STRATEGIC PV PROJECT DEVELOPMENT WITH STRENGTHENED RENEWABLE ENERGY GOVERNANCE AS A SOLUTION TO SUSTAINABLE ELECTRIFICATION IN EASTERN AFRICA, WITH COUNTRY FOCUSES OF TANZANIA AND UGANDA

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ABSTRACT: Solar photovoltaic power plants with their ease of implementation and minimal negative environmental and social impacts can be seen as the potential long-term solution for the rural electrification problem in Eastern African countries, namely Tanzania and Uganda, for reaching their targeted electricity access ratios for the next decades. Appropriate regulation of the renewable energy markets, innovative financing options and effective incentives for Solar PV power generation investments will prove decisive for the pace and extent of their expansion both for public and private initiatives in these countries. This paper starts with a brief analysis of related regulatory bodies, frameworks and policies in Tanzania and Uganda for solar PV implementations and introduces the relevant barriers and opportunities. As a result of this assessment, recommendations for an ideal business plan and competitive strategies to overcome the already existing barriers for PV implementations are presented. The research is based on desktop and on site research performed with key stakeholders.

1 INTRODUCTION

In Uganda, it is aimed to achieve a rural electrification access of 22 % from current level of 5 % for the years from 2013 to 2022 [1]; where in Tanzania, less than 15% of the country has energy access and in rural areas, energy access is about 3% even though continuous reforms had been established since 2003 in the energy sector to increase the level of access to energy [2]. Both countries have eminent targets on rising levels of electrification, for which they still need to overcome their issues related to insufficient financing and organizational capabilities needed for sustainable planning and long term effective execution, additionally to exert more strategic focus on utilizing their excessive renewable energy resource, namely solar energy. Being located on the SunBelt, the countries have excellent solar resource for PV investments: according to the PVGIS database, the yearly sum of global horizontal irradiation values in Uganda and Tanzania is significantly high, ranging from 2000 to 2500 kWh/m². On the contrary the utilization of this resource is not at a similar level yet: in Uganda the current installed PV capacity is estimated to be around 1.1 MWp throughout the country based on small scale installations on institutional and solar home systems, implemented with the project or donor supports through the government, and in Tanzania only around 6 MWp of PV applications are readily in use, consisting of about 2 MWp as solar home systems installations for self-consumption purposes in public service buildings such as schools and hospitals, enterprises, and households, and for street lighting; together with the narrow commercial market with about 4 MWp of PV in various applications accounting to approximate annual sales of about 1.5 MWp.

As suggested in the national Scaling Up Renewable Energy Program (SREP) of 2013, 1 MWp of solar PV located in central Tanzania generating about 1,800 MWh per year after losses shall require about 1 hectare of land, and therefore total estimated electricity demand of 27,000 GWh by 2025 could be met technically with a roughcalculation by only about 0.02 % of Tanzania`s land mass [3]. Taking Germany as an example of one of the most PV intensive countries in Europe, having achieved to reach up to a 35 GW installed PV capacity in 2013, and solar PV provided electricity of 18 TWh of electricity in 2011, with only almost half the solar resource of Uganda and Tanzania, it could be argued that effective governance have higher impact on resolving electrification issues with use of solar energy resources, rather than the actual technical capacity of the resources itself. Thus, utilization of solar PV plants can be a solution for the electrification problem in Eastern African countries when adequate implementation strategies in the governance of energy field are adopted.

2 BACKGROUND ON RENEWABLE ENERGY SECTOR IN TANZANIA AND UGANDA

There are several institutions which lead and regulate the energy sectors in Tanzania and Uganda, influencing directly the character of energy investments and therefore sustainable utilization of renewable energy resources. Effective facilitation and involvement of these institutions play key role in further adaptation of PV in the national energy mixes.

To begin with the main authority in Tanzania, the Ministry of Energy and Minerals (MEM) is the mandate to develop energy and mineral resources, managing the sector and promoting renewable energy through its policies which guide rest of the key stakeholders in the energy sector which are REA, TANESCO, EWURA, private companies, NGOs and financiers. Rural Energy Agency (REA), is an autonomous body under the MEM, responsible for energy access in rural areas via development of energy projects and activities; financing of these projects and the allocation of grants for donor-financed projects taking a least-cost planning approach to rural electrification integrating grid and off-grid options, along with renewable energy sources. Tanzania Electric Company, (TANESCO), on the other hand, is Tanzania`s principal electricity generator, transmitter, and distributor, providing nearly 60 % of the effective

generating capacity of the national grid, serving customers on the main grid and in 20 isolated grids. Energy and Water Utilities Regulatory Authority (EWURA) is an autonomous, multi sectoral regulatory authority responsible for the technical and economic regulation of Tanzania's electricity, thus regulating tariffs for all electricity trade in the country via Power Purchase Agreements (PPAs). The mentioned players and their key interactions are summarized in the organizational diagram given by the Fig.1.

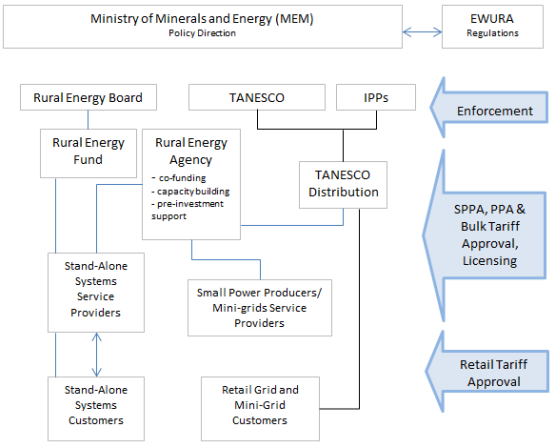

Figure 1: Organigram of Regulatory Authorities in Tanzanian Energy Sector

Besides the governmental institutions, there are also six private sector players contributing approximately to 40 % of the national grid's effective generating capacity, Symbion-Ubungo, IPTL, Symbion Arusha, Songas, Aggreko, and Symbion Dodoma, whom are referred as Independent Power Producers and Emergency Producers. In addition to the state owned power generation plants,

Several other private power companies are in the process of developing large-scale hydro, solar, wind, and geothermal projects. Various private companies are engaged in small renewable power development under the SPPA to sell power to TANESCO and/or sell directly to retail customers. Many of these firms are already working in rural areas in such enterprises as tea, sugar, sisal, and tannin, amongst others. Currently three SPPs are selling power to the grid and an additional eight SPPAs have been signed with TANESCO. In the past years TANESCO has been under significant financial distress due to network losses of above 20% which are considered significantly high compared to an international average of 5 to 8%, reduced hydropower output, electricity tariffs remaining below the cost recovery level caused by emergency electricity from diesel generators which consists 13 % of national energy mix. TANESCO had been incurring losses rather than raising electricity tariffs frequently and by large amounts, thus its creditworthiness had increased off-taker risks to investors interested in IPP projects[1].

Over the past ten years revolutionary organizational changes have been performed in the Tanzanian energy market in order to create a national energy system where demands of people are met in the most economical manner. Participation of private sector was highly encouraged to develop a market economy and provide citizens cheaper electricity. Employing further renewable energies and giving further autonomy to Rural Electrification authorities are the most important pillars of the reforms. Regulatory frameworks to ease implementation of smaller renewable energy projects were introduced with EWURA´s Small Power Producers Program including standardized contracts which enabled reach to isolated rural communities. Solar energy is also foreseen to contribute largely in the Power System Master Plan with 120 MWp until 2016. To make solar PV more attractive, the government has removed the value added tax and import tax for main solar components (panels, batteries, inverters, and regulators), which has allowed end users to get PV systems at a more affordable price.

One of Tanzania`s largest governmental support programs with participation of World Bank and Global Environment Facility (GEF) is the TEDAP program; dedicating $113.7 million for TANESCO to upgrade its transmission and distribution networks, and $47.5 million for the REA to develop small power rural electrification using renewable energies. TEDAP program was designed to make rural electrification investments more attractive to private sector introducing standardized PPAs and tariffs, performance grants for connections in rural areas that do not have grid access, coverage of maximum 80 % of the transmission costs per project, interest rates linked to average term deposit rates, long term (up to 15 years) loan coverage up to 70 % (85 % for projects < 3 MW) refinanced by the credit line through local banks. Interest rates of TEDAP loans are linked to average of BOT term deposit rates; where the rate is revised every six months and actual interest rate to the project is determined by the banks based on the perceived credit risk of the project.

On the other hand in Uganda, The Electricity Act of 1999 defined a new framework for energy governance establishing the Electricity Regulatory Authority (ERA) to regulate the industry independently of the Ministry of Energy and Mineral Development which is responsible for policy. Some functions of the ERA are to issue licenses for the generation, transmission, distribution or sales of electricity, and to establish a tariff structure. This law was a first step to electricity market liberalization, followed by the unbundling of Uganda Electricity Board (UEB) in 2012 into three companies for generation, transmission, and distribution of electricity: Uganda Electricity Transmission Company Limited (UETCL), Uganda Electricity Distribution Company Limited (UEDCL), and Uganda Electricity Generation Company Limited (UEGCL). The UETCL is the System Operator owning transmission lines above 33kV, and is the bulk supplier and single buyer of power for the national grid in Uganda as the purchaser of all independently generated power in the country that is fed into the national grid. UEDCL is the owner of the electricity distribution network which has been leased by UMEME Ltd. Umeme, the national electricity distribution company, supplies over 450,000 customers. Outside the Umeme concession area, grid extensions are financed and owned by the Rural Electrification Agency (REA) with the funding support of several donors. UEGCL is a limited liability company responsible for reliable energy generation via concessioning and monitoring of concessioned facilities [4].

The REA was established in 2001 as part of a three inter-related mechanisms for management of Uganda`s rural electrification program namely, together with the Rural Electrification Fund (REF), and the Rural Electrification Board (REB) all supervised by the Minister responsible for Energy.

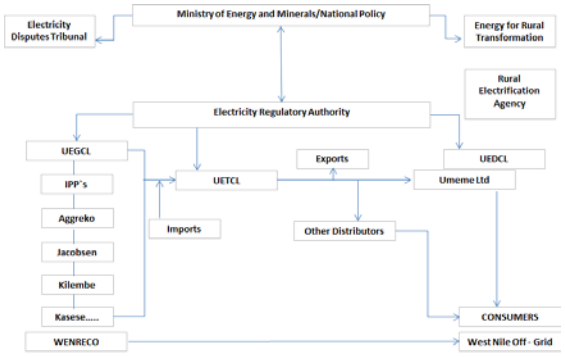

Figure 1: Organigram of Regulatory Authorities in Uganda Energy Sector

In Uganda, the 2007 Renewable Energy Policy introduced a Renewable Energy Feed-in Tariff (REFIT) based on updated levelized costs of production of priority technologies, upon consultation of Energy Regulatory Authority and the system operator shall publish the REFIT tariffs for priority technologies. There are some space for negotiation of some incentives such as requesting higher tariffs in the earlier years and lower tariffs later for enabling debt payback or tax exemptions. These feed in tariffs focus on renewable energy projects in the range of 0.5-20MW, projects with an installed capacity greater than 20 MW will be required to negotiate a tariff and PPA with UETCL, on a case by case basis[4].

The most recent support scheme for medium to large scale PV plants in Uganda is the solar PV package of the GET FIT initiative – the Global Energy Transfer Feed-In-Tariff. The program is designed by Deutsche Bank to support upgrading of the existing regulatory framework and improving the risk profile for better commercial viability of renewable energy investments. First projects of the GET FiT program on small hydro and biogas projects are expected to start construction by mid 2014.
The solar part of this scheme involves Ministry of Finance and Economic Development and Ministry of Energy and Mineral Development and Electricity Regulatory Authority. It is implemented by KfW on behalf of Government of Uganda with Department of Energy & Climate Change (DECC), UK Department for International Development (DFID), Governments of Norway and Germany and Africa Infrastructure Trust Fund of the European Commission participating as donors committing with approximately USD 90 million of funds.

Under the scope of the GET FiT program in Uganda, the top-up of the existing FIT is to be fixed per renewable technology to close the remaining gap between the current FIT and levelised cost of electricity. The top up will be paid after commercial operation date over a period of five years instead of over the full life time of the project, aiming to reduce higher overall financing costs and addressing the lack of availability of long-term funding, without causing moral hazard of proper operation of the plants after the first five years.

The analysis of Deutsche Bank has shown that if carbon markets and Clean Development Mechanisms were up to date, there would not be a need for donor payments. It is aimed to reduce the participation of international donors over time, replacing with growing domestic capital markets.

One other resolution the program offers is the fair risk allocation between the public and private sector, shifting the risk away from the private sector with the use of a Partial Risk Guarantee (PRG). The PRG will assure timely receipt of payments from the UETCL. A contractual structure including an Implementation Agreement (IA) to be signed with Government of Uganda (GoU) in addition to the PPA to be signed with UETCL by the IPPs establishes a governmental commitment to back the potential liabilities of UETCL, which is primarily a liquidity support[5].

The capacity benefiting from the GET FiT Solar Facility is estimated to be a minimum 20 MW, depending mainly on the tariff offered by selected bidders under the reverse bidding tender process. Applicant projects must have an installed capacity of minimum 5 MWp, and one bidder can be eligible for up to two projects.

3 ANALYSIS

Without governmental assistance and subsidy, rural electrification in Eastern Africa is undesirable to private utility companies under the present conditions. The vicious cycle of rural electrification issue is originated from the high costs of initial capital and maintenance of transmission and distribution facilities in remote areas with low consumption and revenue. Due to the high levels of subsidy needed to cover both capital and operating costs, it becomes financially senseless for a private energy generating company with limited supply to canalize this potential to rural areas rather than urban areas with large industries having relatively reliable customers but still in need of electricity.

Investors need to overcome off-taker risks and currency risks in addition to the complex bureaucratic requirements requiring lengthy time to reach financial closure of smaller projects. Financial incentives offered are not yet fully tested, locally available types of financing and conditions of those are not fully suitable for renewable energy project development.

Regulatory and organizational reforms made in the two countries, but have not ensured long term sustainability to the sectors. Sector unbundling itself is still weak and experiencing difficulty in implementations. Reforms favored energy markets of Tanzania and Uganda have been effective in overcoming short term deficits and to improve viability of public utilities urban residents; rural dwellers benefited less since the unit cost of electricity increased. Privatization of energy sector has no incentive for investing in non-profitable rural areas.

Unresolved social barriers, power theft and theft of transmission and distribution system equipment are still

creating high revenue losses, making even more difficult for power providers to justify rural electrification efforts. Moreover, low generation capacities of utilities with insufficient supply not meeting demand creates market failure forcing distribution companies into load shedding, almost always experienced by small unreliable customers.

4 SOLUTION

Both countries are aerially large and low on population density. Their main demand centers are located far from the large power plants which consolidate the majority of their energy mix and this model creates high transmission costs and losses. A technical solution to the electrification problem would be diversified power sources based on renewable energies with a wide geographical spread through an efficiently developed distribution network connection.

Grid connected, unbundled, medium to large scale solar PV plants could be one of the solutions with rainfall and solar irradiation usually correlating negatively it would also be a sustainable choice minimizing potential future energy scarcities. Experiencing its third phase of development, PV module prices and PV energy generation costs are significantly lowered, enabling close to grid parity prices under African solar irradiation conditions. However, major solar developers are not interested in investing in these markets since FITs and incentives necessary for enabling large scale projects are not yet feasible, and donor supported government tenders take lengthy time. Increasing trust and feasibility of FITs for large scale PV projects will create a shift from donor financed projects to commercial investments. Renewable energy implementation strategies started to be included in the national energy master plans only the past ten years, with no specific strategy for photovoltaics only, since this technology is still more expensive then biomass, hydro or wind, it is not easy for governments to justify PV in their planning.

Taking into consideration the current situation in these countries on of the biggest improvements that can be realized by usage of PV implementations as a replacement for the expensive diesel genset technologies needed for emergency productions. This would help significantly both the electricity transmission and distribution companies reducing the cost of electricity directly and individuals being forced to use diesel gensets against the recurrent blackouts and brownouts.

The two countries have growing urban economies in which urban household or industrial urban PV markets already create value and significant know-how and synergies to ease rural electrification PV projects. It is expected to have capable local developers to use their gained experiences in the commencement of larger scale PV plants when regulatory environments for these mature.

Participation of private sector in rural electrification is based on the idea of attracting capital, efficient operation and new technologies for rural electrification.
It is one of the models which is most difficult to set up in practice, bringing together the challenge for governments to maximize private sector participation and minimize subsidies. Overall management of a mixed rural electrification sector needs greater responsibility from the governments for the planning, financing and overall management. Governments shall develop mechanisms that will minimize or absorb major commercial and financial risks of rural electrification programs and remove critical regulatory and institutional obstacles to rapid advancement of investment in the sector. Rural Electrification Agencies shall become autonomous entities, and all rural electrification sector programs planning, management and investment resources shall be centralized within these bodies. Overcoming organizational structure weaknesses shall be achieved by capacity building.

In order to create a fully liberalized energy market with continuous participation of private sector investments in renewable energies, project financing practices in local commercial banks also have to go through some reforms initiated by the governments to overcome issues of lack of transparency, the perceived risk of retroactive changes to FITs, and creditworthiness of the single off-takers (the national transmission and distribution companies). Access to long-term financing through local commercial banks need to be increased. The risks of rural electrification investments should be absorbed by the governments rather than investors.

5 CONCLUSION

It is not possible to define the ideal model for rural electrification by photovoltaic plants: there is no “one-size-fits-all” solution, since success of planning and implementation depends on a range of local and dynamic conditions[6]. Although, creation of stable and attractive regulatory environment can help defeat the lack of investor confidence in the governments of developing countries to amortize their projects in the long run. Highly qualified human force is needed in the sector to achieve in these reformations, especially in the related governmental authorities, where continues capacity building should be employed to overcome the weaknesses of these organizations.

Energy problem of Eastern Africa should be addressed by medium scale projects distributed around the countries since it is more cost effective than distributing energy through one massive power plant to the entire country. It is important to set FITs in a manner not to increase investor returns directly but to increase project profitability to viable levels allowing investors and financers to deploy capital. Subsidies given for PV power plant implementations should be designed in a way that avoids market distortion, not exploiting tariffing schemes [6]. Further efforts shall be canalized to designing customized subsidy systems according to the needs of each specific region, these could include investment subsidies, connection subsidies, indirect subsidies and cross subsidies.

6 REFERENCES

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7 ACKNOWLEDGEMENTS

8 LOGO SPACE