism in all its works, it is supposed to make all its decisions based on transparent techno-economic studies and assessments. However, directives regarding important decisions are expected to be received from high-profile politicians (Aly et al., 2019).

b) Financial Barriers

- i) **Off-Taker Non-Payment Risk**

The off-taker risk in Tanzania is considered among the highest off-taker risk in Sub-Saharan Africa such high off-taker non-payment risk significantly affects the risk mitigation instruments considered by financial institutions (Aly et al., 2019). The off-taker non-payment risk is obviously reflected on the interest rates asked by lenders, which increases the cost of capital significantly, leading to a noticeable increase in the overall cost of large-scale RE power projects.

- ii) **Unfavourable financing conditions for large-scale RE power projects.** Tanzanian financial institutions are not interested in financing RE power projects, especially large-scale RE power project. The unfavourable financing conditions for large-scale solar power projects (either by Tanzanian or international lenders) increase the cost of capital significantly, leading to a noticeable increase in the overall cost of the large-scale RE power projects which is reflected as a high tariff negotiated by the investors with The Tanzania Electric Supply Company Limited (TANESCO).

c) Technological barriers

- i) **Lack of data and studies to support the development of large-scale RE power projects.** It is indeed difficult to compare the potential for the

different RE options due to the scattered validated information.

- ii) **Lack of qualified local personnel-** there is a lack of qualified local personnel who have the capacity to design, build, and operate large-scale solar power projects at technical, business and managerial levels.
- iii) **Technical limit set by the utility for electricity generation from renewables-** from a technical viewpoint, the electricity generation from renewable energy sources (other than large hydropower) should be kept below 10% of the total installed capacity. RE technologies (including solar power) are seen as intermittent electricity generation technologies which cannot contribute to the power system's base load or firm capacity.

Recommendations

- Tanzania must promote RE as alternative source of energy
- Strengthening financial institution to fund RE initiatives.
- Governments and other public funding organizations could support pilots and demonstrations of RE technologies, to prove concepts and stimulate the market.
- Trade bodies, regulators and governments could agree to minimum quality and safety standards.
- Research on effectiveness of different RE sources has to be given priority.
- The focus for RE should be beyond provision of lighting services

- Smaller energy access supplier could group together into trade associations to undertake larger volume purchases with greater bargaining power.
- Demonstration projects on various renewable energy forms be widely established; so that the performance and efficiency with which services are delivered can be sensitized
- Governments and public funders could support development of bespoke RE installation infrastructure.
- Public Private Partnership (PPP) is required to find the solution for RE financing.
- Mainstreaming energy & RE into national, district and village development policies, strategies and plans

Conclusion

Tanzania has great potential of RE which could supply most of the electric supply. There has been more focus on large hydropower and thermal power projects leaving other sources of RE underexploited. Climate change and unpredictable high fossil prices necessitate the gradual shift into RE. Despite of institutional, financial and technological barriers, the promotion and capacity enhancement on issues of RE both government, financial institutions and community is needed to boost RE utilization in Tanzania. Research on RE affordability, mobilization of smaller energy access supplier, setting minimum quality and safety standards, and support the development of bespoke RE installation infrastructure has to be done by the government. Further, there is a need to involve the topic of RE exploitation in policies, strategies and plans to all levels and Public Private Partnership (PPP) is required for the solution for RE financing.

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