CONFEDERATION OF TANZANIA INDUSTRIES

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Challenges of Unreliable Electricity Supply to Manufacturers in Tanzania

A Policy Research Paper Submitted to Energy Sector Stakeholders in Advocacy for Ensured Reliable Electricity Supply to Tanzanian Manufacturers

July 2011

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Table of Contents

L	ist of Abbreviations	3
E	xecutive Summary	4
1	Introduction	9
	1.1 Background	9
	1.2 Concern about Electricity Supply to Manufacturers in Tanzania	. 11
	1.3 Main Objective	. 12
	1.4 Specific Issues of Concern	. 12
2	Approach and Methodology	. 13
	2.1 General Approach	. 13
	2.2 Approaches Used to Conduct the Study	. 13
	2.3 Approaches Used to Develop Policy Recommendations	. 14
3	State of Electricity Supply in Tanzania	. 15
	3.1 General Concerns about Energy and Electricity Supply	. 15
	3.2 Electricity Generation and Transmission in Tanzania	. 20
	3.3 Electricity Supply Load Forecast	. 22
	3.4 Energy Supply Initiatives	. 22
	3.5 Power System Planning	. 23
	3.6 Industrial Tariff Charges	. 23
	3.7 Menu of Measures for a Quick Solution to Power Shortages	. 24
4	Analysis of Reviewed Information and Field Data	. 28
	4.1 Introduction	. 28
	4.2 Reflections on the Desk Review	. 28
	4.3 Examination of Documented Consequences of Inadequate Electricity Supply	. 28
	4.4 Facts about Costs of Electricity to Manufacturers (from the field Data)	. 29
	4.5 Principal Causes of Intermittent Electricity Supply to Tanzanian Manufacturers	. 31
	4.6 Detailed Analysis of the Field Data	. 32
5	Conclusions and Policy Recommendations	. 40
	5.1 Introduction	. 40
	5.2 Key Conclusions	. 40
	5.3 Policy Recommendations	. 43

List of Abbreviations

ACLM	Advocacy Composite Logic Model
BEST-AC	Business Environment Strengthening for Tanzania – Advocacy Component
CTI	Confederation of Tanzania Industries
DSM	Dar es Salaam
GDP	Gross Domestic Product
GoT	Government of Tanzania
GW	Gigawatt
IMED	Institute of Management and Entrepreneurship Development
IPPs	Independent Power Producers
IPTL	Independent Power Tanzania Limited
KWh	Kilowatt per hour
MEM	Ministry of Energy and Minerals
MW	Megawatt
NGCC	National Grid Control Centre
NSGRP	National Strategy for Growth and Reduction of Poverty
PSMP	Power Systems Master Plan
PSRC	Presidential Parastatal Sector Reform Commission
REA	Rural Energy Agency
REF	Rural Energy Fund
R&D	Research and Development
SIDP	Sustainable Industrial Development Policy
TANESCO	Tanzania Electricity Supply Company
TZS	Tanzanian Shilling
URT	United Republic of Tanzania
US\$	United States Dollar

Executive Summary

The overall objective of this report is to present researched facts about intermittent power supply to manufacturers, particularly for facilitation of informed discussions and decisions that are aimed at improving the availability of reliable electricity supply to manufactures in Tanzania. The report is a product of policy research which examined the major reasons for unreliable electricity supply to manufacturers in the country and to draw strategies for overcoming the challenges. Its findings are based on various documents reviewed, the study of 60 manufacturing firms experiencing the challenge of unreliable electricity supply and views of other key stakeholders in the sector. The study shows that in the past few years the Government of Tanzania has attempted to list a number of projects to tackle the problem of power supply in the country. However, with growth of the country's economy it is estimated that the demand for electricity will triple from the current need by 14% of the population to 42% by 2020, of which the planned projects will not be able to meet the demand unless other strategies are used to increase the supply of power.

Regardless of the effort made by the Government, the manufacturing sector continues to experience the obstacle of unreliable, intermittent power supply, frequent rationing and outages. The unreliable power supply causes manufacturers to experience throughout the year poor service quality, power cuts without notice, unplanned power stoppages and interruptions, voltage fluctuations, phase failures and unbalanced voltages. These challenges are due to the worn out power infrastructure (both for production and distribution of electricity); shortages in electricity production, too much dependence on hydro-production - which is prone to the vagaries of the weather (notably drought) - and inadequate implementation of plans and strategies of the PSMP for projects to be accomplished during 2009 - 2013.

As a result of unreliable electricity, manufacturers face the following six major hurdles.

(i) High income losses attributed to frequent interferences due to power supply interruptions. Despite the use of own costly generation at times, income loss to

manufacturing firms owing to unreliable electricity supply alone is estimated to be TZS 31 billion per annum.

- (ii) Machinery damage resulting from high fluctuations and instabilities of the supplied current.
- (iii) Loss of competitiveness in the markets following the sustained price adjustments upward in line with the rising production costs due inter alia to the energy component. It should be noted that 24 hours of work are lost per month per firm (all industrial inputs/factors staying idle) and up to 7,341 workers lose their jobs annually owing to the electricity problem faced by manufacturing firms. These factors obviously reduce productivity and undermine competitiveness.
- (iv) Maintaining excess capacities in the factories for some days is a common strategy to compensate for power cuts, shortages, rationing or prolonged blackouts. This raising of the overall input costs since productive factors remain generally idle for a while.
- (v) Frustration of the prospects and plans for new investments and business expansions.
 With the listed hindrances, investors cannot be optimistic and get discouraged from entering the country's industrial sector.
- (vi) Investors' demoralisation as well as a plunge in the industrial workers' morale. As mentioned, 7,341 jobs are lost per annum due to the electricity supply problem faced by manufacturing firms.

An attempt to quantify the impact of unreliable electricity to manufacturers shows that on average, each manufacturing firm loses at least one day (of labour and all other employed factors of production per month owing solely to electricity supply interruptions) every month since all the industrial inputs/factors remain idle. It is estimated that factory employees work for up to 70 hours per week. It is further estimated that each one of those employees loses up to 34.3% of the total work hours per week. The Government tax loss resulting from the intermittent electricity supply is estimated to be TZS 9.5 billion per year. Around 18.9% of the total cost of production in the interviewed manufacturing firms in Tanzania is attributed to the energy cost. Whereas the intermittent electricity supply has kept total production falling and production costs rising, only 15% of manufacturing firms can afford to increase their product prices to cope with the challenges arising from the continued erratic power supply. Nationally, as we have seen, a total

of 7,341 jobs are lost per year in the formal manufacturing firms, those with an employment capacity of 10 workers and above, on account of unreliable power supply only.

The study shows that the major root causes of the challenge of electricity to manufacturers are as follows.

- (i) Policy hindrances
 - The country's Energy Policy does not explicitly provide enforceable provision for TANESCO (or other energy producers) to assure electricity supply (as an obligation) to manufacturers.
 - Poorly coordinated policies that hinder private investors' effective participation in the energy sector to compete well with the overwhelming TANESCO monopoly
- ii) Power generation, transmission and distribution problems facing TANESCO:
 - The worn out infrastructure amid the unsolved fate of TANESCO privatisation
 - Insufficient production as TANESCO generates electricity without any reserve margin for any emergency event
 - Overdependence on hydro-power production which is susceptible to weather changes; the use of the natural gas alternative could be enhanced to produce electricity as drought leads to water shortages and thus low TANESCO generation capacity
 - Significant technical and non-technical losses including: poor transmission infrastructure, too long transmission distances with a lot of drains; and vandalism on the power system infrastructure
- iii) Operational problems causing big losses, dependency on Government capital injections; inefficiency in customer service, long lags in electricity billing and delays in tariffs reviews; most of these problems emanate from the monopoly nature of TANESCO
- iv) Slow implementation of the Power Sector Reforms including restructuring of TANESCO and speeding up implementation of the Electricity Bill of 2008 and the projects developed from the Power Sector Master Plan.

The following recommendations for policy changes are made by the report.

- i) The Government is advised to speed up implementation of the projects that are underway to quickly redress the problem of intermittent electricity supply generally and specifically to the country' manufacturing industry. Emphasis has to be placed first on the stability (steadiness) of voltage supplied to ensure quality of energy received by manufacturers and other power consumers. If the planned projects could be completed within the scheduled time-frame, the problem of low voltage and shortage could be reasonably reduced.
- ii) TANESCO is better split up into two main companies:
 - a public power generation entity, which should exist alongside other private producers as it is currently set; and
 - transmission and distribution entity, which has to be done by TANESCO. This would deal with customer service in general, including connections, marketing and billing.
- iii) In the short-run, we suggest the Government should facilitate TANESCO in capitalisation of the new power generation programme planned for the interim period of 2010-2013.
- iv) Government needs to foster its commitment to speed up implementation of the Electricity Act 2008 in order to encourage private investments in mini power grid operations. Nonetheless, there will be need to review the Act as it mainly limits private sector investment to renewable energy while it restricts investors from other areas of power generation like the thermal energy production. In addition private investors are given a limit of production of only 10MW each. With the critical power problem, the question remains as to why only 10MW?
- v) The government is advised to waive import taxes on equipment used in the generation, transmission and distribution of electricity in order to reduce the cost of electricity since most of the equipment used in the power sector is expensive and hence contributing to the high cost of electricity in Tanzania.
- vi) Exploring and utilising other potential existing sources of electricity in Tanzania including coal, natural gas, solar, biomass, wind, geothermal and petroleum/oil is highly recommended.

- vii) The Energy Policy can be reviewed to accommodate recent developments and to provide incentives for private investors who are interested in the energy sector so that they can participate effectively.
- viii) Promotion of Public-Private Partnership (PPP) in the power sector is recommended to encourage the private sector to work closely with the Government in rectifying power problems.
- ix) It is high time for TANESCO to improve its institutional capacity to deliver services to its customers satisfactorily. Some of the areas in which TANESCO needs to take immediate action include: communication with customers, marketing, and customer services overall.
- x) It is suggested that TANESCO should undertake rehabilitation of its transmission infrastructure.

1 Introduction

1.1 Background

Manufacturing is one of the key sectors of the Tanzanian economy. Statistics indicate that contribution of the country's manufacturing industry to GDP in 2008 was 9.4%, and over the past eight years, average growth rate of the manufacturing sector in the country was 8.4%. In 2008 the country's GDP growth rate was 7.4%, which was lower than the rate of growth of the manufacturing sector (URT¹, 2009). The manufacturing sector has a great potential for the transformation of the country's economy for the achievement of sustainable economic growth through the sector's contribution to the national income, employment, improvement in the balance of payments and overall economic development. In view of this, the manufacturing sector should be one of the priority sectors of the economy. Promotion of the sector is basically in line with the Sustainable Industrial Development Policy 1996-2020 (SIDP) which intends to enhance sustainable development of manufacturing to encourage private sector participation through increased investment in the sector. The policy emphasises a need to improve economic infrastructure, which has a direct connection with industrial activities. SIDP is committed to the National Development Vision 2025 that raises a need to develop a diversified and semiindustrialised economy with a substantial industrial sector comparable to typical middle-income countries as a way to build a strong and competitive economy. The vision recognises the role of the industrial sector in transforming Tanzania from a least developed to a middle income country.

As the government emphasises its "*Kilimo Kwanza*" policy - Kiswahili for "*Agriculture First*", manufacturing comes into the picture as one of the areas that need high attention in respect of the backward and forward linkages between the two sectors. For example, since high value agricultural products (vegetables, spices, fruits, fish, and livestock products) require processing before reaching the markets, enhancing productivity and efficiency in the food processing industry sub-sector is necessary; and effectiveness in domestic production of industrial inputs to agriculture is of paramount importance. In addition, and besides these linkages between industry and agriculture, manufacturing development is of strategic significance to the country's

¹ URT is a short form for the United Republic of Tanzania (see Abbreviations)

international economic relations. Development of the manufacturing sector will lead to diversification away from the primary sector, thus reducing risks and vulnerability to the longterm deterioration of commodity terms of trade and associated loss in real income. It has a relatively great possibility of technological transfer and the adaptation and creation of technology.

Despite the considerable role of the manufacturing sector and great efforts to create a dynamic industrial environment in Tanzania, there have been many obstacles to performance of the sector over a long period of time. Most initiated manufacturing investments have not survived for long, mainly because of a number of problems including infrastructure, inefficient macroeconomic policies and lack of reliable utilities. In reaction to such constraints, stakeholders of the sector and in particular, Confederation of Tanzania Industries (CTI) have endeavoured to alleviate the notable impediments in manufacturing. As a result, a number of achievements have been recorded in terms of reduction in the cost of doing business in Tanzania, including: removing a number of nuisance taxes and reducing tax rates; improving the relationship between the Government and the private sector; streamlining business licensing and procedures; and improving the business regulatory framework. Notwithstanding legal and these accomplishments, the chronic non-availability of adequate and quality electricity at affordable cost remains one of the major problems facing competitiveness of the Tanzanian industrial sector. According to the Stakeholders' Forum on the Tanzania Power Sector organised by CTI in 2008, if adequate measures are not taken, the high cost of electricity in Tanzania and lack of assured power supply will continue to retard growth of the industrial sector despite the many resources available. Over the past 20 years, the energy sector has been experiencing challenges which adversely affect electricity generation, transmission and distribution. Specifically, frequent power rationing, outages and low voltage have been affecting consumers of electricity and more particularly, the manufacturers, who depend on electricity as one of their main inputs in the production processes. The estimation made in most literature is that, on average, the cost of electricity to the total production cost in manufacturing firms normally ranges between 15% and 40%.

Realising the importance of the manufacturing sector in the economy, but with the great challenge of unreliable electricity supply, CTI in collaboration with the BEST-AC programme has prepared this policy research report to facilitate the advocacy of production of assured supply of electricity in the country. The main objective is to stir up the Government to improve the availability of power supply to manufacturers so as to strengthen their competitiveness in domestic and international markets. This report presents researched evidence that calls for an urgent course of action to be adopted to address this issue. In pursuit of the stated objective, the report specifically presents the background situation concerning the erratic electricity supply impediment; information and facts that have been articulated by others regarding energy and manufacturing; analysis of field information collected through the survey and consultative meetings with some stakeholders; and then are presented some conclusions and policy recommendations.

1.2 Concern about Electricity Supply to Manufacturers in Tanzania

The leading issue is that despite a pivotal role played by industrial sector in the economy, and besides efforts made so far to iron out encumbrances affecting manufacturing performance; unavailability of assured electricity supply has remained a critical impasse. Though all stakeholders of energy and manufacturing are concerned about the inadequate power supply, of the Government has been too slow to unravel manufacturing from setbacks of the there shortage and unreliability of electricity supply. In Tanzania, power supply is characterised by frequent power-cuts, rationing, shortages and low and fluctuating voltage levels, which in essence entail high production costs to manufacturing firms. This is because some of them either stop production for a number of hours or the whole day due to unavailability of power, or resort to temporary use of other very costly sources of energy (notably fuel). Lack of assured electricity supply is one of the major impediments in Tanzanian investment climate given that investors are so much concerned about power input in their production processes, both in the contexts of tariffs and supply reliability. The deadlock of unreliable electricity supply to the manufacturing firms seems to have arisen from the existence of the non-enforceable energy supply policy. This is a gap that needs to be bridged, and to that end, this study is very instrumental in fast-tracking to the solution process.

1.3 Main Objective

The objective of this report is to present facts that can help the Government and other stakeholders in improving the availability of reliable electricity to manufacturers so as to enhance their competitiveness in both domestic and international markets. This is based on the fact that reliable power supply enhances productivity, promotes business development and industrial expansion with a view to improving the quality of life for many Tanzanians through, *inter alia*, the creation of formal employment in manufacturing sector.

1.4 Specific Issues of Concern

This report is a product of policy research for advocacy purposes, thus its concern is focused to a large extent on actionable, practical questions rather than academic, theoretical research questions. The study has two main questions searching for the overall reasons and possible solutions to intermittent electricity supply to manufacturing firms in Tanzania; they are as outlined below.

- (i) What are the major reasons/causes for unreliable electricity supply to Tanzanian manufacturers?
- (ii) What can the Government do to overcome the problem of unreliable electricity supply to manufacturers?

The rest of this report is organised as follows: in the next section we describe the methodology that was used to conduct a survey out of which this policy proposal was born. That is followed by an account of the current situation of electricity supply in Tanzania and analysis of information drawn from the literature and documents reviewed. Then, empirical analysis of the findings drawn from the survey is made to ascertain the impact of unreliable electricity supply to manufacturers and to the national economy at large. Finally, report the report presents key conclusions and practicable policy recommendations towards a solution to the electricity supply problem in the country generally and specifically for the manufacturing industry.

2 Approach and Methodology

2.1 General Approach

The task of preparing this policy research report involved two major phases namely: i) a study on the intermittent electricity supply to manufacturers; and ii) preparation of the policy proposals or recommendations. This approach is guided by the Five-Step and the Advocacy Composite Logic Models (ACLM). Based on these models, a thorough study is required to understand the issues identified before developing proposals and policy strategy to influence policy change. This approach enables the key stakeholders to participate in the advocacy project from the beginning to the end. It also facilitates the gathering of evidence concerning the scale and depth of the impact of the problem while integrating stakeholders' views in a policy proposal.

2.2 Approaches Used to Conduct the Study

The study involved both field and desk work components. The nature of the project dictated analysis of both primary data from the survey and various stakeholders as well as secondary data from existing literature sources. The interviewees involved in the field work were a variety of stakeholders. There was, however, a special focus on various manufacturers situated in different parts of the country and the TANESCO, the country's principle entity engaged in electricity production, transmission and distribution in the country. In the course of the project, the team of experts interviewed and gathered data/information from 60 manufacturing firms. The data were also collected from other selected stakeholders of power supply and allied matters. Data collection was done through questionnaires as well as direct discussions with respondents of the selected organisations.

A sample of 87 firms was selected, of which 10 manufacturers were chosen by CTI and the rest were selected based on sampling amongst six groups of the CTI members from the respective three categories, including: large; medium and small firms. Firms of these categories from Dar es Salaam and outside it were incorporated accordingly. The total number of interviewees whose questionnaires were returned on time was 60 from the various selected parts of the country, namely: Dar es Salaam, Tanga, Arusha, Iringa, Kilimanjaro and Mwanza.

The secondary data and information was generated from many sources including previous studies on the manufacturing sector in Tanzania, Economic Surveys, Budget Speeches, research reports on the crisis of intermittent electricity supply, TANESCO reports on the completed and ongoing projects to increase the reliability of electricity in the country, and documents obtained from CTI on the manufacturing sector and electricity supply. In addition, national policies and strategies related to energy supply and industrial sector development were reviewed to uncover the national priorities on increasing the reliability of electricity supply to the manufacturing sector. In particular, a national policy review focused on the National Development Vision 2025, the National Strategy for Growth and Reduction of Poverty (NSGRP), the Sustainable Industrial Development Policy (SIDP) and the Energy Policy of Tanzania. The purpose of reviewing the literature was to get information concerning the extent to which the challenge of electricity supply is understood and to find out the areas that needed further research. Relevant information and the data generated from secondary sources were combined with the field data to guide the recommendations made by this report.

2.3 Approaches Used to Develop Policy Recommendations

This report puts forward policy recommendations and proposals based on the findings of the study and opinions of the stakeholders. Besides interviews made during the survey, more opinions of the stakeholders were derived from the meetings held with the key individuals and stakeholders to discuss the results of the study. Some of the individuals involved in corroborating the study are CTI and the BEST-AC experts, selected staff from TANESCO and other informed experts. A consultative meeting with stakeholders on the advocacy report and strategy to improve availability of electricity supply to manufacturers was also held to gather ideas on how to address the matter. All useful information obtained from the stakeholders was analysed and combined with the study findings to guide and inform the team on the proposals/recommendations made. Policy recommendations are developed in such a way that they can suffice on their own to form a policy brief on the issue of unreliable electricity supply to manufacturers.

3 State of Electricity Supply in Tanzania

3.1 General Concerns about Energy and Electricity Supply

Energy is a prerequisite for proper functioning of nearly the all sub-sectors of the economy. It is an essential service whose availability and quality determines success or failure of development endeavours (URT, 1992). This argument is valid particularly when we consider supply of energy to manufacturing firms, where power is used as an input in the production process rather than a final consumption service. The importance of energy as a sector in the national economy cannot therefore be over-emphasised. Energy policies and plans must be consistent with the national economic planning and their implementation should be synchronised with other policies, plans and strategies of the rest of sectors in the economy.

Despite the integral necessity of energy in the economy, and the stalwart determination manifested by the national energy policy, in Tanzania the supply of electricity is not at all consistent. The problems of intermittent power supply, low voltage, frequent unpredictable rationing and outages appear to be among the hindrances which cause the country's manufacturing performance in the country to stumble. These electricity supply problems result in the rise in production costs for manufacturers since they are often forced to resort to expensive alternative temporary sources of energy to avoid discontinuities in their production processes. Among other things, cost effects of unreliable power supply strains competitiveness of manufacturing firms in Tanzania (Komba, 1999).

A concern about power supply limitations to industrial performance, and the economy at large, has been raised in many forums and there is a substantial body of literature on this subject. The then CTI Chairman's Speech (Mengi, 2008) points out that despite the encouraging economic growth that has been achieved so far, the majority of Tanzanians are still living in abject poverty which has, *inter alia*, been caused by inadequate and poor power quality . He notes that electricity is a critical input in economic growth; so he emphasises that the Government should improve power supply reliability in order to boost production in the manufacturing sector and business operations, which would in turn promote significant economic growth. He puts weight on the fact that, if the poor quality of electricity supply is not adequately addressed, this

impediment will continue to retard growth regardless of the abundant resources available in the country.

It would be wrong to assume that the Government of Tanzania is unaware of the power supply trouble facing manufacturers in Tanzania. The Prime Minister, Hon. Pinda (2008), acknowledged challenges that are facing the energy sector. He cited various alternative energy sources that could be exploited to enhance power generation, including: natural gas, bio-fuels, wind, coal and solar energy. He urged the private sector, both local and foreign, to invest in the ample investment potential of power generation and supply in Tanzania. The Prime Minister promised that the Government would continue investing in hydro-electric power in order to complement the effort of the other sources so as to satisfy the energy demand in the country. He further noted that the Government had short, medium and long-term plans to address power problems in Tanzania. Although the Government has noted this; as regards the Tanzania Energy Policy (URT, 2003) there is a gap. Because, although the policy puts emphasis on ensuring adequate energy supply at affordable cost to manufacturers and others, as well as industrial power conservation, there is no explicit mention of any enforcement obligations on the part of TANESCO. The policy does articulate well the need for industrial energy auditing and identification of potential for saving energy. While the policy also shows that the Government would continue to look for alternative sources of energy besides hydro-generation, the enforcement of this drive has been extremely poor in the recent past.

Problems facing the country's energy sector have been noted by the Tanzania TANESCO (2009a) – the monopoly public company for the production, transmission and distribution of electricity. TANESCO indicates the overall estimates of suppressed demand² for electrical power for 2009 amounting to 769 MW. This is according to the Power Systems Master Plan; however, by August 2009 average production reached 697 MW, which was below estimated demand by 72 MW or 10.3%. In view of this, electrical power production in Tanzania is insufficient even to the already installed transmission and distribution infrastructure. Nonetheless, the plans are underway to provide a pattern which shows that from 2012 there will be some excess in power supply, in terms only of the installed capacity. Since 2006, however, the Government of

 $^{^2}$ Suppressed demand in the sense that it is rather demand in the installed capacity than the overall country's demand, which includes the vast non-electrified areas (potential) in need of power.

Tanzania has made six official statements and promises to stop power rationing; but this has not been materialised. Several projects have been put in the documents intended to rectify the problem of power supply in the country; yet the power problem has been intensifying and the rationing of electricity is becoming more acute throughout the country.

		Planned Prod	Additional luction	Total Supply	Demand	Surplus/Deficit	
Year	Plant	Туре	MW	MW	MW	Before Addition	After Addition
2009	National Grid	All		697	769	(72)	(72)
2009	Tegeta	Gas	69	766	769	(72)	(3)
2010	Tegeta IPTL	Fuel	100	866	907	(210)	(41)
2011	Mwanza	Fuel	60	966	1005	(308)	(39)
	Cogeneration	Bioma ss	40				
2012	Ubungo	Gas	100	1116	1102	(405)	14
	Singida	Wind	50				
2013	Kinyerezi	Gas	240	1556	1219	(522)	337
	Kiwira 1	Coal	200				

Table 1a: Forecast of Supply and Demand for Electricity (2009 – 2013)

Source: TANESCO

The most recently revised PSMP extends projections of demand and supply of electricity to 2019 and that is done with a view to achieving what is referred to as "base case generation expansion plan", which means implementation of the least cost expansion scenario to meet the base case of load forecast. These forecasts are presented in Table 1b below.

Table 1D: Forecast of the	Base Ca	se Gener	ation Ex	pansion	Plan (20	J14 – 201
Year	2014	2015	2016	2017	2018	2019
Supply forecast (MW)	1,461	1,682	2,348	2,360	2,582	2,582
Demand forecast (MW)	1,349	1,462	1,573	1,726	1,867	1,989
Surplus/deficit (MW)	112	220	775	634	715	593
Sources TANESCO						

 Table 1b: Forecast of the Base Case Generation Expansion Plan (2014 – 2019)

Source: TANESCO

The forecast shows that in the base case scenario, Tanzania will have surplus supply of electricity with additions to the national grid from 2012 (if the PSMP is well implemented as planned), reaching a peak in 2016 and then starting to decline. This implies that there should be

continued investment to ensure sustainable generation to avoid reverting back to the deficit as demand grows.

The Tanzanian power problem has attributed to several causes. TANESCO (2009) underlines some of its main challenges as:

- the worn out infrastructure both for production and distribution;
- shortages in electricity production often occur because TANESCO does not have any reserve margin, which was supposed to be 15%-20% of maximum demand (for supply just in case of any faults);
- too much dependence on hydro-production which is prone to vagaries of the weather notably drought, i.e. absence of alternative sources of power, and
- the challenge of timely implementation of plans and strategies of PSMP for projects to be completed during 2009 2013.

Indeed, Tanzania has a **stumpy** level of industrialisation and hence low levels of income, modernisation, and emission. Less than 10% of the population has access to electricity compared to the Africa average of 30% (Lyimo, 2006). Because of dependence on hydropower, there are significant technical and non-technical losses including the increasing vandalism on the power system infrastructure. Independent Power Producers (IPPs) were allowed to generate electricity and sell to TANESCO since 1994. However, TANESCO still maintains a lion's share of electricity generation and supply, and all the distribution, in Tanzania despite customer dissatisfaction with its operational performance. Consumer dissatisfaction with electricity supply is due to persistent inadequate availability of electricity, low installed capacity and unreliability of the quality of available power as well as the Government's inability to finance further investment in the sector. Lyimo (2006) and SAD-ELEC (PTY) LTD, (2001) highlight many operational problems of TANESCO which cause a big loss owing to among other factors: long lags in electricity billing, customer non-payment for services, delays in tariff reviews, power shortages and extended blackouts.

Underperformance in the power supply results from several noted challenges including the issues related to TANESCO management and a poor investment state in the company. Historical background is relevant in expounding the realities about this Government electrical power monopoly. Mwakapugi (2008) explains that the Government started efforts to reform the energy sector in 1995 when the first energy sector reform study was commissioned to the ESBI International of Ireland to undertake a study on appropriate reforms. The study observed that the

prevailing conditions were not supportive of the privatisation of TANESCO. Another observation was that TANESCO would be improved by enabling the power monopoly to make a technical and financial turnaround. The ESBI International study recommended to *ring-fence* generation, transmission, distribution and rural electrification. However, the Government did not accept these recommendations as they were not aligned with the expectations of the Government and the World Bank that TANESCO should be privatised outright. In 2002, PSRC undertook another follow up study to restructure the power sector in order to privatise it. The study report was submitted to the Government in 2004 with a recommendation for vertical and horizontal unbundling of TANESCO to keep electricity transmission business under the public ownership, as a way to separate distribution and transmission businesses. These recommendations were never implemented either, and the Government decided to continue operating TANESCO as a vertically integrated utility that is wholly owned by the Government.

The Government has tried since 2005 to encourage private investor participation in the energy sector but the response is very poor. Mwakapugi (2008) identifies various major barriers to the wider participation of private investors in the power sector as: a) TANESCO dominance in the market; b) unsynchronised national development policies, and c) a weak power-base envisaged by consumption per capita, which is around 100 KW. He further notes that there are risks imbedded in the high cost of private capital required in large scale energy production in the face of inadequate transmission capacity.

A recent World Bank Africa infrastructure diagnostic study done by Jalbuena (2010) estimates that load shedding and emergency generation overall cost Tanzania over 5% of the country's GDP annually. Further, studies also show that inadequate power takes a heavy toll on the private sector, with firms experiencing an average of outages occurring 63 times per year. Such outages make a significant dent on a company's expenses, representing 6% of turnover on average for formal enterprises and as much as 16% of turnover for informal ones. Tanzania suffers from significant power shortages because of inadequate security and supply reliability in the country's energy system, which is highly dependent on hydropower (TANESCO, 2008). However, hydropower is a risky business because Tanzania is susceptible to droughts. Following the predicament of the power problems in the country, development partner assessments suggest that Tanzania needs enhanced assistance (a big push) in this sector (World Bank, 2006).

The Government's dithering and the consequent slow process of reforming TANESCO has been among the prominent factors widely put forward as obstacles to reliable power supply in the country. Since 2005 TANESCO has been listed by PSRC as a company waiting for its privatisation fate, and for this reason capital investment in TANESCO has remained too low (Abdallah, 2008). While demand for power in Tanzania currently comes from only 14% of the country's population but is growing at around 10% per annum, large scale investment of up to 2009 stood still. Abdallah shows that the customer base for TANESCO went up from 208,000 in 1991 to 771,000 in 2007. It is also noted that the private sector participation in electricity generation had increased from 2% in 1991 to over 30% in 2007, but it has been impossible to cope with such a rapidly growing demand for power in the current settings of the energy sector in the country.

Factors that are widely cited as severely affecting power supply in the country include: weather changes especially when droughts occur; power load shedding owing to high losses in transmission, high level of power inconsistency; poor customer service; meagre financial resources, and perceived corruption in the company. Despite these hindrances, the demand for power in the country has continued to grow in line with increased economic activity, hence exceeding the available capacity for generation, transmission and distribution. By 2007 it was only 12% of the population in Tanzania that had access to electricity notwithstanding the large endowment of sources and potential for power generation that is available inTanzania. According to Abdallah (2008) what many expected was that, by 2012, electricity would have reached 25% of the population following a satisfactory implementation of PSMP.

3.2 Electricity Generation and Transmission in Tanzania

The Tanzania power sector is dominated by a single vertically integrated power utility company (TANESCO), under the Ministry of Energy and Minerals, with the core business of generation, transmission, and distribution of electricity in the country. Although the Government implemented reforms in the National Energy Policy in 2003 allowing private sector participation in electricity business as a way to ending the TANESCO monopoly, the company still vastly dominates the sector. The essence for the Government policy reform was to motivate private sector participation in power trading in addition to putting up a regulatory institution.

TANESCO has a mandate for generation, transmission and distribution of electricity in the whole country. The company is therefore responsible for all power generation though there are other small sources of generation from Independent Power Producers (IPPs) which feed the National Grid and isolated areas. The TANESCO generation system is based mainly of Hydro and Therma, where the Hydro sources contribute the largest share of the power generated by TANESCO. Taking the statistics of 2008, the total electricity generation from TANESCO-owned sources in 2008 was 2,985,275,264 kWh out of which 2,648,911,352 kWh (90%) was from Hydro Power Plants. The total country demand was 4,425,403,157 kWh, of which 33% was supplied by IPPs. The national electricity connectivity, as already pointed out, is about 14% where the contribution of non-hydro, renewable energy for power generation is less than 5%. While the biomass-based fuels account for 90% of the total national energy consumption, commercial energy accounts for only 10% (of which petroleum accounts for 8% and electricity 2%). The generation of electricity by TANESCO and other plants in 2009 is shown in Table 2.

Plant	Units	Installed Capacity (MW)	Current Production (MW)	Remarks
Kidatu	4	204	192	Hydrological limitation
Kihansi	3	180	120	Hydrological limitation
Mtera	2	80	76	Hydrological limitation
N/P Falls	2	68	45	Hydrological limitation
Hale	2	21	0	Hydrological limitation
Nyumba ya Mungu	2	8	4	Hydrological limitation
SONGAS	6	190	160	
TANESCO-Ubungo	12	102	95	Gas availability
IPTL	10	103	0	Arbitration
Diesels (TANESCO)		7	5	Expensive
TOTAL		963	697	

 Table 2: Existing Grid Generation Plants (October, 2009)

Source: TANESCO

TANESCO is also responsible for transmission of electricity through the transmission lines with 2,732.36 km of system voltages 220 kV; 1537 km of 132 kV; and 534 km of 66 kV, 21 kV totalling up to 4,803.36 km. The total installed capacity in the Main Grid System amounts to 963 MW. The system is hydropower dependent, the latter constituting about 562 MW, or 58.4% of total installed capacity. TANESCO is responsible for: running the National Grid Control Centre (NGCC); safeguarding the power network by means of power protection systems to ensure stability and reliability of power so as to have as few outages as possible; maintenance and

operation of the Grid Communication Network; operation of an Electrical Workshop which provides all-weather maintenance and installation services of all electrical equipment and systems. Formulation and development of the long term Power Master Plan for the Company and a Corporate Business Plan; managing the implementation of all major generation, transmission and distribution projects; organising, conducting and reviewing R&D activities and engineering studies.

3.3 Electricity Supply Load Forecast

According to PSMP, load forecast of the main-grid annual power demand growth ranges from 8% to 18% in the period 2009 – 2012. These are indications considered by TANESCO, but under the key assumptions, planning, strategies and identified available power resources in the preparation of short to long-term plans for the development of the power system in Tanzania. The envisaged accomplishments, among others are: connection of 100,000 new customers per year from 2009–2013; reducing load shedding to 5% of the demand within this period; reducing system losses from 23% during 2009 to 21% in 2010, 19% in 2011, 15% during 2012, and 13% for the period 2013 to 2033.

The other long desired accomplishment that TANESCO mentions is to connect all isolated load centres to the national grid by 2020. There is are also expectations that the Zambia-Tanzania-Kenya interconnection is going to be effective in 2015 to allow formation of a spot market for power trading; and the use of a judicious mix of hydro-thermal generation options in order to have a balanced approach to power generation in the near future as envisaged.

3.4 Energy Supply Initiatives

Following the history, the country's power sector has generally grown over time in terms of size and network coverage. Visually, its performance (at utility level) at the end of a strong monopolistic era differs extensively from the levels observed in the period 2002-2009. For instance, the installed capacity both in the main and isolated grids has more than doubled from 482 MW at the end of 1991 to 963 MW in 2009. Generally, the composition of electricity production by source of generation has also grown over time. The corresponding system's peak demand has more than doubled from 297 MW in 2002 to 769 MW in 2009. Nonetheless, in the recent past electricity generation from the hydro-system was adversely affected by drought conditions that hit the country particularly in 2004 and 2006. Owing to such challenges, TANESCO has tried to take measures to reduce hydro-power dependence by resorting to other supplementary sources, which resulted in ongoing efforts to reduce the thermal generation contribution from the current 40% to a balanced hydro-thermal contribution of equal amounts. Up to July 2009 about 40% of electricity was generated from thermal power plants (TANESCO, 2009b). There are expectations that the generation mix will be 39%-hydro and 61%-thermal in 2013, and thereafter.

Review of the Budget Speech for the MEM indicates that the power sector grew by 8.4% in 2009 as compared to 5.4% in 2008. The growth of the sector has been as a result of increasing utilisation of natural gas as a power source. The budget also shows that the contribution of electricity and natural gas to GDP in 2009 (based on 2001 prices) is 2.1% as compared to 2.0% in 2008. Nevertheless, on the basis of the current prices, electricity and natural gas contributed 1.7% of GDP for each of those two years.

3.5 Power System Planning

Power system planning is an arrangement that seeks to balance demand for and corresponding supply of electricity. This system is supposed to work in a way that facilitates installation of supply capacity that meets the projected demand without necessarily tying up capital through over-investment. The demand-supply balance is carried out with the help of planning tools. For several years, , through the Power Systems Master Plan (PSMP), TANESCO has been struggling to have a balanced hydro-thermal power generation. There are a number of objectives in the power planning exercise. Knowing the nature and the mix of power generating resources available in the country is vital, and the main objectives are to: (i) provide a cushion against hydrological risks; (ii) offer a more balanced hydro-thermal mix; (iii) provide more reliable power supply systems, and (iv) a llow good timing and sequencing of new viable investment projects.

3.6 Industrial Tariff Charges

It is important to compare Tanzania and the neighbouring countries, especially Kenya and Uganda, in terms of electricity cost to manufacturers. According to a TANESCO (2010) study,

the 2009 tariff rates for the three countries indicate that TANESCO tariffs were very competitive. Rates for all industrial tariff categories are lower in Tanzania than in both Kenya and Uganda. The category of small and medium firms has a charge of US\$ 0.064 per kWh in Tanzania as compared to US\$ 0.075 and US\$ 0.171 per kWh in Kenya and Uganda, respectively. For the category of large firms, Tanzania charges US\$ 0.060 per kWh whereas Kenya and Uganda charge US\$ 0.062 and US\$ 0.086 per kWh, respectively. Kenya has the higher electricity generation, transmission and distribution cost than most of neighbouring countries. Kenya Power and Lighting Company (KPLC) incurs a cost of around US cents 15 per kWh as opposed to Tanzania's US cents 9 and Zambia's US cents 6, thus Kenya is at a disadvantage regionally (ESABMO, 2009).

Although Tanzania is seen to be competitive in terms of tariffs, the report of the Parliamentary Committee on Energy (by January Makamba (2011)) shows that the country is bearing a high cost burden for electricity due to ineffective contracts and projects in the power sector. The Government of Tanzania and TANESCO, in particular, have incurred and are likely to continue to incur significant legal costs due to the cases lost and the contracts that are not enforceable. For example, the two legal cases of 2010 that are currently in the international courts of law are threatening the future of the power sector. These cases are in the International Centre for Settlement of Investment Disputes (ICSID) between the Government/TANESCO and the IPTL/Standard Chattered Bank of Hong Kong. The cases are likely to cost the Government more severely even than the fine that is to be paid to Dowans. Further, the Government made a contract with Alstom Power Rentals to generate power in Mwanza using HFO oil in Mwanza, where the company has been paid \$1.7 million per month to generate electricity. The Government has lost over TZS 20 billion in this, despite the fact that the project has not generated any power at all. With these examples, it is clear that the electricity cost has been high partly because of the ineffective contracts made by the Government/TANESCO. Seeing the losses incurred by the Government using tax money, it is worth noting that electricity is, in fact, neither so cheap competitive in Tanzania as suggested by Government/TANESCO above.

3.7 Menu of Measures for a Quick Solution to Power Shortages

The main concern has focused on Government's lack of timely implementation of the plans that are on paper for a hastened solution to the power supply troubles. In 2009 TANESCO stated a number of priorities that were supposed to be implemented to eradicate power supply hurdles. However, the feasibility of proper implementation of such measures remains questionable, and despite completion of some of those projects, the electricity supply condition in Tanzania has not noticeably improved. The plans that were proposed as a way forward comprise of the following.

- a) The Government was supposed to accelerate implementation of the 60 MW rental plant at Mwanza and get it finished before the end of 2009. The urgency was due to the fact that there is a long gestation period, usually a minimum of 2 to 3 years for the construction of a new permanent power plant to be completed.
- b) In 2009, there was an approximated power capacity gap of about 132 MW. Nevertheless, completion of the Tegeta 45 MW project and the Mwanza 60 MW project before the end of the year could reduce this gap significantly. The Government completed the Tegeta project and increased natural gas electricity from 291 MW in 2008/09 to 336 MW in 2009/10. The Capacity to generate electricity from natural gas is currently 348 MW when 12 MW generated by Artumas Light Ltd. is included. Three power stations, each with a capacity to generate 2.7 MW in Somanga Fungu were completed in June 2010. Nonetheless, the gap could only be bridged if the IPTL case was concluded as soon as possible to enable the 100 MW plant to operate and supply power constantly.
- c) Five ABC machines each with a capacity of 1.25 MW were inaugurated in Kigoma in June 2010. Together with this project, TANESCO completed other District power supply projects to Kilolo, Kilindi, Bahi and Uyui.
- d) The immediate procurement by the Government of a new gas-fired power plant with a capacity of 100 MW was supposed to be installed at Ubungo-Dar es Salaam and to be operational in 2010.
- e) The Government was supposed to accelerate the implementation of a new power plant with a capacity of 250 MW in two phases to be installed at Kinyerezi in Dar es Salaam to in operation by 2013.
- f) It was recommended to accelerate implementation of the 300 MW gas-fired power plant at Mnazi Bay (Mtwara) with associated transmission line facilities to Dar es Salaam by 2013.

According to the 2010/11 Budget, the power projects that would be funded by the Government in this financial year are as follows.

- i) Funding rural energy projects through Rural Energy Agency, comprising of 41 projects to supply electricity to 16 Regions; once those projects are completed, 20,000 new customers could have electricity connection
- Completion of the Mwanza 60 MW and Ubungo 100 MW projects to be connected to the National Grid
- iii) Concluding negotiations with the Sumitomo Corporation of Japan to complete the Kinyerezi 240 MW project
- iv) Completion of the Mnazi Bay 300 MW project
- v) Starting the implementation of Ruhudji 358 MW project by June 2011 after financial closure. This project is expected to be completed in 2016
- vi) Completion of a feasibility study for the Stiegler's Gorge 2,100 MW project, and carrying on negations with IDF and other investors to invest in this project
- vii) Concluding negotiations with the Government of China which has shown an interest to complete the Kiwira 200 MW projects at a cost of US\$ 400 million
- viii)Completion of a feasibility study for the Ngaka 400 MW project within the 2010/11 financial year
- ix) Completion of the investor selection process for the Mchuchuma 400 MW project by September 2010
- x) Continuing with the effort to conclude the IPTL case in order to enable the 100 MW plant to operate using a dual fuel system
- xi) Rehabilitation of the national grid in Dar es Salaam, Kilimanjaro and Arusha in collaboration with TADEP; other Regions that are in this financial year's plan are Iringa, Shinyanga, Dodoma, Singida, Mwanza, Mbeya, Kigoma and Rukwa
- xii) Promotion to attract private investors to invest in small power generation projects with the capacity of 10 kW to 10 MW; Standard Power Purchase Agreements and Standard Power Purchase Tariffs will be used to simplify the agreement process with the private investors as a strategy to attract them

In addition to the above projects, several others have been completed or are underway as shown in Annex 1. However, evaluation of the current power supply situation in the country shows that energy hindrance is still rampant and frustrates production in manufacturing firms. It is important to notice that the issue is not only about insufficiency of power supply but also unreliability of the available amount of electricity, whatever the supply capacity reached. With growth of the manufacturing sector of the economy in Tanzania, it is estimated that the demand for electricity will triple from the current level of demand by just a mere 14% of the population to a higher level of demand by 42% of the population by 2020. This calls for massive investments in generation, transmission and distribution of electricity in Tanzania.

4 Analysis of Reviewed Information and Field Data

4.1 Introduction

This section concentrates specifically on the analysis of both the information reviewed in the literature and collected through questionnaires. The objective is to analyse all relevant issues that can help us draw strong relevant conclusions and recommendations toward a quick solution to the electricity supply problem facing manufacturers in Tanzania.

4.2 Reflections on the Desk Review

The findings from the overall literature and documents reviewed indicate that energy is a part and parcel of good performance of manufacturing firms, and that its constant supply at affordable tariffs is imperative to enhanced competitiveness of the manufacturing firms. Reviewed literature admits also that there have been long-term problems of electricity supply to manufacturers and these entail a lot of costs. It is good practice to acknowledge the realities on the ground, and for that reason, we need to note that the literature indicates efforts that the Government and its partners through TANESCO have attempted to exert towards solving the power supply impasse. Existing information and data indicate that there are some projects that have been completed by TANESCO in recent years and some that are underway to address the shortage of electricity supply in Tanzania. While this is an indication of a positive move toward solving the electricity problem, the crisis of unreliable power supply is still felt by manufacturers. This implies that there is need for the Government to speed up completion of the ongoing projects and to undertake specific initiatives focusing on the manufacturers' power supply challenges.

4.3 Examination of Documented Consequences of Inadequate Electricity Supply

The impression is that, following blackouts, low voltages and unreliability of electricity supply to manufacturing firms in general, the consequences are as explored below.

(i) Firms experience an average of 63 outages of electricity per annum³. Analytically, manufacturing enterprises are producing less than they should in terms of output levels

³ Jalbuena (2010)

owing to encumbrances emanating from power inadequacy because, during these outages, a majority of production sections in a factory must stop. On the other hand, if they have higher cost of *own* alternative sources of energy, product prices are pushed to a higher side.

- (ii) Using documented information, and some computations based on the field data collected during this study⁴, the output loss due to unreliable power supply to manufactures is estimated to be TZS 31.7 billion per year. According to performance in terms of profits for the formal and informal sectors, the literature shows there is a loss of 6% and 16%, respectively, which can be interpolated to reflect the levels of loss to the Government in terms of corporate tax revenue that would have been collected if reliable power supply was in place. Assuming that the Government could collect taxes efficiently; especially after solving the challenge of electricity supply, corporate tax revenue could be raised approximately by TZ 9.5 billion.
- (iii) Implications for labour market are that there is an employment capacity of manufacturing firms that will be compromised by factory underperformance, a significant part of which is attributed to the energy problem. This is in line with the fact that, factors are combined optimally in the production process, and so if there is a limitation to earnings for any reason, firms would be forced to reduce factor proportions employed in tandem with the earnings (i.e. to appropriately tally factor proportions). If there is no power, there is no reason for a firm to buy labour hours for 'no account'; thus implying an adverse impact on employment and/or labour compensation.
- (iv) On the other factors of production, notably capital, electricity shortages mean nothing better than an increase in excess capacity that could be utilised for more output to a growing economy like Tanzania.

4.4 Facts about Costs of Electricity to Manufacturers (from the field Data)

i) According to the field information, despite the frequent power interruptions, TANESCO's electricity supply is mentioned as one of the very important production inputs for all manufacturing firms in the country. An average of 18.9% of the total cost of production for the interviewed manufacturers is accounted for by energy cost. The overall

⁴ From computations done on Table 9

monthly average costs of energy for the studied firms were: TZS 416.9 million for large industrial firms; TZS 49.4 million for medium industrial firms; and TZS 7.3 million for small manufacturing firms⁵. This is a huge cost and given this unreliable power supply, it remains a big burden to factory owners. An average amount of 586.3 MW is consumed by each large manufacturing firm per month, while the corresponding amounts for medium and small manufacturing firms are 173.6 MW and 20.3 MW. Of the total mentioned monthly energy costs: 59.8% is entirely attributed to the consequences of unreliable TANESCO electricity supply for the large firms; while corresponding percentages for the medium and small such firms are 43.6% and 60.2%. Since the findings show that 59.8% of energy cost is incurred due to unreliable supply by TANESCO (for the large manufacturers), the cost of intermittent electricity supply is 11.3% [(59.8/100)x18.9] of the entire large manufacturers' production cost in Tanzania. For medium and small manufacturing firms the corresponding proportions are 8.2% and 11.4%, respectively, of total manufacturing cost.

- ii) Despite the importance of power to manufacturers, and the fact that TANESCO may even be conscious of impediments manufacturers are going through; the problems of insufficient power supply, electrical current instability, frequent interruptions and power rationing remain at the top of the list of constraints with which Tanzanian manufacturers have to grapple. Manufacturers in this country fail to understand the reason why they cannot get energy constantly given the tariffs they pay, given the high potential for energy production in Tanzania. This is a strain that continues to adversely impact on the quality of investment climate amidst the currently need for private investors in the country.
- iii) There has been an argument that the big manufacturing companies should invest in cogeneration of electricity in order to release the TANESCO generated power for use by small and medium firms. However, for manufacturing firms would find it too costly to establish power production plants that would be sufficient to satisfy their required high amounts of energy. It is reasonable to think about hindering costs in energy production and that manufacturers are engaged in a standalone sector, therefore, they cannot

⁵ In this case, firms are categorised according to their power consumption. Those incurring energy costs of only up to TZS 20 million per month are small manufacturers, while those consuming from TZS 20 million to TZS 100 million are medium size, whereas consumers of TZS 100 million and above are grouped as large manufacturers.

undertake in full the dual and simultaneous responsibility for power production and the production goods. The best they could do as they usually indicate in different forums is to invest only in the safety nets for emergencies. In cases of prolonged shortages, interruptions, etc., they could definitely not be expected to afford to supply manufactured or factory processed products at rational costs.

iv) It must further be noted that the power supply safeguards that can be established by the manufacturers are not capable of production of high energy supply required especially by the heavy manufacturing companies. The firms' safety net for energy shortages mostly comprise of: biogas from wastes; wind and solar energy conservation; coal power generation, and the use of fuel consuming generators. These means are too light to make appropriate supply of power to the electricity-intensive manufacturers. There has been an argument that is also made in discussions with the interviewed stakeholders in this case that the dependable supplementary (*to hydro*) production of electricity can be established by the Government through TANESCO capitalisation to invest in sources like: high power gas turbines, nuclear energy, and natural gas. A reason for expansion of hydroproduction by construction of new dams to cater for expanding the need of electricity is a fundamental issue that most of the stakeholders emphasise in all discussions on the problem of power supply in the country.

4.5 Principal Causes of Intermittent Electricity Supply to Tanzanian Manufacturers

The main reasons proposed in the literature for intermittent supply of electricity to manufactures in Tanzania are summarised as follows.

- (i) The worn out infrastructure both for production and distribution, which results in shortages and extended blackouts due to frequent faults, power load shedding and repairs
- (ii) Shortages in electricity production as TANESCO goes without any reserve margin, which was supposed to be 15% -20% of maximum demand
- (iii) Too much dependence on hydro-power production which is prone to vagaries of the weather
- (iv) Significant technical and non-technical losses, including increasing vandalism on power system infrastructure

- (v) Stagnation in the TANESCO capital investment for improvement of power generation, transmission and distribution mainly due to low capitalisation
- (vi) The Tanzania energy policy is not well enforced and, besides that, its provisions on assurance of energy supply to manufacturers remain vague
- (vii) Unsynchronised policies hamper effective private investor participation in the energy sector to compete well with TANESCO monopoly; the dithering which has surrounded TANESCO reform since it was mentioned and listed for reforms in 2005 constrains management performance
- (viii) TANESCO operational problems causing big company losses as a result of high costs emanating from long lags in electricity billing and delays in tariff reviews

4.6 Detailed Analysis of the Field Data

A total of 60 manufacturing firms were investigated and the data analysed to discover the extent of irregular electrical power supply and its causes. The Regions in the sample were Dar es Salaam, Tanga, Arusha, Iringa, Kilimanjaro and Mwanza. TANESCO as the major producer and supplier of electricity in Tanzania was interviewed and the company cooperated very well in providing useful information concerning causes of electricity supply shortages in the country in general; and to the manufacturers in particular. Statistics indicate a situation that conforms largely to what has been observed from the literature, and addressed in different forums held to discuss hurdles of electricity supply in Tanzania.

4.6.1 Interview Structure

Responses to the interview were good and most of the questionnaires distributed were filled and returned. Out of 87 sampled firms, 60 returned questionnaires in time. Structure of the interview for the selected Regions was good, with Dar es Salaam - which has most of the manufacturing firms in the country - being well represented by a relatively large number of interviewees, approximately 60%, followed by Arusha with about 17%, and then Mwanza and Tanga both with around 8%, respectively.

		Frequency	Percent
1	Arusha	10	16.7
2	Dar es Salaam	36	60.0
3	Iringa	1	1.7
4	Kilimanjaro	3	5.0
5	Mwanza	5	8.3
6	Tanga	5	8.3
Total		60	100.0

Table 3: Structure of the Interview

A variety of manufacturing activities were visited to capture different manufacturing sub-sectors in order to avoid bias and to get opinions of varied categories of firms. Table 4 shows a fairly diverse type of manufacturers with reasonable proportionate representation of the sub-sectors. Food products and beverages category has a relatively higher proportion but it is also a group of enterprises with many participants in the country. The *others* group is comprised of a variety of manufacturing enterprises that were visited but not included in any of the listed categories.

	Activities	Frequency	Percent	
1	Food products and beverages	14	23.3	
2	Tobacco products	1	1.7	
3	Textiles	2	3.3	
4	Publishing, printing recorded media	2	3.3	
5	Furniture manufacturing	2	3.3	
6	Recycling	1	1.7	
7	Paper and paper products	10	16.7	
8	Chemicals and chemical products	7	11.7	
9	Rubber and plastic products	1	1.7	
10	Fabricated metal products, except machineries and equipment	1	1.7	
11	Tanning and dressing of leather, luggage, handbags, saddlery	2	3.3	
12	Machinery and equipments	1	1.7	
13	Others	16	26.7	
	Total	60	100.0	

 Table 4: Companies Included in the Study

4.6.2 Analytical Hindrances of Inadequate Power Supply to Manufacturers

Before we look at specific problems facing the studied manufacturers in the country, it is important to see the frequency of power interruptions and also the number of production hours lost due to unreliable electricity supply.

Table J. Estimated Rumber of Lower Interrubtions (<i>iter intolitie</i>)
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Number of times of interruption (per month)						
Range of the number of interruption times	2008	2009	2010**			
0 - 10	13	16	8			
11 - 20	6	6	5			
21 - 30	3	3	1			
31 - 40	1	2	2			
41 and above	3	4	3			
	26	31	19			
Weights for the number of inte	rreuption time	s				
Used median class value for averaging *	2008	2009	2010**			
5	0.50	0.52	0.42			
15	0.23	0.19	0.26			
25	0.12	0.10	0.05			
35	0.04	0.06	0.11			

* A minimum value of the class of 41 and above is the one used in the averaging to avoid exaggerations ** *Projected figures*

Table 5 presents a weighted number of interruptions; findings of this study indicate that there are 16 of these per month. The findings of Jalbuena (2010) estimates that there are up to 63 interruptions per annum, and the National Bureau of Statistics (2005) in the Tanzania Investment Climate Survey suggests 72 interruptions per annum⁷.

Bearing in mind that it takes some time when an interruption occurs for electricity to be restored or re-stabilised, the analysis looks also into the weighted length of time it takes without power in each interruption event. This is tantamount to the language one could usually speak like "today we did not have power for *a certain* number of hours". Table 6 summarises information on the time loss, and its main interpretation is that, on average, 24 working-hours of labour (*all employees*) and all other respective employed factors of production are lost each month owing to electricity supply interruptions.

⁶ It is important to note that interruption in this study is "broadly defined" including *inter alia* outages and episodes of inadequate low voltages. In some other studies like Jalbuena (2010) and NBS (2005), interruptions are defined simply as "power cuts" and there are 63 and 73, respectively per year.

 ⁷ Nevertheless, in this study power interruption is broadly defined including unexpected blackouts (cuts and outages), days of inadequate, low voltages and power rationing. In the other studies mentioned the number of power interruptions takes into account only cuts and outages.

Average number of hours int	erruptions tal	ke (per month)				
Range of the number of hours of interruption	2008	2009	2010**	_		
0 - 10	8	7	4			
11 - 20	4	3	6			
21 - 30	5	6	3			
31 - 40	1	2	3			
41 and above	7	9	8			
	25	27	24			
Weights for the hours interreuptions take						
Used median class value for averaging *	2008	2009	2010**			
5	0.32	0.26	0.17			
15	0.16	0.11	0.25			
25	0.20	0.22	0.13			
35	0.04	0.07	0.13			
41	0.28	0.33	0.33			
Weighted hours of interruptions per month						
	2008	2009	2010**	Average		
Average hours of interruption per month	22	25	26	24		

Table 6: Estimated	Time	Loss due	to Power	Interruptions

* We have used the minimum value of the class of 41 and above in the averaging to avoid exaggerations. ** *Projected figures*

N = 60

4.6.3 Cross-cutting Episodes of Power Supply Interruptions

In the light of the foregoing general picture of power interruptions, there are critical issues that are virtually cross-cutting to manufacturers and those are mentioned in this study as the *general listed problems* (see Table 7), including: frequent low voltages, cuts and outages, poor communication as well as unplanned and uninformed interruptions. About 85% of all respondents mentioned the general listed problems as burning issues concerning power generation, transmission and supply in Tanzania. It is interesting but not absurd that only 8 firms in Dar es Salaam and 1 firm in Mwanza did not come up with the general listed problems as an outstanding issue for them. Those must be among the few firms that are either not so much power intensive or (and this is most likely the reason) are the light manufacturing firms with their own alternative sources that they think they can at a halt bear the costs for the moments when TANESCO power is unavailable. Whichever the case, that is still a small proportion of firms and it does not rule out generalisation that the mentioned problems of low voltages, rationing, cuts and outages, poor communication, unplanned and unannounced interruptions are a critical matter to all the manufacturers in the country.

	Electricity Supply Problems Mentioned by the			Nomination of the Problem by Region						
		Respondents	Arusha	DSM	Iringa	Kilimanjaro	Mwanza	Tanga	Total	
1	Those mentioned all the general listed problems*			28	1	3	4	5	51	
2	2 Those mentioned other one as a single major problem			1					1	
	(i)	Poor service quality		1					1	
	(ii)	Power cut without notice					1		1	
	(iii)	(iii) Unplanned power stoppages and interruptions		1					1	
	(iv)	(iv) Voltage fluctuation		3					3	
	(v)	Voltage fluctuations causing machinery damage		1					1	
	(vi)	Frequent voltage fluctuations, voltage unbalanced		1					1	
		phase, and phase failures								
	Total		10	36	1	3	5	5	60	

Table 7: Electricity Supply Problems Facing Manufacturers

* General listed problems include: low voltage, interruption (cuts and outages), poor communication, and unplanned interruption DSM = Dar es Salaam

The other burning issue of reasonable weight in addition to the aggregated general aspects of power encumbrances is the question of unstable current. This is sighted as a setback resulting in machinery damage, which causes added repair and technical costs that are often not accounted for in the additional (*or external*) costs of power supply problems.

There are also complaints levelled at poor service quality owing to delayed connections after the due fees are paid, delayed bill adjustments in cases of errors and slow follow-up to reported technical problems or faults. At times, there are too short notices in cases where power cuts are often announced at too short a notice, and in some cases no announcements are made at all for the power interruptions no are there any regrets for such events. The overdue rectification of the long-term voltage imbalances in distribution lines to factories and other consumers of energy are also singled out as one of the major problems surrounding electricity supply in this country.

4.6.4 Coping Mechanisms for Costs Associated with Electricity Shortages

Because costs must rise whether the firms stop production for some time waiting for restoration of power, or otherwise, resort to use of their own generation alternatives, they often cope with this problem in three main ways: (i) they raise the price to compensate for part of the losses (i.e. becoming less competitive); (iii) they remain reserved to the usual ongoing market prices (i.e. accepting lower margins of profit), or (iii) a combination of the two (i.e. raising prices slightly and accepting some reductions in profit margins).

Table 8	: Co	ping I	Mecha	anisms
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Solution	Number	Ratio
Prices of the products are raised	9	15.0
Prices of the products sold are not raised (accepting lower profit margins)	27	45.0
A combination of raised prices and lower profit margins	23	38.3

Statistics show that, only about 15% of manufacturing companies afford to raise prices to cope with problems arising from erratic power supply. The majority of them (45%) are unable to take any action and thus accepting a reduction in the profit following increased costs attributed to unreliable power supply. It is essential to notice that frequent price adjustments would be embarrassing to a firm's customers and therefore, a manufacturer shoulders a lot of these costs, which means in competitive markets they cannot transfer such costs to consumers accordingly. Nonetheless, cost transfer to users of goods cannot be a solution for this kind of problem because consumers are a part of the society that is too sensitive to changes in the cost of living. Except for the most basic necessities, a cost transfer approach will lead to commodity substitution and consumption cuts, which in any case, are not good news to manufacturers either.

6.6.5 Unreliable Supply of Electricity to Manufacturers: Impact on the National Economy

According to the National Budget 2010/11, the total GDP in 2009 was TZS 4,293.1 billion where the proportion of the manufacturing sector was 8.6% (TZS 369.2 billion). The contribution of electricity and gas to GDP based on 2009 prices was 1.7%. Natural gas alone contributed a total of US\$ 21.8 billion to GDP. This survey shows that regardless of the contribution of electricity each manufacturer loses an average of 24 hours per month due to power problems. With the average number of 10 working hours per day, the proportional loss of hours or rather of the employed work-force time due to unreliable electricity supply is 7.9% [which is ((24x12)/(365x10))] of the total number of hours/work-force time⁸ that would be fully spent in production annually. The total loss of GDP per year due to the power problem is estimated to be TZS 31.7 billion (Table 9). Corporate tax lost due the unreliability of electricity supply is TZS 9.5 billion. About 7,341 jobs are lost in the formal manufacturing firms with employment capacity of 10 workers and above.

⁸ We can simply define hours of work as units of labour to enable translation of hours into the number of employees engaged in the production process.

	6						
Data	2009/2010	2009/2010					
	Proportion of Impact	TZS Billions					
GDP Value of Manufacturing	8.6% x 4,293.1 billion	369.21					
Contribution of electricity and natural gas to GDP ⁹	2.1% based on 2001 prices	90.16					
(2010 Budget Speech of the MEM).	_						
GDP loss (per year) due to power problem.	(369.21/92.1) x 7.9	31.7					
Tax loss (assuming total collected tax is 30% of the	30% x 31.7	9.5					
whole income)							
Employment lost							
Formal industrial units with more than 10 workers employed 92,927 workers. If 7.9% of the							
employment size of this sub-sector is affected due to the problem of electricity, the total impact is a loss							
of 7,341 jobs							

 Table 9: Impact of Unreliable Electricity on the National Economy

We need also to see the *multiplier* effect of irregular electricity supply to manufacturers on other sectors of the economy. We have selected a few sectors that experience noticeable income effects due to a decline in manufacturing output on account of unreliable electricity supply. This analysis is done roughly through the use of the coefficients of the Tanzania Input-Output model (1992), which is applied as one of the tools that can help relating the production sectors of the economy. Table 11 shows the effect of the decrease in manufacturing output owing to unreliable electricity supply on other sectors.

Table 10:	Impact of 2%	fall in Manufac	cturing Output	on Production in	Other Sectors(<i>in %</i>)

Agriculture	Construction	Transport	Real estate	Trade	Financial interm.	Business services	Electricity
0.68	0.22	0.08	0.01	0.03	0.02	0.01	0.01

This analysis shows that if manufacturing underperforms by 2%, the agricultural sector becomes the next mostly affected sector as in response, it underperforms by 0.7%. The reason is that there are linkages both forward and backward between these sectors, and those are obviously affected as the electricity problem strikes manufacturing. Other largely impacted sectors are construction and transport which would under-perform by 0.2% and 0.1%, respectively. In addition to these sectors, the effect of unreliable electricity supply to manufacturers has further repercussions to other areas of the economy including: financial intermediaries, trade, real estate, and business services as shown in the table. Regarding that multi-facetted impact, the results of input–output coefficients analysis indicate that the effect of unreliable electricity supply eventually backfires

⁹ Bearing in mind that there is 7.9% loss of work-force time, manufacturing GDP is only an output of 92.1% of the potential total work-force (time) output.

against the electricity sector itself. This means that underperformance of manufacturing by 2%, has a consequence of a decrease in the electricity sector performance by 0.01%. That is, the reciprocating impact on electricity emanates from the revenue side since the energy sector fails to effectively harness the power supply opportunity available in manufacturing. As we can see from these few most prominent examples, the effect of unreliable electricity supply spreads to all the other areas of the economy.

Economic effects of the electricity problem to manufacturers are cross-cutting in this context, and that can be translated into an upshot on the Government revenue because as the productive sectors go under, the total taxable capacity of the economy goes down. This tells us that the electricity problem facing manufacturers is rather a national problem at large, and a Government problem in particular. With "Kilimo Kwanza", the implication is that the multiplier effect of the electricity supply problem to manufacturers strangles most the agricultural sector, and thus one of the ways to release agriculture from hindrances, would be through resolving obstacles facing the manufacturing industry in the country.

5 Conclusions and Policy Recommendations

5.1 Introduction

The main purpose of any policy paper is to provide a balanced analysis of a particular problem or issue in order to help policymakers to make informed decisions. In this report, the policy problem is clear, that Tanzanian manufacturers are facing the challenge of unreliable electrical power supply that affects their productivity and competitiveness, not to mention the consequent multiplier effect impacting the rest of the country's economy. In view of the situation experienced by manufacturers in Tanzania, we make a recapitulation of the major points on the causes and effects of unreliable electricity supply and then we put forward recommendation regarding actions that need to be taken to redress the deadlock. Our hope is that this report, by suggesting alternative course of actions to deal with the problem of unreliability of electricity supply to manufacturers, will form a basis for an overall power policy reform. It should be noted that the basic purpose of the proposed power supply reforms is to establish a mechanism that will enable manufacturers to have effective access to electricity as and when they need it.

5.2 Key Conclusions

Causes of irregular and unreliable electricity supply in Tanzania are many, some of which are external to the power generating and supplying entities (basically a few policy matters); some others are internal to the power firms, especially relating to TANESCO technical and operational matters. The major root causes of the problem of unreliable electricity supply to manufacturers in Tanzania are as outlined below.

- (a) Policy hindrances: Under this obstacle, there are two issues of major concern:
 - Because of vagueness in the National Energy Policy, there are no explicitly enforceable standards and provisions for TANESCO (or other energy suppliers) to ensure, as an obligation, a reliable supply of electrical power to this country's manufacturers and all other power consumers.
 - Poorly formulated and coordinated policies that hinder the effective participation of private investors in the energy sector to compete well, fairly and equitably with TANESCO, and so to demolish its inefficient monopoly. Unless there are well defined standards and provisions, and a strict exclusion of politicisation of investment in the

energy sector, private investors will never consider active serious participation in the power sector

(b) Power generation, transmission and distribution problems facing TANESCO, which can be analysed as follows:

- The worn out infrastructure amidst the unresolved fate of TANESCO privatisation, which for the past five years hindered high capital investments altogether
- Insufficient production owing to the previous point, as TANESCO generates electricity but without any reserve margin as a buffer for any emergency event
- Over dependence on hydro-power production which is susceptible to weather changes, especially drought.
- Significant technical and non-technical losses including: poor transmission infrastructure, too long transmission distances with a lot drains, and growing vandalism on the power system infrastructure
- Operational problems causing big losses, dependency on Government capital injections; not forgetting inefficiency in customer service, long lags in electricity billing and delays in tariff reviews

c) Slow implementation of Power Sector Reforms:

- There has been a long overdue recommendation to restructure TANESCO so as to retain electricity transmission business under public ownership, to separate distribution and transmission business, move to a wholesale electricity competitive market structure and, finally, to separate supply from distribution to facilitate retail competition. But, for some unclear reasons, the Government has continued to operate TANESCO as a vertically integrated utility and wholly it. Because of the limited capacity of TANESCO to effectively undertake generation, transmission and distribution of adequate and reliable electricity, manufacturers will continue to experience the challenges they are facing.
- Although the Government passed the Electricity Bill of 2008 with the intention to enhance private sector participation in the sector, incentives for private investments in the power sector are too low. EWURA regulation should be extended to all power producers and not only to those producing above 10MW.

- The Government should allocate some funds to the power sector to align the development of the Power Sector with the Power Sector Master Plan; however, most proposed power projects are never completed on time or end up with violation of the agreements entered into.
- d) The monopolistic nature of TANESCO: TANESCO has been operating with monopoly power that leads to inefficiencies, corruption and poor customer service. The tendencies of power cuts and interruptions, delays in billing customers, slow response to customer complaints, slow connections of electricity, etc. are some indicators of TANESCO inefficiencies.

Based on the findings of this study unreliable electrical power supply has caused many hindrances to manufacturers, the Government, as well as the economy at large. In particular, manufacturers face the following main hurdles.

- i) High income losses attributed to frequent interferences with the production process due to power supply interruptions
- ii) Machinery damage resulting from high fluctuations and instabilities of the supplied current
- iii) Loss of competitiveness in the markets following the sustained elevated price adjustments in line with the rising production costs due, inter alia, to the unreliable energy component.
- iv) Maintaining excess capacities in factories for some days on account of power cuts, shortages, rationings or prolonged blackouts; this raises overall input costs as productive factors overall remain idle for a while
- v) Frustration of the prospects and plans for new investments and business expansions
- vi) Demoralisation of investors as well as a plunge in workers' morale

Apart from these setbacks to manufacturing companies, empirical analysis uncovers tax erosion that the Government experiences as corporate incomes drop. The fiscal impact of power disturbances are systemic in the sense that, a tax loss is disparaging to the public sector as a whole, whose performance is vital for the economy overall.

Consistent with these kinds of effects, the single major issue that arises from unreliable power supply in the economy is the downsizing of the general economic growth. While Tanzania is striving to alleviate poverty through prioritisation of agriculture, a favourable performance of the manufacturing sector is an important priority. As the principal focus is on *Kilimo Kwanza* (agriculture is priority number one), the supportive instrument for this policy to succeed should be a vibrant domestic manufacturing industrial sector for the provision of the necessary linkages, both forward and backward.

5.3 Policy Recommendations

Since the electricity supply problem is cross-cutting in the economy, the responsibility for its resolution cannot be shouldered by one player in the economy. The Government is indeed a major stakeholder for the wellbeing of the people of this country, and thus it has a big stake in obtaining a solution. Therefore, as the largest body entrusted with the supply (i.e. undertaking generation, transmission and distribution of electricity, TANESCO does in deed have a significant role to play; on the other hand, as an important beneficiary, the private sector too has its own part to play. We are of the opinion that Tanzania's development partners, who have wilfully agreed to move together with us towards sustainable development, have a good reason to also play their part in bringing about the resolution of this long-overdue problem of unreliable electricity supply to manufacturers and all other consumers in Tanzania. The underlying issue of the biggest concern to manufacturers about electricity supply is actually not only the generally unreliable supply, but also and specifically the unreliable *quality* of the supplied power - even before the concern for unreliable *quantity* supplied. Our specific recommendations are here given as bold bullets outlining what needs to be done, and are ordered in accordance with their priority rank.

i) TANESCO is advised to invest heavily in improving its institutional capacity to deliver services to its customers satisfactorily. Some of the areas in which TANESCO needs to take immediate action include: rehabilitation of transmission infrastructure, communication with customers, marketing, and customer service overall. If the proposed improvements are made, TANESCO will be able to respond to customer demands immediately, especially when there are problems. This will improve the TANESCO corporate image and ensure that there is customer trust and confidence. Indeed, more Effort is required to improve customer service at TANESCO. The company should speed up implementation of its Customer Service Charter that seeks to improve customer connection, installation of more LUKU metres to phase out conventional type metres, notification of interruptions, recognition of customers' rights and obligations, prompt attention to customer complaints, handling inquiries and requests effectively, provision of essential telephone services, etc. TANESCO can maintain and improve service levels by capacity building in its workforce and other personnel coupled with improvement of its tools and equipment.

- ii) It is recommended that the Government should speed up implementation of the projects that are underway to quickly redress the problem of unreliable electricity supply. Emphasis has to be placed first on the stability (steadiness) of the voltage supplied to ensure quality of energy received by manufacturers. If the planned projects could be completed within the scheduled time-frame, the problem of low voltage and shortage could reasonably be reduced.
- iii) In the short-run, we suggest the Government should facilitate TANESCO in recapitalisation of the new power generation planned for the interim period of 2010-2013.
- iv) Government needs to increase its commitment to speed up implementation of the Electricity Act 2008 in order to encourage private investments in mini power grid operations. Nonetheless, there will be a reason to review the Act as it mainly restricts private sector investment to renewable energy while limiting investors in other areas of power generation like thermal energy production. If this is this policy problem is rectified and the private sector is encouraged to diversify sources of power, there is a possibility to redress the power problem to a large extent. One of the strategies that could be used by the Government is to give special incentives to the power sector especially private investors in order to attract more investments into the energy sector including the renewable energy source.
- v) The Government could waive taxes on equipment used in the generation, transmission and distribution of electricity in order to reduce the cost of electricity since most equipment used in the power sector is expensive and hence contributes to high cost of electricity in Tanzania. If this is done the private sector will be attracted to invest in the power sector.

- vi) Exploration and utilisation of the other potential sources of electricity existing in Tanzania. For example, statistics on the power sector show that the potential for: Hydro is 4.7 GW (with only 12% developed); coal is 1.2 billion tones of which 304 million tonnes are proven; and natural gas is greater than 45 billion cubic meters (REA, 2009); others sources of power in the country that have the potential to generate electricity are solar, biomass, wind, geothermal and petroleum/oil; the way to exploit those other power sources is to encourage the private sector participation in the sector
- vii)The energy policy needs to be reviewed to accommodate recent developments and to provide incentives for private participants who are interested in investing in the energy sector so as to do so effectively; effective participation of private investments in the energy sector would enable the country to meet the increasing demand for electricity, which is rising at 8.8% per annum (URT, 2010); the rising electricity demand requires massive investments in generation, transmission and distribution which cannot be achieved by the Government alone
- viii) A total privatisation of the public utility may not be an immediately viable option. Nonetheless, disaggregating of responsibilities is a feasible choice for efficient performance. For this reason, we recommend that TANESCO be divided into two main institutions.
 - A public power generation entity, which should exist alongside other, private producers as it is currently set
 - A transmission and distribution entity, which has to be done by TANESCO; this should deal with customer service in general, including: connections, marketing and billing

There is no doubt that an arrangement of this type needs experts to resource on setting the rules of the game; it is a good approach towards ensuring a better performance in the energy sector, especially if well implemented

ix) Promotion of Public Private Partnership (PPP) in the power sector is required in order to encourage the private sector to work closely with the Government in remedying power problems; this can be achieved through developing collaboration between the Government and Private Sector Organisations to work on the power projects and develop joint initiatives to solve the problems of electricity; the private sector has a role to play especially in the efficient use of power, investing in the sector and providing information to TANESCO on how to improve its services; however, effective participation of private institutions in the power sector can be realised if the PPP is well implemented

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