



Sustainable energy alternatives to foster macro-economic growth in Tanzania

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This thesis is designed to examine the current constraints on energy to a growing economy in Tanzania. The purpose of this thesis is to describe the current energy situation in Tanzania, which is hindering the growth of the economy, and to provide a solution via renewable energy. Energy, and especially electricity, is a basic necessity which businesses and the local people living in Tanzania have been deprived of due to poor infrastructure, management and lack of technology. Tanzania is among the fastest-growing economies in Africa. However, this constraint is preventing the economy from reaching its full potential. Ensuring adequate energy supply will allow businesses to be more cost efficient and enhance the growth of the economy while also tackling poverty.

This thesis identifies renewable energy as an alternative to the current method which is not viable. Therefore, during the thesis project the various different renewable energy options are researched in order to determine which are the most advisable in terms of resources and cost-efficiency to produce energy in Tanzania. For investors and stakeholders within the energy production sector this report is designed to give useful information about entering the Tanzanian market and the renewable energy choices which are optimal given the conditions available in Tanzania.

The methodologies used in the research of these Findings are that of the PESTEL which examines the market conditions. This methodology will give an accurate analysis of the current economic state of Tanzania, and as a result will indicate the optimal conditions in which to tackle the problem. The research also involves a questionnaire and answers from people with more expertise to provide a solution as they are based in the field. The overall findings will be concluded on the basis of the research and the answers from questionnaire.

Key words: Tanzania, Renewable Energy. solar power, wind power, biomass, waste to energy.

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Opinnäytetyöni kuvastaa tämän hetkistä rajoitettua energian saantia Tansanian kasvavalle taloudelle. Tämän opinnäytetyön tarkoitus on tuoda esille hidasteet, sekä rasitteet energian tuotannossa ja sitä kautta kehittää pätevä ratkaisu uusiutuvan energian kautta. Energian saanti on perus tarve joka puuttuu Tansanian kansalaisilta, sekä yrityksiltä huonon infrastruktuurin, hallinnon ja heikon teknologian johdosta. Tansania kuuluu Afrikan nopeimmin kasvaviin ja kehittyvien talouksien keskuuteen, mutta nykyinen rajoitettu energian saanti hidastaa kasvua huomattavasti. Uudistuva energia tuo ratkaisun rajoitettuun energian saantiin, jota kautta yritykset ovat kustannustehokkaampia. kansalaisten elintaso kasvaa tämän myötä.

Opinnäytetyö tuo esille uusiutuvan vaihtoehtoisena ratkaisuna nykyiselle energian saannille, joka ei toimi. Opinnäytetyö etsii parasta mahdollista ratkaisua uusiutuvalla energialla Tansaniassa. Tämä raportin tarkoitus on tuoda hyödyllistä informaatiota energiatalouden sijoittajille ja osakkaille, kuinka toimia Tansanian markkinoilla, sekä mikä uudistuva energia sopii parhaiten Tansanian olosuhteisiin.

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1 Introduction

I am half Tanzanian and half Finnish and have lived in both countries for a considerable time, which has enabled me to perceive the economic differences and challenges between a more developed country and less developed country. As my major is economics and I have a personal attachment to the country I want to witness economic development and see my country fulfill its potential. As a result in this thesis I have combined my knowledge and research to provide a solution which I think will be crucial in helping a massive amount of people through the use of renewable energy. I recognize that for this to happen Tanzania needs to think differently and have an innovative approach while economics suggests that foreign aid and internationalization is needed. As such my thesis compliments and works to help the CONNECT project by supporting growth and speeding up of internalization of Finnish renewable energy small and medium scale Enterprises entering developing countries.

This thesis will provide a strategic analysis for the Connect project in terms of a case study about Tanzania and in turn will be immense in determining what factors Finnish Small and medium sized enterprises (SME'S) will need to know when investing in the Tanzanian market for energy. The connect project will also examine and create new ways to providing support and access to networks, assist in development of internationalization and cultural competence. The connect project combines research such as this thesis as an external strategic analysis and knowledge in a co-creation model. The project stakeholders consist of Finnish Universities of applied sciences, SME'S and supporting organizations. The Connect project and my thesis will provide information that will develop the ability of Finnish businesses to enter target markets and so in this case Tanzania.

The research in this thesis is intended to give a clear indication of the current restrictions of energy to a growing economy in Tanzania; and research the basic economic flaws that are essential in fostering growth in Tanzania. The PESTEL methodology will provide an external analysis and permit a transformation towards a new economic strategy for the future. By researching the market structure along with the resulting effects on renewable energy; this thesis will examine the different macro environmental factors in order to provide a solution. Energy supply in Tanzania is awfully poor as the whole country is not receiving this necessity so the aim of this thesis is to examine how much economic growth is lost; how much the small and big business which make up the economy of Tanzania suffer. How this basic necessity restricts the life of people because economics deals with both poverty and economic development. Thus, there is a theoretical approach in terms of economics to find a solution that allows growth in Tanzania. The solution to allow economic development is through the renewable energy sector.

2 Theoretical framework

In order to determine the opportunities and risks of global expansion and new potential sustainable energy alternatives in Tanzania it was important that the theoretical approach to give an accurate analysis was the Pestel methodology. Pestel is an abbreviation that stands for Political, Economic, Social, Technological, Environmental and Legal. In this theoretical approach the analysis is made up of an accurate breakdown of each of the mentioned sectors to portray opportunities and risks. When entering a new market and trying to grow beyond national borders it is essential that the current state of the political, economical, social, technological, environmental and legal issues are portrayed so that companies are made aware of political instability or government willingness to attract foreign direct investment and to what degree the government looks to intervene. All these portray and give accurate information whether it is a good opportunity or a risk to expand.

Furthermore, learning the advantages and disadvantages of how Tanzania operates is crucial information. What the economical state is and whether or not inflation, GDP and currency are in theory at a favorable condition. For example the technological aspect may give a clear indication on new ways of producing goods or distributing and in this case is the technology at a good enough stage to support sustainable energy alternatives. This thesis uses the Pestel framework to depict factors that have an impact on an organization. This theoretical approach is extremely beneficial to companies as it portrays opportunities and risks. However, this is not sufficient by itself and as such a few other aspects such as the business environment that have an impact on any organization.

As this thesis is designed to support the CONNECT project which was described in the introduction and the Pestel offers much valuable information it does not cover certain aspects such as access to Finance and business environment which also impact any company. Furthermore, I have added these theoretical fields as useful information on top of the pestel framework. High opportunity costs due to poor work discipline are important knowledge for companies and the business environment tackles such aspects as bribes and crime which are important for companies to know how the business environment may differ to allow them to be as ready as possible. The theoretical framework in this thesis is designed to work within the desired information which is relevant for companies in determining and analyzing the overall current situation.

2.1 Political Factors

The investment climate in any country is set by the tone of the government and in terms of how stable and open the country is to eradicating poverty and allowing development to occur. Tanzania is one of the most politically stable countries in Africa and has been steady ever since its independence from colonial rule by the United Kingdom. Analysts believe that Tanzania's good relations and the successful rule by the British Empire has carried on and has established a politically stable country in comparison to other African countries that had been colonized by other empires such as the Netherlands or the Portuguese empires. The projections for serious and sustained violence in Tanzania are very low; Tanzania has been fortunate to enjoy a significant degree of peace and stability which has attracted investors and foreign multinational companies.

2.2 Economic factors

The Tanzanian Economy has seen an encouraging few years of economic growth to propel it to the leading developing countries within Africa. The main contributors to this economic growth have been the prompt growth of the mining sector to match demand for mined goods such as gold in foreign markets. Exports have risen by 15% of GDP in 1999 to 22 percent of GDP in 2006. Furthermore, other key sectors which have highlighted the development of Tanzania have been the construction sector, which, as of late has been more frequent because of the need to build new housings. Many companies have also expanded their operations by building either new shopping malls such as *Mlimani City* with an area of 19,000 m² or 200,000 sq. ft.; in other words this small city which is full of shops, café's, restaurants and a movie theater which boasts of the largest screen in the whole of East- Africa. *Mlimani City* is just another example of evidence of the emergence of SME's (Small and medium sized organizations) as well as foreign multinational companies which are important for any growing economy.

Other sectors which have contributed to the large economic growth have been the trade and tourism sector as well as the manufacturing sector. The advertisement of just Tanzania as a tourist attraction has been extremely large, currently "visit Tanzania" or "climb Mnt. Kilimanjaro" banners are being portrayed at Premier league football matches in the UK. A few stadiums in the UK reveal these banners; it is top flight football with the attendance of over 30,000 people per match who are the targeted audience of the advertising campaign. Furthermore, not forgetting that sky sports and canal plus show almost all the premier league games live on TV with millions of viewers within Europe and around the world seeing the adverts, the scale of advertisement is so big that even for all the football fans in Finland who have canal plus and watch the games will subconsciously fall victim to the this advertisement

mechanism. This only further illustrates how large the tourism sector in Tanzania is and how dependent on tourism the government is.

Tanzania's Investment climate has shown openness towards foreign direct investment as there are no restrictions in foreign exchange. "Among investment and trade opportunities promoted by the TIC (Tanzania Investment Center) are agriculture, mining, tourism, tele-communications, financial services, and energy and transportation infrastructure. The government accepts foreign investment in Build, Operate and Transfer (BOT) projects and has launched a concession system aimed at attracting foreign investors to build infrastructure". The economy is still in a state of transition as it aims to move from a largely public sector economy towards a more private sector economy. This meaning that foreign investors are aggressively courted to take over the management of previous state-run companies. The government aims to privatize operations and services as it has done so with Air Tanzania and the Julius Nyerere International airport.

The raw materials at disposal within Tanzania are enormous; the geographical and physical layout sit Tanzania on a long coast line and the climate varies from tropical along the coast to temperate in highlands. The natural resources consist of hydropower, tin, phosphates, iron ore, coal, diamonds, gemstones, gold, natural gas, nickel. The GDP composition by sector is mainly divided in to three sectors.

Agriculture 28%

Industry 24%

Services 47, 6%

(Africa: Tanzania)

The figure below represents a visual configuration of which sectors dominate the Tanzanian economy.

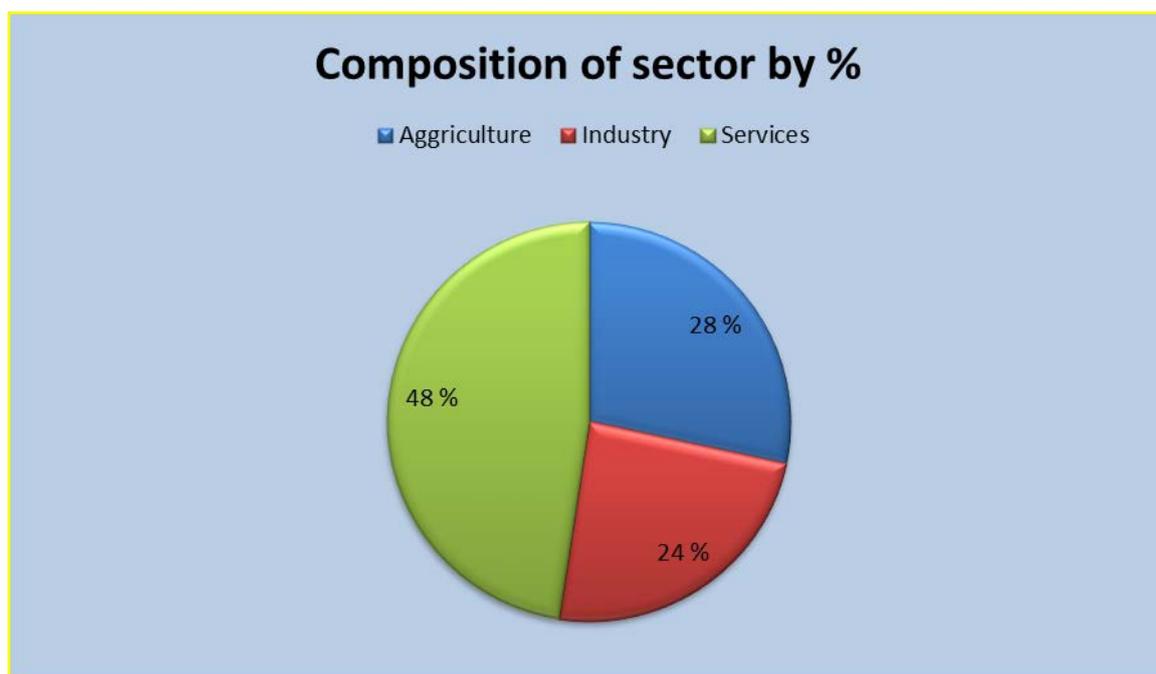


Figure 1 - Composition of sector.

Almost half of the total GDP per capita is made up of the services sector, this would further illustrate that the Tanzanian economy is more reliant on SME's and multinational foreign companies. This stance by the government is once again evident when looking at the Air Tanzania privatization plan as it is a service orientated business along with the dozens of tourist service companies and restaurants. In theory this is an ideal situation because if you have many SME's competing it will create more jobs, more income for the average Tanzanian and as such he will then go on to spend that money which will then bring business to other companies. This cycle is a positive cycle and you can witness this from the construction sector as a testimony that companies are expanding and that there are more and better housing availability's for the average Tanzanian, hence this an indication of the move away from poverty to allow better living standards, which by definition is what economic development is.

However, on the contrary and not bearing in mind the theoretical approach there is a significant difference between large and small enterprises in Tanzania. Large firms which are often Multinational companies are extremely profitable. They may not be as productive as SME's in terms of labor productivity (creating jobs = allowing higher living standards for the locals), Nevertheless, larger companies are more capital intensive and may hire better educated and more highly skilled workers. The labor force in Tanzania is estimated to be around 21.23 million. The estimated labor force is large as it is almost 20 million more than that of Finland's which is one of the only countries in EU which does not face an economic crisis and along with Germany is one of the most stable countries. Furthermore, the labor force that Tanzania

boasts off is half of that of the German labor force. This indicates that the capacity to succeed is there if the jobs and the industries are available. It is important to note that the estimated 21.23 million labor force does not include the untapped potential of women workers. In Tanzania most women stay at home to care for the children and or to help the household in everyday matters. Gender equality is not up to the same ideology which the rest of the world demands, hence, the result imply that roughly at least 20% of labor force is lost.

It is important to consider those women living outside the main cities who have neither education nor means of traveling to work. A good example is again the masai tribe, as they live a life of a farmer. The husbands would graze cattle and make sure the household has food on the table where as the women will stay at home and look after the children and cook. This is a signal of the potential untapped working force available to the country.

Figure 2 illustrates the GDP per capita for the last 10 years.

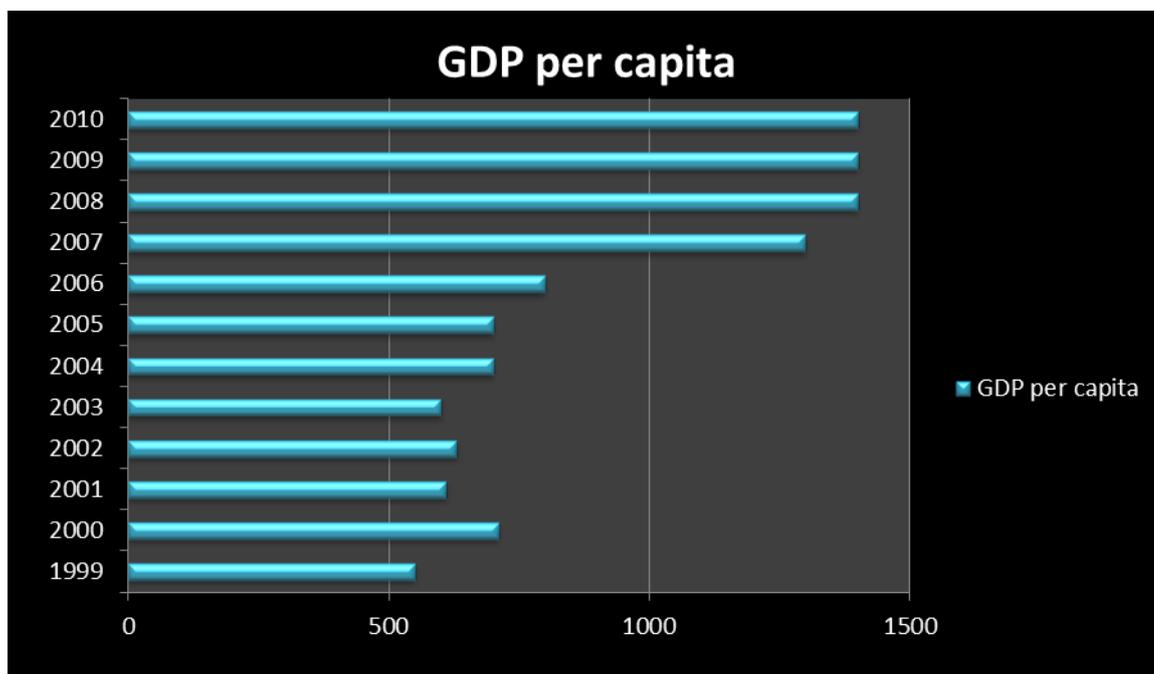


Figure 2 - GDP per capita 1

This figure shows the progress in which the Tanzanian economy has revealed in during its last 10 years. The GDP per capita was also estimated to rise further in 2011 to 1500tsh. (Tanzanian Shillings). The figure also shows how GDP grew in 2006/2007 at an alarming rate of 6.5% as the GDP in 2006 was only 800 and in 2007 1,300 per capita. This can be realization of many factors such as previous investments starting to bear fruit or the advance in technology around the world allowing infrastructure to grow. Furthermore Communication improved as well as building sector among with trade, hotels and restaurants. It is impossible to put a finger on what exactly contributed to the sudden growth in GDP per capita; however, one thing is for sure; living standards improved.

Yet the GDP per capita still grew after 2007 and shows signs of further growth. In 2010 the GDP was measured at 1,400 and according to estimates it is projected to rise further in 2011 to 1,500tsh. (Tanzanian Shillings). This is highly important for investors who want to invest in the electricity and power market as it clearly indicates more and more people have the means to cover the cost of power for their household.

2.1.1 Inflation rate:

The general levels of prices for goods and services have increased over the years, figure 3 shows a typical trend for a developing country as it is victim of the demand-pull inflation. Demand is growing faster than supply, this can be seen with the advances of technology and goods available on the market, however, with only very few importers of certain goods in the business supplying the products. Same goes for electricity, below there is a clear explanation adding further weight to support this theory in section 2 of general electricity supply with demand being more than that of supply. The demand for electricity is high for firms and for the normal households; however, the problem is that supply of electricity is low and these are the contributing factors for the demand pull inflation that is persistent in Tanzania. It is important to note that yes inflation can represent poverty levels as there is too much money chasing a limited amount of goods available; hence it is mainly the rich who have too much money. On the contrary price rises should also suggest that wages rise as well, so not only in theory but in real terms comparing the inflation rate to that of the GDP per capita chart in the above figure; therefore, this clearly depicts it is on the rise along with the rapid changes in inflation. Inflation along with GDP is yet another real indicator of the economic growth Tanzania is relishing.

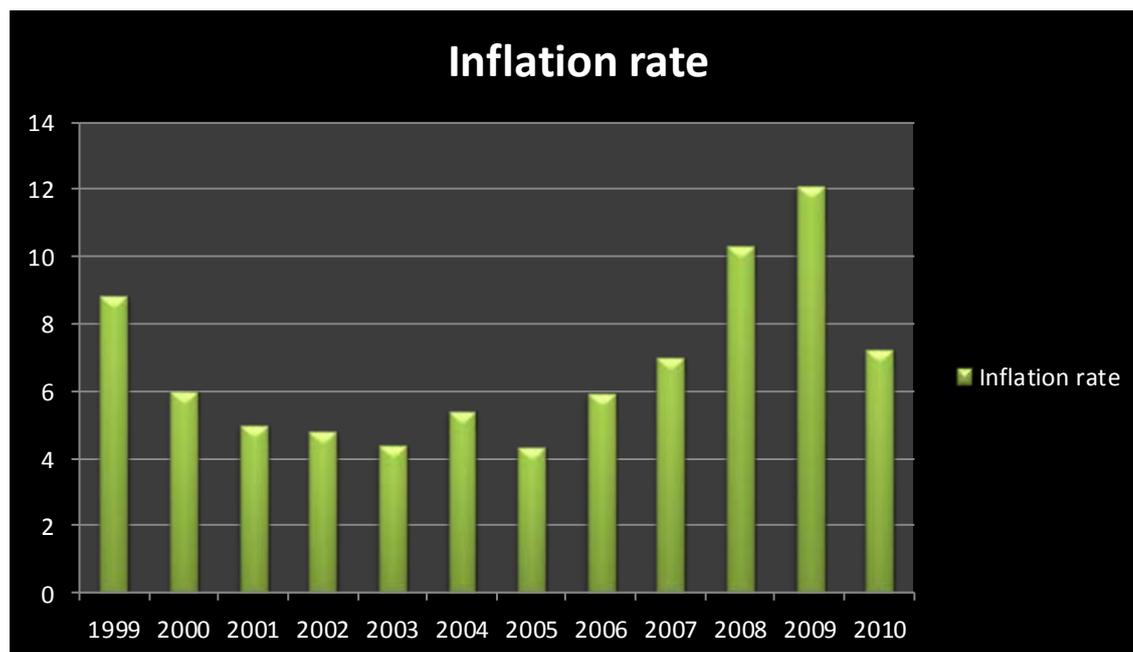


Figure 3 - Inflation Rate

Tanzania's monetary growth has been on the rise in recent years which further illustrates the economic growth. To a large a degree this is because of the great inflows of foreign aid. "It is interesting to note that higher monetary growth did not result in increased inflation, reflecting both the faster economic growth and increased monetization and deepening of financial markets in recent years". (Sustaining and sharing economic growth in Tanzania pg. 25)

2.1.2 Exports vs. Import

Further evidence of the rapid development taking place in Tanzania is proof of rise in total amount of exports. The main exports for Tanzania are gold, coffee, cashew nuts, manufactured products and cotton which according to figures accumulated to a net total of \$2.744 billion in 2009. This export figure is experienced a percentage change of 9.875% by 2011, providing further confirmation that the economy is growing as more of its products are being purchased overseas. Not forgetting that Tanzania's location is an attractive destination for investment in export-oriented industries. Tanzania's geographical positioning gives it an advantage over its competing countries such as Burundi, Rwanda, and Uganda who all belong to the EAC (East African Community).

Growth in exports enhances international competitiveness and allows macroeconomic growth as more has to be produced to match the demand abroad. So if growth is 9.8% in theory this means more people will need to be employed to produce more of the goods being sold in the international market. Furthermore, a good produced in Tanzania such as Gold or Tanzanite diamond which can only be found in Tanzania can be sold overseas at a higher price because

it is a scarce good and rather unique; hence, the export value is higher and the profits larger because it is being sold at the rate of the dollar or the Euro. The theory of competitive advantage is seen firsthand here as Tanzania has an advantage over most countries in raw materials such as Gold and Tanzanite which most European Union countries may not have. The major importing partners for Tanzania is the European Union countries, however, with the increased investment for electricity and mining have seen Tanzania importing goods from other countries such as China and South Africa. Tanzania's main imports include machinery and technical equipment. Other imported goods are made up of consumer goods, crude oil and industrial raw materials. Total imports were worth \$5.545 Billion in 2009 which is double the figure on exports, however, this figure has decreased since 2008 as the total imports were worth 7.08\$ billion. Furthermore, the expected change in imports figures suggests a 5.399% change for 2012 which depicts a further drop in import figures in comparison to 2009. This clearly indicates that the reliance on importing goods is slowing down and the economy is able to produce goods of its own within the market to rid the need to import goods. At the same time exports have been projected to grow which are all positive indicators as it suggests the economy is becoming more self-sufficient by the year.

2.1.3 Currency

The Tanzanian currency is Tanzanian Shilling. Below we have a diagram showing the exchange rates of the Tanzanian TZS against the dollar to give a sign of the strength of the TZS.

Year	Exchange Rate to 1\$
2005	1,128.93
2006	1,251.9
2007	1,255
2008	1,178.1
2009	1,317.5

Table 1 - Tanzania trade: Exchange rates 1

The fluctuations in the exchange rate have not been too severe as the currency has remained more less the same from 2005 to 2009. Currently in 2012 the exchange rate and the TZS has depreciated as it stands at 1 USD \$ = 1,594.50. This can be seen as a negative factor for investors that the currency is not as strong as before. However, it is important to remember that most countries let alone the EU countries are facing economic problems and the value of the Euro has not been as strong as it was a few years back in comparison to the USD. The development of TZS currency in comparison to the USD has not been optimal for the Tanzania.

On the contrary currency can be affected by the current account deficit which rose last year by 3.6%. Tanzania's oil imports account for about 30% of total imports and the prices for oil increased by 18.6% in within a year (2011-2012).

This clearly illustrates that while the currency in Tanzania has not developed too well it is affected by overseas economies and trades. Hence, if imports affect current account deficit which then have a net on effect on the currency it must be seen as positive indication that imports are lessening and exports are growing as mentioned in section exports vs. imports. This evidently portrays that the even though the currency is not doing well at the moment it does show signs of becoming a stronger currency, bearing in mind that there are not too many countries currently doing too well, the EU is a good example and you need not look too far with problems in Greece, Spain, Italy and Portugal to name a few "overseas" countries effecting the currency of the EU. (Tanzania current account deficit widens year to May. 2011. Tanzania Export Volume of All Items Including Goods and Services (Percent Change) Statistics. 2010. Tanzania Import Volume of All Items Including Goods and Services (Percent Change) Statistics. 2010. Tanzania Trade, Exports and Imports. 2010. Tanzania: Unemployment Major Macro-Economics Challenge. 2012)

2.1.4 Unemployment Rate

Unemployment as a "theoretical term" is classified as the number of people employed along with the number of people unemployed but seeking work. Bearing in mind the unskilled and lack of jobs available in the country side I do not think the unemployment rate reflects the true potential of the country. As mentioned above the labor force in Tanzania is estimated at around 21.3 million. This does not include the untapped working force of women laborers and the lack of jobs available to people still living in tribes such as the Masai. The lack of infrastructure and investment in rural areas and simply the amount of goods offered in the remote areas. If there is no demand then there is no supply; hence, if people in the rural areas do not need nor demand let alone know about buying products or services such as going to the cinemas then one cannot expect there to be job creation. Dr.Mahanga the Deputy Minister of Labor is quoted as saying that "the main cause of labor market deficits in the country is the imbalance between the supply of labor force and demand of labor as an important factor of production in the labor market" (Tanzania: Unemployment Major Macro-Economics Challenge. 2012.)

The unemployment rate would therefore, only depict the known educated people looking for jobs but would disregard the unskilled and/or women workers who may not be aware of the availability of jobs. Furthermore, we must acknowledge that foreign investors employ more expensive foreign expatriate staff. The theoretical idea of unemployment rate would work in a country like Finland as most people are registered under looking for jobs because if they do not have a job they receive government aid. In less developed countries people do not need

to register to an office or to a government to suggest that they are looking for jobs because they will not receive government support

The Tanzanian government has said “that the issue of youth unemployment has become a time bomb that needs urgent attention of both the public and private sectors through innovative measures and greater political will.” For foreign investors this is ideal, as it is much easier to train and educate younger people than for example to show a 60 yr. old how to come to grips of the modern day technology.

The unemployment rate in Tanzania in 2011 was 10.7%. Which means the official registered people looking for jobs is roughly about 2.3 million of the country’s population. The diagram below will give a slight idea of the trend of the unemployment but just as figures were hard to find it can only confirm my assortment that we simply do not know the real figures for unemployment.

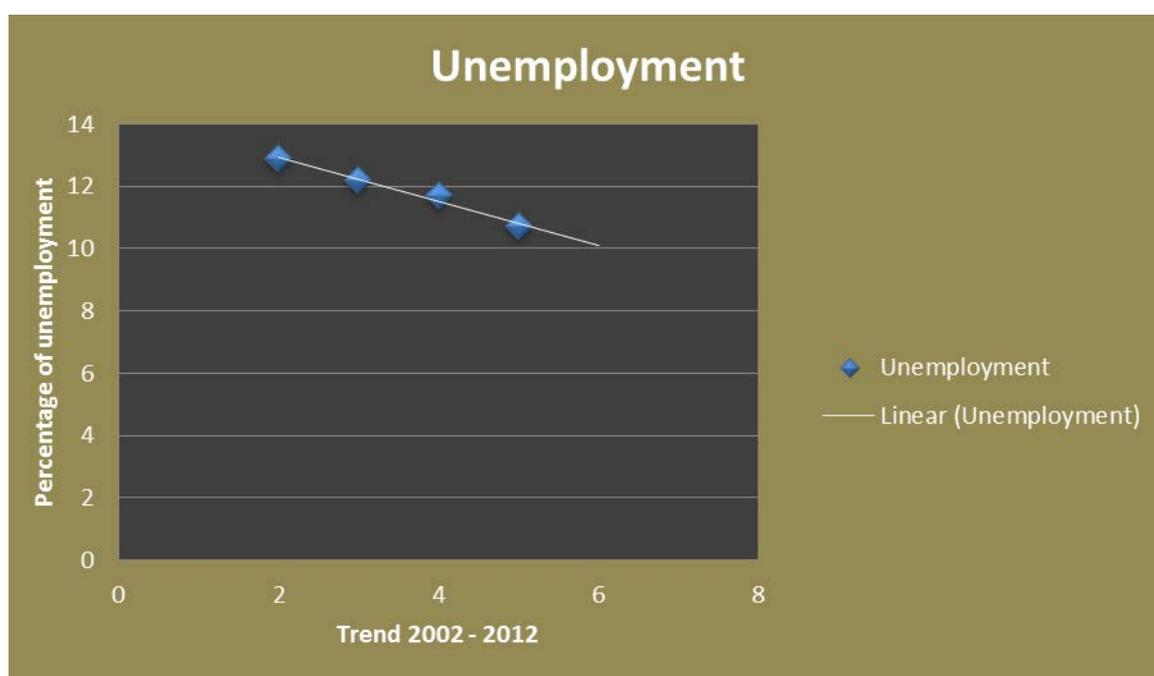


Figure 4 - Unemployment

2.1.5 Tax

“Tanzania’s Tax system has undergone significant reform, including the replacement of the sales and tax with value added tax in 1998, the elimination of nuisance taxes, the removal of tax exemptions, the adoption of a new income tax in 2004 and the rationalization of local government taxes.” When analyzing any operating environment of a country one of the first thing that deters or raises interest from investors and entrepreneurs is the tax rates. Tanzania’s standard corporate tax rate is not significantly high; however, the value added tax (VAT)

is higher than most competing countries in Africa. The diagram below depicts the taxation scheme in Tanzania and compares it with a few comparator countries to give an indication that the Tanzanian taxation scheme may act as an obstacle for firm growth and willingness to invest. (Robert J. Utz. Sustaining and sharing economic growth in Tanzania. Oct 2007. Pg. 23)

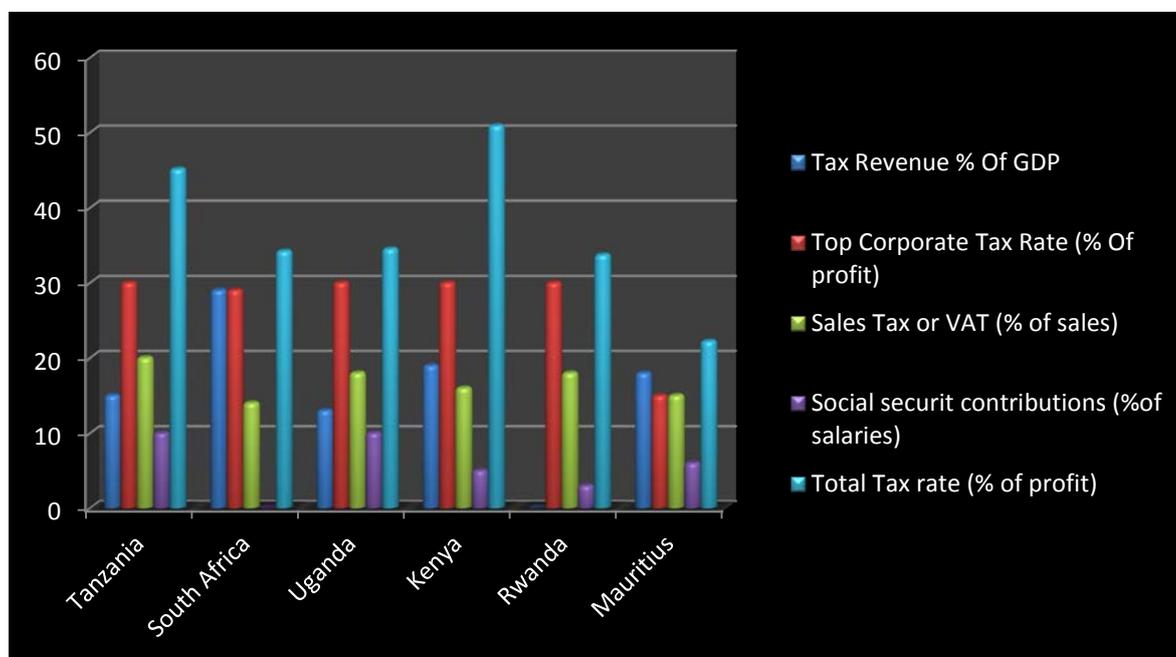


Figure 5 - Tax rates and revenue in Tan

The figures compare to other African countries to give a clear illustration on how much the taxes differ between competing countries. Tanzania, Kenya, Uganda, Rwanda and Burundi all belong to the east African community (EAC). It is apparent that even though they all belong to the same community they compete against each other and as such you compare the Tanzanian taxation scheme and Tanzania consists of a higher VAT than all the countries depicted in the diagram. The republic of Tanzania has also set its taxation scheme to be among the upper tier in top corporate tax rate while total tax rate was second highest to Kenya with a total tax rate of 45.1.

Regardless of the tax rate it has not wavered investors greatly because firms do not only base their judgments on behalf of how the taxation scheme works, however, instead they will also look at stableness of countries, foreign exchange rates, security to name a few indicators. The GDP growth rate was 6, 5 % in 2010 which was higher than that of all the East African countries. This indication nullifies the theoretical approach of the effect of taxation as an obstacle for growth and investment

2.3 Social Factors

The approximately estimated figures for population in Tanzania are 46,912,768 with a population growth rate of about 1.96% per annum. When this figure is further broken down in to three age categories to give a more accurate overview the results are as follows:

Years	% of population	Male/Female
0-14	42%	Male: 9,003,153 Female: 8,949,061
15-64	55.1%	Male: 11,633,721 Female: 11,913,951
65 years and over	2.9%	Male: 538,290 Female: 708,445

Table 2 - Population/age structure

The main language in Tanzania is Kiswahili with the next language being English which is spoken widely as it is the official primary language of commerce, administration and higher education. It is therefore used daily and most people are therefore more than familiar with the English language. The religion is divided in to three categories with approximately 30% being Christian, where as 35% being Muslim and the remaining 35% living by the tribe traditions or better known as indigenous beliefs.

To further give evidence of the reason Tanzania has been so stable as highlighted in the introduction is because the historical actions of uniting the country when it was first given its independence in 1961 was to make a common language which was Kiswahili to be spoken in all tribes. This decision was important because you needn't look far for examples of tribal bickering with the Kenyan elections in 2007 which led to a total death toll of 800. Further evidence is the ongoing conflicts in the democratic republic of Congo where some tribes even speak Kiswahili and others French. It is important to balance the social aspects by controlling the ethnic groups as well and such a reason has seen Tanzania aim to appoint the leaders of the country to represent both religious groups. So throughout history if the president has been Christian then the prime minister has been Muslim and vice versa.

On the negative aspects of social behavior and from the SME's point of view another challenge in the economic business climate in Tanzania is the competition from the informal sector. The informal sector stretches out from people selling cashew nuts on the streets to coun-

terfeit goods being sold on the black market. The competition from the informal sector is not as significant a blow to SME's as access to finance and the main problem of electricity. On a macro-economic point of view it is a huge hindrance to growth of the country as these informal firms and business do not pay taxes. In theory if 10% - 20% of the economy accounts for the informal sector of business then how much tax money is lost? It is impossible to give an accurate total on the money flowing through the informal sector because it is hard to follow every seller on the street to monitor his/her earnings. The main point being that these earnings in the informal market are not being taxed, and as such the government is losing out. The extra 10%-20% of untaxed money could go a long way to help SME's if the government would reallocate that to banks to allow access to finance for SME's for example. In other words informal firms escape a tax which means it weakens the fiscal base; these result in lower government revenues and higher tax brackets enforced on the formal firms that comply.

Furthermore, Informal firms can compete with formal firms because they have an unfair advantage. As a counter statement it is important to remember that not all theory is rational and that this problem cannot be tackled because it is also part of the culture within the country that you can buy products off the street while stuck in traffic. The other argument is that informal enterprises can be useful in reducing poverty along with inspiring entrepreneurship meaning that in theory living standards improve.

Corruption has been one of the negative factors which have deterred foreign investors. The problem lies with the low levels of income and the failure to enforce the laws and regulations as well as penalties to rid corruption. The government had launched a campaign to battle corruption and as such in 2008 many leading figureheads had been charged with corruption, however, the government still has a big problem as corruption is happening at state-owned enterprises. Privatization, taxation, ports and customs clearance, the port authority and the Tanzania revenue authority are still a deterrent for the fight against corruption. Unpredictable and lengthy clearance delays and bribes to expedite service are commonplace for state-owned services. Furthermore, the Transparency International (TI) has ranked Tanzania weakly and the Corruption Perceptions Index (CPI) has depicted unrelenting decline resulting in a drop of 24 places to a rank of 126. Not only is corruption taking place at government enterprises but petty corruption is evident when it comes to dealing with customs, immigration and traffic police which indicates that low salaries may be the reason why corruption exists in such large scale.

Further evidence of the scale of corruption was a survey performed by a local NGO known as Dar-es salaam International Academy (DIA) in 2009 published the state power utility of Tanesco as the most corrupt institute while 2nd in the published report was the police force.

The other more intriguing sources of corruption were linked to the judiciary and licensing and revenue offices.

It is apparent that the biggest obstacles to the growth and development of the Tanzanian economy are the corruption and power/electricity restraints. The potential of the economy and its investment climate are good in terms of cheap labor, cheap taxation policies, and large customer base as many goods & services available to most people in a country like Finland or the United Kingdom are not available in the Tanzanian economy.

2.4 Technological state

The technological state of the country is improving with the help of FDI, as businesses bring in necessary tools to aid the day to day procedures which businesses need to be successful. Private companies have invested more heavily on technological features and a very good example is the amount of internet café's in comparison to 5 years ago. Even the more remote cities and towns seem to have these available to them. However, Technological change is still needed to foster growth. The technological strides need to be seen and taken on larger industrial sectors such as with the transmission of electricity and the generation of electricity. In other words new up to date technological equipment for large scale output is needed to foster growth. The Technology related to renewable energy is not up to the standard where it could produce energy for the larger population to be dependent on it. In other words we realize that renewable energy is self-sufficient once it has been set up. However, Tanzania's technological state for renewable energy production is just about non-existent from a macro-economic point of view. Single businesses and foreign companies may have some solar panels but we must also bear in mind that solar power for example is still a relatively new idea and power source and harnessing it to the full operating potential is still a predicament. To further portray that renewable energy is a new technological feature to most of the globe and not just Tanzania according to a study on USA Today; The year 2010 was record breaking for the global renewable energy sector as a total of US \$211 billion was invested into renewable. This figure is approximately one third more than that of the USA'S 160\$ billion investment into the US' own energy sector. The global trend clearly depicts a large shift in favor of renewable energy and Tanzania is following suit regardless of its poor current technological advances in renewable energy.

Furthermore, we must recognize that Tanzania is currently using hydro-power to produce energy and this is an excellent indication of the poor state of technology in terms of energy production as the power outages and current crisis clearly depict. On the contrary as the price of solar power begins to lower year after year and the conventional fuel prices rises there is a need to invest more heavily in new technology aiding renewable energy. The gov-

ernment recognizes this and in 2008 they passed a new electricity bill with the intention to gain more private investment for the energy sector. With increased investment it would mean that the technological factor would also be addressed.

2.5 Environmental Factors

"Tanzania has a varied geography, including deep and large freshwater and salt lakes, many national parks, and Africa's highest point, Mount Kilimanjaro". There is great plains along the coast of the country and in the center of the Tanzania we have a large plateau which is part of the east African plateau and is also known as the great rift valley. Northern Tanzanian and southern Tanzania consist of highlands with lots of fresh water lakes such as lake Victoria which is the second largest fresh water lake in the world. Our coastline faces the Indian Ocean and is roughly about 800km long. (Geography of Tanzania)

The climate in Tanzania ranges from tropical to temperate in the highlands of north and south Tanzania. The temperatures vary from 17°C and 27°C depending on the location. However, the temperature seldom drops below 20°C. Instead of having four seasons such as most European countries have Tanzania mainly has two seasons which are summer and winter. Summer period which is extremely hot and humid is from November until February while the coldest period comes into reckoning in May and lasts until august. So in comparison to European countries the seasons are the other way around. The cold period is also known as the Tanzanian winter and instead of snow usually long heavy rain starts in May. However, given the geographic size of Tanzania the rainfalls vary by months to the location. For example in the north and northern coast there are more frequent rains and last from October to December and from March to May. In the southern, south-west, central and western regions of the country the rain season is usually towards the end of December up until April. (Development and climate change in Tanzania. 2003.)

2.6 Legal Factors

Obtaining permits are obviously the first legal requirements any company has to have and it is no different is it in Tanzania or Finland; permits to portray the permission of granted land for business purposes or for sales of goods are legally required. Legally different permits require different fulfillment criteria and quotas because the industries and sectors of businesses vary from agriculture to service sector. Legally every company must be registered and legally every company must pay tax. The exact figures for Tax are described below. Tanzania belongs to the EAC which means it also has to follow the legal rules which this committee enforces just like the EU.

The most important legal factors when considering investment into a foreign market are the trade policies. Tanzania implemented the common external tariff of the EAC in 2005, meaning there was slight reform in the tariff policies and it has since lowered its average tariff from 13.8% to 12.3%

2.7 Access to Finance/ level of credit accessibility

When examining the operating environment it is important to look at government subsidies and the availability access to finance that SME'S have to their disposal. "Access to finance ranked as a greater problem than other areas of the investment climate. About 40% of SMLE's and about 50% microenterprises said that access to finance was a serious constraint for their enterprises". (An assessment of the investment climate in Tanzania. 63) These circumstances would obviously suggest that firms in Tanzania are more dependent on retained earnings to finance new investment and working capital. Then add to this the problem with electricity which depicts a loss of 6% of earnings due to electrical malfunctions. Compare this financing method to that of the Asian comparators for example and you will find that most Asian firms finance over a third of their new investment with bank financing.

Access to Finance is extremely important because SME's may not be able to sustain and grow if they are mainly dependent on retained earnings, however, the counter argument is that the bank finances bigger projects such as education, electricity or industrial reform because they will also have a net on effect on people as more citizens will be skilled and the construction industries will be able to employ more people. Therefore, in theory this will also allow economic growth, the question then is how fast will this method bear fruit? However, many businesses are lost and shut down which acts as a deterrent to the economy because they do not have the financing to grow. It is also important to bear in mind that the banks just do not have the means to offer finances to all SME's because just like the world bank they have a set budget allocation, which unfortunately are decided by foreign investors in Washington who then finance the money in tied aid.

It is important to note that most foreign direct investment no matter how aggressively courted by the government is not at all an effecting financing scheme because tied aid obliges developing countries such as Tanzania to purchase competitively priced imports from richer countries. Donor money comes with strings attached meaning that the donor receives a large chunk of the profits whether it is in shares or another form; meaning the true value of the money borrowed is about 25-40% less in real value in a long term. This is the main problem faced by most developing countries such as Tanzania. There has been much controversy on this matter on the international scene with the developing countries voicing their opinions

against aid which has strings attached, however, because they are not in a position to receive additional funds to promote economic growth they are forced to resort to tied aid.

2.8 Business Environment

The level of credit accessibility, exports vs. imports, infrastructure and inflation do give a good indication of how the country is performing, however, and this does not tell the whole picture for an investor. Hence, for any investors aiming to tackle the electricity problem in Tanzania they will have to understand the business environment. Business environment determines the ease or difficulty of running a business profitably in any given country. So apart from electricity as a hindrance to business and economic growth in Tanzania the other factors worth mentioning are import clearance, attaining business/trade licenses, land acquisition to name a few obstacles that may deter investors.

These obstacles are severe as they have repercussions for firms as they produce high opportunity costs as officials are not in the office or poor work discipline means that more than one visit to an office to clear a good from the port is required. Attaining land availability and registration certificates may take anywhere from 3 months to 12 months and bribery may sway the process which is an additional cost to speed up the firm's own business cycle.

The diagram below portrays the percentage share of the inefficiencies that the business environment in Tanzania includes:

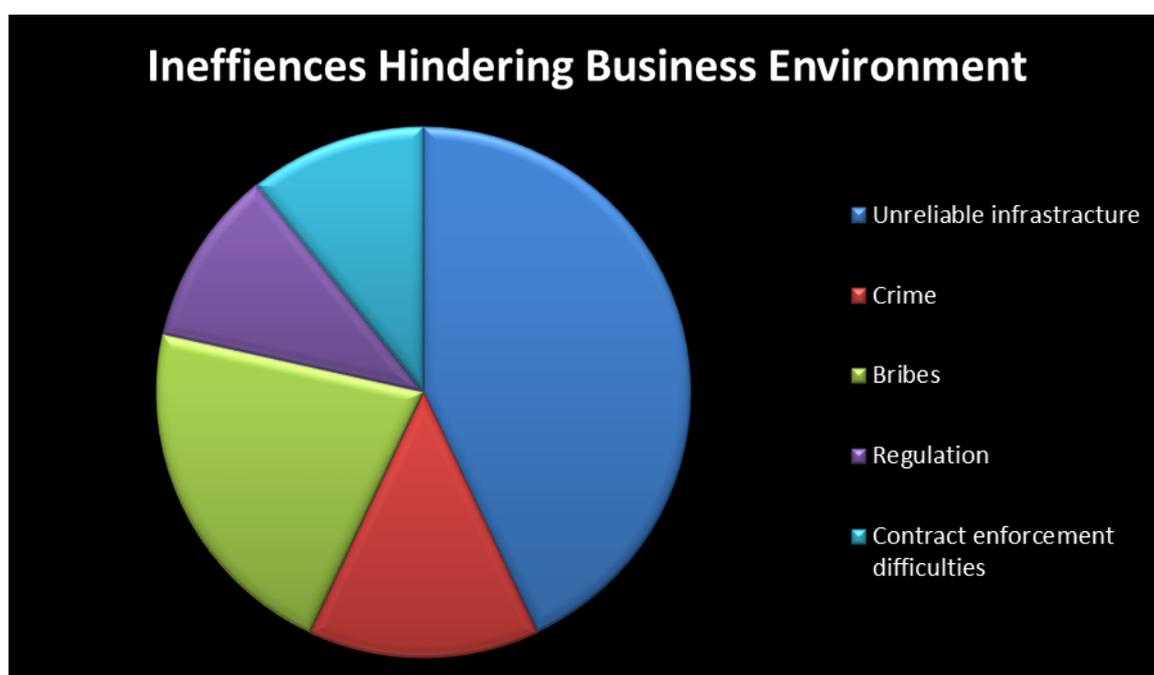


Figure 6 - Inefficiencies hindering business

3 Current Situation of Electricity

The current situation of electricity in Tanzania is extremely poor; there are frequent power cuts without notice as well as frequent power rationing. It is hard for companies to operate and for daily living aspects to be addressed without any power. The current situation of electricity is one of the biggest obstacles in allowing economic development. Unplanned power stoppages and interruptions and even the quality of the electricity to power numerous industries at once really halt daily necessities.

It is important to note that reliable power supply enriches productivity in any one country let alone Tanzania, the results of reliable power supply promotes business development and industrial expansion. The accumulative effect will then also be witnessed in the quality of life obviously as a result of formal employment creation industries. As such in an effort to deter unemployment and to promote growth the Tanzanian government has tried to privatize Tanesco. Therefore, currently all the contribution for power supply in Tanzania is happening through the government owned subsidy. The aim has been to address this problem and as such the government has recently signed a 3 billion deal with the Chinese government to mine coal and iron ore. Part of the deal requires a 600-megawatt thermal power station to be built by the government of china in southern Tanzania. This along with the "expected additional 1.06 billion deal to build a natural gas pipeline from the south of the country to its commercial capital, Dar-es salaam" clearly identifies the stance of the government in courting foreign investment for the electricity problem. This will be good news for all the stakeholders because it will allow better living standards for the people and communities in Tanzania, especially in the southern part of the country as the people are the main stakeholders as they are most directly affected by any change. The other stakeholders are obviously the businesses both local and foreign owned companies, as well as other government owned subsidies. Not forgetting the UN agencies and other governmental projects all residing in Tanzania. (China cosigns \$3 bln Tanzania coal, iron deal. 2011)

3.1 Supply

The energy industry in Tanzania is one of the sectors affecting the potential development of the economy; the industry itself is primarily dominated by one company which is in a monopoly position known as Tanesco. The power supplier Tanesco is government subsidized company and in the last few years the Tanzanian government has also independently launched various projects to tackle the problem of power supply in the country. In more simple terms the aim to supply power across Tanzania is one of the main agendas as it a hindrance for the development of the country.

When referring to the supply of power the main emphasis is on the generation of power and its transmission as well as the distribution to all the stakeholders. The generation of power is not operating at its optimum as the infrastructure system is ageing and not up to the standards required to produce the sorts of energy needed. As technology improves and the emergence of new facilities such as movie theaters and internet café's is evolving the demand for power is growing and the infrastructure which has been in place is no longer up to standards and as such is not sufficient enough. Furthermore, to yet give a more detailed illustration of the failure to produce electricity is due to machinery damages. The machines used in the production process have suffered due to high fluctuations and instabilities of the supplied current. All these factors further portray the poor infrastructure within the power sector. The other aspect which has contributed to the poor supply of power has been the overdependence on hydro-power. Hydro-power is a source of energy which is dependent on the weather conditions; hydro-power is dependent on precipitation. Since 2006 there have been severe droughts in the greater eastern Africa affecting countries such as Sudan, Ethiopia, Somalia, Kenya and Tanzania which have contributed to famine struggles; with the most notable crisis taking place in Somalia where refugees have fled in there thousands to U.N refugee camps in Ethiopia and Kenya in search for food and water.

The humanitarian problem is not relevant to the hindrance of power supply in Tanzania; however, it offers a very real and accurate indication of the severity of the drought which has affected the African countries in different ways. Various scientists point the finger at global warming, however, regardless of where and what the reason for the severe droughts may be it is not a shrewd solution to rely on a "raw material" such as rain which is available very seldom.

Furthermore, another clear indicator of poor infrastructure is the transmission distances from the power plants, if there are long distances to supply the energy and a few plants then the distribution becomes harder. Supply in terms of economics is not only the production process as supplying a good contains the operational incentives to allow supply and demand to match. Tanesco is facing the problem of "High income losses attributed to frequent interferences due to power supply interruptions" and as such is more dependent on Government capital injections also known as subsidies to propel the company forward. It is obvious that Tanesco is not sustainable regardless of it being in a monopoly position and the government itself has various costly projects aimed at developing other sectors within the Tanzanian economy which will also require subsidize; and quit simply the government does not have the financial clout to subsidize various multimillion projects.

The inability to operate and supply is also affected by poor management as there is insufficiency in customer service as well as poor billing scheme to allow the company to receive in-

come for it to be operational, which in turn then affects supply. As a result of these countless problems Tanesco is only able to produce/supply/generate electricity without any reserves in case of emergency's events; or to reduce the power outages for firms by having reserves would be another way to allow stakeholders to operate at optimum levels. However, the inability to generate such amounts of electricity is simple not an option for Tanesco due to the financial restrictions, transmission difficulties, poor management and a worn out infrastructure.

Plant	Units	Installed Capacity (MW)	Current production (MW)	Remarks
Kidatu	4	204	192	Hydrological limitation
Kihansa	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 3 - Existing Grid Generation plant

3.2 Demand

As depicted in the investment climate sector it is evident that Tanzania is a country on the upswing as its economy is enjoying growth. Local business as well as multinational organizations will also enjoy growth and aim to expand operations; the knock on effect with increased operations will also contribute to an upsurge in demand for electricity. Hence; "With growth of the economy of Tanzania it is estimated that the demand for electricity will triple from the current 14% of the population to 42% by 2020".

14% of the population is enjoying the benefits of electricity and even that power is rationalized with the quality of supply being poor due to low voltage. This 14% undoubtedly however, depicts the poverty levels with the wealthy having a more consistent supply of power because they can afford it; with the adverse effect of poor power supply not reaching the underprivileged people. It is important to bear in mind that electricity supply also depicts quality of life. Much of the population in Tanzania live outside the bigger cities and in small towns and communities such as the Masai tribe to name a few. It is not right to only criticize the government and point all the blame at not ensuring power to these communities because some of them choose to live in the wilderness and to graze cattle and live a life of a farmer. However, the blame should be on the poor supply to these people living outside the rural areas and it is also clear that if the Masai had electricity it would aid them in harvesting crops and so yielding in a better quality of life as they could with the help of power ensure harvest for the communities to some degree. "The majority of Tanzanians are still living in abject poverty which has been caused by inadequate and poor quality of power".

The demand for electricity is therefore mainly received by the more fortunate Tanzanians and then companies, businesses, and industrial sites. Out of the 14% of the population which has electricity the overall estimates by TanESCO was found that in 2009 the suppressed demand for electric power amounted to 769 megawatts. In that same year of August 2009 the average production reached 697 megawatts, this showing that supply fell short of demand by 10.3% or in more real terms 72 megawatts of power. Suppressed demand portrays the demand in the installed capacity (existing) rather than the overall country's demand, hence, the 14% of population.

It is interesting to then bear in mind what is the real effect on businesses if 10.3% of the demand is not met, how much business is lost?. Of the 10.3% which is demanded but not supplied can be considered to be the potential of what business in the private sector could be achieving but are not. In real terms the inadequate power supply is resulting in enterprises facing 63 power outages per year on average. These outages act as a decay because they influence enterprise expenses by affecting turnover of formal businesses by 6% on average and as

much as 16% on informal businesses (those not in the tax bracket/ taxing system of the country).

“Tanesco’s electricity supply is mentioned as one of the very important production inputs for all manufacturing firms in the country. Around 18.9% of the total cost of production for the interviewed manufacturers is accounted by energy cost.” (Challenges of Unreliable electricity power supply to Manufacturers in Tanzania. 2011.) the overall monthly average costs of energy for the studied firms were TZS 416.9 million for large industrial organizations. 49.4 million for medium industrial enterprises and tzs 7.3 million for small manufacturing firms.” This clearly indicates a huge cost for unreliable power supply.

4 Renewable energy status

The main source of renewable energy in Tanzania is solar power due to the geographic and climatic area in which Tanzania is situated it is logical that the in terms of renewable energy the most common is solar power. There is one organization in Tanzania which is responsible for renewable energy in Tanzania. This organization is known as Tanzania renewable energy association (TAREA) which is a non- profit as well as independent from the government. TAREA is tasked with bringing together investors and actors in the renewable energy sector to facilitate and stimulate the accessibility and use of renewable energies in Tanzania. The organization was established in 2000 and has had a various projects through donors and partnerships with solar power distribution companies in Tanzania; the aim is to develop and promote rational use of renewable energy.

Even though such organizations exist and solar power companies such as Ensol LTD have been established since 2001 the current situation on renewable energy is not self-sufficient on macro-economic scale. The over dependence on hydro power has been the main source of energy in Tanzania as stated earlier. As a result renewable energy which is still also new to the world has a very small share in the Tanzanian energy market due to the lack of skilled laborers, donors, technology and over dependence on hydro power as the main reasons limiting the growth of renewable energy. In other words, small firms and certain customers may turn to Ensol for solar power but where the larger general public is concerned then renewable energy use is almost non-existent.

The TAREA organization completed an annual report in 2009 which tackled awareness in Tanzania and various running projects as well as checking the quality control of renewable energy. The findings below and conclusions best some up the current situation in Tanzania in terms of renewable energy.

- “Diversify resources to reduce overdependence on one project or donor.”
- “Facilitate registration of technicians capable of installing solar systems and disseminate widely such information to all levels from national, regional, districts and local level.”
- “Allocate resources for spot purchase and testing of solar components to be wrong quality and specifications on and work of TRA and others related to fight fake (counterfeit) products from entering the market.”
- “Continue with technical training and information dissemination on solar technologies and services especially at district level where quality control is very difficult to enforce.”
- “Develop guidelines for branches- headquarters to strengthen the association. “

(Tasea Annual report 2009. 2009. Accessed September 25th 2012.)

4.1 National energy policy and renewable energy

The energy policy in Tanzania is open and in need of heavy investment for renewable energy to become present in the Tanzanian economy. The Tanzanian government recognizes this and has its own ministry allocated to tackling this issue of energy production. It has undertaken several projects such biofuel development and energy development and access expansion project. Furthermore, the Ministry of energy and minerals has issued the following statement in commitment to the energy policy which they have.

“Energy and Minerals resources play an important role in poverty reduction and in supporting socio-economic development in Tanzania. The Ministry of Energy and Minerals (MEM) has been mandated to facilitate development of energy and mineral resources. The Ministry delivers various services related to development of energy and minerals resources through the participation of various stakeholders including public, private, public-private partnerships, local communities, NGOs and civil society”. (Ministry of energy and minerals. 2012.)

4.2 On-going Government projects to tackle energy and other supporting institutions

The government’s policy in regard to energy production and reduction of poverty suggests that the Ministry of Energy and Minerals are heavily involved in finding donors and with ongoing projects with various institutions. The ministry of Energy and minerals has also got agencies such as the Rural energy agency which is an autonomous agency designed to promote access to modern energy services in rural areas of Tanzania. In relation to the findings of the TAREA organization it is evident that the government recognizes that to rid poverty aspects such as quality control and accessibility to energy must improve. Hence, an agency which is

only designed to tackle these problems has been put in place by the government. It is important to note that this agency aims to provide financial and technical support to project developers.

On-going projects also include biofuel development projects. These projects consist of close working relationships and donor help from the governments of Sweden and Norway through SIDA and NORAD since 2008. The aim of these projects is to create a solid framework for the support and to further aid development of the biofuels industry in Tanzania.

(Current projects. 2012)

As mentioned earlier Tanesco is Tanzania's main power supplier and its position in the Tanzanian market has seen it draw similarities of a monopoly power company as it has been dominant and at the fore front of Tanzania's energy sector since independence. The energy development and access expansion project is was a project where the Ministry of energy and minerals cooperated with Tanesco and REA with the aim to improve the "quality and efficiency of the electricity service provision on grid". The project also aimed to create a sustainable basis for energy access expansion and renewable energy development in Tanzania. In terms of renewable energy the project was designed to finding and mounting up project targets for renewable energy. Hence; the reason why REA was involved as its task is to provide financial and technical support to developers by offering grants.

Other supporting agencies in terms of donor help and by offering grants to support the innovative change in Tanzania have been the World Bank And the global environmental fund (GEF). "The GEF is an organization which invests in business around the world that provide cost-effective solutions to environmental and energy challenges". The role of the World Bank as a financier as well surely suggests that there has been heavy investment in these various projects with the World Bank financing a total sum of \$27.8 Million. Yet further evidence the Government has recognized that the growth and development in Tanzania clearly lies within the energy sector. (Projects & Operations. 2012. Global environment Fund. 2012)

4.3 Development obstructions for renewable energy

Development trends in Tanzania in the power industry have first and foremost been the privatization of the electricity company Tanesco. The idea is that to develop and rid the current problem is to enhance the private sector participation. The government passed the electricity bill in 2008 with the intention to gain more private investment for the energy sector. Another trend and idea behind allowing development has been to rid the overdependence on hydro-power production as it is prone to weather changes which obviously is a renewable energy source. This does not mean that because hydro-power has proven to be unreliable that it implies to the other forms of renewable energy because there is a variety of types of renewable energy available. In simple terms this all indicates the trend for development is to allow

change and to allow openness towards new energy solutions. For investors this is the perfect timing to for innovation in the energy sector.

Linking this with the global aim of moving towards the use of renewable energy clearly portrays that the renewable energy trend is on the rise. "Drops in solar cell prices and surging interest in developing nations led to a 32% increase in investments in renewable energy globally in 2010, a United Nations report finds". The year 2010 was record breaking for the global renewable energy sector as a total of US \$211 billion was invested into renewable. This figure is approximately one third more than that of the USA'S 160\$ billion investments into the US own energy sector. The global trend clearly depicts a large shift in favor of renewable energy and Tanzania is following suit. (Global Investments in Green Energy up Nearly a Third to US\$211 billion. 2010)

The challenge is therefore, the change and step from a monopoly power position to attracting and allowing private companies to run the energy sector. This has to be the major challenge because clearly the solution and way forward both globally and in Tanzania is renewable energy. Hence, the challenge is the implementation of a new infrastructure and the work load faced at transforming the current crisis in Tanzania. It is important to note that this challenge is slowly being addressed with investment deals such as that mentioned above with Tanzania and China. Also coincidentally according to the latest studies on the trend of renewable energy China and the developing countries are currently the largest investors in renewable energy contributing to the figure mentioned above; US\$ 211 billion mentioned above. Further evidence that China and Tanzania are already addressing this major challenge in the united republic of Tanzania

5 Renewable energy alternatives in Tanzania

Renewable energy is energy generated from natural resources; these consist of sunlight, wind, rain, tides and geothermal heat which are renewable. Therefore, to avoid any sense of ambiguity non-renewable energy is energy that cannot be replaced as we consume it. Whereas in contrast renewable energy is supplies which will never be depleted because the source of energy is natural. Sunshine, wind, biomass and water power are more or less limitless.

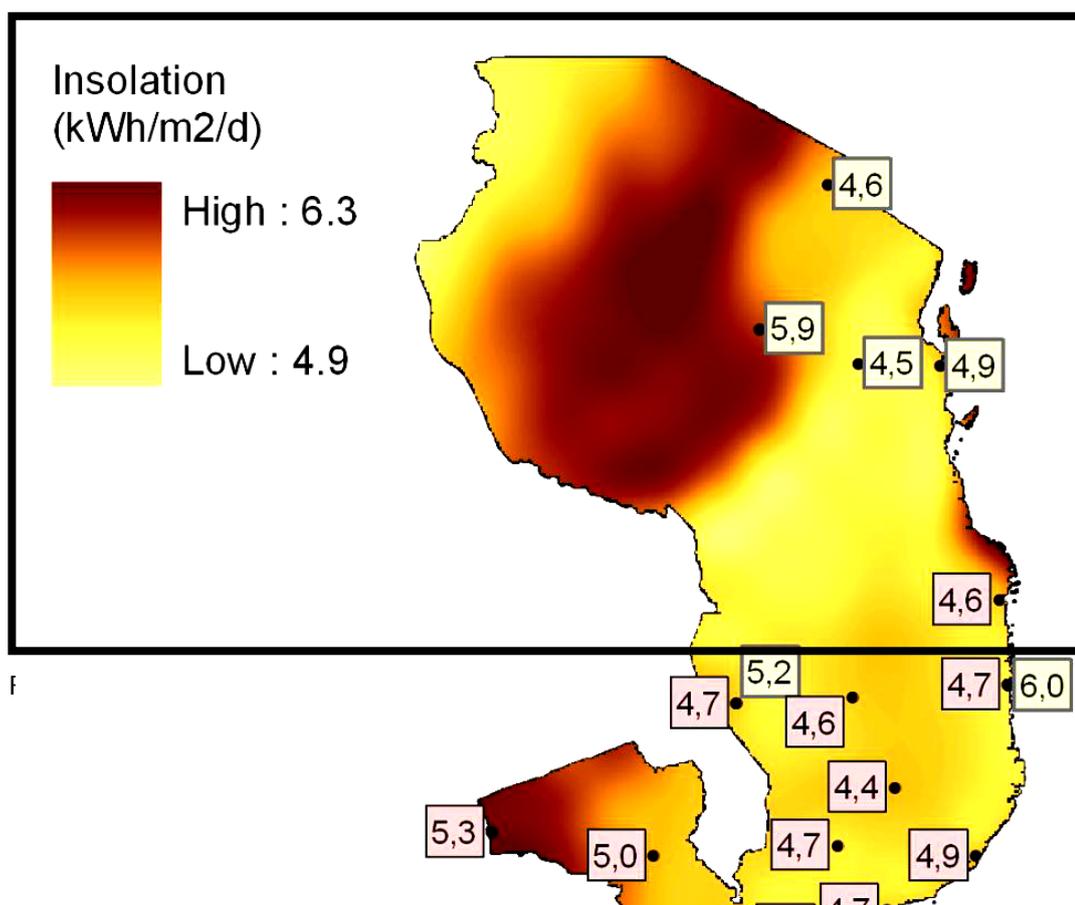
5.1 Solar Power

Solar energy in Tanzania has already been exploited to some degree as it is the most sensible and cost effective solution for energy production. In regard to renewable energy it is a shrewd method for harnessing power in a country like Tanzania due to the climate. The geographic location of Tanzania places the country by the equator which allows the countries

within this atmosphere to contain the most consistent amount of sunlight during the course of the year. On average the amount of hours per day in the major cities in Tanzania is approximately 8 hours of sunlight annually. Obviously the rainy seasons mean it might shift slightly and the hours might drop in a day to 5-7 hours. However, In comparison to other African countries or even European countries placed outside the equator Tanzania is not subject to much weather change. (Tanzania's Weather and Average Temperatures. 2012)

In regard to solar power it is good to remember that all life on earth is supported by the sun. Tanzania is fortunate to be able to have a large consistent supply of sun light. Therefore, it comes as no surprise as TASEA (Tanzania solar power association) has a large directory of companies in Tanzania from different cities attributed to harnessing solar power. A large directory of companies clearly depicts the focus of renewable energy in Tanzania to be solar power. The directory compiles of more than 40 organizations all involved with Tarea in different provinces in Tanzania. "TAREA offers the consultancy service on the process of the development of renewable energy systems like Solar Photovoltaic System. The service offered covers planning and design of the system, system specification, tender documents, technical data assessment, and installation quality and specifications verifications. This consultancy service helps developers without renewable energy capacity to develop quality systems and avoid the counterfeit and substandard equipment parts". (Renewable energy Directory. 2013)

The daily solar irradiation on average is 4.5 kW/h M². These measurements also vary on the location of the country as figures of 6.3 Kw/h M² have been recorded daily. These figures depict and offer further proof that the insolation resembles good solar energy potentials. (Distribution of Wind and Solar Energy Resources in Tanzania and Mozambique. 2011)



5.2 Wind power

Once again the geographic position of Tanzania makes it the ideal place for renewable energy alternatives. Tanzania is fortunate as it sits on a long coast line which amounts to 1,424 km. The country faces the Indian Ocean and this depicts the potential it contains in terms of wind power.

The infrastructure in Tanzania is not adequate enough to support the wind power alternative; furthermore, there have been a few projects implemented by the government through the commissions and donors mentioned earlier in this report. However, the emphasis in terms of business aiming to utilize wind power does not equal the same amount of stakeholders as to solar energy. This could be down to the possibility that maybe it is easier for people and business to be able to buy and set up solar panels and as such the availability and common sense point to solar power.

However, the lack of investment in to wind power remains an ambiguity because studies suggest that there is a good potential for wind energy abstraction in Tanzania along the coast but also in some highland hot-spots. The figure below represents the annual average wind speeds and clearly shows that not only are the measurements high along the coast line but northern and some central areas measure wind speeds in excess of 5m/s. This diagram gives a good indication of the wind power potential. Furthermore, it is important to highlight that throughout the country the average annual wind speed is 5m/s which have been recorded at a 10m height. (Distribution of Wind and Solar Energy Resources in Tanzania and Mozambique. 2011. Energy sector development in Tanzania. 2011)

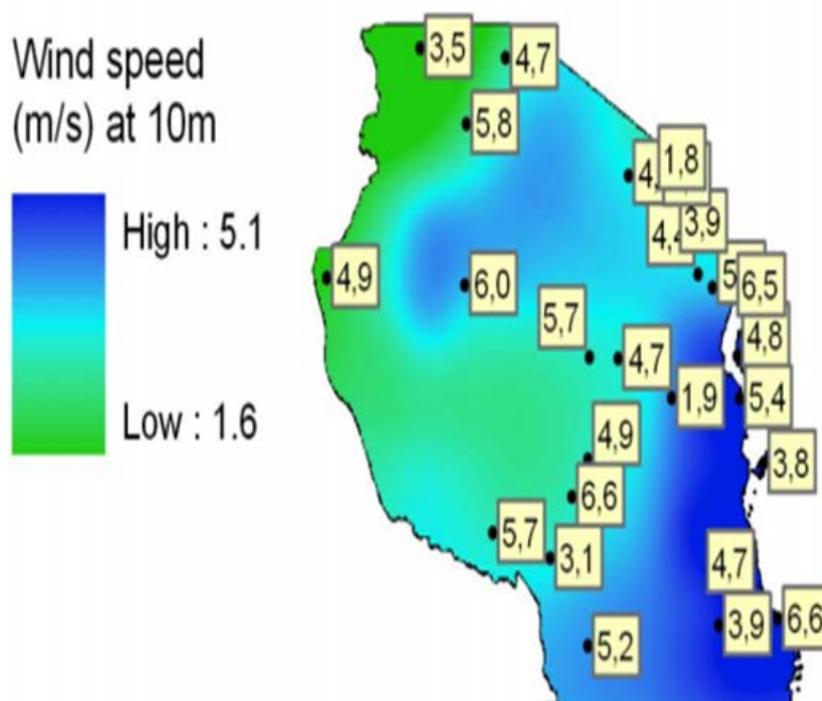


Figure 8 - Wind speed

5.3 Biomass

Biomass as an energy alternative is a good method in theory and in the case of Tanzania the biomass from crops is a major source. Furthermore, Tanzania consists of the land suitability of plants to support biomass production. Plants such as cassava, sugar cane, sweet sorghum, palm oil and sunflower to name a few; are examples which support biomass production in Tanzania.

The problems are however, that irrigation of large scale production and pest disease control may be costly. In other words improving agricultural practices would have to be undertaken to yield sustainable energy. Not to mention that there is a risk that bioenergy could negatively harm the environment. The inadequate infrastructure acts as further hindrance because even though the Tanzanian economy is largely made up of the agricultural sector it is mainly small scale farmers without the adequate irrigation systems.

Wood is also something that Tanzania boast's a lot of and is an ideal source and most common source for biomass production. However, in terms of the environment and with the already short rain fall periods it would not be in a sense a renewable energy. This is because even though tree's can be planted and grown the time spent waiting for the tree to reach its right age is not the same time frame as that of a plant.

Therefore, in theory the biomass for energy production is an option and there is potential in this method, however, the question arises in terms of how much could the country produce sustainably? (Biomass potential. 2010.)

5.4 Waste to energy

Waste to energy is a method of creating energy in the form of electricity or heat from the burning of waste resources. According to a study published by the world bank in 2010 the combustible renewable and waste (% of total energy) in Tanzania in 2009 was measured at 87.71%. Waste management in Tanzania is a serious problem due to poor management of urban waste. The management mechanism of waste disposal in Tanzania is no were near the standard of European countries such as Finland to give an example and a comparison. There is no need for an in-depth analysis of waste disposal because the amount of urban waste on the streets of Tanzania is extremely visible whereas in Finland you might find the occasional trash on the street.

The reasons for poor management of urban waste are due to the lack of necessary tools to collect and properly dispose of municipal waste. To further avoid an in-depth analysis I can personally testify to having never witnessed a garbage truck come and collect the waste from a certain neighborhood; whereas in most countries such as Finland this happens at every neighborhood once a week after most people have taken their waste to a certain waste disposal area within the housing complex. This is evidence of lack of resources for the collection and disposal of urban waste as well as poor management.

As mentioned that the levels of urban waste in Tanzania are enormous; especially in the main cities such as Dar-es salaam or Dodoma. This is depicted by the illegal dumpsites and rising garbage piles in the alleys of the cities. There is an estimated 30-50% of waste which remains uncollected. This portrays the potential of creating energy from waste to energy to be gigantic. "Energy recovery from wastes has the potential of greatly altering the situation - turning an environmental liability into a socio-economic and poverty alleviation asset". (Energy recovery from municipal waste.2010)



Figure 9 - Solid waste management standards vital to curb filthiness

To further depict the potential of the waste to energy studies done by the University of Dar-es Salaam estimate that in the year 2000, "Tanzania could have generated about 60 MW of electricity from municipal solid waste alone which would substitute roughly about a million tons of fossil (petroleum and coal) fuels". The table below portrays energy potential from urban waste digestion in Tanzania according to studies carried out by the university of Dar-es salaam. (Energy recovery from municipal waste.2010)

Year	Total Annual waste production (Tons)	Annual Energy generation (GWh)	Effective power generation (MW)
2000	2105932	546.6	62.3
2005	27414495	711.5	81.1
2010	3576300	928.2	105.8
2015	4680274	1214.7	138.5
2020	6084624	1579.2	180.5

Table 4 - Total potential energy generation from urban waste digestion in Tanzania.

The poor management and lack of resources show that there is no infrastructure in place to currently allow Tanzania to enjoy the waste to energy potential which it contains. Once the infrastructure and educating the residents has been sorted out it would create more jobs and fight against poverty and health issues as well as environmental issues; and not to mention improving the current situation of electricity supply in Tanzania. Reducing greenhouse gas emissions, creating renewable energy, protecting our air and water are just a few of the bonuses which waste to energy potential can realize. (Waste to energy. 2013. Municipal solid waste processing and recycling. 2012. Trading economics. 2012. Energy recovery from municipal waste. 2010. Cdm opportunities under waste management in Tanzania. 2010. Sustainable energy news. 1997)

6 Analysis of Questionnaire

The questionnaire results matched the theoretical approach and the research results which have been gathered from various sources/references in this thesis. The results of the questionnaire further supported the idea of solar power as the best means of renewable energy. The questionnaire gave field data from a first perspective from a few companies involved in the renewable energy sector. From an investors point of view the questionnaire as mentioned above portrays the same results in terms of what renewable energy is the best option; that being solar power. However, the answers also shed light on the growth of this sector as seen in the answers of the questionnaire; "Tanzania is becoming increasingly aware of the benefits of renewable energy. Likewise the government is beginning to realize its potential for the development of the country".

As mentioned in the report there are more and more companies involving themselves with TAREA which shows growth as TAREA supports renewable energy in various ways through the different organizations. One organization is called ARTI Energy who answered this questionnaire and also backed the research findings in this thesis to further depict the growth in Tanzania. In reference to the growth and TAREA's impressive directory of companies ARTI went as far as to back up this claim while answering the question of the current situation of the renewable energy; "It is growing, Business is growing, we as a company are growing". This suggesting that not only the government but more and more locals are turning to renewable energy as an alternative, as it is growing that simply means people are willing to spend more money on this energy alternative.

There is also mention of the Biomass industry which bears huge potential and is estimated to be valued at 650\$ million USD per year. Other aspects which require attention while analyzing the questionnaires is the competitive nature which is always an important factor when considering how much to invest and whether it may be profitable. The answers show that revelry in the solar market is competitive; however, with the right structure, partners and business model can yield good profits. In terms of the main customers it is mainly average citizens looking for low cost systems for lighting and cooking purposes and this has a positive correlation to the growth of the solar power sector as business is growing according to ARTI.

The amount of questionnaires I got back were not what I would have wished for but of the few that I received they clearly have first-hand expertise and know-how of the situation and as such really backed the research findings. They are good references as they are main stakeholders in this energy sector and as such of the few answers provided it gives any potential investors a really good understanding of the situation of renewable energy in Tanzania.

7 Conclusion

The current situation of electricity in Tanzania is extremely poor; there are frequent power cuts without notice as well as frequent power rationing. It is hard for companies to operate and for daily living aspects to be addressed without any power. Clearly the lack of electricity and energy is hindering living standards and day to day business operations and services.

There is however, a solution, this thesis clearly indicates the potential in the untapped energy sector of renewable energy. The industry is currently growing and there is more and more investment from the government and foreign companies, however, with indications that only 15% of households have modern electricity and the awareness of renewable energy as an alternative growing there is a huge market potential that is unexploited.

Investment is heavily needed to kick start the renewable energy sector but once it is up and running and more households and organizations will start to turn to this solution as it is reliable and cost efficient it will begin to pay itself back and start yielding profits within time.

There is also Tax exemptions for solar power and a willingness to allow foreign direct investment in the renewable energy sector the only restraints and main market entry problems being corruption and contract enforcement difficulties and as such attaining certificates and licenses can take a considerable amount of time and as such have a high opportunity cost and setting up a company/business can take time before it is up and running. The other main problem is the unreliable infrastructure, however, the whole ideology behind renewable energy is that it is self-sufficient meaning it will not be dependent on anything else than acquiring sun or wind to generate power and as such unreliable infrastructure will not be hindrance to any business operations.

This report clearly identifies that solar power currently holds a competitive edge and is a safe option for companies aiming to enter the energy sector industry. This does not mean that wind power is a bad option as it the report clearly portrays it to have a good chance in succeeding and biomass contains huge potential with an industry that stretches to 650\$ million USD yearly. However, solar power is extremely cost efficient and in a country like Tanzania which is situated right by the equator and solar irradiation figures of 4.5Kw/h M² on average it is already been proven by companies in the field currently who are growing to be a the best energy alternative whilst remembering that not even a quarter of the full potential has been reached and it is an open and growing industry. This report reveals the economic growth and development Tanzania is undergoing currently with the economy growing and competition resulting in alternative options in which way Tanzania will move forward. The report also reveals the current problem in unreliable power and tackles the various options available to foster growth in Tanzania via renewable energy sources. The potential is enormous and one of a kind as it is a growing economy looking to establish a new method for the future. Could

Tanzania be an example and show the rest of the world that renewable energy is the way forward? This report clearly suggests that Tanzania has the right conditions to thrive. Investment and leadership is heavily needed to aid the development and allow renewable power to become even larger supplier of energy in Tanzania.

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Appendices