TANZANIA: SMALL POWER PURCHASE AGREEMENTS – A CASE STUDY

2013

CHAPTER 6: The Regulatory Environment

TANZANIA: Small Power Purchase Agreements (SPPAs) – A Case Study

2013 Case Study by Jorry Mwenechanya

INTRODUCTION

Tanzania, an East African country of 45 million people comprising 945,000 square kilometers, is among the world's poorest countries. About 80% of the people live in the rural areas, where agriculture provides livelihoods to 90%. In the arid and semi-arid regions of the north and center of the country, most people depend on growing food crops and tending livestock. Under conditions of inadequate basic infrastructure and weak supportive institutions, agriculture and livestock generate incomes that pale in comparison to earnings from paid employment. Thus, extreme poverty in Tanzania has a distinctly rural character.

Map of Tanzania from Geology.com (2007)

Tackling poverty is a constant priority in the development strategies of successive Tanzanian governments. The current program, known in Swahili as *MKUKUTA II,* or the Second National Strategy for Growth and Reduction of Poverty, covers the period 2011 to 2015. But such efforts have had a low impact on levels of poverty. Reviewing progress, the government says in *MKUTUTA II* that "Tanzania's GDP growth rate has been impressive in the recent past. However, the incidence of income poverty did not decline significantly."[1] To realize its full economic potential, Tanzania puts priority on providing electricity to rural areas. "*Big Results Now*!," a companion initiative to *MKUKUTA II*, identifies six areas most likely to accelerate national development in the medium to long term. At the top of this list are energy and natural gas.

Power Sector and Energy Resources

Tanzania's power sector is characterized by thermal and hydro power generation. About 62% of the total installed capacity, 1522 MW, is thermal, while 37% comes from hydro. Imports and biomass make up the remainder.[2] The reliance on thermal sources, especially liquid fuels, makes for a high average cost of generation while the fuel imports deplete foreign exchange reserves. According to the Central Bank of Tanzania, "the share of oil to total value of goods import increased to 39.1 percent compared to 33.0 percent in the year ending November 2012."[3]

Generation from fuel plants puts pressure on the finances of the national utility Tanzania Electric Supply Company Limited (TANESCO) and for this reason the plants are often not fully dispatched. Cheaper electricity from hydro plants is limited by frequent droughts. For example, Tanzania experienced consecutive droughts from 2009 to 2012. To cope with such conditions, TANESCO reduces the operating reserves and leases at high cost additional capacity from fuel-based merchant Independent Power Producers (IPP). Apart from putting pressure on the price of electricity, fuel imports for the IPPs add to the demand for foreign exchange. In addition, TANESCO resorts to load-shedding as it tries to contain demand and cut the cost of generation. The inability to supply adequate electricity to a fast-growing economy hinders the attainment of the national development vision, an essential element of which is to build a strong and competitive economy.[4]

Tanzania can draw on several untapped sources of energy to increase its generation capacity. New discoveries of natural gas have provided Tanzania with the prospect of doubling the installed capacity to 3,000 MW.[5] Costing US$ 1.2 billion, a 532-km gas pipeline from Mtwara in the south will transport natural gas to new power stations in the commercial capital, Dar es Salaam. With the first of the power stations due to begin production in 2015, Tanzania expects to provide adequate electricity for its growing economy, and to reduce consumer tariffs. In addition, by switching to gas generation, Tanzania will reduce GHG emissions and cut the fuel import bill.

The additional capacity from natural gas will benefit current consumers in the urban areas through lower tariffs and a higher reliability of supply. Tanzania also plans to export the expected surplus, and neighboring Kenya has already shown interest.[6] However, to electrify the rural areas will take more than an increase in generation capacity. The current supply system suffers from a limited geographical reach and from years of inadequate maintenance. Therefore, the rehabilitation and expansion of the transmission and distribution networks requires significant investment and considerable time. It will be many more years before electricity reaches rural areas where the majority of the people live, and where wood fuel and animal waste supply energy to 90% of the people.

Tanzania also has significant renewable energy resources that, in the short to medium terms, could accelerate the pace of rural electrification. The current installations of small hydro power stations total about 15 MW, out of an estimated potential of between 300 and 500 MW[7]. Similarly, Tanzania has average solar insolation of 187 W per square meter and, while average wind speeds fall between 0.9 and 4.8 m/s, they can reach 8 m/s.[8] In this mainly agricultural country, farm and animal waste, and also the sisal industry provide good potential for biomass electricity generation. The reform of the energy sector that took place in 2007 aims to stimulate the development of renewable energy power plants.

Energy Reforms and Policy in Tanzania

The Rural Energy Board that began operations in 2007 was established to facilitate "extended access to modern energy services for the productive economic uses, health and education, clean water, civil security and domestic applications".[9] The Rural Energy Act 2005 mandated the Rural Energy Board to give financial and technical support to developers of rural electricity

supply schemes. The Board executes its functions through the Rural Energy Agency (REA) that, apart from administrative responsibilities, recommends support to projects that meet established criteria. Developers receive subsidies toward capital costs of projects, training in project planning and preparation, and grants to meet specified project development costs.

When the government established the Rural Energy Board, TANESCO was still a legal monopoly in the generation and supply of electricity. Private sector participation as envisaged by the Rural Energy Act became possible only after the liberalization of the industry through the Electricity Act of 2008. The Electricity Act, which is the principal law, entails far-reaching reforms, including the unbundling of the utility, TANESCO, into separate, autonomous units for generation, transmission and distribution, and the establishment of a system operator to administer a grid code. Even though in 2013 TANESCO remained vertically integrated, the law had opened the generation and distribution segments to industry players licensed by the Energy and Water Utilities Regulatory Authority (EWURA).

Established under the Energy and Water Utilities Regulatory Authority Act, EWURA regulates the energy sector by issuing operators' licenses, determining tariffs and monitoring compliance to rules and regulation.[10]

The energy sector reforms that led to the establishment of REA and EWURA were direct results of the Energy Policy of 2003. On the promotion of renewable energy the policy intentions were to:

1. "Introduce appropriate rural energy development, financial, legal and administrative institutions; and
2. Establish norms, codes of practice, guidelines and standards for renewable energy technologies, to facilitate the creation of an enabling environment for sustainable development of renewable energy sources."[11]
3.

With these guidelines and the specific legal and institutional mandates, EWURA, REA and TANESCO have worked towards the national policy goals in energy.

Rural Electrification

In many developing countries in Africa the majority of people rely on primitive forms of energy like firewood, charcoal and animal waste because only a small percentage of the national population has access to electricity and to other modern forms of energy in rural areas.

The disparity in electricity access puts the rural areas at an economic disadvantage compared to their urban counterparts. Without electricity people in rural areas have fewer options of earning a living and their productivity is limited. Yet, the majority of people live in rural areas, and increasing their economic productivity holds the key to reducing income gaps and social inequality. Rural electrification is a potent tool for expanding economic overcoming barriers to increasing income and for accessing a better life.

One way of expanding electricity to rural areas is to extend the national grid through the construction of distribution lines and substations. This approach assumes that sufficient

generating capacity exists to meet the additional demand of the rural communities. Where the sources of power are centralized, the extension of the national grid involves the erection of long transmission and distribution lines to remote areas. In addition, rural communities in most countries tend to settle widely apart due to low population densities and traditional land use patterns. This population dispersion adds to the overall cost of the distribution network. Add to this the high costs and long gestation periods for large centralized power stations, and it is easy to see why grid extension slows down the progress of electrification.

Renewable energy offers alternative possibilities for increasing system capacity and the opportunity to reduce transmission and distribution distances, thus accelerating the pace of electrification. Decentralized generation can remove many of the constraints to rural electrification imposed by grid extension. In addition, renewable energy sources often displace fuel-based thermal plants, thus mitigating adverse environmental impacts of carbon-based generation. A policy that promotes increased renewable energy sources for electricity generation can result in a beneficial convergence of the goals for increased access and for clean energy use.

Regulatory Roles

The responsibility for the detailed design of the Power Purchase Agreement (PPA) lies with the developer supported by teams of experts in engineering, project finance, and law. This considerable costs involved can be justified only in relatively large projects; the regulator plays a more significant role in smaller projects, such as the following:

On-grid small power project
A developer of a small generation plant intended to supply power to the grid still requires a PPA to demonstrate the financial viability of the project. Usually, as part of the PPA, the utility will also require the developer to commit to a set of approved technical operating standards. The average promoter or developer of small systems may be unprepared for the task of executing such a PPA. In addition, the developer often meets outright resistance from the incumbent utility against connecting small power plants to a utility's grid. Often the utility is wary of the costs of managing contracts of many small generators; a large number of small generators based on wind and solar could potentially degrade the overall technical quality of supply; in addition, and most often, the utilities are simply unprepared for distributed generation. Therefore, the regulator intervenes to facilitate the interface between the utility and developers of small on-grid power plants.

Isolated grid supply

Another type of small generation project is one that supplies an isolated grid. Some of the targeted communities are often supplied by fuel-based thermal plants owned by the utility. In this instance, the regulator can issue guidelines for a tariff methodology to be used for investment decisions. An agency for rural electrification can also ensure that the tariff methodology takes account of any existing subsidy schemes for reducing the tariff by off-setting the capital investments.

Mini-grid projects

In the mini-grid type of project, the small power producer supplies a local community, but also has the possibility to export to the grid. Here too, the regulator can provide mandatory guidelines for tariffs for local community consumers, side by side with those for exports to the main grid.

This study highlights how PPAs can be used to encourage investors to put their money in small renewable energy projects. These projects add to the overall capacity of a supply system; they also provide an effective means for providing electricity to new areas, especially rural areas of developing countries.

The Small Power Development Programme in Tanzania

The Small Power Project Development Programme (SPPDP) in Tanzania promotes renewable energy and co-generation. Government expects small power projects, based on renewable energy, to accelerate rural electrification.

Power Purchase Agreement (PPA)

A contract to sell and buy electricity is known as a Power Purchase Agreement (PPA). The buyer, who may be a distributor or a large consumer, contracts an Independent Power Producer (IPP) to supply specified quantities of energy and capacity for an agreed period. The PPA secures for the buyer a source of electricity to sell to customers. For the IPP, the PPA demonstrates to project lenders the viability of the project. It shows that the projected revenues from the sale of the electricity will be sufficient to repay the loans. The viability shown by the PPA also assures the equity holders that the project will provide them with a return on their investments.

Owing to its centrality, the PPA should be carefully designed, especially since it is signed well before construction begins. The gestation period of larger projects, such as hydro power plants, could be several years. In addition, from the date of its commencement, the PPA generally covers a period of 15 years and more. Because the agreement anticipates a future fraught with uncertainties, it is a highly technical, legalistic and voluminous document developed by teams of financing and legal experts. Among the issues that a PPA would cover are the currency of the contract, the methods and triggers for review of the prices, plant dispatch, and availability of the plant.

Energy regulators play roles guided by the prevailing market model. The competitive markets found in Europe, the U.S. and parts of Latin America typify one end of market models. The maturity of these markets implies that the players are in sufficient numbers and the diversity wide enough to enable competition as well as the existence of financial institutions capable of handling energy market transactions. In these markets the energy regulator plays only an indirect role in the execution of PPAs. However, both suppliers and off-takers have to be mindful of the regulatory framework that applies to regulated segments of the targeted consumers. At the other end of market models is the single-buyer market model in which all IPPs sell power to a central buyer who operates and often owns the transmission and, often, distribution assets. Although detailed practice varies, the execution of a PPA requires the consent, if not formal approval, of the regulator. In many developing countries, IPPs that exist on the margins of a state-owned utility can compete for the unregulated market of large consumers. However, because of the dominance of state-owned utilities, and because they own the transmission and distribution assets, the market tends to be reduced to a single-buyer model. When in addition there exists a deficit in generation-capacity, the utility offers the best guarantees for long-term PPAs. Because of the absence of competition, this market structure draws the regulator into direct participation in executing PPAs.

To ensure that it takes into account the views of stakeholders, EWURA spearheaded the formation of a Working Group on Small Power Development (WGSPD). The Group, which meets twice a year, advises EWURA on regular reviews of the SPP Programme and plays an active role in the annual review of Standardized Tariffs for Small Power Projects. The Group includes representatives of the Ministry of Energy and Minerals, the Rural Energy Agency, TANESCO and SPP developers.

Guidelines

In 2011, to help SPP developers, EWURA published "Guidelines for Development of Small Power Projects." The guidelines explain:

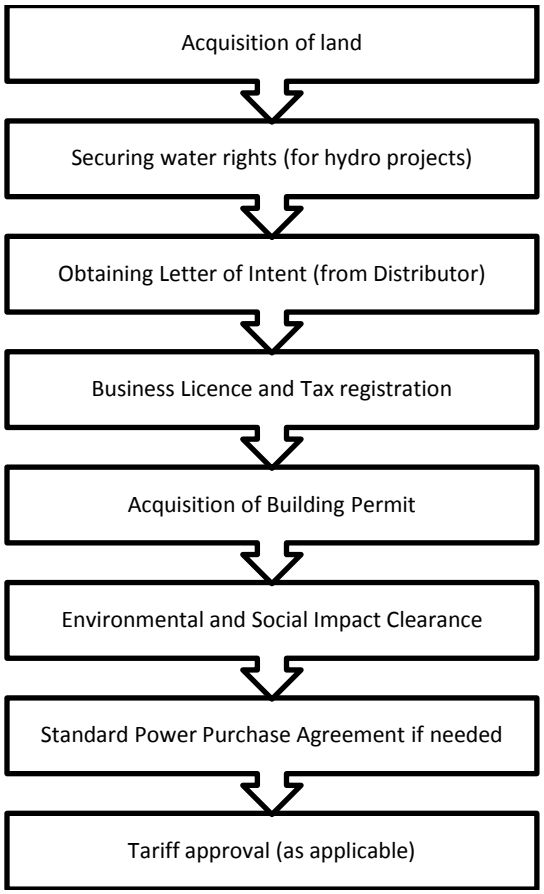
a) The laws and procedures related to Small Power Projects
b) How to obtain licenses
c) How to obtain other project consents
d) The commercial and regulatory aspects for implementing Small Power Projects.

Main Features of a PPA

The following are the most important features of a PPA:

1. The PPA protects the tariff that will apply to the available capacity and electrical output from the plant. Generally, the tariff consists of two parts: the first, a fixed charge based on the capital investment, including a return on equity, and the second, a variable charge for the quantity of power supplied and for the producer's variable costs.
2. The PPA guarantees the tariff over the life of the contract, 15 to 30 years being typical. Over such a period many factors change and affect the value of the money paid. Two examples of such factors are inflation and exchange rates. The second of these factors is of special significance when a PPA is denominated in a currency that differs from the currency of payments by customers. The lenders to the IPP project need assurance that the revenue flows stated in the currency of the PPA can service the debt. Therefore, the PPA includes methods for periodic review of the tariff.
3. In the single-buyer model, the PPA often imposes an obligation on the utility to buy all the output from licensed producers, thus minimizing the risk for the producer. On the other hand, the regulator acts to ensure that consumer prices reflect only the cost of maintaining the plant that is used to produce the electricity.

The ten-page document concludes with the following summary of the stages for developing an SPP:



A twenty-page appendix to the Guidelines consists of forms and templates for the immediate use of developers and their partners. For example, one document that a developer needs early in the process is a Letter of Intent, in this case, from TANESCO. The Guidelines have a template for the application to TANESCO and another for its response. In this way, the Guidelines, the forms and the templates simplify the project planning tasks for the small developer.

The Electricity Act

The Small Power Project Development Programme derives its mandate from the Electricity Act of 2008. EWURA, REA and TANESCO have legal obligations to small power developers. Provided the conditions in the law are satisfied, a distributor, mainly TANESCO, is obliged to accept applications for connection to the network. By minimizing the discretion of the distributor, the law helps the developer to reduce project risk. TANESCO has established in the Distribution Directorate a dedicated Small Power Projects office that handles enquiries and advises potential developers on everything from obtaining permits to explaining the technical requirements for interconnections. Such an office is also prescribed by the Electricity Act, thus minimizing the bureaucratic hurdles for small power developers.

Part VII of the Electricity Act is devoted to rural electrification. In several ways the law enjoins EWURA to take special account of the needs and requirements of rural electrification. Thus, under the Act, EWURA can delegate its monitoring functions to REA and, to promote rural electrification, EWURA can prescribe lighter regulatory standards aimed at reducing costs.

Tanzania has ensured that the strategies for promoting renewable energy use in rural electrification are enshrined in law. By this measure Tanzania seeks to provide a stable environment for private sector investments. Fulfilling its mandate, EWURA has published on its website (www.ewura.go.tz) two key sets of documents: templates for PPAs and guidelines on tariff methodologies.

Small PPAs

EWURA licenses Small Power Projects (SPP) of up to10 MW. However, rural projects of 1 MW or less are in a category of their own, requiring no license, their only obligation being to submit periodic operation reports to EWURA. Because of the small electrical loads, 1 MW can considerably improve the quality of life in a village. Typical needs in a village are water pumping, heating, lighting, refrigeration, phone charging, powering TVs and radios, and grinding grain. A 1 MW power plant goes a long way in meeting such needs. Therefore, with a judicious management of pumping and heating loads, EWURA's light handed approach to projects of up to 1 MW has potential to increase access to electricity for households and for social institutions like schools and health centers.

The SPPs that need EWURA licenses may supply power to the TANESCO grid or to an isolated mini-grid. Developers of such small power projects, of both grid and mini-grid types, have free access to various implementation materials. Among the most important are the Standardized PPAs produced by EWURA in 2009, which can be downloaded from the EWURA website. The structure of the PPAs in the two cases is identical, and it includes the key provisions for sale and purchase of power, for interconnection and metering and for the term of the agreement, 15 years. During the term of the SPPA the distributor or TANESCO is mandated to buy all the power available from the plant. The current version of the SPPAs also anticipates events after the impending restructuring of TANESCO. As the Government expects to restructure TANESCO by 2015, the PPAs minimize uncertainties among investors regarding the status of projects after TANESCO is unbundled.

The similarity of the SPPAs for grid and mini-grid small power projects arises from the electricity market structure defined by the Electricity Act of 2008 that bars simultaneous ownership of generation and distribution assets. The difference lies only in some of the detailed arrangements. For example, the roll out of the Power System Master Plan[12] will result in the extension of the grid to rural areas that may already be supplied from an isolated mini-grid. In this case, the SPPA for mini-grid projects stipulates the rights of the owners and the conditions of transfer to the main grid. Another example is the ownership and reading of meters. For main grid generation, the distributor owns, reads and maintains the meters, while for mini-grids these conditions apply to the seller of power, that is, the SPP. The metering arrangements for main grid SPPs are consistent with the practice in most jurisdictions: the distribution utility owns the

equipment and is responsible for reading them. The different approach adopted for isolated mini-grid systems reduces the technical and financial burden on the distribution entity. In the context of rural electrification, this arrangement gives much-needed flexibility to the formation of a distribution entity, which could be a community-based organization.

Tariff Methodology

The SPP tariff methodology rests on the concept of avoided costs. By this principle the methodology determines a tariff that is comparable to the cost of alternative options available to the buyer. TANESCO has many isolated grids supplied from fuel-powered plants in different locations of the country. Since these are envisioned to eventually integrate with the main grid, the principle of avoided cost applies to all SPPs. However, the application of the methodology to mini- and main grid SPPs diverges for several reasons. The cost of running fuel-based generators is higher than TANESCO's weighted average cost of generation. EWURA therefore pegs mini-grid tariffs to the cost of running diesel or HFO generators that are displaced by renewable energy sources. The result is that the tariffs for mini-grids are considerably higher than those for main grid generation.

Using the principle of avoided costs, the tariff reflects a reliable estimation of TANESCO's long range generation costs. However, there are significant short-term variations in TANESCO's supply costs caused by an underlying shortfall in total capacity and recurring droughts which reduce the availability of the hydro power plants. To cope with these variations, EWURA annually reviews and determines a Standardized SPP Tariff. Before the signing of a PPA a floor pro ice and a price cap are established. The SPP receives the annually adjusted Standardized SPP Tariff, provided it falls in the range of the floor price and the price cap. The price cap is adjusted using Tanzania's Consumer Price Index. To ensure fairness to the consumer and the producer alike, EWURA has begun to revise the tariffs based on a 2013 Cost of Service Study report. By continuous improvement of the tariff methodology and by ensuring that the tariffs assure the viability of the industry, EWURA expects to establish an investment environment for SPPs that is predictable and attractive.

To add impetus to mini-grid development, EWURA will in the future use a cost-based tariff methodology instead of TANESCO's avoided cost methodology. This will result in tariffs that are more attractive to investors, but less so to consumers who will have to pay more. These consumers pay a uniform TANESCO tariff that is far below the cost of running diesel generators. However, electricity tends to be erratic because often the generators have no fuel. Therefore, the higher cost of renewable energy realistically compares not to diesel generation, but to firewood, charcoal, kerosene, agricultural waste, all of which are regressive energy types and ultimately far more expensive.

Results

Between September 2009 and February 2013 EWURA approved 10 SPPAs of sizes from 0.3 MW to 10 MW. Out of the total capacity of 40.1 MW, 22.5 MW came from 4 hydro projects, 15.6 MW from five biomass projects and 2 MW from one solar project. Six out of the ten

projects were for off-grid projects. Table 1 shows the projects for the mini- and main grid as of October 2013.

Table 1: Summary of SPP developers (2009 – 2013)

Mini (Off-grid)			**Main (On-grid)**		
Name	**Technology**	**MW**	**Name**	**Technology**	**MW**
Operating plants			*Operating plants*		
Ngombeni	Biomass	1.5	TANWAT	Biomass	1.5
Symb-KMRI Tunduru	Biomass	0.3	TPC - Moshi	Biomass	9
Symb-KMRI Kigoma	Biomass	3.3	Mwenga - Mufindi	Hydro	4
St Agnes Chipole	Hydro	7.5	EA Power - Tukuyu	Hydro	10
AHEPO	Hydro	1		TOTAL	**24.5**
NextGen Solawazi	Solar	2			
	TOTAL	**15.6**	*Letters of Intent*		
Letters of Intent			Mupembazi	Hydro	10
Mofajus - Mpanda	Hydro	1.2	Darakuta	Hydro	0.9
Nkwilo Hydro - Sumbawanga	Hydro	2.9	Tangulf - Nakatuta	Hydro	10
Windpower Mpanda	Solar	1	Ilundo Community	Hydro	0.4
	TOTAL	***5.1***	Maguta Hydro	Hydro	2.5
			Luganga Hydro	Hydro	2.8
			Luswisi Hydro	Hydro	4.7
				TOTAL	**31.3**

Table 1 shows that hydro projects will attract the highest investment compared to other technologies. Solar and wind projects are unattractive because the tariff is too low. Current discussions center on technology-specific tariffs and an enhanced capital subsidy scheme. The Tanzanian government plans to introduce an Energy Subsidy Policy that will aim to clarify the objectives and targets of the subsidies. Table 1 also shows a dominance of planned hydro projects to supply the main grid. Project promoters prefer TANESCO as the main off-taker because of its size, even if it does not pay on time. TANESCO as the off-taker gives the developers much greater scope for a high utilization of the energy from the plants and therefore good revenues. As the Electricity Act obligates the developers to supply nearby communities, mini-grid projects also advance rural electrification, but only for settlements near the grid and close to the planned hydro plants. The limitation re-emphasizes the importance of efforts to stimulate increased interest in other energy forms that have greater design flexibility especially regarding size: solar, wind and biomass. In 2014, the 2003 Energy Policy will be revised, and it is the intention of the Tanzanian government to enhance the policies for renewable energy, taking into account the SPP experience thus far.

Along the lines of the Electricity Act, TANESCO is set for restructuring before 2015. It is among the 29 projects included in the "Big Results Now!." An important objective is financial viability of the electricity industry. The private sector will welcome the restructuring, especially

if it reduces social and political constraints to the review of retail tariffs. The low main grid tariff and delayed payments to SPPs by TANESCO are disincentives to new investments.

Conclusion

Renewable energy generation projects help to increase system capacity sustainably. Often the projects also displace fuel-based generators that are costly to the country and to the environment. When renewable energy sources supply isolated mini-grids they have the potential to increase the pace of rural electrification programs because of their relatively short development time. They also have the advantage of shorter transmission and distribution lines, and this reduces overall costs. Therefore, reducing barriers to the development of small power projects based on renewable energy can contribute to advancing multiple policies in energy and environment sectors

Regulators, rural energy agencies and utilities can collaborate to ease the participation of private investors in small power projects. An important area of intervention is the execution of PPAs. This study shows that in Tanzania a coordinated approach has begun to produce results.

[1] Government of the Republic of Tanzania: "Second National Strategy for Growth and Strategy, 2011-2015", Dar es Salaam, Tanzania.

[2] Msyani, Christian M.: "Current Status of Energy Sector in Tanzania", USEA Executive Exchange Program on Developing an Ancillary Service Market, Washington D.C., March 2013.

[3] Bank of Tanzania, Monthly Economic Review, December 2013, page 6, https://www.bot-tz.org/Publications/MonthlyEconomicReviews/MER_%20Dec_2013.pdf.

[4] The United Republic of Tanzania: "The Tanzania Development Vision 2025".

[5] Minister of Energy and Minerals, Tanzania as reported by Reuters, August 15, 2013.

[6] Ibid

[7]Yohana, R. A. and Kirahuka, J. K.: "Small Hydro Power Development in Tanzania", Tanzania Country Paper presented to the Training Workshop on Small Hydropower Technology for Developing Countries, May-July, 2011, Hangzhou, China.

[8] Mwihava, N. C. X.: "An Overview of Energy Sector in Rural Tanzania", Presentation to Workshop on Innovations in Off-grid Lighting Products and Energy Services for Rural Tanzania, April 8-9, 2010.

[9] The Government of the United Republic of Tanzania: "The Rural Energy Act, 2005", Dar es Salaam, Tanzania.

[10] The Government of the United Republic of Tanzania: "The Energy and Water Utilities Regulatory Authority Act", Dar es Salaam, Tanzania.

[11] The Government of the United Republic of Tanzania: "The National Energy Policy", February 2003, Dar es Salaam, Tanzania.

[12] Government of the United Republic of Tanzania: "Power System Master Plan – 2012 Update", May 2013, Dar es Salaam, Tanzania (www.mem.go.tz).