FINAL REPORT

Mandate 2: Knowledge, Attitude and Perception *Study of the Biomass Energy Sector*

Submitted to the

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List of Abbreviations and Acronyms

BEST	Biomass Energy Strategy
CBO	Community Based Organization
ESIA	Environmental and Social Impact Assessment
EUEI PDF	European Union Energy Initiative Policy Dialogue Platform
FBD	Forest Bee Department
FGDs	Focus Group Discussions
GoT	Government of Tanzania
HBS	Household Based Survey
IDI	In-Depth Interview
KAP	Knowledge, Attitudes and Perception
LCA	Life Cycle Analysis
MEM	Ministry of Energy and Minerals
MNRT	Ministry of Natural Resources and Tourism
MUST	Mbeya University of Science and Technology
NAFORMA	National Forest Monitoring and Assessment
NEP	National Energy Policy
NGOs	Non-Governmental Organizations
SDC	Swiss Development Cooperation
TANESCO	Tanzania Electric Supply Company
TAREA	Tanzania Renewable Energy Authority
TDBP	Tanzania Domestic Biogas Programme
TFCG	Tanzania Forest Conservation Group
TTCS	Transforming Tanzania's Charcoal Sector
WB	World Bank

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EXECUTIVE SUMMARY

Introduction

Over the last ten years, domestic energy demand in Tanzania has grown rapidly due to both the increase in economic activity and population growth. Access to electricity and other forms of renewable energy is extremely limited and the energy balance is dominated by biomass-based fuels particularly fuelwood (charcoal and firewood). To date there is no coherent policy framework governing charcoal production. This is despite the fact that the production and supply of charcoal is one of the country's biggest industries in terms of revenue generated and jobs created. The European Union Energy Initiative Policy Dialogue Platform (EUEI PDF) is supporting the Government of Tanzania (GoT) to develop its Biomass Energy Strategy (BEST). The Government has finalized the National Forest Monitoring and Assessment (NAFORMA) in 2013. The current effort is now to develop an advocacy strategy and communication instrument mix for the implementation of the National Biomass strategy in Tanzania. To achieve this a Knowledge, Attitude and Perception study of the Biomass energy sector was commissioned by the Swiss Development Commission.

Methodology

Study regions were purposively selected to include regions that are well known for the production and consumption of biomass. The regions selected included Morogoro, Mbeya, Mwanza, Tabora and Coast region. Dar es Salaam was selected as it is the single largest consumer of biomass, particularly charcoal. Data collection included the understanding of a KAP survey, in-depth interviews and participatory focus group discussions with different stakeholders in the biomass energy sector. A critical review and analysis of key policies, legislations/ acts and reports that are linked to the biomass sector was also carried out. The team also reviewed various project reports in the field that were availed by the responsible regional and district authorities.

Key findings

- There are knowledge constraints of the different forms of biomass energy sources. The understanding of biomass energy sources is limited to charcoal and firewood.

- There is a strong feeling among stakeholders that the promotion of biomass energy, especially charcoal and firewood in its current production status will negatively affect the environment.
- There is limited appreciation of the economic value of charcoal and the other forms of biomass.
- With the right technology and regulatory framework stakeholders see the possibility of having a sustainable biomass energy sector.
- There are concerns with regard to the efficiency and reliability of biomass energy sources and the limited investment in the sector.
- Among producers of charcoal there is limited knowledge of modern methods of charcoal production.
- There is limited understanding of the role of the private sector and NGOs/CBOs in promoting biomass energy particularly among producers, transporters and consumers
- The biomass energy sector is perceived as an uncoordinated sector with too many actors.
- There is a serious outcry for the need to streamline the policy and institutional framework for the biomass energy sector.
- Stakeholders in the biomass energy sector have both complementing and conflicting interests.
- There are a number of best practices from collaborative initiatives between multiple stakeholders in promising sustainable biomass energy technology in the Tanzania.
- Change in policy environment constitute a pre-requisite for a biomass friendly energy sector

1.0 CHAPTER 1: Introduction and Background to the Study

Tanzania is struggling to meet its own energy needs and access to modern energy is still very limited. The country is faced with great challenges of developing markets for renewable and efficient energy services. Most of the energy sources including wood, charcoal wood, coal, natural gas, petroleum and hydro are not sustainable and reliable. Over the last ten years, domestic energy demand has grown rapidly due to both the increase in economic activity and population growth. Access to electricity and other forms of renewable energy is extremely limited and the energy balance is dominated by biomass-based fuels particularly fuelwood (charcoal and firewood), which are the main sources of energy in both urban and rural areas. Charcoal is one of the major sources of biomass energy next to firewood in terms of demand and use in Tanzania. It is reported to be the single most important source of energy for millions of urban dwellers in Tanzania. The country's reliance on the biomass sector indicates a potential over exploitation of the natural forests and at the same time a potential extinction of the natural resource species. It is believed that at least more than 90% of the primary energy consumption in the Tanzania is from biomass. Studies have reported that wood fuel consumption in Tanzania in 2005 was about 46.2 million cubic meters of solid round wood. It is further estimated that more than 95% of households in Tanzania use firewood and charcoal as their source of energy for cooking. Between 2001 and 2007 the proportion of households in Dar es Salaam alone using charcoal increased from 47% to 71% (World Bank, 2009). The annual charcoal business volume in Dar es salaam is estimated to be worth US $ 350 million (World Bank, 2009). With the increase in price of alternative fuels it is evident that the importance of charcoal is unlikely to decline in the near future.

Even though charcoal is being used by a significant portion of the population, it has continually being treated as something unwanted, with a number of restriction being placed on the production of charcoal due to its negative environmental impact. A 2009 World Bank paper on the charcoal sector in Tanzania estimated that between 100,000 and 125,000 hectares of Tanzanian forest is lost annually as a result of charcoal production (World Bank, 2009). The continued unsustainable wood harvesting for charcoal, including its inefficient production

technology and its efficient use are explained to be the main contributing factors to the rampant ongoing deforestation in the country.

In Tanzania to date there is no coherent policy framework governing charcoal production. This is despite the fact that the production and supply of charcoal is one of the country's biggest industries in terms of revenue generated and jobs created. The National Energy Policy (NEP 2003) describes biomass as an important rural fuel source but makes no reference to its contribution to economic development, in spite of the size of the industry and the number of people it supports, both in the value chain and as end-users both in rural and urban areas. Overtime there have been several fragmented efforts to address some of the challenges related to access to sustainable biomass energy sources, especially in the rural areas, but theses have been crippled with limited investment, poor participation, poor coordination and synergies, and successes have barely gone beyond projects' lifetime. Information about the demand and supply of biomass energy, about the best practices regarding promotion, introduction and services for – especially - rural renewable/biomass energy is largely missing or outdated. The charcoal sector has been widely studied and documented since 1980's (BEST 2009), however, energy switching away from biomass energy and especially woody biomass energy has proved to be difficult due to issues of affordability, availability and reliability. Instead, there is strong evidence that more and more people are moving towards it mainly due to its availability, affordability, and reliability (HBS 2007, WB 2011, BEST 2013, and CAMCO 2013).

The uptake of the recommendations in national energy policies and strategies has been very low. The World Bank's Policy note for Tanzania titled "Environmental Crisis or Sustainable Development Opportunity? Transforming the charcoal sector in Tanzania" among other things, hints at the potential to change trends in biomass energy utilization and make charcoal (one of the biomass energy sources) not only a driver of the economic development but also sustainable forest resource use and management. This is based on the fact that, the charcoal sector generates revenue for government as well as direct income and employment for many people in Tanzania (see WB 2009). However, due to the inherent "complex and multi-layered regulatory context" in

the structures and processes that shape the production, transportation and consumption of biomass energy sources the benefits have not been adequately appreciated.

The European Union Energy Initiative Policy Dialogue Platform (EUEI PDF) is supporting the Government of Tanzania (GoT) to develop its Biomass Energy Strategy (BEST). The development process of this strategy is led by MEM but involves a number of other ministries including the MNRT and non-state actors. With the support of Finland and FAO the Government has finalized the National Forest Monitoring and Assessment (NAFORMA[1]) in 2013. These are important milestones towards coordinated biomass energy governance and accountability, economic development and the reduction of environmental impacts. The Swiss Development Cooperation (SDC) is building on these development processes with its Transforming Tanzania's Charcoal Sector (TTCS) project, which aims at improved climate change adaptation and mitigation, enhanced environmental sustainability and leveraged returns on biomass resources, delivering sustainable development to Tanzania and its people. The project operates under two major components namely (i) Sustainable Charcoal Value Chain Development and (ii) Biomass friendly governance of the energy sector.

The first component of the project was launched in March 2012 and is operational in Kilosa district in Morogoro region. The lead implementing partner is the Tanzania Forest Conservation Group (TFCG). A sub-component to this component addressing Environmental and Social Impact Assessment (ESIA) and Life Cycle Analysis (LCA) is separately contracted to a consortium of two Swiss based organizations, CDE (Centre for Development and Environment (University of Bern)) and EMPA (Swiss Federal Laboratories for Materials Testing and Research). The second component is in phase one which involves obtaining current data on biomass energy sector through research, analysis and knowledge management, and based on this, the development of an effective communication and advocacy strategy and communication instrument mix for implementation of the National Biomass strategy in Tanzania. This report is

[1]The National Forest Monitoring and Assessment (NAFORMA) is the first comprehensive and nationwide forest inventory for Tanzania. Over the last 30 years sub-national inventories for different parts of the country have been carried out.

based on a Knowledge, Attitude and Perception study that was undertaken as part of the first phase of component two.

This report covers the second mandate of the three different but interrelated mandates under the SDC initiative to support the biomass friendly governance of the energy sector in Tanzania. The focus was on the knowledge, attitude and perception and areas of concern and common interest among key players, policy makers and civil society engaged in the biomass sector.

The objectives of the study were;

1. To develop an overview of past surveys/studies on knowledge, attitude and perception studies on biomass energy conducted in Tanzania in the last decade and to review current legal and institutional framework in the biomass energy sector, representing the official view of the situation as it is supposed to be ruled "de jure".
2. To identify relevant stakeholders, including those who have the potential to effect policy or influence practice regarding the biomass energy sector, (including establishment of contact with private sector players in biomass energy industry identified in mandate one)
3. To carry out a Knowledge, Attitudes and Perceptions (KAP) survey with stakeholders groups assessing their knowledge, attitude and opinion regarding the ideal legal regulation ("de jure"), the real situation ("de facto") and their views on possible solutions.
4. To establish a typology of stakeholder groups and their characterization (who are they, what do they know, what do they believe and how are they to be approached in order to become part of a positive change in the biomass energy governance).
5. To produce a synthesis by drawing (from the findings) convergences and bottlenecks to sustainable biomass energy enterprise and proposition of solutions.
6. To establish baselines for the indicators of the Logframe of component 2 of the TTCS project for phase two.

1.2 Methodology

The study used both qualitative and quantitative methods of data collection. While a survey tool was designed to capture quantitative information, guideline tools were designed for qualitative information. A systematic review of relevant documents including policy, legislative and project documents were also reviewed. The study regions were purposively selected to include regions that are well known for the production and consumption of biomass and hence the study does not claim representation but is focused on collecting views from a varied groups of stakeholders in different regions of the country. The regions selected included Morogoro, Mbeya, Mwanza, Tabora and Coast region. Dar es Salaam was selected as it is the single largest consumer of biomass, particularly charcoal. In each of the regions one district that is the highest producer of biomass energy was picked in consultation with the regional administrative authorities. As a result, the districts of Urambo (Tabora), Kilosa (Morogoro), Mombo (Mbeya), Sengerema (Mwanza), Kisarawe (Coast) were purposefully picked

1.2.1 KAP Survey

The KAP survey was designed to capture knowledge, attitude and perceptions towards the biomass sector. The distribution of the participants considered three main categories namely: end users of biomass which included small users or households, business premises and institutions as big users of the energy. Secondly, the private sector was also targeted where the producers, transporters, wholesalers, retailers were interviewed. The third group consisted of government actors from the village, ward, district, regional and ministry level. In total the sample included 298 end users; 109 producers; 85 transporters; 104 wholesalers; 127 retailers and 158 government officials.

1.2.2 Key informant's interviews

Key informant interviews were carried out with the key players in the biomass energy sector, people involved in the biomass value chain, managers of biomass related sources, decision and policy makers at different levels (districts and national), NGOs, academicians and members from

the donor community. Key issues discussed in the interviews covered the following areas, sustainable biomass energy production and utilization, marketing and promotion of biomass energy, gaps and overlaps of legislations and policies governing the biomass energy sector, challenges and opportunities in promoting biomass energy and the significance of the biomass energy sector in national development. In total a number of 102 key informant interviews were carried out with the different key actors in the sector.

1.2.3 Participatory focus group discussions

Participatory focus group discussions were carried out with representatives in the private sector, NGOs, local government authorities and end users. Key issues covered in the discussions among other things focused on the contribution of the biomass energy sector in the socio-economic development, governance and management of the biomass energy sector and sustainable biomass energy production and utilization. A total of 12 participatory focus group discussions were carried out at the village level. The members of the group discussions came from the local and influential leaders, members of the village committees, ward or street leaders excluding the councilors, end users, representative of the private sector, the NGOs and other influential and knowledgeable people.

1.2.4 Systematic Reviews

A critical review and analysis of key policies, legislations/ acts and reports that are linked to the biomass sector was carried out. The key documents such as the Forest Act, 2002; the National Energy Policy, 2003;the Rural Energy Policy 2003; National Environmental Policy, 1997 ; Framework of Forest Policy and Legislation for Charcoal Utilization; National Forest Policy, 1998; Tanzania National Strategy for Growth and Poverty Reduction, 2005; Environment Management Act, 2004; Charcoal Regulations, MNRT 2006; Joint Forest Management Guidelines MNRT, FBD 2007; The National Strategy for Growth and Reduction of Poverty (MKUKUTA); Land Act, 2004; Village Land Act 1999; Local Government Act 1982;

Guidelines for sustainable Harvesting and Trade in Forest Produce, MNRT, FBD 2007; New Royalty Rates for Forest Products, MNRT, FBD 2007.

Together with these key policy and laws and bylaw documents, the team also reviewed various project reports in the field that were availed by the responsible regional and district authorities. The selection of these key policy and legislation documents was important as they are directly or indirectly driving the development of the biomass sector in the country. The review therefore closely looked at the underlying policy and legislation objectives and how these impact on future changes in the sector, expected outcomes and trends. During the review process we were also interested in identifying regulatory contradictions and congruencies or overlaps and gaps that could help improve the sector. We were able to capture the dynamics, key actors and players in the sector and relationships between and among the actors.

1.2.5 Mapping of the key actors

Mapping of the key actors and stakeholders in the biomass sector was carried out through various ways. We particularly utilized our inception meetings with SDC staff to already lay out the key actors and potential study informants. Secondly, the review process also provided an understanding of active actors in the field. Other key actors were also identified during the data collection process in the field.

2.0 REVIEW OF POLICIES/ACTS/REGULATIONS AND PAST STUDIES ON BIOMASS ENERGY

The review of policies and regulations on biomass was guided by the following questions: What do the policies/acts say about biomass? How do the policies/acts impinge on biomass? Are they consistence or contradictory or both? Are they effective? Are they implementable? Since there is no single policy on biomass, the following related policies and acts were reviewed: The National Environmental Policy 1997, National Forest Policy 1998, Energy Policy 2003, and National Strategy for Growth and Poverty Reduction Strategy 2010. The following Acts were reviewed: Local Government Act 1982; Land Acts 1999 & 2004; Forest Act 2002, Rural Energy Act 2005; National Environmental Management Act; Joint Environmental Management Guidelines of the MNRT (2007); the recent Guidelines for Sustainable Harvesting and Trade in Forest Produce 2014. The first part focuses on the analysis of policies and the second focuses on the analysis of regulations.

2.1 Review of Policies and Strategies Related to Biomass Energy in Tanzania

The National Environmental Policy of 1997 is the main policy document governing environmental management in Tanzania. The policy underlines that investment in development is vital for environmental conservation including biomass conservation and vice versa. Thus the policy aims at: promotion of the use of environmentally sound technologies, promotion of sustainable renewable energy sources; minimization of wood fuel consumption through the development of alternative energy sources and wood fuel energy efficiency; and the assessment and control of development and use of energy. The Policy also recognizes the importance of the role of the local government in receiving local concerns and in the implementation of ways to create sustainable conditions. In line with the National Environmental Policy of 1997, the overall goal of the National Forest Policy is to enhance the contribution of the forest sector to *the sustainable development* of Tanzania and the conservation and management of her natural resources for the benefit of present and future generations. *The forest policy similar to the environmental policy also recognizes the role of the local government by decentralizing responsibilities for forest management to local communities and local government authorities and change from more centralized management and control to integrated and participatory*

approaches (co-management), which recognizes the rights and responsibilities of all stakeholders, including rural communities.

The policy acknowledges that woodfuel is the main source of energy both in rural and urban areas in Tanzania. It credibly attributes degradation of natural forests (due to practically uncontrolled harvesting of woodfuel) and lack of alternative and affordable sources of energy. The policy identifies charcoal burning and over-exploitation of wood resources as among the main reasons for deforestation in Tanzania (others being- clearing for agriculture, overgrazing, and wildfires) *while it is clear that in absence of alternative sources of energy, rural and urban households in Tanzania will continue to rely on wood fuel and charcoal respectively. Nevertheless, the policy acknowledges that trade in wood and non-wood forest products offer considerable potential for increased economic development through income and employment generation as well as export earning thus accomplish one of the objectives in the NEMA. With large number of youth unemployment and lack of alternative sources of energy, it is likely that many youths will engage in fuelwood and charcoal business thus limiting sustainability of the sector.*

In respect to the above, the policy envisages promotion of free trade of forest produce in the long-term without causing destruction of the resource base. Among the most important measures and instruments for sustainable forest management incorporated in this policy are forest management plans and monitoring systems for their implementation. The policy stipulated that internal trade and export of certain forest products such as round wood, charcoal and endemic species, may be restricted or remain under licensing until the conditions for sustainable forest management and utilization are in place; supporting the introduction of mechanism for sustainable forest management through national, regional or global initiatives; *the policy while recognizing the importance of the local government it also talks of encouraging the private sector initiatives in respect to the above which creates two structure with no clear mandate. It however, provides room for multi-sectoral collaboration in managing forest resources but a clear structure is needed on how the different stakeholders are to relate.*

A specific policy on energy is the 2003 National Energy Policy which focuses on energy production, distribution and consumption. The policy has taken into consideration the need to: have affordable and reliable energy supplies in the whole country; enhance the development and utilization of indigenous and renewable energy sources and technologies; adequately taking into account environmental consideration of all energy activities. The Policy acknowledges that the current energy balance is dominated by biomass based fuel (charcoal and firewood) which accounts for more than 90% of primary energy supply. At the same time it talks of wood fuel as having a negative consequence to the environment. *Although the policy promotes for the application of alternative energy sources such as renewable energy than fuel-wood and charcoal in order to reduce deforestation the development of such energies as solar and wind is very slow in the country. It is also slowed by the fact that the capital required for installation is beyond the reach of many households.* . Other tasks that the policy is committed to are: promote development of alternative energy sources including renewable energy and wood fuel end use efficient technologies to protect wood land; promote efficient biomass conversion and end use technologies; support research and development in renewable energy technologies.

The National Strategy for Growth and Poverty Reduction of 2005, similar to the three policies discussed above is committed to the notion of sustainable development and especially sustainable growth and poverty reduction. The strategy realized the fact that poverty reduction and natural resources utilization and management go hand in hand. As human population is trying to alleviate poverty there is a danger of over exploitation of natural resources for income. It recognizes challenges in laws and policies and by laws for different actors in management of resources. The strategy also acknowledges that the constraint to rural growth is due to environmental degradation among others and that the natural resource sectors which contribute to 5.7% of GDP is not sustainable; the cutting of trees for timber and charcoal has destroyed the environment. The 2005 Strategy as it has been pointed out in the 2010 strategy has a number of weaknesses and failed to reduce poverty. In 2010 another 5 year poverty reduction Strategy was launched. The 2010 Poverty Reduction Strategy although it gives emphasis on Biomass sector, the focus is mainly on solar, wind and bio-fuels as the most alternative resources of energy to be promoted instead of wood fuel and charcoal. The policy points out clearly that this can be achieved through expanding renewable energies (solar, wind, mini-hydro and biogas) for off-grid areas where distribution costs are prohibitive, especially rural areas, expanding exploitation of

bio-fuel potential without compromising food security, promoting use of energy-efficient appliances and equipment, use of natural gas for industrial heating and domestic cooking, promoting energy saving technology, at household, firm, institutions, and community levels, promoting energy efficient and conservation as well as integrated environmental management. The NSGRP talks about

1. Strengthening capacity for administration and monitoring
2. Strengthening the capacity of TRA in capturing taxes from natural resources rents;
3. Supporting the private sector;
4. Enhancing community-based natural resource management arrangements.
5. Strengthening weather projection and early warning systems;
6. Promoting private sector investments.

Similar to the Forest policy the NSGRP does not adequately put emphasis on decentralization and empowerment of the local government but also emphasize on the private sector and private sector investments. Evidence shows that the private sector in energy is dominated by foreign private companies whose interest is on profit and not sustainable development or access to energy by rural population.

2.2 Review of Acts Related to Biomass Energy in Tanzania

Local government act of 1982 give power to village and district authorities to make by laws for regulating land use for forest, use of forest and forest products. It is the village leaders who give permit to harvest forest on village land and enforce the village by laws. Villagers make decision through the village meetings, council, land committee and environmental committees. They have the power to sell and mortgage land. They also give permits for cutting trees and charcoal making and take fees and fines. Despite the fact that villagers have power, there exist a tension between planning for land use between the Central government and local in that on matters of land are centrally controlled by the President who can declare different use of the land. Therefore limiting the decision and powers of the villagers. . *Of recent there has been developments as new policies are put in place promoting private investments sometimes at the expenses of the local communities.*

The 1999 Land Act has outlined three types of land, the village land, general land and the protected land. However, all land is public and is vested under the president trustees for benefit of all. Given these categories of land we also have forest lands which are village, general and protected and private land. Protection of forest on the land depends on ownership and nature of land tenure and the land use plan in place. All villages are required to have a village land use plans therefore they can plan for forest land and decide on how to use it. Not all villages have land use planning in place as it is expensive and time consuming. In some cases private investors on land have been assisting in land use planning before they are given a portion of land for investment but in most cases this has led to village land grabbing due to lack of knowledge or involvement of villages in planning. The problem in the implementation of the Land Act is that land is under the trustee of the President who has the mandate to change the land use plan. Recent experience shows that there is promotion of access to land for investors than the local communities. Issues of land for investment are dealt with the Tanzania Investment Centre. Villages are also required to set aside land for investment but in most cases investors are interested in the land used by villagers or forest and as it is the most fertile. *Despite the power given to local governments by the Local Government Authority Act of 1982, the Land Act gives power to the President to change and decision of the local government.* Both the Village land Acts and the Land Acts are silent about land for firewood or charcoal for energy use by community.

The Forest Act of 2002 classifies forests into 3 types national forest reserves, local authority forest reserves and village forests. Since these forests grow on land there is no matching between the different types of land and the forest classifications. Village forests can be said to correlate with village land but are further classified into village land forest reserves, community forest reserves, forests on village land - the management of this land is vested in the village council and private forests - managed by individuals under customary rights. *Since there is no such things as individual land in the classification of land what this means is that when it comes to forests individuals can own forest but not land. In the absence of security on land it is difficult for individuals to sustainably manage the resources as they might one day lose their land*. The Acts

needs to be explicitly on the definition of the different classifications of forest and link them to classifications of land.

The Act also talks of two different levels of forest management as: village forest management plan and private forest management plan - the provisions can have provisions regulating the commercial exploitation of the resources of the forest including any provision regarding afforestation and reforestation. At the same time the Local Government Authority Act of 1982 is given the mandate to manage local forest reserves - they can make by laws to govern local forests (the act empowers the local governing bodies to manage local forest reserves). *Despite the fact that there is recognition of village forest the decentralization of power is not adequately enforced at the village level. Thus districts still plan on different village forests. Decentralization of forest officers is up to the district level.*

The Forest (Amendment) Regulations of 2013 contains the 2007 New Royalty Rates Forest Products. The rates for biomass is discussed in Part II section (b) Item no 4: Firewood and Item 5; Charcoal. Item no 4 states that "license for firewood by quantity (per stacked cubic meter from dead branches and off cuts) and firewood obtained from standing tree shall be charged T. Shs 5,120. Item no 5 states that "fees for a bag of charcoal (90 kg. per bag shall be charged T. Shs.14,400.

The National Management Act 2004 is also general about legal and institutions for environmental management and does not provide any laws on used of fuelwood and charcoal despite the fact that the policy talks about minimization of use of these energy sources. The Rural Energy Act of 2005 though specifically on energy it supports the provision of modern energy services. It defines modern energy as energy based on petroleum, electricity or any other energy form that have commercialized market channels, a higher heating or energy content value than the traditional biomass fuel and that which may be easily transported, stored and utilized.

The 2006 Charcoal Regulations by MNRT acknowledges that woodfuels (fuelwood and charcoal) as the most important energy sources in the country. The Act point out that 90% of the country's energy comes from woodfuels. The Act proposes analysis of the value chain of charcoal production and consumption and this is believed to be a solution to make the charcoal sector into a driver for sustainable forest management and utilization. It acknowledges that despite effort to introduce fuel-efficient stoves, promotion through different actors, the impact is yet to be realized; the revenues are distributed unevenly; the structure of the charcoal chain is complex with different actors who have different interest; the charcoal sector operate within a complex and multi-layered regulatory context; people and processes along the value chain interact with several government bodies, policies, laws operating at national, local and village levels; illustrate a need to have a decentralized forest management approaches that reflect the decentralization of the government system; promotion of alternative fuels must go hand in hand with potential to create domestic employment and import dependency; call for clear rules, transparent enforcement, strong incentives and awareness-creation or capacity development are also some of the solutions.

The 2007 Joint Forest Management Guidelines of the MNRT does not directly address the Biomass sector but it has outlined tasks on how to jointly manage the forest sector at the district/ forest level. It recognizes the importance of Village Natural Resource Committee (VNRC) who are elected by the Village Assembly and approved by the Village Council to act as Managers of forest resources in the village. It proposes inclusion of certain people in the community with special knowledge of the forest – such as traditional healers, cattle keepers, charcoal makers, and so on. *It insists on community representations. The joint management places the power under the community but it does not own the land on which the forest is growing which is the major challenge. Secondly, assumes that villagers will have all the knowledge necessary for forest management.* All villagers are bound to report illegal users and any person failing to do so, will be fined. There are also several rules such as no charcoal may be produced on farm until further notice.

The 2014 Guidelines for Sustainable Harvesting and Trade in Forest Produce draws from the National Forest Policy of 1998, Forest Act chapter 323 of 2002 and government notices no 69

and 70 of 2006. The Guidelines underline the power of the villages to regulate the harvesting and trade in forest produce. It promotes the establishment of harvesting committees to oversee harvesting of forest produce. The villages are given power to harvest, license and transport and processing. At the moment, district forest officers are charged with the responsibility of regulating forest management. It empowers the district harvesting committee to assess harvesting inside the forest. Section 2.1.2. of the Guideline states that firewood harvesting and collection and compiling in the forest farms will be done following the schedule identified in the Forest Act 2002.

The overall review indicates that there is no single policy and Act on wood fuel and charcoal but there are many policies, acts and regulations related to woodfuel and charcoal. The review shows that the documents differ in terms of who should do what, the issues of power where they recognize the importance of the local government but also are attracted by the presence of the private sector. There is also contradiction between the Central and the local government specifically on land ownership and when it comes to forest land there is mismatch between forest classifications and land classification. Issues of alternative energy to fuelwood and charcoal and alternative sources of income to natural resources extraction for poverty reduction are still the most challenging issues in managing charcoal and wood fuel. The villagers are given power by the joint forest management but other challenges of lack of ownership on land and knowledge on forest management are a stumbling block.

2.3 Mapping of Stakeholders in the Biomass Energy Sector

This section highlights the key stakeholders who can effect policy and influence the practice in the biomass energy sector in Tanzania. From the previous section it is clear there are many actors who engage with the sector in one way or the other, some more directly others indirectly. As articulated in the reviewed policy and institutional framework of the sector, some actors deal with policy and law making as well as formulation of regulations pertinent to the governance of the sector both at national and local levels. Others are mandated to implement policies and enforce laws and regulations on the ground. Yet others indulge in the scientific and technical aspects of the biomass energy sector. Equally important are those actors whose core mission is to lobby, advocate and/or finance certain biomass energy production and /or utilization. There are also those who engage in business related to the biomass energy sector. Basically these stakeholders can potentially influence change in the sector. What follow is a brief mapping of the above stakeholders in terms of their broader categories namely: Government or State Stakeholders; and Non-Government Stakeholders.

2.3.1 Government Stakeholders

There are several government ministries whose mandate touch upon the confines of the biomass energy sector (see section one of this chapter). Nevertheless, about seven ministries seem to be directly engaging with the sector. This also includes the government agencies and local government authorities falling under the respective ministries as shown in the table below. It is important to note that previous mapping of stakeholders have tended to confine the sector under four ministries (the first four on the list). This is presumably because such analyses often focus on the charcoal sector alone.

Table 1: Government stakeholders in the biomass energy sector

Government Ministries
Ministry of Energy and Minerals
Ministry of Natural Resource and Tourism
Prime Minister's Office, Regional and Local Government
Vice President's Office, Environment
Ministry of Trade and Industry
Ministry of Finance
Ministry Land and Settlement

Government Agencies/ Departments
Forest and Bee Keeping Department
Tanzania Forest Service Agency (TFSA)
Tanzania Revenue Authorities (TRA)
Rural Electrification Agency (REA)
National Environmental Management Council (NEMC)
TANESCO
COSTECH
VETA
SIDO
TRIDO
CAMARTEC
Local Government Authorities
Regional Secretariat
District Councils
Ward Government
Village Government

The pertinent question in the context of the present study is "to what extent the above government stakeholders interests can influence policy and practice in the biomass energy sector?" This question is addressed in chapter three and four of this report.

2.3.2 Non-Government Stakeholders

It is perhaps fascinating that the biomass energy sector has attracted the attention of a wide range of non government stakeholders. These include but are not limited to Civil Society Organizations (CSOs); Private organizations and companies; International and Donor Organizations/Agencies; and Research/Training Organizations. Apparently, there are different actors under each of the categories of non government stakeholders who engage in specific aspects of biomass energy sector. For the sake of painting a picture that shows how far biomass energy in its different sources are increasingly gaining fame in Tanzania, the table below summarizes some of the mentioned stakeholders and they type of biomass energy sources they are/have been promoting. It is important to note that stakeholders in the charcoal sector are focusing on sustainable charcoal production and utilization technology or/ and some aspects of the value chain.

Table 2: Non-governmental stakeholders in the biomass energy sector

NGOs/Civil Society					
	Charcoal	***Briquettes***	***LPG***	***Biogas***	***Others***
MJUMITA	✓				
TFCG	✓				
TaTEDO	✓	✓			
MIGESADO				✓	
Community Based Enterprises (CBEs)		✓			
CARE	✓				
Jane Goodall Institute	✓				
Tanzania Renewable Energy Association (TAREA)				✓	✓
FIDE				✓	
ELCT				✓	
New Rural Children Foundation				✓	
CARITAS				✓	
Private Sector/Profit making organisations					
	Charcoal	***Briquettes***	***LPG***	***Biogas***	***Others***
ARTI Energy	✓	✓			✓
Sim Gas Tanzania				✓	
Bagamoyo Brikwiti Company(BBC)		✓			
Moto Poa Ltd			✓		
TanCarbon Market Ltd	✓				
Mkonge Energy System Company Limited				✓	
Tanganyika Planting Company (TPC)				✓	
AB. Biogas Enterprise Ltd				✓	
International Organisation/Donor Community					
	Charcoal	***Briquettes***	***LPG***	***Biogas***	***Others***
World Bank	✓				
EU	✓	✓			✓
Netherlands				✓	✓
Sweden					
SDC	✓				
WWF	✓				
SNV				✓	
Hivos				✓	
GTZ				✓	
Finland	✓	✓			

Norad, Norway	✓				
USAID	✓				
UK	✓				
Energy Development Partner Group Tanzania	✓	✓	✓	✓	✓
Research and Training organisations					
	Charcoal	***Briquettes***	***LPG***	***Biogas***	***Others***
SUA	✓				
COET,UDSM	✓	✓		✓	✓
IRA,UDSM	✓				
MUST	✓			✓	✓
COSTECH	✓			✓	✓
VETA	✓			✓	
Appropriate Rural Technology Institute		✓			
SIDO	✓	✓		✓	
CAMARTEC		✓		✓	

It is worth noting that many international and donor organizations and private companies have extended their feet in the biomass energy sector. What is perhaps striking which is also reflected in the findings in chapter three, is that some of the forms of biomass energy sources (e.g. charcoal and biogas) have attracted the attention of many stakeholders compared to others (e.g. LPG). Just like in the case of government stakeholders, the potentials for the nongovernmental stakeholders to influence the biomass energy sector are many and have been reflected in the subsequent chapters of this report.

3.0 CHAPTER THREE: KNOWLEDGE, ATTITUDES AND PERCEPTIONS TOWARDS BIOMASS ENERGY AMONG STAKEHOLDER GROUPS

3.1 Introduction

This chapter focuses on the presentation of the typology of stakeholders in the biomass energy sector, by presenting their levels of understanding and knowledge of the biomass energy sector, their attitudes towards the promotion of biomass as an important source of energy and perceived challenges facing the biomass energy sector and potential opportunities within the sector. The characterization of the different stakeholder groups in done using 4 main group; (i) end users of biomass energy, (ii) the private sector engaged in the production and supply of different forms of biomass energy, namely producers, transporters, wholesalers and retailers, (iii) government agencies and local government including key actors at the regional, district, ward and village level (iv) NGO/CBOs, Research institutions and donor agencies.

3.2 END USERS OF BIOMASS ENERGY

3.2.1 Profile of end users of biomass energy

This section begins with a presentation of the profile of the end users of the different forms of biomass energy that took part in the study. End users were categorized into 3 groups namely; households, business premises and institutions (schools, hospitals). Overall the study included 43.6% (130) of household users; 49.7% (148) of business premises and 6.7% of institutions (20)

Table 3: Profile of end users of biomass energy by study region

Region	Type of user			Number
	Business	Institution	Household	
Dar es Salaam	57.1% (28)	22.4% (11)	20.4% (10)	(49)
Morogoro	52.1% (25)	0%	47.9% (23)	(48)
Mbeya	48.8% (23)	0%	51.1% (24)	(47)
Tabora	45.1% (23)	7.8% (4)	47.1% (24)	(51)
Mwanza	48.0% (24)	2.0% (1)	50.0% (25)	(50)
Coast	47.2% (25)	7.5%(4)	45.3% (24)	(53)
	49.7% (148)	6.7%(20)	43.6% (130)	(298)

Firewood (84.9%) and charcoal (87.9%) ranked highest as sources of energy used for cooking. Electricity was mentioned by only 0.3%; gas by 5.0%; biogas by 2.0%; plant residue by 5.9% and kerosene by 6.0%. When asked to identify their main sources of energy used for cooking 50.7% of the respondents mentioned firewood; 43.6% charcoal; 0.7% kerosene and 1.7% gas. Other sources were also mentioned like plant residue, dried cow dung and biogas.

Firewood being collected for household consumption

Retailer selling charcoal to clients

In the FGDs it was reported that there is a massive consumption of biomass energy, especially for charcoal and firewood. It was however noted that in the case of charcoal most of the consumption takes place in the urban areas and the rural areas remain mostly as production sites. The majority of people in the rural areas were reported to use firewood as their main energy sources for cooking in their households, in their small businesses and other activities such as the drying of tobacco. Plant residues was also mentioned as a source of energy especially in the rural areas, however it was noted that very little is done to purposely cater for its use as an important source of energy. It was also discussed that plant residues are only limited to the harvest seasons and it is during this time people replace firewood with plant residues as a source of domestic energy.

> *"We prefer firewood as a source of energy because it is easily accessible but also in our context there is no electricity, paraffin and gas is expensive" (FGD Biomass stakeholders- Nakawale Village, Mbeya)*

Table 4: Main source of energy used for cooking

Region	Type of energy source				
	Firewood	**Charcoal**	**Kerosene**	**Gas**	**Others**
Dar es Salaam	22.4% (11)	57.1% (28)	0	6.1% (3)	14.3% (7)
Morogoro	47.9% (23)	52.1% (25)	0	0	0
Mbeya	66.0% (31)	31.9% (15)	2.1% (1)	0	0
Tabora	60.8% (31)	35.3% (18)	2.0% (1)	2.0% (1)	0
Mwanza	38.0% (19)	60.0%(30)	0	0	2.0% (1)
Coast	70.6% (36)	27.5% (14)	0	2.0% (1)	0
	51.0% (151)	43.9% (130)	0.7% (2)	1.7% (5)	2.7% (8)

3.2 2 Knowledge of Biomass energy

All of the end users reported knowing what the term "biomass energy" means. When asked to mention the different sources of biomass energy the most cited sources were charcoal which was mentioned by 99.0% and firewood 98.7%. Farm residue as a source of biomass energy was mentioned by 41.3% of the respondents and only 18.1% mentioned biogas and 2.7% mentioned biofuel.

In the FGDs charcoal, firewood and plant residues were the most familiar forms of biomass that participants were able to mention. On the other hand biogas was mentioned only in a few cases and surprisingly even in areas where people kept cattle. The main reason mentioned in the discussions was that the costs for installing the biogas system are high and hence discouraging its use.

Household using biogas for cooking

Biogas system used for household cooking

Biomass energy source was perceived to be an important source of energy by a significant percentage of the respondents (82.8%). The percentages were much higher among the business and household end-users when compared to the institutional end-users. The figure below summarizes the findings. The main reason that was cited by the end users as to why they thought that biomass was the most appropriate source of energy was easy availability of biomass sources of energy (84.1%). Price of biomass (45.1%) and reliability (45.9%) were also mentioned as a reason for picking biomass over other sources of energy.

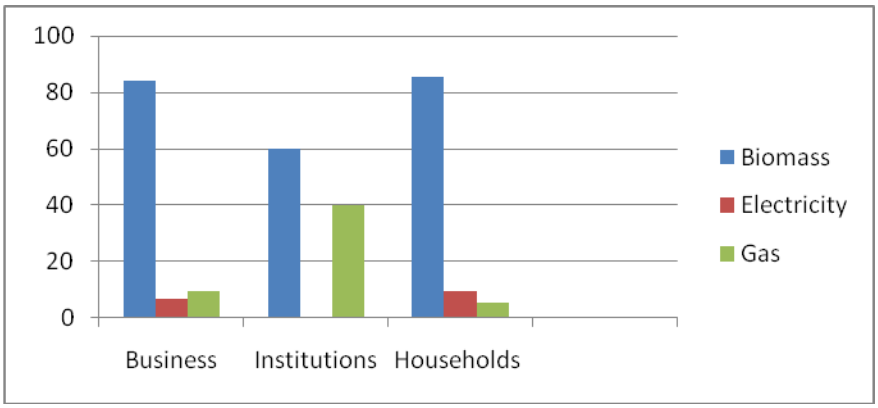

Figure 1: The most appropriate source of energy cited by the end users

Biomass energy was also considered to be an important source for economic development (83.9%), with most of the respondents (88.4%) seeing it as an important source of income for households or individuals engaged in the biomass energy industry. The sector was also seen to be important in providing employment opportunities (59.2%) and providing the government with revenue (55.6%).

Charcoal being transported to selling points

Firewood being transported to selling points

In the FGDs there was a consensus among participants that the biomass energy sector has a crucial contribution in the socio and economic development at all levels of society, that is at the individual, village, district and even at the regional level. At the individual level it was reported that many people engage themselves in the charcoal and firewood business either as producers, transporters, wholesalers and retailers and some of them depend on the sector as their sole source of income.

It was discussed that villages that provide harvesting zones for charcoal and firewood also benefit either from the direct collection of revenues from the charcoal and firewood businessmen/ women or through some percentages of the revenue collected by the district councils from money paid for permit levies. It was discussed that the village governments would

then use the revenue to fund socio-economic projects. However, there was a feeling among focus group discussion participants that revenue from permits should be collected at the village level to enable villages benefit from the resources in their villages.

> *"Sustainable charcoal project has increased the productivity by fifty percent and the benefits are being felt by everyone in the village….the revenues collected through levies paid to the village have allowed us to finance development projects in the village without having to burden the villagers or beg from the district or central government…we have constructed a house for the health personnel at the dispensary…we have also financed the renovation of one of the teacher's house which was in bad shape….and still we have 58 million in the village account" (IDI: Representative of Natural Resource Committee- Ihombwe Village, Morogoro)*

Biomass energy was considered by 45% of the end users to be a reliable source of energy and 39.6% stated it was a very reliable source of energy. Reliability of biomass as an energy source was most linked to the fact that it is easily available, especially for charcoal and firewood, although there were concerns among the end users that the sources of biomass energy source are decreasing (50.7%).

Much has been said on the effect charcoal and firewood use has on the environment and this was also reflected by the end users who 39.7% felt that biomass energy use is not good for the environment. The main reason cited was that biomass energy is contributing very much towards deforestation (72.9%).

Table 5: Reasons why biomass energy was considered not good for the environment

Type of user	Reasons given			
	Pollution	**Deforestation**	**Not sustainable**	**Degradation**
Business	44.7% (21)	66.0% (31)	2.1% (1)	59.6% (28)
Institutions	33.3% (5)	80.0% (12)	20.0% (3)	60.0% (9)
Households	30.4% (17)	76.8% (43)	5.4% (3)	50.0% (28)
	36.4% (43)	72.9%(86)	5.9% (7)	55.1% (65)

Harvesting of forests for charcoal production

Preparations for charcoal production

Asked whether they as end users were aware of laws and policies governing the biomass energy sector, less than half (40.4%) of the respondents reported being aware of such laws and policies. Knowledge was higher among the business and institutions end users (41.9% and 45.0% respectively) as compared to household end users (38.0%). Of the respondents who were aware of the laws and policies governing the biomass energy sector, 57.8% were of the opinion that if the laws and policies were enforced it could improve the operations of the biomass energy sector. Certification of charcoal was also perceived to be a good thing (59.3%). The main reason given as to why the end users think that the certification of charcoal was a good thing was linked to the following possibilities: price of charcoal going down (68.8%); reducing illegal forest harvesting (42.0%); improve sustainable harvesting (28.4%) and improve quality of charcoal produced (12.5%).

3.2.3 Perceptions on the Quality of Charcoal

For the users of charcoal the most important assessment made in terms of identifying the kind of charcoal they would want to buy was the weight of charcoal. It was believed among the users that the heavier charcoal weighed the better the quality. Quantity was also used as a criterion

when making a decision to purchase charcoal. The table below summaries the different assessment criteria used by the users of charcoal when purchasing charcoal.

Table 6: Assessment criteria used by end users when purchasing charcoal

Type of user	Assessment criteria used when purchasing charcoal				
	Quantity	Cheap price	Hard wood	Weight	Easy to heat up
Business	44.6% (66)	30.4% (45)	41.9%(62)	60.8% (90)	39.9%(59)
Institution	45.0% (9)	20.0% (4)	50.0% (10)	55.0% (11)	25.0% (5)
Households	36.9% (48)	24.6% (32)	28.5% (37)	61.5% (80)	35.4% (46)
	41.3% (123)	27.2% (81)	36.6% (109)	60.7% (181)	36.9% (110)

The price of biomass energy when compared to other sources of energy was perceived to be cheaper. 40.2% of the end users stated that the price was low and 41.9% stated that the prices were average.

3.2.4 Challenges in using biomass energy

Challenges in using biomass energy were reported by 77.5% of the users, with the percentages being higher for the business and institutional end-users (85.1% and 95.0% respectively) and much lower for the household end-users when compared to the other end-users (66.2%). The main challenge mentioned was the price of biomass energy (72.5%); followed by issues of availability (45.3%) and lastly quality (12.8%).

3.2.5 Perceptions on the Sustainability of the Biomass energy sector

Asked as to whether they thought the biomass energy sector had the possibility of being a sustainable sector, 61.7% of the end users thought that it would be possible to have a sustainable energy sector. Of the 5 biomass energy sources, 53% of the end users thought that there was a possibility that charcoal was a sustainable source of biomass energy with less mentioning firewood (38.3%). Other forms of biomass energy were mentioned by less than 10% of the end users and this could be mainly because they are not well known among them (liquid biofuel 1.6%; farm residue 8.7%; biogas 9.3%). The main reason that end-users gave as to why they

thought that charcoal was the most sustainable biomass energy source was that it was the most available source of biomass energy (70.3%). 53.7% of the end users believed that charcoal production could be done in a sustainable manner.

In the FGDs it was noted that not so much effort is being done to promote the biomass sector, with the exception of some efforts being made by some private organizations to promote the use of biogas. It was reported that there is very little effort to promote charcoal and firewood. This was attributed to the fact that there is a constantly high demand and popularity of the use of charcoal and firewood.

FGD participants were of the view that based on the fact that the biomass sector is an important source of income at different levels there is need to emphasize its promotion. The suggested promotion was in the form of investing in the producers by imparting them with knowledge on sustainable ways of charcoal and firewood production. According to the participants this will ensure that the biomass energy sector will keep on generating income for socio-economic development.

3.3 PRIVATE SECTOR PLAYERS IN THE BIOMASS ENERGY SECTOR

The private sector in the biomass energy sector was defined as the producers, transporters, wholesalers and retailers of the different forms on biomass energy sources. Overall, the study included 109 producers; 85 transporters; 104 wholesalers and 127 retailers. Most of the private actors were engaged in either the production, transportation, wholesale or retail selling of charcoal and firewood. Very few were engaged in producing or selling farm residue, biofuel or biogas.

Table 7: Profile of the actors in the private sector engaged in biomass

Producers	***Transporters***
Charcoal was the main biomass energy source that most of the producers were involved in	Charcoal was the main biomass energy source that most of the transporters were involved in

(90.8%). Firewood ranked second (34.9%); farm residue had 2.8% of the actors; biogas 1.8% and none of the producers interviewed were engaged in the production of biofuel.	(87.1%). Firewood ranked second (36.5%); farm residue had 1.2% of the actors and biofuel 1.2%.
Wholesalers Charcoal was the main biomass energy source that most of the wholesalers were involved in (79.6%). Firewood ranked second (38.8%); farm residue had 2.9% of the actors and biofuel 1.0%.	***Retailers*** Charcoal was the main biomass energy source that most of the retailers were involved in (84.1%). Firewood ranked second (37.3%); farm residue had 2.4% of the actors and biofuel 0.8%.

3.3.1 Knowledge on Biomass energy among actors in private sector

All of the private sector actors reported knowing what the term "biomass energy" means. When asked to mention the different sources of biomass energy the most cited sources were charcoal which was mentioned by 100% of the respondents and firewood 94.6%. Farm residue as a source of biomass energy was mentioned by 41.2% of the respondents and only 17.7% mentioned biogas and 2.1% mentioned biofuel. Generally, private sectors actors reported that they were aware of the laws and legislations regulating the biomass energy sector (79.2% and 80.9% respectively). The biomass energy sector was perceived to avail a number of opportunities, namely employment (65.4%); income (91.5%) and revenue for the government (48.1%).

Figure 2: Knowledge of the different forms of biomass energy

3.3.2 Importance of Biomass Energy

Majority of the respondents (98.8%) identified biomass as an important source of energy, with 92.2% citing that the sector plays an important role in economic development (as an important source of government revenue 58.6%; employment 65.2% and income 88.3%). Asked what their most preferred source of energy was 82.5% (349) mentioned biomass; 9.0% (38) mentioned electricity and 8.5% (36) mentioned gas. For those who mentioned biomass as their most preferred energy source the most cited reasons were that it is easily accessible (72.5%); cheap (55.9%) and it is also a reliable source (54.0%). Those mentioning electricity as their most preferred energy source mostly cited efficiency (68.4%); reliability of electricity (57.9%) and friendly to the environment (34.2%) as their main reasons of their choice. Among those selecting gas as their most preferred energy source their cited reasons for their selection was mostly that it is an efficient source (72.2%); it is reliable (61.1%) and it is friendly to the environment (58.3%). When specifically asked on their perception of the price of biomass many of the respondents reported that the prices were average and low (33.3% and 34.9% respectively). Very few mentioned that the prices were high or very high (8.0% and 7.1% respectively). The table below summarizes the different reasons given as preferences for the selected energy choices.

Table 8: Reasons for preferred energy sources

	Energy source		
	Biomass	Electricity	Gas
Cheap	55.9% (195)	7.9% (3)	2.8% (1)
Easily accessible	72.5% (253)	18.4% (7)	5.6% (2)
Efficient	9.2% (32)	68.4% (26)	72.2% (26)
Reliable source	53.0% (185)	57.9% (22)	61.1% (22)
Friendly to the environment	5.2% (18)	34.2% (13)	58.3% (21)
Common Source	31.8% (111)	2.6% (1)	0%
Liked by most people	21.6% (75)	10.5% (4)	0%

When asked on the demand of biomass energy, 71.3% cited charcoal as being of very high demand, followed by firewood at 51.3%. Other forms of biomass energy scored very low with only 1.2% mentioning farm residue as being of high demand; 0.5% mentioned liquid biofuel and 0.2% mentioned biogas. It was also reported that over the past 5 years the demand of biomass energy has increased (73.6%). The findings are summarized in the figure below.

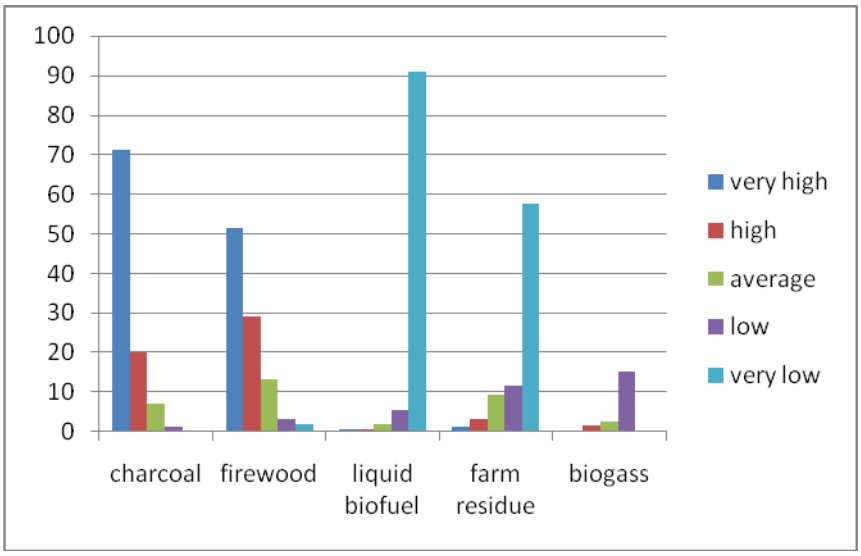

Figure 3: Perceived demand of the different sources of biomass energy

Overall charcoal and firewood were perceived as the main sources of biomass energy that had a market (83.7% and 80.4% respectively). Very few respondents felt that the other sources of biomass energy had a market (farm residue 12.3%; liquid biofuel 1.2% and 4.6% biogas).

There were however concerns that the sources of biomass energy have been decreasing (59.5%), with very few of the respondents reporting that the sources have been increasing (18.6%) and 16.5% reporting that the sources have remained constant. Despite the fact that respondents felt that the sources of biomass energy have been decreasing there were also of the view that the supply is still reliable and reference was mainly made to charcoal (73.2%) and firewood (84.4%). Many respondents were not able to comment on the reliability of biofuel, biogas and farm residue supply by stating that they don't know. The figure below presents a summary of the findings.

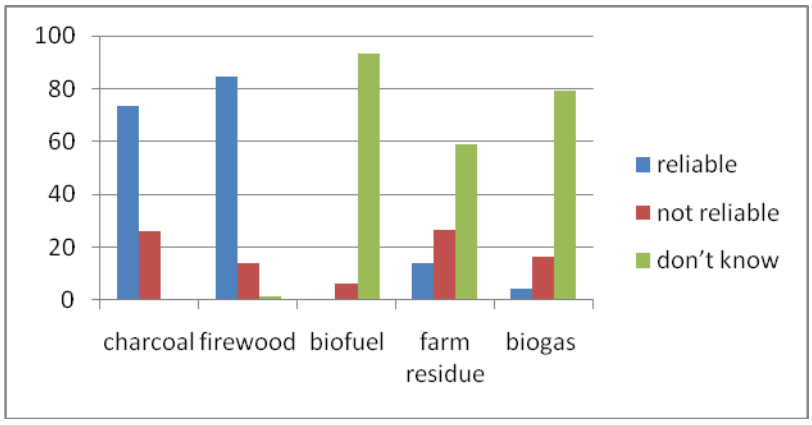

Figure 4: Perceptions on the reliability of supply of the different forms of biomass energy

3.3.3 Perceived Challenges in the Biomass Energy Sector

This section looks at challenges reported in two folds, on the one hand challenges that private actors perceive as characterizing the biomass energy sector and secondly challenges they foresee in promoting different biomass energy sources.

a) Challenges in the biomass energy sector

Most of the private sector actors (93.6%) reported that there are a number of challenges in the biomass energy sector. For the producers the most cited challenge was poor

technology (58.7%); complicated production procedures (54.1%); poor infrastructure (48.6%) and lack of capital (47.7%). Transporters mostly complained about poor infrastructure (70.6%); corruption in the sector (65.9%) and too much bureaucracy (50.6%). Main challenges cited by the wholesalers were corruption in the sector (52.4%); lack of capital (49.5%); too much bureaucracy (42.7%); high taxes (41.7%) and poor infrastructure (41.7%). For the retailers the main challenge mentioned was lack of capital (46.8%).

Table 9: Challenges mentioned by producers, transporters, wholesalers and retailers on biomass energy sources

	Producers	Transporters	Wholesalers	Retailers
Lack of enforcement of policies	4.6% (5)	4.7% (4)	5.8% (6)	4.0% (5)
Conflicting guidelines in the management of biomass	3.7% (4)	4.7% (4)	5.8% (6)	2.4% (3)
Too many actors in the biomass energy sector	4.6% (5)	7.1% (6)	9.75% (10)	7.1% (9)
Poor technology	58.7% (64)	12.9% (11)	11.7% (12)	19.0% (24)
Lack of capital	47.7% (52)	32.9% (28)	49.5% (51)	46.8% (59)
Biomass energy sector is not sustainable	10.1% (11)	2.4% (2)	10.7% (11)	12.7% (16)
Corruption in the sector	29.4% (32)	65.9% (56)	52.4% (54)	23.8% (30)
High taxes	22.9% (25)	28.2% (24)	41.7% (43)	14.3% (18)
Poor infrastructure	48.6% (53)	70.6% (60)	41.7% (43)	20.6% (26)
Too much bureaucracy	22.0% (24)	50.6% (43)	42.7% (44)	19.0% (24)
Complicated production procedure	54.1% (59)	11.9% (10)	15.5% (16)	20.6% (26)

In the FGDs with producers and transporters it was reported that there is lack of proper governance and management of the sector. A lot of complaints were directed to the Natural Resource Department. It was explained that the department has mainly concentrated in the collection of revenue through permit levies without doing much to improve the sector. There was a general feeling among group participants that the sustainability of the sector is in jeopardy because of the high rates of deforestation. Currently producers and transporters have to travel long distances to get wood/trees for production.

In the discussions it was also noted that the sector is being used by some unethical officials to generate self-income through corruption. Transporters and other dealers in the charcoal and firewood business complained that they have been subjected to harassment from corrupt officials who are all the routes they pass. It was reported that having a valid permit for transportation of charcoal and firewood is not enough to escape from the harassment of the government officials who would always come up with reasons to delay them. To avoid delays transporters would end up bribing the officials.

b) Challenges in promoting different forms of biomass energy sources

A number of challenges were identified in the promotion of the different biomass energy sources, however a significant number respondents were not able to mention challenges that are likely to face the promotion of bio liquid, farm residue and biogas and this can be a result of the limited knowledge of these forms of biomass energy sources. Hence this section will only address the common sources, namely charcoal and firewood.

i. **Charcoal** - the main challenges in promoting use of charcoal was cited as price (48.5%) and availability (43.5%). Quality of charcoal produced was only mentioned by 5.9% of the respondents.

ii. **Firewood** - Availability of firewood was cited as the main challenge that would affect its promotion as a source of energy (60.7%). Price of firewood and quality of firewood were only mentioned by few of the respondents as likely to affect the promotion of firewood (17.9% and 8.9% respectively)

3.3.4 Sustainable Charcoal Production

This section mainly focuses on perceptions on whether or not the biomass energy sector can be sustainable. The first part focuses on the producers of charcoal with the intention to assess levels of knowledge in sustainable charcoal production and attitudes towards sustainable charcoal production. The second part looks at the practices that producers are using in trying to produce

biomass in a sustainable way and the third part presents a general understanding among all the actors, that is, the producers, transporters, wholesalers and retailers.

a) Knowledge in Sustainable charcoal production methods

Overall, 62.6% of the charcoal producers mentioned that they were aware of the different methods that can be used to produce charcoal in a sustainable manner. The percentages differed among the producers in the different regions covered in the study with Morogoro scoring the highest (100%); Dar es Salaam (70%); Tabora (70%); Mwanza (53.3%); Coast (47.4%) and Mbeya (33.3%). When asked to identify the different methods of charcoal production they knew most of the producers cited the basic earth mould kiln (62.9%). Other methods mentioned were the brick kiln (29.0%); half orange kiln (19.4%); improved earth mould kiln (9.7%) and the Casamance kiln (8.1%). Knowledge of the different methods used in charcoal production varied across regions as summarized in the figure below.

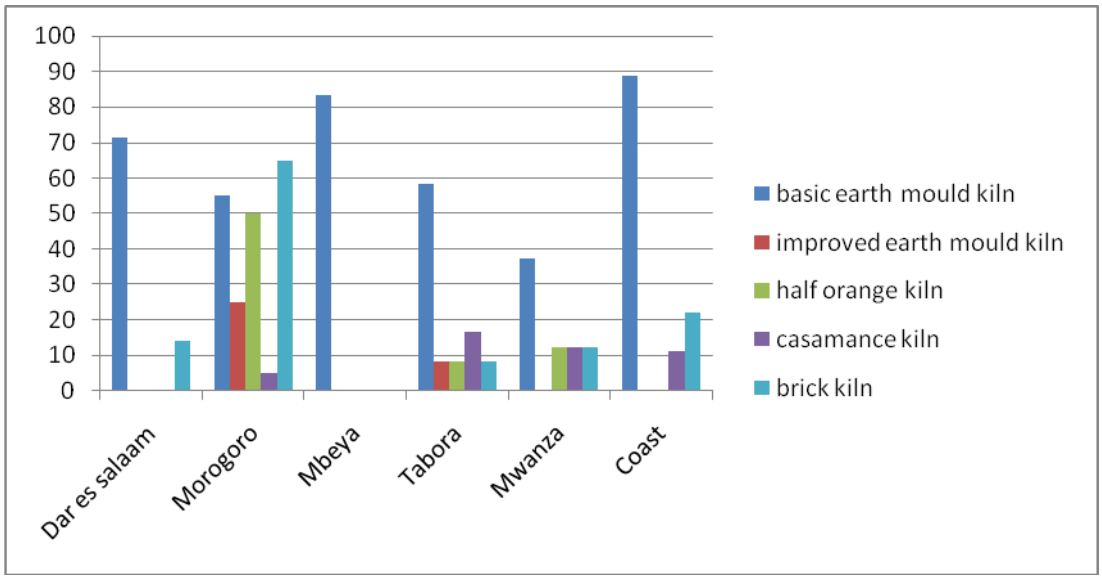

Figure 5: Knowledge of different charcoal production methods by region

In the FGDs with producer and transporters of charcoal and firewood it was reported that most of them are still using the local ways of production which involves cutting down of a significant number of trees. This kind of production was explained to be the main contributor of

deforestation. Producers were aware that the methods they are using are not environmentally friendly, but is was explained that the improved ways of charcoal production are expensive and beyond their reach.

Charcoal production taking place in some of the study sites

b) Practices in promoting sustainable biomass production

Producers who reported belief that charcoal can be produced in a sustainable manner were asked to mention what they as producers are doing to produce charcoal in a sustainable manner. Investing back in the environment by planting more trees ranked the highest (42.2%); followed by using improved technology (17.4%); improving quality (11.9%) and 38.5% reported that they were not doing anything to ensure that they produce charcoal in a sustainable manner. Although overall, use of improved technology seems to have scored low (17.4%) almost half of the producers in Morogoro (45.0%) reported using improved technology as a means to ensure that they are producing charcoal in a sustainable manner.

c) Attitude towards sustainable charcoal production

Overall, 71.9% of the private sector actors felt that it is possible to have a biomass energy sector that is sustainable. Percentages were higher among the producers (80.7%) as compared to the retailers (62.2%). A significant percentage of the private sector actors (79.2%) felt that it was worthwhile investing in biomass production technology and

formalizing the biomass energy sector (91.7%), with 62.6% reporting that they actually believed that charcoal could be produced in a sustainable manner.

3.3.5 Actors in the Biomass Energy Sector

A number of actors were identified as having a role to play in the biomass energy sector. The local government was cited by many of the respondents (80.0%); local communities (74.0%); government agencies (64.2%); private sector (17.7%) and the NGOs/CBOs (17.7%). When asked to mention who they thought to be the key player in the biomass energy sector, local communities were ranked the first (46.2%) followed by the local government (25.0%) and the government agencies (20.0%).

Respondents were asked to rank the performance of the government, local government, private sector and NGOs/CBOs in the management of the biomass energy sector. Overall the local government was ranked positively by 46.7% reporting that its performance was average, compared to the government and its agencies (28.3%); private sector (18.6%) and NGOs/CBOs (18.2%).

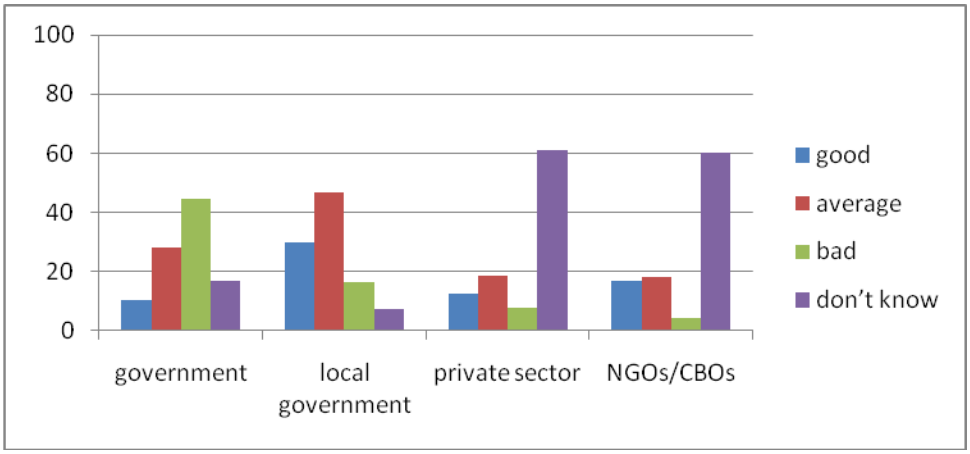

Figure 6: Assessment of actors in the biomass energy sector

3.3.6 Perceptions on the quality of charcoal and others sources of biomass energy

Overall, respondents had a positive assessment on the quality of charcoal with 46.8% reporting that the quality was very good; 33.2% reporting that the quality was good and 16.5% reporting that the quality was average. The perceptions on the quality of charcoal were also assessed by asking the respondents what they consider when making judgment on the quality of charcoal. Weight of charcoal (heavy charcoal) seemed to be the most important assessment criteria (71.0%), with respondents reporting that their assessment criteria is based on whether or not charcoal is heavy. However, looking across the different actors few producers (56.9%) felt that weight mattered as compared to the transporters (77.6%); wholesalers (75.0%) and retailers (75.4%). The second highest ranking criteria used were the hardness of charcoal (54.2%) and charcoal being easy to light (51.7%). The figure below summarizes the findings.

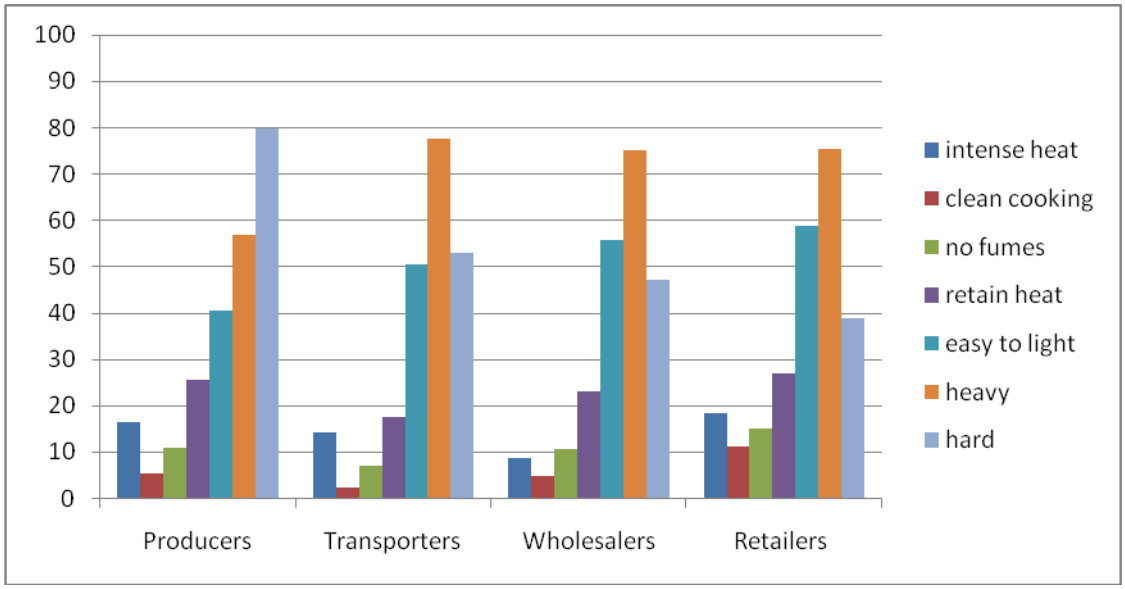

Figure 7: Assessment criteria used in assessing quality of charcoal

Respondents were also asked as to what they think are the important elements used by their clients in assessing the kind of charcoal they would want to purchase. It was reported that most of the buyers look for charcoal that is heavy in weight (76.7%); look at the quantity of charcoal (63.7%) and the hardness of the wood used to make charcoal (46.5%).

The quality of firewood was also assessed in a positive manner with 34.1% reporting that the quality was very good; 34.4% reporting that the quality was good and 26.4% reporting that the quality was average. With regards to the quality of biofuel and biogas most of the respondents reported that they did not know about the quality (98.4% and 82.9%). As for the case of farm residue 63.7% reported not knowing about the quality of the energy source, with 16% rating the source as average, 8.3% as good and only 1.9% rating the source as very good.

A number of issues were identified as important in ensuring the improvement in the production of biomass energy. Most of the respondents (75.0%) stated that the improvement in the production of biomass can be done by planting more tress and 43.6% mentioned improving the legislations and laws governing the biomass energy sector. Overall, not very many of the respondents mentioned improved technology (34.0%), however the percentages were much higher among the producers (60.6%). Value addition was only mentioned by 13.0% of the respondents as important in improving production of biomass energy as summarized in the figure below.

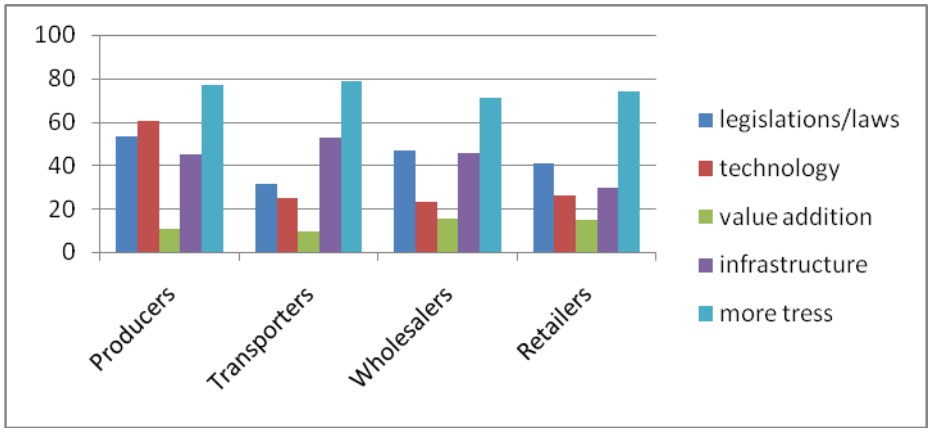

Figure 8: Factors identified in improving the production of biomass energy

3.4 STATE ACTORS ENGAGED IN THE BIOMASS SECTOR

State actors in the study were defined as government employees working in departments that are in one way or another linked to the biomass energy sector. These included government officials at regional, district, ward and village level. At the village level where most of the production of charcoal and firewood is carried out a number of other actors were included, these were members

of different committees at the village level. In total 158 officials took part in the quantitative part of the study, 20 regional officers; 25 district officers; 15 ward officers and 98 village level officials.

Interviews and discussions with different government officials that have a direct or indirect stake in the biomass energy sector echo the findings presented in the previous sections. As earlier indicated in the review of institutional framework of the biomass energy sector, the sector cuts across a wide range of sectors. In this section knowledge, views and perspectives of various government officials from different sectors are presented along four major thematic areas. These include opportunities/potentials of the sector; institutional dynamics; challenges facing the sector; and the question of sustainability.

3.4.1 Knowledge of biomass energy sources

Overall, 99.4% of the government officials reported knowledge of the term "biomass energy". Like the other respondents in the study knowledge of biomass energy was mainly limited to the 3 sources namely; charcoal (100%), firewood (96.2%) and farm residue (63.3%). Half of the respondents (44.9%) were able to identify biogas as a source of biomass energy and very few respondents (7.6%) were able to mention biogas and biofuel as sources of energy. Biomass was reported to be an important source of energy by 95.6% of the respondents, with respondents reporting that the prices were average (29.1%); low (33.4%) and very low (12.0%). Very few of the respondents were of the view that the prices were very high (8.9%) and high (16.5%).

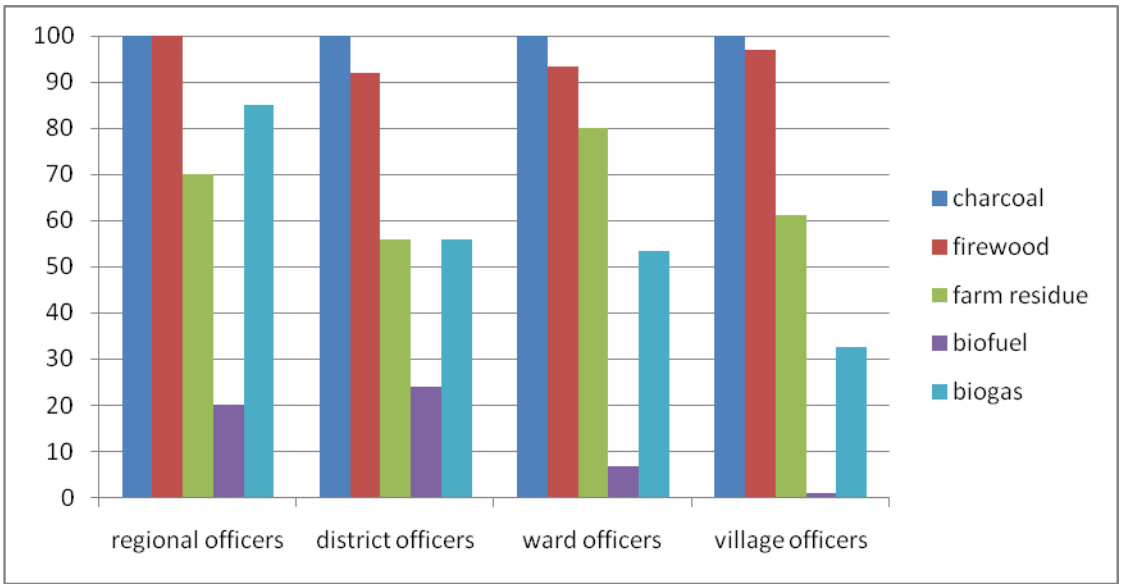

Figure 9: Knowledge levels of the different sources of biomass energy among government officers

The overall demand for biomass energy was assessed to be high, although there were concerns that the supply of biomass was not meeting the demands of the market. 50.0% of the respondents felt that the current supply of biomass energy is not meeting the demands of the market.

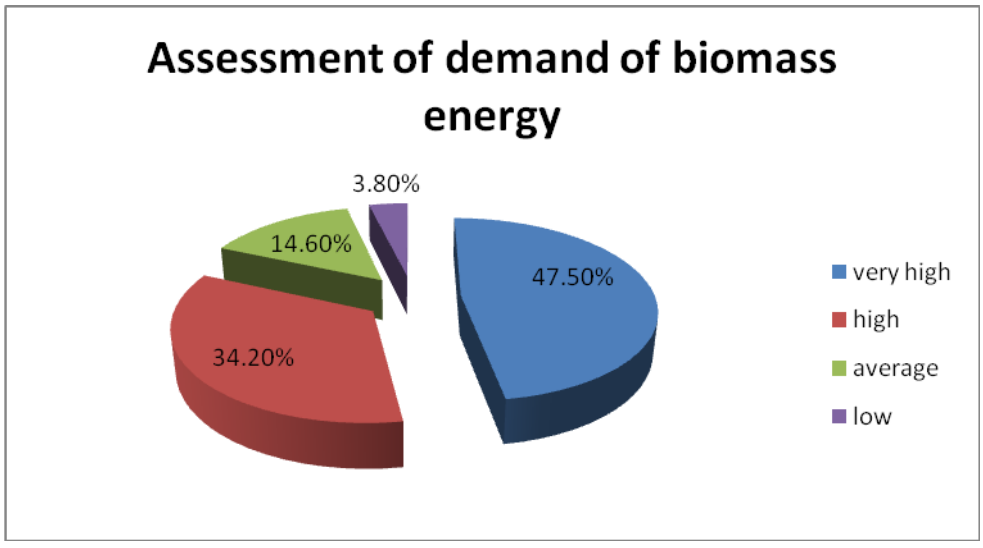

Figure 10: Assessment of demand of biomass energy among state actors

3.4.2 Perceived challenges in the biomass energy sector

Overall, a significant percentage of the respondents (97.5%) stated that the biomass energy sector is facing a number of challenges. Poor technology used in the production of biomass energy was the most cited challenge (57.6%). Other challenges mentioned were conflicting guidelines (31.0%); the sector is unsustainable (30.4%); lack of enforcement of policies (29.7%); lack of capital (24.7%); too many actors (20.9%); corruption in the sector (12.0%) and high taxes (8.9%). Poor technology was also discussed in the context of lack of capital …*Limited budget allocation for the development of biomass energy sector….the sector relies on ministry level budget allocation, little or no allocation at the district council level…*(IDI: Official, Forestry department-Morogoro).

Table 10: Challenges facing the biomass energy sector

Challenges	Regional officers	District officers	Ward officers	Village officers
Lack of enforcement of policies	35.0% (7)	28.0% (7)	26.4% (4)	29.6% (29)
Conflicting guidelines	45.0% (9)	32.0% (8)	40.0% (6)	26.5% (26)
Too many actors in the sector	25.0 (5)	28.0% (7)	26.7% (4)	17.3% (17)
Poor technology in production	70.0% (14)	48.0% (12)	60.0% (9)	57.1% (56)
Lack of capital	15.0% (3)	12.0% (3)	13.3% (2)	31.6% (31)
Unsustainable sector	30.0% (6)	36.0% (9)	26.7% (4)	29.6% (29)
Corruption	10.0% (2)	4.0% (1)	6.7% (1)	15.3% (15)
High taxes	15.0% (3)	0	6.7% (1)	10.2% (10)

Qualitative findings show a clear sense of dissatisfaction among different actors when it comes to the current institutional arrangement or framework governing biomass energy sector in Tanzania. In particular, conflicting/competing policy and institutional arrangement, weak or lack of mechanisms to ensure sustainable management of biomass energy sources and conflicting interests among stakeholders were repeatedly voiced. It was argued that lack of coordination for matters pertaining to the growth of the sector are also causing lack of understanding about the sustainability of the sector in terms of awareness, communication, principles of implementation plans, areas of concentration and defined roles for both public and private sectors. Some of the interviewed actors suggested possible solutions to redress the current situation as delineated in the quotations below:

"The Institutional framework governing biomass energy sector is not clear at the moment..the sector is just going like that..the establishment of Forest Agencies is an initiative in the right direction but it should be scaled up beyond the current approach of small projects (IDI: Official Forestry Department-Morogoro)"

I don't see an institution seriously working on biomass and alternative energy in Tanzania because if it was there we in TANESCO would have felt some kind of competition (IDI: Official TANESCO- Morogoro)

"…the biggest challenge in the sector is the human resource, we are very few and most of us aren't even that committed because we don't see possibilities in solving the problems of the sector soon. There has to be more incentives and in particular there has to be a deliberate move to recruit the animators. These will help with the human resource gap. They will be the models and will spread the good will of conserving the environment and in particular the forest. They will also demonstrate an alternative source of energy. These are the ambassadors and the government should consider them as important as always fighting with the people who cut the trees and those who transport charcoal" (IDI: Official, Community Development Office-Sengerema)

Implementation of laws and policies were identified as areas which are challenging. It was explained that despite that fact that there are a number of laws and policies guiding the biomass sector there is a gap in terms of the strategic implementation of the laws and policies. This was mainly attributed to the fact that government officials and other stakeholders lack the necessary awareness of several key issues and therefore inadequate understanding of the biomass energy sector as a whole.

"At the ministry level we are more into policy making but we work with many stakeholders, one of our main partners is the Ministry of Natural Resource and Tourism, the Ministry of Industry and Trade .....complementing each other…key players in the sector entail those in the policy making level both on the demand and supply side of biomass energy …What is lacking across board is coordination…biomass is a cross-cutting sector, but the question is who should coordinate…..there is need for a clear institutional framework….perhaps an agency need to be formed to take the lead…probably there is need to strengthen the Vice Presidents Office which is actually responsible for environment management (IDI: Official, Ministry of Energy and Minerals)

Box 1: An example of coordinated efforts to promote biomass energy technology

Apart from focusing on policy issues, the Ministry of Energy and Minerals also provides technical and financial support through agencies such as REA. It has also had pilot projects such as the promotion of improved cook stoves through TATEDO (by then it was a government agency). The project had a component of training producers on improved charcoal kernels and has played an important role in linking of manufactures of improved cook stoves with end users under the Tanzania Domestic Biogas Programme (TDBP) hosted by CARMARTEC with technical assistance from SNV. The project is under the Ministry of Trade and Industry and the Ministry of Energy and Minerals serves at the steering committee because it is an energy project. The project is also operated in partnership with the private sector.

Likewise, the manager of TANESCO in one of the study regions echoed in his remarks on what seems to be the challenge in the energy sector in the country:

..the energy sector in our country is increasingly shifting towards gas and alternative energy sources from water which has for long been looked at as the only source of electricity…it is high time that we need a paradigm shift (...) in TANESCO for example, the problem has been mainly perception towards other sources of energy (…) we need to see biomass as a source of energy not mere supplement(…) we should take biomass as a base…for this we need to both change the habitual way of looking at biomass but we also need sound knowledge of biomass energy technologies. The department of research within TANESCO is increasingly focusing on other sources of energy (IDI: Official TANESCO - Mwanza)

"With a move towards big results now (BRN) we have seen each of the priority sector is striving to excel…We have seen that "Kilimo Kwanza" calls for increased production..in areas like ours where most of the land is no longer productive, it is obvious that people are going to clear forest in order to get fertile land … It is sometimes difficult to reach consensus for instance while the council needs more revenues from license and levies from forest products, the forest department is often reluctant to issue many license or permit" (IDI: Official, Community Development Office- Mbeya).

"… it will always remain a challenge as long as the government doesn't come with an alternative source of energy that is environmentally friendly. People are

> *forced to stop using charcoal and wood fuel, fine but what else do they use. Animal dunk? Where do they get the animals as they have also been dying from drought! There is a need to come up with more realistic propositions than simply coming up with solutions that are thought of by someone sitting in the office. How will Mwanza residents live if we say today let us stop charcoal coming from Sengerema and other neighboring districts!" (IDI: Official, Community development office, Sengerema)*

A number of gaps were identified in the management of the biomass energy sector. Lack of coordination among the different actors dealing with the biomass energy sector was mentioned by 63.9% of the respondents, 43.7% mentioned weak policies and legislations and 42.2% mentioned lack of investment in the sector.

> *We have multiple players in the biomass energy sector but the ministry of natural resource and tourism, the ministry of energy and minerals, and the Vice President Office-environment are probably among the central players. Unfortunately there is a lot of conflicting dimensions in policies, guidelines, laws and regulations…we have once proposed to have a joint session to harmonize the mentioned contradictions but this has never been done (IDI: Official, Forestry department-Morogoro)*

When asked to mention which institutions should be responsible for overseeing the management and coordination of the biomass energy, 80.3% of the respondents felt that the local government structure should take charge, followed by government agencies (65.8%), central government (60.8%). The private sector scored the least with only 31.6% of the respondents mentioning it. Respondents were also asked to assess the performance of the different actors in the management and coordination of the biomass energy sector and overall, the local government was the most positively assessed institution as summarized in the figure below

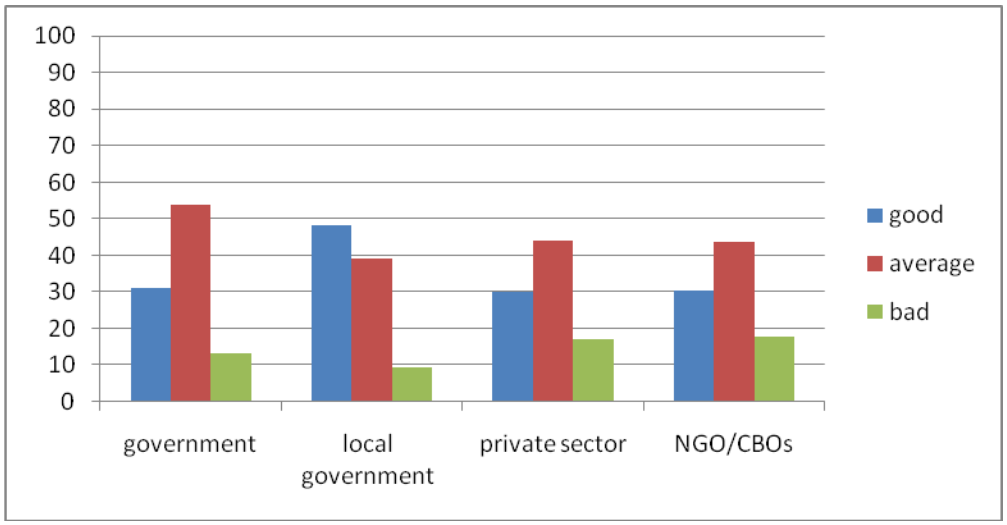

Figure 11: Assessment of the performance of the different actors in the management of the biomass energy sector

When asked to identify the most influential key player in the biomass energy sector the three highest ranked players were the local government, government agencies and local communities as summarized in the chart below.

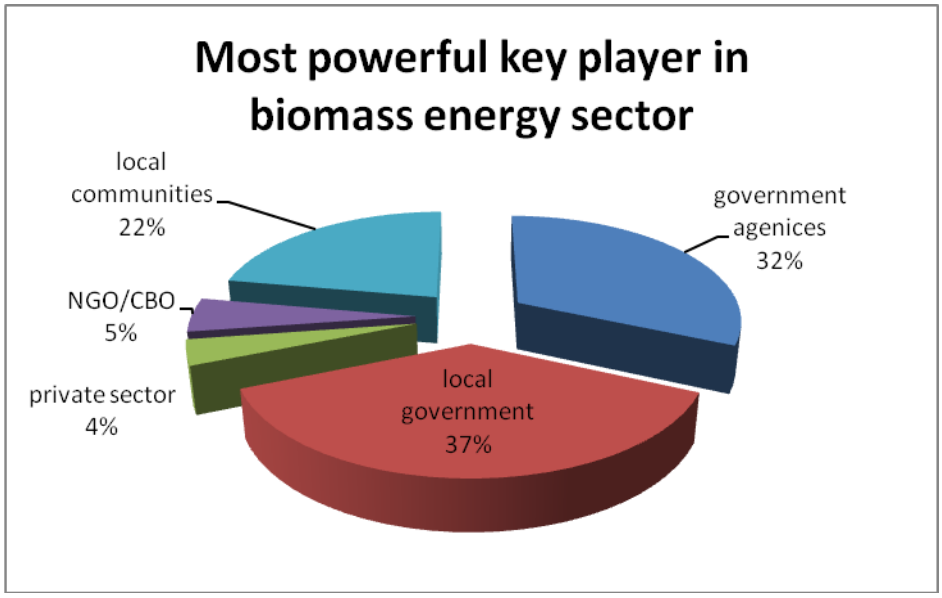

Figure 12: Most powerful key players in the biomass energy sector as identified by state actors

3.4.3 Opportunity/ potential of the biomass energy sector

The biomass energy sector is perceived as a sector that carries with it a number of opportunities. It is seen as important in national development, this being underlined by the fact that more than 90% of the people in the country depend of charcoal, firewood and farm residue as their primary source of energy. 62% of the respondents reported that the sector is important in providing the government with revenue; 67.7% see the sector as providing employment opportunities and 95.6% argued that it is an important source of income for many people as explained in the following extract from one of interviews with a key actor in the sector.

> *…source of income for about 80% of the population in Kisarawe District comes from biomass energy sources especially charcoal..most young people have abandoned agricultural production and resort to charcoal trade…The council itself considers charcoal as an important source of revenue …so it is almost impossible to abandon common biomass energy sources because there is no alternative as of yet…(IDI: Official Community Development Office-Kisarawe district)*

Most of the government officials (95.6%) noted that biomass is an important source of energy and when asked what they perceive to be the most appropriate source of energy 57.0% picked biomass over electricity and gas.

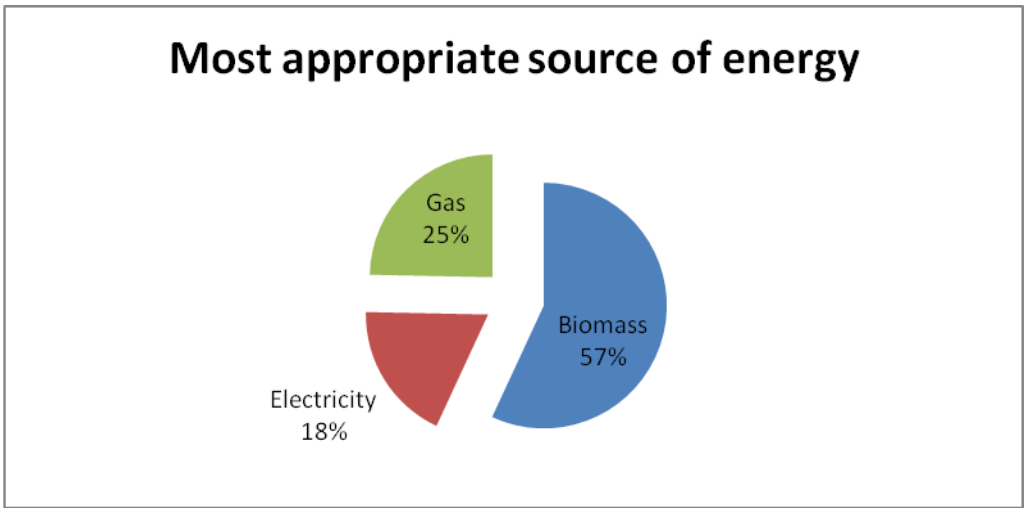

Figure 13: Most appropriate sources of energy as identified by state actors

Although overall analysis indicate that most of the respondents picked biomass over electricity and gas, officers at the regional and district levels showed little preference for biomass as indicated in the figure below. For respondents that picked biomass as their most preferred source of energy their main reasons were mainly because it is easily accessible (86.7%) and cheap (75.6%). Not so many respondents saw biomass as efficient (20.0%) and reliable (32.2%).

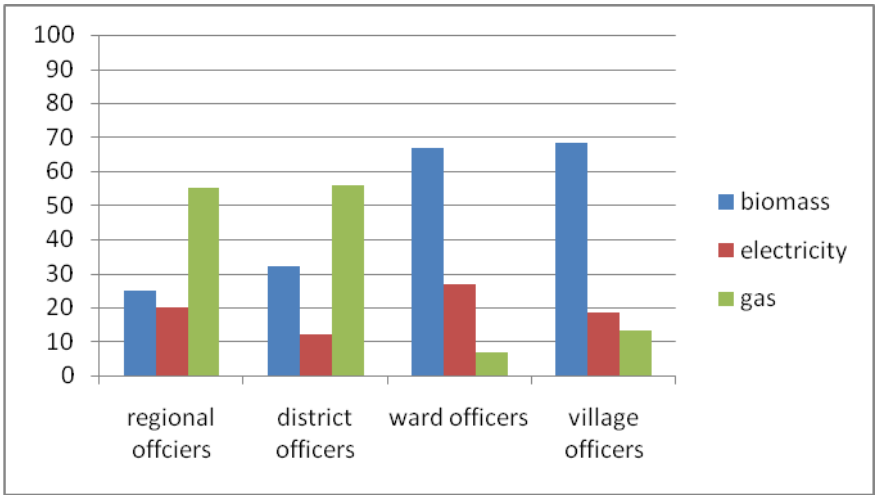

Figure 14: most appropriate source of energy reported by government officials

Most of the state actors at various levels and from different sectors acknowledge and are knowledgeable about the general potential and opportunities availed by biomass energy sector but the degree of appreciation and understanding was different across actors . Interestingly, most of these actors are cautious about the adverse impact that could emanate from the sector if proper efforts would not be directed towards making the sector sustainable.

> *…we are seeing promising trends in the biomass energy sector such as the use of husk, improved/efficient stoves both among household and in business related consumers, brick making using husks from paddy. Equally people in the private sector are investing in efficient technology for biomass energy products…the challenge ahead is how best to scale up and sustain these practices…(IDI: Official, Forestry department, Morogoro).*

Some actors situate the potential/opportunity of biomass energy sector within the current trends of the energy sector in Tanzania which is leaning towards the use of gas and renewable energy sources. In line with the current National Energy Policy and ongoing investments in alternative energy sources in Tanzania, a senior official responsible for energy in the Ministry of Energy and Mineral summed up the opportunity for the biomass energy sectors as follows:

> *"Biomass contributes 90 percent of energy in Tanzania ….it is provided for in the National Energy Policy 2003 ….the ministry is currently reviewing the policy to accumulate changes in the energy sector …the policy provides for sustainable development of biomass energy in terms of production and utilization of the energy sources …..production of charcoal using improved charcoal kernels, harvesting should be followed with planting of forests …..since we have been lacking an articulated strategy for the sector, thanks to the EU support for developing the Biomass Energy Strategy and Action Plan. It has been developed to a stage that is now waiting for approval (IDI: Official from the MEM)*

It was also noted that despite the limited knowledge of other source of biomass energy such as liquid biofuel and biogas there are still opportunities of promoting these sources of energy as discussed with an official from the ministry of energy and minerals

> *"There is a multitude of opportunities for various from of biomass energy sources be it liquid, gaseous or solid. The sources are not sustainable so the government and other stakeholders ought to take up the opportunities, we have areas that can produce biomass energy sources, the transportation of biomass offers huge potentials for tapping revenue …the market is huge…and such the supply is obviously a huge potential for business….Supply at the moment does not match the demand….this can be reflected by the rate of deforestation, the rising price of charcoal for example…… (IDI: Official from the MEM)*

Recommending for an energy sector that accommodates multiple sources of energy to suit the contexts of diverse population of Tanzania, the state actor emphasized:

> *We need to identify what potentials we have ….and sensitize the society on the use of multiple technologies with regards to energy…For that matter biomass is important because to be realistic we are resource constrained to provide electricity to every Tanzanian. Therefore it is necessary to tap on the multiple sources to diversify sources of energy in order to solve energy problems in the*

> *county…If pastoral communities can be facilitated to tap biogas from animal wastes this would ensure affordability of electricity in the respective communities….(IDI: Official, TANESCO Morogoro)*

Actors in the government believed that there is a ready market for biomass, although this was mainly limited to charcoal (75.3%) and firewood (70.9%). For the other sources of biomass energy very few actors believed that there is a market for farm residue (16.5%); biofuel (6.4%) and biogas (9.5%).

Overall, the quality of biomass energy was perceived in a positive manner with 16.5% seeing the quality of biomass as very good; 54.4% as good and 20.3% as average. Only 5.7% stated that the quality was poor and 0.6% as the quality was very poor. Biomass was also perceived to be a reliable source of energy (74.1%). To better improve the sector there were two main proposals, first to improve policies and legislation governing the management of the biomass energy sector (69.9%) and to improve the technology used in the production of biomass energy (60.8%). Improve the biomass value chain was only mentioned by 7.0% of the respondents.

3.4.4 Sustainability of the biomass energy sector as perceived by State actors

Although there is great push towards electrification with limited consideration of biomass as a potential source of energy especially due to the fact that it is mainly linked to deforestation, a high percentage of the government officials interviewed believed that charcoal production can be done in a sustainable manner. However, when asked if they knew how charcoal can be produced in a sustainable manner only 51.5% of the respondents said they were aware of the different methods used in producing charcoal in a sustainable manner. Basic earth mould kiln, improved earth mould kiln and brick kilns were the most mentioned methods. The figure below summarizes the knowledge of different methods of charcoal production.

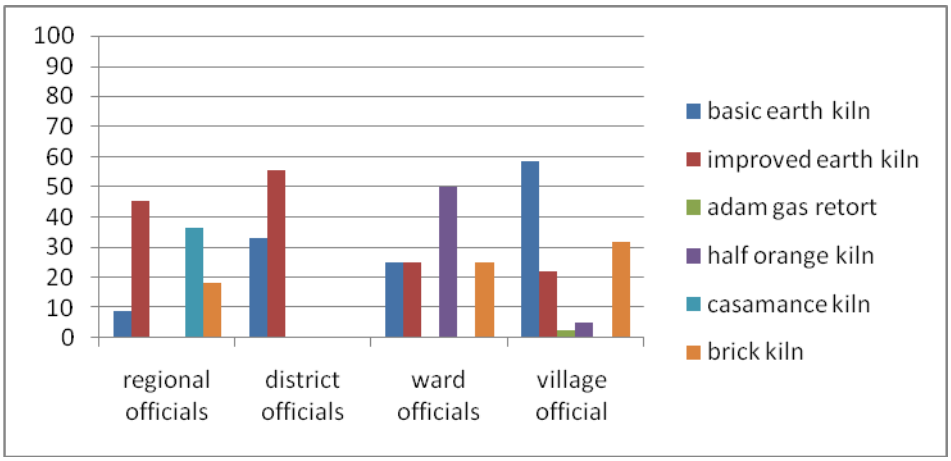

Figure 15: Knowledge levels of different methods of charcoal production among state actors

Sustainability of the biomass energy sector was perceived as key and central needing to be given due attention given that a significant portion of the population depend on it as their main source of energy.

> *"..Since the majority of the population still depend on biomass energy sources especially charcoal and firewood...it is important to promote improved technologies such as the use of improved stoves..these should be scaled up and cascaded to the community rather than the current practice where they are project based, short term and it is more of a fire brigade approach— (IDI: Official, Community Development Office- Mbeya)*

> *"Thus, at the national level there is a need for a policy on alternative energy…It can also help to allocate forests for charcoal harvesting rather than the current situation of open harvest as it is here in Kisarawe..(IDI: Official Community Development Office-Kisarawe district)"*

> *"…there is a need to have a deliberate move to ensure that the slogan of plant a trees-cut a tree needs to be enforced. This will help the forest and will make sure that the next generations will also benefit from the natural resources. The leaders at all the levels as well as the communities need to make sure that the forests in their areas of jurisdiction and next to their homes are protected" (IDI: Official, TANESCO-Urambo)*

Despite the positive perception of the possibilities of having a sustainable biomass sector, there were concerns that the source of biomass energy were on a decrease rather than an increase.

72.2% of the respondents felt that there has been a decrease in the sources of biomass energy with specific reference to wood fuel. Technology used in production of biomass was seen as negatively affecting the environment. 75.9% of the respondents reported that the kind of technology being used in the biomass energy sector is not friendly to the environment and there was an agreement across the different actors that it is important to invest in biomass technology. The presences of the Tanzania Renewable Energy Authority (TAREA) was seen as key in raising awareness on renewable energy and at the same time promoting for the investment in technology to boost the sector.

In addition to views of promoting the sustainability of the biomass energy sector many of the respondents (84.8%) were also of the view that it would be important and beneficial if the sector is formalized. It was also a feeling among many of the respondents (72.2%) that the certification of charcoal would be positive.

Despite the positive perceptions towards the sustainability of the biomass energy sector it was a concern among the state actors that given the state of things as they are currently the promotion of firewood and charcoal as a source of energy will have negative impact to the environment.

3.5 OTHER INFLUENTIAL STAKEHOLDERS

The study also solicited views from other key influential stakeholders in the biomass energy sector. These included key ministries, politicians (key parliamentary committees) donor/ development partners, private entrepreneurs/NGOs, Research Institutions and Universities. The list provided below is not exhaustive but depict the diversity of stakeholders who can be strategically engaged in promoting coordinated policy and strategy for a biomass energy friendly sector in Tanzania (for a list of stakeholders see appendix 1).

3.5.1 Land, natural resources and environment committee

The committee is responsible for overseeing matters related to environment and natural resources including land. The committee is mandated to oversee the implementation of government policies related to issues of land, natural resource and environment. In particular the committee

oversee the performance of MDAs that are relevant to the biomass energy sector namely, MNRT, VPO-Environment, and the ministry of land, housing and human settlement. Being an important organ with influence on government policies, laws and regulations it is a resource that is better placed to engage with, in the promotion of biomass energy. The main concern of the committee is that given the current state of the charcoal sector in Tanzania it is impacting negatively on the environment. However, they also realize that charcoal and firewood are the main sources of energy and income for the people they are representing and hence at times feel that they are trapped between concerns for protecting the environment and concerns that the people they are representing have access to affordable energy sources and income generation. One of the important messages from the committee is that there is urgent need to promote sustainable charcoal production. It was acknowledged that even among themselves they have very little understanding on sustainable charcoal production and would like to see it being promoted because of the growing pressure on natural resources, especially land and forests. Being politicians, they would like to see tangible and immediate result that would complement and supplement their efforts of serving the communities and being assured of being re-elected.

3.5.2 Energy and minerals committee

This is the committee responsible overseeing and monitoring the performance of the government in issues related to minerals and energy. The committee is thus mandated to oversee the MEM its departments and agencies. Indeed, the biomass energy sector and charcoal directly falls under the mandates of this committee. The committee acknowledges that charcoal is the most important source of energy to many Tanzanians, however it also notes that given the long association of charcoal production and environmental degradation charcoal carries a negative connotation and it has been a challenge to promote the sector. It is noted that a lot of effort is now being put on gas and oil in terms of resources with very little into energy sources that are of high demand among many of the rural poor. Being politicians they feel that they have the obligation of ensuring that their voters have access to affordable energy sources and there was some level of skepticism that rural electrification will not solve the energy needs for cooking for the rural population given the high prices of electricity. This committee provides an important platform that the actors in the biomass energy sector and charcoal can utilize to induce the idea of having

a friendly charcoal production sector and consumption environment. They have influence on energy related issues; they are the right target to change the mindset of criminalizing the charcoal sector.

3.5.3 Finance, industry and trade committee

The committee is mandated to oversee the ministry of finance and the ministry of trade and industry which are among the influential stakeholders for biomass energy sector. The committee scrutinizes government proposals on the estimates of expenditure of each year; considers government bills related to its area of mandate; considers government proposals, follow up execution of and to deliberate on development progress of national projects and programmes; and evaluates the private sector projects in line with the national programmes. It is indeed a strategic partner for policy engagement. Since the committee oversees revenues, different policies on tax, it provides an important base for the biomass and charcoal intervention campaigns. One of the concerns raised during interviews with actors in the private sector who are investing in biomass energy and charcoal is the imposition of taxes and in particular the value added tax (VAT).

3.5.4 World Bank

The organization recognizes charcoal as an important source of energy for the majority of people in Tanzania and also sees charcoal as potential for economic growth. The fact that the majority of people in the country rely on charcoal as their main source of energy and that it is processed using traditional technologies, the organization acknowledges the effects the charcoal industry is causing on the environment. Therefore, it considers that great attention is needed to have a user friendly charcoal production as well as initiatives of seeing it as a formal and legal activity that improve the wellbeing of people. The Bank has over the years being actively engaged in the charcoal sector and has supported through funding research, policy dialogues among others. The Bank has demonstrated that it is a potential source of funding for the biomass energy sector especially charcoal. Similarly, it is a potential organization that can pull together influential partners with interest in the biomass energy sector. For instance its collaboration with Worldwide

Fund for Nature, Danish Government and Global Environment Facility shows only some of the other partners that can team up to boost the charcoal sector. In fact its initiatives aren't new in Tanzania. It has for decades supported the Tanzanian Government in the promotion and sustainable production of charcoal by targeting the communities especially the Forest Resources Management Project, Tanzania Social Action Fund. It also supports projects in regions of Tanzania that adopted the model of Participatory Forest Management. This model led to National Tanzania Forest Conservation and Management Project. It is also supporting organizations such as Arti-Tanzania who are pioneers of biomass energy sector and have demonstrated how the sector has potential of changing local community's wellbeing. One challenge raised by the World Bank is on the global trend where global debates aren't about charcoal and biomass anymore but extractive industries especially gas and oil.

3.5.5 United Nations Food Association Organization

This is another Multilateral United Nations Agency that supports adequate supply of fuel wood and charcoal in an agreed framework that is environmentally friendly. FAO recognizes the importance of biomass energy sector in national development. It envisages that the promotion of the biomass sector becomes a national agenda since it is a sector that has a lot of potential in changing the livelihoods of local communities especially the poor communities. The organization is providing technical and staff support to Forest and Beekeeping Division in the Ministry of Natural Resource and Tourism which has a lot of potential in bringing together important stakeholders in supporting the charcoal production in a sustainable manner. The organization has largely contributed for the establishment of the National Forestry Resources Monitoring and Assessment (NAFORMA). FAO developed a unique interest on ongoing debates on biofuels that could easily threaten the food security in poor communities. It sees a thin line and risk of biofuels if enough evidence and policies are not in place to protect the marginalized communities. As a result it is supporting studies on biofuels that provide possible solution and providing alternative solution energy sources that do not necessarily threaten food security. It sees a shift in global debates that have centered on biofuels and cautions these debates to center around agricultural practices that are ecologically friendly. The potentiality of the organization is seen through its agenda of investing in ecologically friendly agricultural practices, forestry and

fishing. Its investment and relationship with the Forest and Beekeeping Division which has representatives in all districts of Tanzania is a great resource to be utilized during interventions geared towards the promotion of biomass energy.

3.5.6 European Union

The European Union supports various projects ranging from preservation of forest, environmental management, integrated improved wood fuel services and climate change. What is common in these projects is that charcoal production is seen as a possible threat to the environment and hence deliberate efforts are needed to promote friendly charcoal production. The EU is a big potential funder for sustainable charcoal production and biomass energy sector in general. It supported the review of MKUKUTA with main focus on infrastructure and governance interventions. It also supported the Biomass Energy Strategy in Tanzania which brought together different partners. What is of particularly interest which can benefit the biomass energy sector is that EU works with other international agencies and has given these agencies and countries continue support in the biomass energy sector.

3.5.7 Swedish International Development Cooperation agency (Sida)

Sida has a long history of supporting Tanzania. Apart from supporting education, health and infrastructure, it has particularly targeted the hydropower projects over time. It has participated, funded and advised the government and local partners on biomass and biofuel projects. The development of solar PV and regulating frameworks for biofuel development is mainly facilitated by Sida. It is supporting large scale agricultural practices through the organizations such as EcoEnergy which is interested in sugar cane production. The organization supports studies on sustainable energy and market system in Tanzania. Thus renewable energy and energy efficiency has been a key area of interest over years. Organizations such as TaTEDO have benefited from its generosity where the rural energy became the primary focus of the organization. It is a potential agency for networking. Sida work with government, organizations and other international development partners thus provide an opportunity for networking and pulling other partners together. It highly supported financially the establishment and development of Rural Energy Agency and is supporting the Rural Energy Fund.

3.5.8 The Appropriate Rural Technology Institute (ARTI-Tanzania)

This is a registered NGO working on the promotion of sustainable technologies for energy production. ARTI works on identifying appropriate renewable energy technologies that will facilitate environmental protection as well as employment and income generating opportunities. The potential of ARTI in the biomass energy sector is mainly due to its vast experience working on the promotion of improved cooking stoves which use charcoal and firewood and the production of charcoal briquettes. ARTIs position is that charcoal does not necessarily have to come from trees, it can be made from agricultural waste or any other biomass. ARTI sees the potential in the production of charcoal briquettes given the basic and affordable technology used in production. However, they also note that if VAT is introduced on the briquettes it could threaten its production by increasing price beyond the reach of the poor. Another challenge that ARTI sees is the shifting priorities of donors and the government to issues of gas and oil. Although they acknowledge that the shift is positive they are concerned that realizing the benefits of gas and oil is not something that is likely to happen in the near future and hence biomass will continue being marginalized despite that fact that it is the main source of energy. Linking up with ARTI will be of significant importance given its main role in the promotion of improved cooking stoves and its capacity building and training component that it has over the years provided to Community based enterprises.

3.5.9 TaTEDO

This is a private enterprise committed to enabling the rural majority in Tanzania to access sustainable energy technologies. TaTEDO has over the years worked towards the promotion of sustainable energy through the use of renewable energy technologies. Its link to the biomass energy sector is mainly due to its promotion of efficient cooking stoves and charcoal production. TaTEDO has been very instrumental in capacity building of CSOs and entrepreneurs to effectively produce and market energy efficient technologies. One of the major limitations TaTEDO sees in its efforts in promoting energy efficient technologies is among other things the change of focus of donors who are now moving towards the promotion of oil and gas as energy sources and the low commitment of the government in the promotion of the biomass energy

sector. Lack of coordination of the biomass sector is noted as a threat in the promotion of biomass energy. They also see that general awareness of biomass energy is low posing as a challenge to the private sector who would be willing to engage in the sector.

..in terms of policy and strategy biomass energy is highly marginalized mainly because of low knowledge among the responsible policy makers and practitioners leading to wrong perception that it is a dirty energy and not friendly to the environment..(IDI- Official, TaTEDO).

..the biomass energy sector can lead to economic development if sustainably managed.. the problem is not charcoal but the way we manage the sector .. the potential is huge but untapped and undeveloped…to redress the situation we need coordinated policy, coordinated strategy and framework but there must be incentives for collaborative and coordinated efforts… .(IDI-Official, TaTEDO).

3.5.10 The Tanzania Forest Conservation Group (TFCG)

TFCG is one among the largest NGOs focusing on the conservation of natural forests in Tanzania. It has also been key in the implementation of REDD and has had a close working relationship with the government and other partners in the sector. It has over the years actively campaigned for improved forest management and reduced deforestation and is very optimistic that despite some few challenges the capacity of the districts to manage natural resources in areas with Community Based Forest Management has improved. TFCG has also been actively involved in the education and communication component of the UNDP/ GEF conservation and Management of the Eastern ARC project. TFCG is positive about the promotion of biomass but see the sector operating in an uncoordinated manner with multiple actors in the sector each promoting their own agenda (not talking to each other).

The future of the biomass sector is painted as positive especially if sustainable utilization of forestry is linked to income generation. To achieve this TFCG is proposing that communities should be empowered to benefit more from its natural resources as a way of giving them the incentive to be good managers of natural forest reserves. TFGC has a positive option of Community Forest Management initiatives going on in some part of the country as they are seen as benefitting their respective communities and hence calling for the scaling up into other areas.

TFCG are of the view that charcoal can be produced in a sustainable manner and there is need for more proactive efforts towards that direction given that charcoal will remain the main source of energy for many years to come.

3.5.11Tanzania Community Forest Conservation Network (MJUMITA)

MJUMITA is a well networked organization working with thousands of community members in villages across Tanzania. MJUMITA's vision is to see sustainable management and utilization of forests and forest products. MJUMITA has been actively engaged in REDD activities in partnership with TFCG and has vast experience in the biomass energy sector where it has been involved in the promotion and capacity building of sustainable charcoal production. On the basis of its experience working with local communities it identifies politicians as having a very important role to play in the promotion of sustainable charcoal production. It was explained that politicians are very supportive if there are efforts to merge the promotion of livelihoods within the biomass sector and the conservation of natural forestry. It also notes the importance of engaging districts actors in promoting biomass especially since they are important in setting the context. Media is also identified as an important stakeholder in biomass promotion especially given the limited understanding of the sector among community members and other important actors in the field. One of the major constraints seen to Community Based Forest Management is the presence and at time conflicting parallel structures in natural resource management village land and state land.

3.5.12 Research Institutions and Universities

The study also covered research institutions and universities targeting departments/ individuals who are directly or indirectly engaged with the biomass energy sector. Representatives from Mbeya University of Science and Technology (MUST) underlined the potentials of biomass energy sources available in the communities which have not been translated into reality so far. However, missing links between Universities and Industries was cited as one of the major hurdles for science to contribute in developing the biomass energy sector. According to them…*in Tanzania scientists are not valued by policy makers …so the only opportunity is for scientists to shows case their innovative potentials. One way and probably the most powerful way for*

scientists to show case their potentials in a language that is easily understood by policy makers is to strengthen links between universities and industries(IDI Researcher-MUST, Mbeya)

The above was also reiterated by a researcher from the center for sustainable development at Sokoine University of Agriculture (SUA). In particular, he stressed on the role of research in informing improved/efficient biomass energy technology, and how to actualize the potentials for biomass energy from diverse sources available in Tanzania. Another researcher from the University of Dar es Salaam pointed out that …*doing good research is one thing but the potential of research in Tanzania is often constrained by policies and politics…it's possible to make the biomass energy sustainable but honestly this requires a lot of collaborative efforts.*.(IDI: Researcher-COET, UDSM).

Scientists/researchers are also concerned with the basic question; what type of biomass energy source should be promoted in Tanzania? All scientists that were interviewed emphasized on the need for undertaking a thorough situational analysis addressing the fundamental dimensions.
…*we first of all need to undertake an assessment of potentials and needs as well as costs and benefit analysis...the latter should also take into account environmental and social contexts i.e. social and environmental assessment* (IDI: Researcher-SUA)

On the potential of biomass energy sector, researchers acknowledged that the sector has a lot to offer if managed in sustainable ways. For instance, a researcher with vast experience with the sector noted that: …*biomass energy sector is everything(…) it provides a wide range of employment opportunities from producers, transporters and traders as well as revenue for both local and central government…..The question however is to what extent will it be sustainable without being properly managed?*(IDI: Researcher-IRA, UDSM)

CHAPTER 4: DISCUSSION AND CONCLUDING REMARKS

Biomass remains the most important source of energy for more than 90% of the population in the country both in the rural and urban areas. It is anticipated that with population growth the percentage of the population depending on biomass is likely to increase. Despite the significant contribution of biomass to the energy sector it has overtime received little priority, low investment and is mainly managed in the informal sector with a large section of the biomass energy sector operating outside the law inhibiting the uptake of modern systems of production and consumption.

Overall, the results of this study show that there are a number of concerns/gaps that need to be addressed to enable a smooth promotion of demand for biomass and markets of biomass. The table below outlines key issues that would inform the communication strategy by targeting the different stakeholders as identified in the study.

Table 11: Summary of concerns/gaps and opportunities as identified by stakeholders

Stakeholder	Concerns/Gaps/ Opportunities
End users of biomass energy	- There are knowledge constraints of the different forms of biomass energy sources. The understanding of biomass energy sources is limited to charcoal and firewood. There is limited knowledge of biofuel, biogas and farm residues as sources of biomass energy that can cater for the household energy requirements - Despite the fact a significant part of the rural population are engaged in agriculture, they are limited attempts to take advantage of farm residues as alternative energy sources. - Perceive that the promotion of biomass energy will negatively affect the environment -See benefits of certifying charcoal production - See the possibilities of producing charcoal in a sustainable manner
Producers, transporters, wholesalers and retailers	- There are knowledge constraints of the different forms of biomass energy sources. The understanding of biomass energy sources is limited to charcoal and firewood. There is limited knowledge of biofuel, biogas and farm residues as sources of biomass energy that can cater for the household energy requirements - Concerns on the reliability of biomass energy - Concerns that biomass promotion will negatively affect the environment

	-Questions on the efficiency of biomass energy - Concerned about the market outlets for biofuel, biogas and farm residues as source of energy - There is limited knowledge of modern methods of charcoal production - Concerns on poor infrastructure -Lack of capital investment in the sector in terms of investing in modern production technology - Limited adoption of efficient charcoal producing technologies - The sector is characterized by bureaucracy and corruption. - High taxes -There is limited understanding on the role of the private sector and NGOs/CBOs in promoting biomass energy -Concerns on the quality of charcoal being produced. - Are not very sure of the advantages and opportunities available in the biomass energy sector - Limited appreciation of the economic value of charcoal and the other forms of biomass
State actors (ministry, regional, district, ward and village level)	- limited knowledge on the different forms of biomass energy (biogas, biofuel, farm residue) -negative labeling of biomass energy especially in the context of environmental destruction -Concerned with the poor technology in production - Concerns on the sustainability of the sector - Concerns on the conflicting guidelines and regulations - Perceive the sector as uncoordinated sector with too many actors -There is a limited understanding of the role that NGOs/CBOs and the private sector can play promoting the biomass energy sector - Concerned with the efficiency and reliability of biomass as a source of energy - Concerns on the under-developed market. -Are not very sure of the advantages and opportunities available in the biomass energy sector -Limited appreciation of the economic value of biomass

4.1 Approaching multiple stakeholders for a positive change in the biomass energy governance

The route towards coordinated biomass energy governance and accountability, economic development and the reduction of environmental impacts is not an easy one. This is in keeping with the fact there are multiple stakeholders with varied and often competing if not conflicting interests who are involved in the biomass energy sector in Tanzania. Indeed, as it is evident in

the above findings from different stakeholder that the structures and processes that shape the production, transportation, and consumption of biomass energy sources are inherent in a "complex and multi-layered institutional and regulatory context" (WB 2009: Malimbwi et al. 2009). As such, multiple stakeholders with different objectives (motives), interests and influences are involved in the governance of biomass energy sector (see also Sander et al. 2013).

Drawing on the KAP findings and review of previous studies as well as policy and regulatory frameworks governing the biomass energy sector, further analysis of stakeholders is undertaken in this section. The idea is to identify individuals and groups with ''interest'' in and ''influence'' over the biomass energy sector. This is pertinent in informing initiatives aiming at engaging coordinating and approaching different stakeholders in the efforts towards a biomass friendly energy sector on the one hand, and sustainable biomass energy sector in Tanzania on the other. In this analysis we are inspired by Reeds et al. (2009) who provides a sound overview of a typology of stakeholder analysis methods for natural resource management.

According to Reeds et al. (2009: 1938) one of the popular methods to stakeholder analysis of interest and influence is to classify stakeholders into four clusters namely: ''Key players"; ''Context setters''; ''Subjects'' and ''Crowd''.

- Key players: are stakeholders who should be actively groomed, because they have high interest in and influence over a particular phenomenon.
- Context setters: are highly influential stakeholders, but have little interest. For that matter, they may be a significant risk, and should be monitored and managed.
- Subjects: are stakeholders with high interest but low influence and although they are supportive, they lack the capacity for impact (but they may become influential by forming alliances with other stakeholders.
- The Crowd: are stakeholders who have little interest in or influence over desired outcomes and there is little need to consider them in much detail or to engage with them.

The analytical power of this method is that it helps to specify how stakeholders might be engaged, for example, for instrumental or strategic ends. Interestingly, the method accommodates temporal dynamics in real life of stakeholder engagement by acknowledging that "interest and influence typically change over time and the impact of such change can be considered". For example, stakeholders may form alliances to either promote or defeat a particular outcome and a stakeholder analysis can be used to identify where such alliances are likely to arise. In addition, the analysis can further be improved by adding more attributes to the stakeholders. Patterns in these attributes can then be considered in terms of the categorization factors. For example, stakeholders located in an interest and influence matrix could also be labeled as ''supportive'' or ''unsupportive''. This helps to determine whether there are any clusters of supportive or unsupportive stakeholders and if so, the implications considered in the context of interest and influence. Any number of stakeholder attributes can be included in this way and the resulting patterns examined and the implications assessed (Reed et al. 2009: 1938).

4.2 Interests and Influences of different stakeholders in the biomass energy sector in Tanzania

Both primary and secondary data presented in the previous chapters suggest that stakeholders in the biomass sector are "interested" actors striving to influence the sector in a manner that suits their aspirations. The degree of interest projected into the sector and the power of the stakeholders to influence the sector varies. Indeed, the findings of this study show that even the seemingly less or not influential actors such as those falling under the cluster of "subjects" may actually influence biomass energy policy or its practices at different levels. Nevertheless, for significant improvement of the biomass energy sector to happen, more influential stakeholders ought to engineer policy and institutional reforms in favor of the sector. What should change and how to lobby and advocate for change are among the issues to be underlined in this section. Since most stakeholders credibly believe that it is almost impossible to have a biomass friendly energy sector without creating enabling environment in terms of policy and institutional framework, it is important to consider engaging with some of the MDAs relevant to the sector as underlined below.

4.2.1 Ministry of Energy and Minerals

The Ministry of Energy and Minerals (MEM) is mandated to facilitate development of energy and mineral sectors in Tanzania. Under the current policy and institutional arrangement, MEM is perhaps the most critical and influential stakeholder in the promotion of the energy sector including biomass energy in Tanzania. This is precisely because, MEM is responsible for playing the government's role in the energy sector that is to facilitate development, provide stimulus for private investment initiatives, and promote effective regulation, monitoring, and coordination of the sector (World Bank 2009). Accordingly, MEM supervises implementation of the energy policy, which is the main guidance for change, backed by legislation and regulations as discussed in the previous chapter.

The mission of MEM is to set policies, strategies and laws for sustainability of energy and minerals resources to enhance growth and development of the economy. Specifically, the Mission for the energy sector is to create conditions for the provision of safe, reliable, efficient, cost-effective and environmentally appropriate energy services to all sectors on a sustainable basis. The energy sector falls under the energy division of the ministry with five sections namely; Petroleum section, Electricity section, New and Renewable energy section, Energy Development section, and Gas utilization section. The overall responsibilities for the aforementioned sections are;

- Formulating sector policy and strategy and implementing and monitoring programs in the areas of power, petroleum, new and renewable sources of energy subsectors, and energy efficiency
- Major energy procurement, development, resource allocation, and energy pricing policy formulation
- Coordinating energy sector development programs with other sectors and other countries in the region and beyond
- Supply and distribution of petroleum products
- Development, promotion, and dissemination of renewable energy technologies (RETs)
- Promotion of energy efficiency in all sectors of the economy.

As far as the biomass energy sector is concerned MEM is responsible for policy matters relating to the utilization of biomass energy, broadly speaking the "demand side" along with some aspects of production/supply side. Biomass falls under MEM's New and Renewable Energy Section, which is mandated to develop incentives in support of the government's two main policy objectives related to biomass energy, the first being to promote a switch away from biomass and the second being to support the development and dissemination of more efficient conversion and utilization technologies for producers and end-users. This testifies the level of interests that the ministry projects into the sector, and explains why biomass energy sector is largely marginalizes both in terms of favorable policy and resource allocation. The unpopular fact is reiterated by different actors (including state and non state actors) in the previous chapter of this report. Biomass and especially charcoal and firewood are not identified as renewable energy sources. Given the current focus on oil and gas, biomass is still perceived as a source of energy that is less developed and not sustainable. Although charcoal is mentioned in its policy document as an important source of energy there are no concrete plans to promote its production rather the trend has been moving away from charcoal.

MEM is also the key coordinator in the energy sector and has a close working relationship with other key ministry for example the ministry of natural resource and tourism. It is hence important that the ministry, especially the Renewable Energy Section is targeted as one of the influential partners in the promotion of the biomass energy sector.

Agencies falling under the energy division of the ministry who ought to be targeted in efforts to promote biomass energy services include TANESCO, EWURA and REA. Whereas, TANESCO is the main supplier of electricity in Tanzania, The Energy and Water Utilities Regulatory Authority (EWURA) issues licenses, formulates and enforces quality codes and standards, reviews and determines rates and charges, approves Power Purchase Agreements, ensures security of supply, energy efficiency, and promotes effective competition and economic efficiency. On the other hand, the Rural Energy Agency (REA) promotes investment in modern energy services specific to rural areas. It works in partnership with the private sector, NGOs, CBOs and government departments to: improve access to energy for rural Tanzanians through the development of rural energy sources, technologies and projects in social sectors; and promote

energy for productive use (such as agro-processing and industry) to accelerate rural economic development and associated benefits. REA manages a Rural Energy Fund financed by development partners including the Swedish and World Bank. The Fund is biased towards modern energy projects including mini-hydro projects and grid extensions but has also financed few biomass related projects. It is thus a potential stakeholder that can be groomed to promote the development of biomass energy sector.

4.2.2 Ministry of Natural Resources and Tourism

The Ministry of Natural Resources and Tourism (MNRT) of United Republic of Tanzania, is the ministry responsible for management of Natural, Cultural and Tourism resources. Since most of the solid biomass energy sources (woodfuels) in Tanzania come from the forest, the MNRT particularly the Forestry and Beekeeping Division (FBD) is responsible for overseeing and regulating the production, licensing and transport of woodfuels in the country. As such, the FBD is actually the lead government agency on the production or 'supply side' of biomass energy in Tanzania. As a division in the Ministry of Natural Resources and Tourism, TBD is responsible for the Sectoral Policy, Planning, Manpower, Research, Training, Statistics, Licensing and Quality control of Forestry and Beekeeping agents. Unlike the officials responsible for biomass energy in the MEM, FBD's staffs are decentralized to district level and its District Forest Officers (DFOs) report through a District Lands, Natural Resources and Environment Officer to their respective District Executive Director.

In terms of policy, Forestry and Beekeeping sector is guided by the National Forest and Beekeeping Policies adopted in March 1998, whose overall goals are to enhance the contribution of the forest and beekeeping sector to the sustainable development of Tanzania and the conservation and management of her natural resources for the benefit of present and future generations. Two agencies under the MNRT are very central to forest management and the biomass energy sector. One is the Tanzania Forest Fund, a Conservation Trust Fund established as a mechanism to provide long term reliable and sustainable financial support to forest conservation and Sustainable Forest Management (SFM) in the country. Tanzania Forest Service Agency (TFS) is the second agency that has been given the mandate for the management of

national forest reserves (natural and plantations), bee reserves and forest and bee resources on general lands. TFS as an Executive Agency is expected to enhance the management and conservation of forest and bee resources for sustainable supply of quality forest and bee products and services. The biomass sector especially the charcoal would benefit from its decentralized governance structure. The representatives in districts could be of great support to charcoal production initiatives. Thus, capitalizing on the promising tendency toward community based forest management (CBFM) is another entry point towards promoting sustainable biomass energy sector.

4.2.3 Vice President's Office, The Environment Division

The Environment Division was established in 1991 under the Ministry of Natural Resources and Tourism before it was transferred to the Vice President's Office in 1995. The idea was to elevate the division and give it the requisite priority and attention on promoting management environmental agenda. The Division of Environment is responsible for the overall environmental policy and regulation, formulation, coordination and monitoring of environment policy implementation in the country. Although the enforcement of policies and laws in regards to environmental management lies in Sector Ministries, and agencies such as National Environment Management Council (NEMC) and Local Government Authorities, the Environment Division is responsible for coordination of national and international matters related to environmental conservation and management. This is indeed a strategic stakeholder to engage with in efforts to promote a cross-cutting sector like biomass energy which has far reaching environmental implications if it is left uncoordinated. In terms of its structure, The Division is to be led by a Director and comprises of three Sections as follows: Environmental Natural Habitats Conservation, Environmental Management of Pollution and Environmental Impact Assessment

As potently argued in the Tanzania Best Scoping Study (2010) it is important to actively engage the environment division in promoting the biomass energy friendly agenda because by virtue of its position within the Vice President's Office, the environment division operates at a higher level as line ministries such as MEM and the Ministry of Natural Resources and Tourism

(MNRT). This provides an opportunity to capitalize on the division's well placed position to foster collaboration and linkages between government departments involved in energy, as well to ensure the participation of more powerful ministries and agencies such as MOF and PMO-RALG.

Equally important is the National Environmental Management Council (NEMC) another agency under the VPO but mandated to advise government on technical matters relating to effective environmental management; coordinate the technical activities of bodies concerned with environmental matters; enforce environmental regulations; assess, monitor and evaluate all activities that have an impact on the environment; disseminate information relating to the environment; and build capacity for effective environmental management. NEMC has in the past with funding from UNDP undertaken the promotion of energy saving stoves, friendly technologies and improved energy sources. NEMC is an important player in the biomass energy sector and its Directorates of Environment Communication and Information Outreach and Directorate of Research and Planning are of importance to the sector.

4.2.4 Ministry of Finance

The Ministry of Finance (MOF) manages the overall revenue, expenditure and financing of the Government of the United Republic of Tanzania and provides the Government with advice on the broad financial and economic affairs. MOF oversees budget preparation and execution hence can be instrumental in influencing financial aspects of promoting the sectors including increasing budget allocation taking into account the fact that only 2% of the finance for energy sector goes into biomass energy development. Equally important, the Ministry also formulates and manages revenue policies and legislation which include but are not limited to developing tax policy and legislation; managing Government borrowings on financial markets; determining expenditure allocations to different Government institutions; and transferring central grants to local government authorities.

Thus, the ministry has influence in regulating taxation systems that affects the biomass energy sector. For instance, the World Banks' Policy Note (2006) suggested that that the government of Tanzania fails to collect taxes of about US$100 million annually because of the illegal and

informal nature of the charcoal business in the country. Integrated efforts by multiple stakeholders including the MOF/TRA, and the PMO-RALG among others would benefit the sector. The ministry acknowledges that the charcoal sector is a very important sector in terms of its potential contribution to local revenue; however it notes that the complex nature of the sector is an obstacle towards the realization of the contribution of the charcoal sector. The MOF argues that it is open to policy discussions on the charcoal sector but these efforts need to be initiated by the MEM which is overall responsible for the energy sector. To realize this the MEM should bring together key stakeholders to harmonize the sector especially because it has many players with different interests. Among the strategic actors to engage with, in the ministry is the Division of Policy analysis under the commissioner of policy analysis. Equally important is the major agency in the ministry, that is the Tanzania Revenue Authority (TRA). If these actors see the economic potentials of the biomass sector and how such potentials can be actualized, then the charcoal sector can contribute significantly to local revenue.

4.2.5 The Prime Minister's Office –Regional Administration and Local Government (PMO-RALG)

PMO-RALG is responsible for coordinating the regional secretariats and LGAs (both urban and rural). It is also the bridge between LGAs and sectoral interests represented through line ministries at national level. In the context of biomass energy sector for example, district councils are responsible for the collection of royalties and license fees for the harvesting of forest products, including commercially-traded woodfuels, as well as identifying areas where these products can be harvested. Since the adoption of the Local Government Act (1982) forestry officers have been decentralized and are answerable to the district executive directors. The forest officers placed in each of the districts are tasked to providing backstopping and technical expertise to the district administration in order to ensure sustainable utilization of natural forests and environmental conservation and protection. Within the decentralization framework:

- LGAs are permitted to retain 5% of the value of woodfuels in the form of a district "cess" (a local government tax). This is a small percentage but in some districts represents an important contribution to council budgets, particularly so because these funds are

discretionary and not earmarked to specific sectors. As such revenue collection constitute one of the core interests for LGAs towards the biomass energy sector

- District Harvesting Committees (DHCs) are mandated by the Ministry of Natural Resource and Tourism to identify areas suitable for harvesting of forest products and, on this basis, to issue licenses. These committees are chaired by the District Commissioner and the DFO acts as secretary.
- Taking into account the important role of LGAs in the collection of revenues from licenses, royalties, levies and taxes from the sale and transport of forest products, LGAs constitute influential stakeholders in the biomass energy sector.
    - Among the key or strategic divisions to work with include the Sector Co-ordination Unit which is responsible for coordinating the PMO-RALG critical interfaces with Ministries, development partners, RS and LGAs.
    - Others include Local Government Finance Section: This section facilitates budget processes and implementation in the LGAs; tracking disbursement of funds to LGAs in liaison with the Ministry of Finance; and facilitate development of revenue enhancement plans for LGAs monitor their implementation and negotiate with Ministry responsible for Finance on revenue sources for LGAs. Policy and Planning division which provide expertise and services in policy formulation, implementation, monitoring and evaluation. In particular, the division coordinates preparation of ministerial policies and monitors their implementation and carry out their impact assessments. In specific terms, there is a policy section that is mandated to implement and monitor PMO-RALG's policies and their consistency with national policies, frameworks and strategies.

4.2.6 Ministry of Trade and Industry

The ministry's core mandate is promote Trade and industry in the country. Availability of affordable energy is central catalyst for SMEs and industrial production. The current National Trade policy addresses issues of energy under the theme of Infrastructure development. Accordingly, the ministry of Trade and Industry have shown greater interest in promoting environmental friendly technologies including improved biomass energy production and

utilization. In carrying out its mandate, the Ministry of Industry and Trade have a number of functions which include the following:

- Formulation, coordination, implementation and review of policies and strategies for the industry, trade, marketing development and Promotion of SMEs
- Monitoring and evaluation of performance of industry, trade, marketing and SME sectors, industry and trade support institutions
- Awareness creation and promotion of environmental friendly technologies
- Collection, analysis and dissemination of industry, trade, marketing and SME information and creation of industry, trade, marketing and SME databases
- Promotion of domestic and foreign investment, promotion of business support services and value addition and post
  harvest management for enhancing public-private competitiveness in the industry, trade, marketing and SME sectors
- Facilitation of industry, trade, marketing and SME related infrastructure
- Facilitation of Research for Industrial development

In the context of biomass energy sector, some of the agencies under the ministry have a direct relevance to biomass energy promotion and development. For instance, the Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) have been developing and disseminating improved technologies for agricultural and rural development. The technologies have included energy-efficient wood stoves and biogas systems for domestic and institutional use. In collaboration with multiple stakeholders such as (SNV) and MEM, CAMARTEC is currently implementing the Tanzania Domestic Biogas Programme under the African Biogas Partnership Programme. It also promotes the use of briquettes in agricultural processing industries and has encouraged investments in briquettes making using saw dust in the southern regions. Interviews with the ministry officials revealed the ministry's emphasis on the fact that Industries need reliable sources of energy and should not be dependent on limited sources. Other agencies under the ministry of trade and industry include: TRIDO; TEMDO; SIDO; NDC; and TBS among others.

For a summary of influence and interest of the above MDAs and other stakeholder categories refer table 12 below and Appendix 1.

Table 12: Summary findings of stakeholders'' interest and influence levels towards the biomass energy sector

Cluster of stakeholders	*Stakeholders*	*Interest*	*Influence*	*Remarks*
Key Players	Politicians	High	High	✓ Biomass as political capital i.e. used by majority of voters ✓ Politician are at the same time decision makers i.e. can influence policy and practice
	Prime Minister's Office Regional &Local Government	High	High	✓ Biomass as source of revenue (formal & informal channels) ✓ Involved in both forest management and regulation ✓ Have wider scope for promoting the sector if sensitized ✓ Implement most of the biomass energy related policies and enforce respective regulation
	Ministry of Finance	High	High	✓ Biomass energy as source of revenue (collection from the 1 billion USD generated from the sector per year) ✓ Tax collected from growing private sector dealing with biomass energy technology ✓ Can provide policy incentive for biomass energy sector e.g tax policy friendly to the sector ✓ Can influence government other ministries and agencies to allocate adequate resources for biomass energy sector development
	Ministry of Trade and Industry	High	Low	✓ Biomass energy for growth of SMEs and local industries ✓ Promoting environmental friendly technologies ✓ Biomass energy research and technology ✓ Have limited (indirect) mandate to influence policy on either demand or supply side of the biomass energy sector
Context setters	Ministry of Energy and Minerals	Low	High	✓ promote a switch away from biomass (traditional) to modern energy sources ✓ envision increased efficiency in the production and utilization of biomass energy ✓ Determines energy policy direction ✓ Determines resource allocation to the biomass energy services (less than 1% of the annual energy development

				budget of the Ministry) ✓ Controls the demand and utilization of biomass energy sector
	Ministry of Natural Resource and Tourism	Low	High	✓ Sustainable utilization of forest resources ✓ Allows for community based forest management (CBFM) ✓ Overseeing and regulating the production and trade of woodfuels ✓ Attributes deforestation to solid biomass energy sector
	Vice President's Office, Environment	Low	High	✓ Clout to promote coordinated environmentally friendly biomass energy sector
	Donor community	High+ Low	High	✓ Heavily promote both modern energy ✓ Increasingly investing in the biomass energy sector ✓ Promote environmentally friendly efficient biomass technology ✓ Support research and disseminate knowledge on the opportunities and challenges of biomass and other renewable energy in Tanzania ✓ Can shape policy direction through change in funding priorities in favour of biomass energy sector
Subjects	Producers	High	Low	✓ Employment, income and livelihood ✓ Investment opportunity with a readily market (high demand especially charcoal) ✓ Limited room to influence practice but not policy
	Transporters	High	Low	✓ Employment, income and livelihood ✓ Limited room to influence practice but not policy
	Traders (retailers& Wholesalers)	High	Low	✓ Employment, income and livelihood ✓ High demand i.e readily available market ✓ Limited room to influence practice but not policy
	End users	High	Low	✓ Accessible, reliable, and affordable energy source ✓ Limited room to influence practice but not policy
	Private sector	High	Low	✓ Investment opportunity including improved biomass energy technologies ✓ Limited policy incentive e.g high tax for imported raw materials ✓ Promote biomass energy technology

	Researchers	High	Low	✓ Mismatch between policy and practice ✓ To inform biomass policy direction and practice ✓ To improve biomass energy technology ✓ Lobby and advocate for biomass friendly energy sector but with minimal influence on policy
	NGOs	High	Low	✓ Sustainable biomass energy sector for sustainable community livelihood and development ✓ Conducive policy and institutional environment for biomass energy services ✓ Capture funding from funders interested in the sector ✓ Promotion of biomass energy technology ✓ Potential to influence policy if they mobilize efforts with other stakeholders

These findings are not new because previous analysis of stakeholders in the biomass sector especially charcoal in Tanzania have highlighted the importance of policy and institutional reforms along with other changes in the sector (see for example, Malibwi et al. 2007, World Bank 2009, Sander et al. 2013). Yet still, discussions about the factors accounting for limited success in promoting the biomass energy sector in Tanzania are rife with controversy. Some spectators attribute the situation to the complexity and informality of the sector; the absence of feasible and affordable alternative energy sources, and limited or lack of political will (World Bank 2009). Others situate the standstill of the biomass energy sector in the nature of the existing relationships and influences between a constellation of actors and institutions playing different roles in the sector (Sander et al. 2013). However, findings of the presented study are in favor of a holistic view, one that accommodate the aforementioned perspectives. Apparently, it is hard to comprehend the knowledge, attitude and perceptions of different stakeholders with regards to the biomass energy sector without situating the respective actors in the institutional contexts, that is, how they interact or engage with various institutions. Equally, the experiences of the stakeholders as individuals and groups shape their knowledge, attitudes and perceptions as well as practices relevant to the biomass energy sector. There are a few observations from both quantitative and qualitative findings worthy noting in terms of how best to approach different stakeholders in the sector.

First, there is a serious outcry from state actors at all level for the need to streamline the policy and institutional framework for biomass energy sector. This is in respect to fact that the mandate for managing the sector cuts across several institutions both in the central and local government. The mentioned institutions are charged with obligations of policy, law and regulation making, implementation and enforcement.

- ✓ To be able to effectively mainstream biomass energy, some of the stakeholders called for harmonization of all relevant policy, legal and regulatory instruments.
- ✓ Others went as far as demanding for the establishment of the national biomass energy policy and agency responsible for biomass energy promotion and development

- ✓ There is also opportunities to lobby and advocate in favor of the biomass energy sector in the ongoing review of the current National Energy Policy.
- ✓ The sector can also capitalize on the increasing tendency of the energy sector to lean towards natural gas, and renewable energy sources including biofuel, biogas, and other forms of biomass energy

Second, there are a number of best practices from collaborative initiatives between multiple stakeholders in promoting sustainable biomass energy technology in Tanzania. These include but are not limited to projects and programmes focusing on sustainable charcoal, improved stoves, biogas, LPG, and biomass briquettes. The successes stories from these projects ought to be taken as opportunities and evidence to advocate for the promotion of biomass energy sources and the sector at large. Apparently, such best practices can be used as tools for raising awareness, educating and challenging negative attitudes and perceptions towards biomass energy sources.

The third observation is related to the above but it is concerned with the value of investing in science and technology for biomass energy. From the perspectives of both state and non state actors at the national and regional level, this was singled out as another potential to promote biomass energy by providing evidence for advocacy. Indeed, the fundamental role of research towards promoting sustainable biomass energy technology is underlined in the National Energy Policy of 2003. However, missing links between Universities and Industries was cited as one of the major hurdles for science to contribute in developing the biomass energy sector. The link should be strengthened in order to provide space for scientists to show case their innovative potentials in a language that is easily understood by policy makers.

Fourth is the fundamental question on what kind of biomass energy source and technology to be promoted. Some of the biomass energy sources such as charcoal and firewood are heavily contested than other. While most state actors agree on the promotion of biogas, LPG, briquettes, improved stoves, the same are contested by the end users on different grounds.

Fifth is the question of sustainability whereas some actors (both state and non state) believe in the possibility of making charcoal sector sustainable, many others don't see the value in promoting charcoal especially because of its environmental costs. Instead such actors call for the promotion of other forms of biomass energy sources. By and large, there is still lack of interest and motivation among some influential actors to promote biomass energy and use improved biomass energy technology.

4.3 Conflicting and complementary interests of different actors in the biomass energy sector

It is important to note that there are both conflicting and complementary interests within and across the categories of actors with a stake in the biomass energy sector. This is also reflected in their knowledge, attitude and perceptions towards the sector. Strategic engagement with different stakeholders with a view of promoting biomass energy sector would require paying attention on competing interests so that they are carefully monitored and managed while at the same time exploiting the common grounds. In what follows we highlight but a few common and competing interests.

Complementary interests

- Need to address adverse environmental impact caused by biomass production and utilization practices. Though with varied emphasis, it is in the interest of most stakeholders to see that biomass energy production and utilization does not jeopardize environmental sustainability. When it comes to the way through which the aforementioned desire can be achieved different stakeholders had different views. For instance, some of the influential stakeholders from both the demand and supply sides of biomass energy sector negatively perceive biomass energy on environmental grounds. However stakeholders who support the sector argue that the biomass energy is not a problem in its own right but how it is managed and by extension it is possible to produce and utilize biomass energy in a manner that is friendly to the environment.
- Linked to the above is the need to improve biomass energy technology in order to ensure efficiency both in its production and consumption. Whether a stakeholder believes in

reducing or promoting the use of biomass energy is not important in this regard but the common interest is to attain energy efficiency.

- Harmonization of policy, regulations and institutional framework is also desired by most stakeholders taking into account that issues pertinent to the sector cuts across the mandates of MDAs and LGAs. Overlapping and competing structures affect many stakeholders in one way or the other.
- Contribution to national growth, improved livelihood and living conditions are among the shared commitments even though approached differently by the stakeholders. Both proponents and opponents of the biomass energy sector strive towards improving some dimensions essential for economic and social development.

Conflicting interests

- Whereas there are many stakeholders promoting the actualization of the potentials of biomass energy sector, some influential stakeholders strive towards undermining the same as traditional and environmentally unsound. For instance, while stakeholders in the supply side of the sector envisages increased productivity in many respects (see National Forest Policy 2002 and Forest Regulation 2004), those who control the demand side push to significantly reduce utilization of biomass energy (see National Energy Policy 2003 and MKUKUTA II). This is grounded in the negative perception that biomass energy has little to contribute to the envisaged modern and industrialized Tanzania.
- Efforts from some stakeholders who want to formalize the charcoal sector threaten interests of stakeholders who have been benefiting from the informal nature of the sector. This often gets complicated when such actors are backed up by political connections that enable them to increase their profits through fees and tax evasion.
- The distribution of revenue collected from biomass energy sector is another source of tension between stakeholders in the sector. For instance, there are complaints from the district councils about revenues (cess) that they are meant to receive back from the treasury. Equally, with CBFM some actors at the district councils consider the changes to have diverted revenues from the district to the villages.

- Whereas some stakeholders who support the promotion of biomass energy sector put more emphasis on the benefits offered by the sector, others are concerned with both taping the potentials and conserving forests.

From the above observations and building on the knowledge, attitudes and perceptions of stakeholders in the biomass energy sector, there are either common grounds or spheres of convergence and contested grounds or spheres of divergence. Understanding how to capitalize on the common grounds and minimizing the divergence zone is critical to the development of the communication strategy for the biomass energy sector. How to engage them/approaching /coordinating actors with different degree of interests and influence in various dimensions of biomass energy sectors is a subject at the core of the mandate 3 assignment. Nevertheless, the latter would need to consider the following tips;

- Understanding the core interest and motivation of the respective actors
- Using the right channel
- Evidence based/show case
- Mainstreaming biomass energy in key policy articulation
- Harmonization meetings/sessions-space for actors to negotiate
- Managing expectations
- Building trust among stakeholders
- Creating incentives and addressing disincentives for promoting sustainable biomass energy sector
- Raising public awareness of the various benefits (environmental, social, and economic) of biomass energy sources.

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Appendix 1: Potentials and engagement of different stakeholders in the biomass energy sector

Stakeholder	Issues/interest in the biomass energy
Donors/ Development partners	
World Bank	• Economic potentials of the biomass sector and believes that it is possible to have sustainable charcoal sector • It has over time supported charcoal related studies, policy briefs and organizations that support or produce different forms of biomass
United Nations Development Programme	• It supports energy and environment programme activities • It is key in promoting sustainable use of woodfuels by supporting energy-saving stoves and improved technology • It has influenced the integration of the environmental concern into different government's plans and policies
EU	• They support the production, promotion and sustainably produced charcoal and briquettes • Support the government in the development of the biomass energy strategy and action plan
Finland	• Potential partner in biomass • Has long interest and experience especially in natural forest reserve and bee keeping • Particularly interested in plantation development and timber harvesting
WWF	• Has supported networking and sharing of information between and among partners with interest in the biomass sector • Supports the creation of different forums that stimulate dialogue, share information and collective input into Bioenergy policy processes. • Supported the establishment of the Bioenergy NGO Platform (BNP) in 2009.
DFID	• Has been collaborating with the government and other development partners including the NGOs and civil society organizations through funding or advice • Potential supporter for research institutions and organizations that focus on training in biomass sector
SDC	• Support the promotion of charcoal and work with different implementing and research partners • Playing a key role in transforming the charcoal sector in the country

SNV	• Support the biomass sector and the production of the sustainable and user friendly charcoal • Interested in the charcoal value chains and alternative technologies particularly the improved cookstoves • Supports organizations that develop biogas
GTZ	• Support the biogas sector and has been supporting the BEST process • Potential partners to support and network with organizations they work with within the energy sector • It pushes for renewable and sustainable energy agenda especially the improved technology
NORAD-Norway	• Potential supporter and has been supporting alternative energy and utilization of the improved cook stoves • Supports research institutions and organizations that have vested interest in the biomass sector • Supports government initiatives in producing sustainable charcoal
USAID	• Support the charcoal sector and establishment and improvement of various policies on biomass • Also interested in the preservation and a sustainable production of the wood fuel
Sida	• Supported the renewable energy sector in Tanzania for decades • Supports and promotes solar PV and frameworks for biofuel development • It has supported REA and in particular the Rural Energy Fund
Government ministries and agencies	
Forest and Bee Keeping Division (FBD) in the Ministry of Natural Resource and Tourism (MNRT)	• Primary policy lead at the national level • Issue policy guidelines, and regulations on the use and management of forest, and forest or produces • Managing charcoal transportation and trade
Division of Environment -VPO office	• Oversee and coordinate other line of ministries to observe environmental protection • Enforce requirements for protecting the environment such as conducting environmental and social impact assessment
Ministry of Energy and Minerals (MEM)	• Primary policy lead on energy use especially biomass • Has the potential to link and bring partners together
Ministry of Finance	• Oversees the management of revenue, expenditure and financing of the government activities • Potential in promoting charcoal production as an important source of revenue for the government and the formalization of

	the charcoal sector • Key in reinforcing the reinvestment in natural resources by ensuring remittance to districts from revenues collected
The Prime Minister's Office – Regional Administration and Local Government (PMO-RALG)	• Implementing biomass related policies and enforcing relevant by laws and laws on the ground through regional, districts , wards and village offices • Potential agent in reinvesting the revenues from charcoal
Ministry of Lands and Human Settlement Development	• It coordinates and regulates land tenure in both urban and rural areas • The department of Land Use Planning Commission is responsible in support land use planning at all levels including the villages where raw materials for charcoal production is found
National Environmental Management Council (NEMC)Vice President's Office, Environment	• Potential partner in brining the charcoal policies into environmental management • Oversees the enforcement of policies, laws and bylaws and other regulations related to environmental management • Potential partner to monitor and coordinate the environment friendly charcoal production technologies
Ministry of Trade and Industry	• Potential for boosting industries that develop technologies related to user friendly charcoal • Supervises industries and research institutions that focus on the areas of industry and trade thus potential to support improved technology for the production of charcoal
COSTECH	• Potential government agent that can coordinate and promote biomass and charcoal production • Potential in supporting the development and use of technology • Can advice the government to have full support in terms of resources, policies and plans that are pro-biomass and charcoal
CAMARTEC	• Responsible in developing and disseminating improved technologies for biogas • Develops energy efficient, wood stoves and biogas systems for domestic and institutional use
SIDO	• Important agent in developing small and medium industries • Potential to develop policies that favour the charcoal production • Potential in linking and networking actors with interest in charcoal and biomass through its branches in all regions in the country

	• Research, support and provide advice on sustainable charcoal production, briquettes and biogas in general
Key Parliamentary Committees	
Local government parliamentary committee	• The committee supervises and monitors the performance of the local government thus is knowledgeable and can influence the promotion of the sector and integration of the sustainably produced charcoal and improved technology into parliamentary agenda • The chair of the committee, Mohamed Rajab Mbarouk is a potential active member • Others include Maige Ezekiel Magolyo, Majaliwa Kassim Majaliwa
Land, Natural Resources and Environment parliamentary committee	• Has a potential influence in the Biomass sector and the management of natural resource • Members of Parliament such as Hon.Lembeli James Daudi who is the chair and Myika John John, Bulaya Easter Amos and Laizer Michael Lekule can be targeted
Minerals and energy parliamentary committee	• The committee oversee the performance of the government in the sectors of mineral and energy • The chair is, Mwambalaswa Victor Kilasile and other active members who can be targeted such as Malecela Anne Kilango
Economic affairs, industries and trade parliamentary committee	• This is another committee that can facilitate the promotion of the biomass and charcoal sector • It has active members such as Mbowe Freeman Aikael, Kamata Vicki Paschal, Kafulila David Zacharia, Kigoda Abdallah Omar
Private entrepreneurs and NGOs	
MJUMITA	• Provides the platform or voice for the community level forest managers implementing PFM approaches • It is the potential for lobbying and advocacy and has a network of members who are already producing and consuming sustainable made charcoal
TFCG	• In partnership with MJUMITA are implementing sustainable production of charcoal • Supports sustainable management of biodiversity through environmental education • Has experience in dealing with commercially viable charcoal value chains projects • Potential in networking, lobbying and advocacy for improved

	technology and sustainably produced charcoal
ARTI Energy	• Very active in promoting and developing improved charcoal technology • Conducted pilot projects on improved charcoal production • Potential partner who can link other partners with the government as they have a good relationship with actors within the government • Has experience of working with international organizations such as the World Bank and EEP • Are knowledgeable and have experience of establishing community based enterprises that deals with sustainable charcoal production
East Africa Briquettes Company	• Experience in producing fuel briquettes from urban charcoal waste and carbonized biomass
Green Resource AS	• Active in the biomass sector and has been promoting new technology of generating energy using wood waste
TaTEDO	• Oldest NGOin biomass energy • Has vast experience in the promotion of ceramic lined charcoal stoves, efficient charcoal kilns and capacity building • Has the potential of networking different actors in the sector as they have worked with different local and international partners
Cleaner Production Centre of Tanzania	• Is an established organization by the support of UNIDO under the Vice President's officer • It serve as the executive secretariat for the African Roundtable on Sustainable Consumption and production • It is a potential organization for networking as well as coordination of the sector
Research Institutions and Universities	
SUA	• Potential experienced research institution in the biomass sector • Have researched and worked with different local and international partners on conservation of the forest, bee keeping • Have been supporting the production of charcoal especially the improved technology
COET,UDSM	• Support research on charcoal and biogas sector • Support research and knowledge on briquettes • Work with different research organization and implementing partners

IRA,UDSM	• Research and provide advice on charcoal sector and production • Potential to assess the capacity of the organizations implementing biomass sector and charcoal
MUST	• Research on charcoal and biogas • Research on the improved technology
VETA	• Research and produce improved technology for charcoal and other biomass energy sources

Appendix 2: Baselines for the indicators of the logframe of component 2

Theme	Baseline indictors
Knowledge	- Limited knowledge of the potential of charcoal to the contribution of the country's GDP - Understanding of biomass is limited to mainly charcoal and firewood - Limited understanding that charcoal energy can be a renewable energy source - Charcoal production is seen as the main source of deforestation - Limited understanding of the charcoal value chain among policy makers, government officials and producers - Energy is being equated with electricity - Limited knowledge of improved energy saving stoves - Limited understanding of the potential of the private sector in the promotion and marketing of charcoal - Limited understanding of the sustainability of charcoal production - Limited knowledge among producers of charcoal on the use of efficient charcoal production techniques - Limited understanding of the concept of improved charcoal - Significant levels of awareness, of laws and legislations governing the biomass energy sector among private sector actors
Attitudes	- Strong attitude that investment in gas and electricity will reduce the charcoal consumption - Strong attitude that promoting charcoal production will negatively impact the environment - Charcoal use indicate backwardness - Perception that charcoal certification will reduce illegal forest harvest - Some level of expectation that proper management of charcoal value chain can lead to sustainability of charcoal production - Limited promotion of the biomass energy sector - Charcoal is highly perceived as an important source of energy - Moderate perception of charcoal as an efficient source of energy for cooking and heating when compared to electricity/gas
Practices	- Low promotion of energy efficiency technology - Low use of energy efficiency technology - Slow transition from traditional charcoal production to more efficient kilns technology - Limited participatory forest management practices - Limited number of households are using improved stoves - Biomass energy sector is highly characterized by poor technology
Governance	- Limited implementation of sound forest management practices - Regulations/policies based on limited understanding of sustainability of biomass - Ineffective implementation of regulation governing charcoal production - Low financial incentives for local actors to effectively monitor and enforce regulations

	- Weak institutional frameworks to support charcoal production - Significant tax evasion in charcoal trade - Charcoal production and trade largely uncontrolled and unrecorded - Lack of regulations enforcing use of accepted an efficient kiln technologies - Limited capacity of local actors on the supply side to manage and oversee charcoal production sustainably - High criminalization of activities along the charcoal value chain - The charcoal sector is not formalized - Limited promotion for the recognition of charcoal as an important source of revenue - Limited reinvestment of the revenue from charcoal to the forest management - Weak charcoal production tracking system and record keeping mechanism
Coordination	- Poor coordination of key actors in the biomass sector - Insufficient consultation with key stakeholders - Few charcoal producer's associations limiting investment (in improved charcoal producing techniques) - No formal institution on ground governing the charcoal sector (manage charcoal production and marketing) - Limited engagement of the private sector in biomass sector
Technology and investment	- Low investment to improve energy efficiency of charcoal production - Limited engagement of professional SMEs dealing with charcoal production and marketing - Limited investment in forest management practices - Limited promotion on the use of improved stoves among main consumers who are the urban dwellers
Opportunities/best practices	- Acknowledgement of the importance of biomass energy to economies and livelihood of majority population - Growing interests in promoting Community Based Forest Management (CBFM) as an opportunity to show case and scale up sustainable charcoal production - Complementary interests among influential stakeholders - Ongoing dialogue related to biomass energy at various levels as triggered by the processes to develop the BEST, National Energy Policy review, climate change etc - Institutional change and initiatives that touches on the biomass sector like introduction of the National Charcoal task force/national charcoal steering committee (NCSC) - Growing interests on biomass energy related aspects by CSOs as well as selected actors from the public and private sector - Collaboration between multiple stakeholders in biomass energy related projects/programs - Indicative desire for collaborative efforts such as joint meetings between MDAs with a stake in the biomass energy sector - Media and social media as a window to promote biomass energy related

	technology, products and agenda - Learning from previous successful policy engagement in other sectors (taping the readiness of political leaders such as MPs to engage through organizing briefings with relevant committees)

Appendix 3: List of People Consulted/ Contacted

	Name	Position	Organization
1.	Bettie Luwuge	Communication Officer	Tanzania Forest Conservation Group
2.	Carlos Mbuta	Principal Environmental Management Officer	National Environment Management Council
3.	Elida Fundi	Advocacy Officer	MJUMITA
4.	Eng. Deodatus Ndunguru	Assistant Director Support and Promotion Section	Ministry of Industry, Trade and Marketing
5.	William Nambiza	Program Officer, Natural Resource and Inclusive Growth	Embassy of Finland
6.	Mikko Leppanen	Counsellor, Natural Resources	Embassy of Finland
7.	Mkoma Masanyuwa	Forestry Officer	Ministry of Energy and Minerals (Renewable Energy Section)
8.	Monica Kagya	CEO	Tanzania Forestry Service
9.	Sebastian Malisa	District Forest Officer	Kilosa District Council
10.	William Mhoja	Senior Economist -Tax Policy	Ministry of Finance
11.	Matias Lema	Manager- Training and Research	Ministry of Natural Resource and Tourism
12.	Charles Ng'atigwa	Publicity and Extension Officer	Ministry of Natural Resource and Tourism
13.	Alvera Ndabagoye	Senior Tax Payer Services	Tanzania Revenue Authority
14.	Fredrik Berglien Werring	Consultant- Energy	Norwegian Embassy
15.	Abasi Musa	Coordinator Energy and Environment Partnership	Ministry of Energy
16.	Joshua Nasari	Member of Parliament	Arumeru

17.	Andrew Mzava	Senior Research Officer	COSTECH
18.	Charles Leonard	Project staff	TFCG- Morogoro
19.	Nachiket Potnis	Executive Director	ARTI
20.	Manon Lelievre	Program Officer	ARTI
21.	John Mnyika	Member of Parliament	Ubungo
22.	Estumih Sawe	Executive Director	TaTEDO
23.	Dr. Godwin Lema	Researcher	University of Dar es Salaam
24.	Dr. Oportuna Kweka	Researcher	IRA- University of Dar es Salaam
25.	Waziri Mkumbwa	Natural Resource Officer	Kisarawe District - Coast Region
26.	Thobias Massare	Official	Tanesco - Kisarawe
27.	Wanchoke Chinchibera	Community Development Officer	Kisarawe District- Coast Region
28.	Joseph Butuyuyu	Natural Resource Officer	Mbeya Region
29.	Jumanne Njogoya	Natural Resource Officer	Momba District- Mbeya Region
30.	F. Kaombwe	Natural Resource Officer	Mwanza
31.	Mr. Masese	Natural Resource Officer	Urambo District- Tabora Region
32.	Mr. J. Chuwa	Natural Resource Officer	Morogoro Region
33.	Sima	Forestry Officer	Sengerema District
34.	Felician Mcheye	Program Officer	Telecenter NGO- Sengerema
35.	Mr. Mkilindi	Forestry Officer	Mwanza
36.	Mr. Mwinyi	Program Officer	Nyasa NGO- Mbeya
37.	Emmanuel Bihogora	Village executive Officer	Nsenda Village -Tabora
38.	Martha Corol	Village Executive	Mtakuja-Urambo-Tabora

		Officer	
39.	Zebeda Mwesiga	Village Chairperson	Kyitundu -Urambo
40.	Maila Lubona	Village Executive Officer	Sengerema
41.	Yusuph Ngwebeya	Village Executive Officer	Sina- Sengerema
42.	Francis Kaponya	Ward Executive Officer	Urambo Tabora
43.	Asma Lukonge	Ward Executive Officer	Nyitundu -Sengerema
44.	Barbara Shibugulu	Village Chairperson	Nyitundu - Sengerema
45.	Enock Lufunga	Village Chairperson	Ishoshango'lo- Sengerema
46.	Sauli Kamanga	Ward Executive Officer	Ndalambo- Mbeya
47.	Framson Mwasalindi	Ward Executive Officer	Chiwezi- Mbeya
48.	Elias Mkupa	Village Executive Officer	Kapele Village-Momba District
49.	Ms. Paulina	Village Executive Officer	Chiwezi Village- Momba District
50.	Mohamed Mchalango	Village Executive Officer	Kurui Village- Kisarawe
51.	Iddy Pakacha	Village Executive Officer	Chole Village- Kisarawe
52.	Sultan Wambo	Village Chairperson	Chole Village- Kisarawe
53.	Ramadhani Mungi	Village Chairperson	Kurui Village- Kisarawe

FGD 1- Kisanga Village -Kilosa District (Morogoro)

1. Given Schone
2. Hoboka Mbembele
3. Paulo Mudolo
4. Halamsi Kombe
5. Zaksi Siano
6. Supas Kapizye
7. Michael Siamu

8. David Mkenda
9. Given Sichakwe

FGD 2 - Ihombwe Village - Kilosa District (Morogoro)

1. Hamisi R. Nyamabyaki
2. Emasi Makanda
3. Philimuni Robert
4. Abdul Risasi
5. Amina Bwenyega
6. Antony Masheli

FGD 3 - Ndalambo Village - Momba District (Mbeya)

1. Salum Saimon
2. Ally Abdalh
3. Proches Mishiro
4. Hatibu Kakama
5. Mkwele Dumte
6. Kilian Eliasi
7. Joseph Swila
8. Abdallah Mrisho
9. Amos James
10. Ramadhani Said

FDG 4 - Chiwezi Village - Momba District (Mbeya)

1. Dorothea Nakamba
2. Yoweli Siame
3. Keneth Sinkala
4. Sesitoni Haonga
5. Alam Sikombe
6. Awawia Siame
7. Joseph Sikaponda

FGD Members - Busisi Village - Sengerema

1. Saphia Ibrahim
2. Tumain Kiwango

3. Mayila Lubona
4. Mtalirwa Lumalango'mbe
5. Elias Lwino
6. Masumbuko Lugali
7. Goodluck Jumbe
8. Valery Kitambo
9. Ramadhani Rashid
10. Henery Hongoro

FGD Members Nsenda Village Urambo (Tabora)

1. Evaristi Gabriel
2. Selemani Ramadhani
3. Emanuel Paulo
4. Abdala Majilamba
5. Malimo Samweli
6. Emanuel Bihogoru
7. Ramadhani Mihambo
8. Issa Mabula
9. Hamidu Said
10. Shabani Adamu
11. Julius Masalago

FGD Members- Ukondamoyo Village - Urambo

1. Msecafa M
2. Francis Kaponya
3. Issack Kaaya
4. Emmanuel Bihogora
5. Martha Carol
6. Shaban Adam
7. Leokadia Bernard
8. Zebeda Mulesiga
9. Elias Biteko
10. Amini Leonard

FGD - Sima Village -Sengerema (Mwanza)

1. Lucia Shabani
2. Enock Lufunga
3. Tumaini Kiwango
4. Emanuel Buhalija
5. Asma Lukonge
6. Maila Lubona
7. Barbara Shibugulu

FGD Members - Chole Village - Kisarawe

1. Iddi Pakacha
2. Sultan Wambo
3. Nassoro Chutamanile
4. Zuhura Mombwe
5. Ally Pakacha
6. Abdul Pakacha
7. Wadhifa Chambasi
8. Said Bogo

FGD Members - Isurui Village - Kisarawe

1. Mohamed Mchalango
2. Mohamed Gude
3. Awadhi kiluwale
4. Juma Dolola
5. Jumanne Joswa
6. Rashid Issa
7. Ramadhani Mungi

Appendix 4: QUESTIONNAIRE 1: END USERS OF BIOMASS FUEL

Thank you for agreeing to participate in this important study. During the interview, I want to get as accurate information as possible and will therefore be reading you all of the questions. If you don't know the answer, please say you don't know.

INTERVIEW INFORMATION	
Date: (dd /mm /yy)	
Start Time: (hour: minutes)	
End Time: (hour: minutes)	
Total Time of interview:	**Minutes**
District:	
Region:	
The type of the end user:	**1.** Commercial **2.** Institution **3.** Household
If commercial please identify:	
Interviewer's name:	
Field Supervisor name:	
Checked by PI (name)	

SECTION A: KNOWLEDGE ON BIOMASS

101	Do you know different types of biomass energy sources?	**1.** Yes **2.** No	
102	What are the main sources of the biomass that you know? **(Possible to identify multiple sources)**	1. Charcoal 2. Firewood 3. Liquid biofuel 4. Farm residues 5. Biogas 6. Others (specify)	
103	What opportunities does the biomass sector provide? (**Possible to identify multiple answer**)	1. Employment 2. Income 3. Revenue Government 4. Others (specify)	
104	As a user of biomass energy are there any challenges that you are facing?	**1.** Yes **2.** No **3.** I don't know	If the answer is NO skip to 106
105	State the challenges that you face	1. Costs 2. Availability 3. Quality of biomass 4. Corruption 5. Not reliable source 6. Not regulated sector 6. Others (specify)	
106	Are you aware of the laws, bylaws, guidelines, legislatives, policies that govern and regulate the biomass energy sector	**1.** Yes **2.** No **3.** I don't know	
107	Does the current supply of the charcoal energy match the demand in the market?	**1.** Yes **2.** No **3.** I don't know	

SECTION B: PERCEPTION AND ATTITUDES ON BIOMASS

108	Of the following what do you consider as the most appropriate source of energy? (**Only ONE source should be identified)**	**1.** Biomass **2.** Electricity **3.** Gas **4.** Others (specify)	
109	Why is this source the most appropriate? **(Possible to identify multiple answers)**	1. Cheap 2. Easily accessible 3. Efficient 4. Reliable 5. The price does not change frequently 6. Others (specify)	
110	Is it possible to make the biomass energy sector sustainable?	**1.** Yes **2.** No **3.** I don't know	**If the answer is NO skip to 113**
111	Of the many sources of biomass energy what do you think is the most sustainable source? **(Only ONE source should be identified)**	1. Charcoal 2. Firewood 3. Liquid biofuel 4. Farm residues 5. Biogas 6. Others (specify)	
112	Why is it the most sustainable source of biomass energy?	1. Renewable sources 2. Regulated 3. Efficient 4. Easily available 5. The source is reliable 6. Others (specify)	
113	Do you think biomass is an important source of energy?	1. Yes 2. No 3. I don't know	

114	Is the biomass energy sector an important source of economic development in the country?	**1.** Yes **2.** No **3.** I don't know	
115	If yes, how?	**1.** Revenue **2.** Employment **3.** Income generation **4.** Others (specify)	
116	How reliable is the supply of the biomass energy?	**1.** Very reliable **2.** Reliable **3.** Slightly reliable **4.** Not reliable	
117	What is your assessment of the quality of the improved biomass energy sources other than charcoal and firewood? (**Firewood and charcoal should be excluded)**	**1.** Good **2.** Average **3.** Bad **4.** I don't know	
118	Do you think the main sources of biomass energy are increasing or decreasing?	**1.** Increasing **2.** Constant **3.** Decreasing **4.** Don't know	
119	Do you think the laws, bylaws, guidelines, legislatives, policies can improve the biomass energy sector?	**1.** Yes **2.** No **3.** I don't know	
120	Do you think charcoal production can be done in a sustainable manner?	**1.** Yes **2.** No **3.** I don't know	
121	Compared to other sources of energy how do you perceive the price of biomass energy?	**1.** Low **2.** Average **3.** Expensive **4.** I don't know	

122	What are your criteria in assessing the quality of charcoal?	1. Ability to generate high intensity heat 2. Clean cooking 3. No fumes 4. Retains heat for a long time 5. Easy to light up 6. Should be heavy 7. Should be hard 8. I don't know 9. Others (Specify)	
123	Do you think the use of biomass energy is good for the environment?	**1.** Yes **2.** No **3.** I don't know	**If YES skip to 125**
124	If NO, why do you think it is not good for the environment?	1. Emission of fumes 2. Deforestation 3. Not sustainable 4. Pollutes the environment 5. Others (specify)	
125	Do you think that "certifying" the production and use of charcoal would be a good thing?	**1.** Yes **2.** No **3.** I don't know	**If NO skip to 127**
126	If YES, why do you think biomass charcoal certification would be a good thing? **(Possible to identify multiple answers)**	1. Improve quality 2. Control illegal harvesting of forests 3. Sustainable production of charcoal 4. Will reduce the price of charcoal 5. Other (specify)	
127	Is it worth investing in biomass technology?	**1.** Yes **2.** No **3.** I don't know	
128	Is there any value of formalizing the biomass sector, in particular the charcoal?	**1.** Yes **2.** No **3.** I don't know	

129	What is your opinion on the demand of charcoal energy?	1. Highly demand 2. Average demand 3. Low demand 4. I don't know	
130	What challenges do you anticipate in introducing alternative source of biomass?	1. Availability 2. Price/cost 3. Quality 4. Not having a fixed price 5. Others (specify)	

SECTION C: PRACTISES RELATED TO BIOMASS USE

131	What energy sources do you use for cooking? **(Possible to identify multiple sources)**	**1.** Electricity **2.** Gas **3.** Kerosene **4.** Charcoal **5.** Firewood **6.** Other (specify)	
132	What is the **MAIN** source of energy that you use primarily for cooking? (**Only ONE source should be identified)**	1. Electricity 2. Gas 3. Kerosene 4. Charcoal 5. Firewood 6. Other (specify)	
133	As a charcoal user what do you look for most?	**1.** Quantity **2.** Quality **3.** Packaging materials **4.** Cheap price **5.** Should be heavy **6.** Hard charcoal **7.** 5. Others (specify)	

General opinions on the biomass energy sector in the country

Thanks for your participation in this research and we highly appreciate for your valuable information

Appendix 5: QUESTIONNAIRE 2: PRIVATE SECTOR ENGAGED IN BIOMASS

Thank you for agreeing to participate in this important study. During the interview, I want to get as accurate information as possible and will therefore be reading you all of the questions. If you don't know the answer, please say you don't know.

INTERVIEW INFORMATION	
Date: (dd /mm /yy)	
Start Time: (hour: minutes)	
End Time: (hour: minutes)	
Total Time of interview:	**Minutes**
District:	
Region:	
The type of engagement:	**4.** Producer **5.** Transporter **6.** Wholesaler **7.** Retailer
Interviewer's name:	
Field Supervisor name:	
Checked by PI (name)	

SECTION 1: KNOWLEDGE ON BIOMASS

134	Do you know different types of biomass energy sources?	**1.** Yes **2.** No	
135	What are the main sources of biomass energy that you know? (**Possible to identify multiple sources)**	**1.** Charcoal **2.** Firewood **3.** Liquid biofuel **4.** Farm residue **5.** Biogas **6.** Others (specify)	
136	Are there challenges in the biomass energy sector?	**1.** Yes **2.** No	If NO skip to Q. 105
137	Mention challenges that the biomass sector is facing (**Possible to identify multiple answers)**	1. Lack of enforced policies/ guidelines 2. Conflicting guidelines/ policies 3. Too many actors 4. Poor technology 5. Lack of capital 6. Unsustainable 7. Corruption 8. High taxes 9. Poor infrastructure 10. Too much bureaucracy 11. Complicated production procedure 12. Others (specify)	
138	What opportunities does the biomass sector provide? (**Possible to identify multiple answers)**	1. Employment 2. Income 3. Revenue Government 4. Others (specify)	
139	Are you aware of the laws and bylaws that regulate the utilization of the biomass sector?	**1.** Yes **2.** No **3.** I don't know	
140	Are you aware of the legislative, policies, licenses permits and acts in the biomass sector?	**1.** Yes **2.** No **3.** I Don't Know	

141	**QUESTION FOR PRODUCERS ONLY** Are you aware of any methods that are used to produce charcoal in a sustainable manner?	**1.** Yes **2.** No **3.** I Don't Know	If NO skip to Q. 110
142	**QUESTION FOR PRODUCERS ONLY** If Yes, mention them (**Possible to identify multiple answers)**	1. Basic Earth-mound Kiln (BEK) 2. Improved Basic Earth-mound Kiln (IBEK) 3. Adam Gas Retort 4. Half Orange Kiln (HOK) 5. Casamance Kiln 6. Brick Kiln 7. Other (specify)	
143	Can you mention institutions that are supposed to be supervising the biomass energy sector? (**Possible to identify multiple answers)**	1. Central government 2. Local government 3. Government agencies 4. Private sector 5. Local Communities 6. Others (specify)	

SECTION B: PERCEPTION AND ATTITUDES ON BIOMASS

144	Is it worth investing in biomass technology?	**1.** Yes **2.** No **3.** I don't know	
145	Is there any value of formalizing the biomass sector?	**1.** Yes **2.** No **3.** I don't know	
146	Do you think biomass energy is an important source of energy?	**1.** Yes **2.** No **3.** I don't know	

147	Is the biomass energy sector an important source of economic development?	**1.** Yes **2.** No **3.** I don't know	If NO skip to 116
148	If yes, how	1. Revenue 2. Employment 3. Income generation 4. Others (specify)	

149	What is your opinion on the demand of biomass energy?		Very high	High	Average	Low	Very low	I don't know
		Charcoal						
		Firewood						
		Liquid biofuel						
		Farm residue						
		Biogass						

150	Does the current supply of the biomass energy match the demand in the market?	**1.** Yes **2.** No **3.** I don't know	
151	Can charcoal production be done in a sustainable manner?	1. Yes 2. No 3. I don't know	

152	What challenges do you anticipate in introducing biomass energy?		Availability	Costs/ Price	Quality	Others	I don't know
		Charcoal					
		Firewood					
		Liquid biofuel					
		Farm residue					
		Biogass					

153	Of the following what do you consider as the most appropriate source of energy? (**Only ONE source should be identified)**	1. Biomass 2. Electricity 3. Gas	

154	Why is the source the most appropriate one? (**Possible to identify multiple answers)**	1. Cheap 2. Easily accessible 3. Efficient 4. Reliable 5. Does not pollute the environment 6. A common source of energy 7. Liked by many people 8. Others (specify)	

155	Do you think that there is a market for biomass in its different forms as a source of energy?	Type	Yes	No	Don't know
		1. Charcoal			
		2. Firewood			
		3. Liquid biofuel			
		4. Farm residue			
		5. Biogass			

156	What are your criterions in assessing the quality of charcoal?	1. Ability to generate high intensity heat 2. Clean cooking 3. No fumes 4. Retains heat for a long time 5. Easy to light up 6. Should be heavy 7. Should be hard 8. I don't know 9. Others (specify)	
157	What do charcoal buyers look for most	1. Quantity 2. Quality 3. Packaging material 4. Weight of charcoal 5. Hardness of charcoal 6 Others (specify)	
158	Compared to other sources of energy how do you perceive the price of biomass energy?	1.Very high 2. High 3. Average 4. Low 5. Very low	
159	Do you think the main sources of biomass energy are increasing or decreasing?	1. Increasing 2. Remained constant 3. Decreasing 4. Don't know	

160	What is your opinion on the supply of biomass energy over the past 5 years?	1. Increasing 2. Remained constant 3. Decreasing 4. Don't know						
161	What is your opinion on the demand of biomass energy over the past 5 years?	1. Increasing 2. Remained constant 3. Decreasing 4. Don't know						
162	What is your assessment of the quality of the different sources of biomass energy		Very good	Good	Average	Poor	Very poor	I don't know
		Charcoal						
		Firewood						
		Liquid biofuel						
		Farm residues						
		Biogass						
163	How reliable is the supply of the biomass energy?		Reliable		Not reliable		I don't know	
		Charcoal						
		Firewood						
		Liquid biofuel						
		Farm residue						
		Biogass						
164	Which of the following can improve the biomass energy production?	**1** Legislation /Laws **2** Policies/ Acts **3** Technology **4** Value chain **5** Improve infrastructure **6** Plant more tress **7** Others (specify)						
165	Do you think current biomass production technology is good for the environment?	**1.** Yes **2.** No **3.** I don't know						
166	Do you think that "certifying" charcoal (e.g., where it is produced, from what sources it is produced, whether it is sustainably produced, etc would be a good thing?	**1.** Yes **2.** No **3.** I don't know						
167	Who do think are the key players in the biomass energy sector? **(Possible to have more than one answer)**	1. Government agencies 2. Local government 3. Private sector 4. NGOs/ CBOs 5. Local Communities 6. Others						

168	Of those you mentioned, who do you perceive as the most powerful key player? (**Only one actor source)**	1. Government agencies 2. Local government 3. Private sector 4. NGOs/ CBOs 5. Others (specify)	

169	What is your assessment of the performance of these institutions in the management and governance of the biomass energy sector		Good	Average	Poor	I don't know
		1. Government Agencies				
		2. Local government				
		3. Private sector				
		4. NGOs/CBOs				
		5. Local Communities				
		6. Others (specify)				

170	What are the gaps in the management and governance of the biomass energy sector?	1. Weak policies/ legislations 2. Conflicting policies/ legislations 3. Lack of coordination among actors 4. Lack of investment in the sector 5. Lack of sensitization on environment conservation 6. Corruption 7. I don't know 8. Others (specify)	

SECTION C: PRACTISES RELATED TO THE BIOMASS BUSINESS

171	Which sources of biomass energy are you involved in? (**Possible to identify multiple sources)**	**1.** Charcoal **2.** Firewood **3.** Liquid biofuel **4.** Farm residue **5.** Biogas **6.** Others (mention)	
172	Is it possible to make the biomass energy sector sustainable?	**1.** Yes **2.** No **3.** I don't know	
173	**Question for PRODUCERS ONLY** What are you doing to make sure that biomass energy remains sustainable over a long period of time?	1. Improved production technology 2. Investing in different forms of Biomass 3. Improving quality of biomass 4. Investing in the environment 5. Not doing anything	

174	**Question for PRODUCERS ONLY** Based on the production costs, would you prefer using modern method of producing biomass over the traditional method?	**1.** Yes **2.** No **3.** I don't know	

General opinions on the biomass energy sector in the country

Appendix 6: QUESTIONNAIRE 3: GOVERNMENT AGENCIES, REGULATORS AND REPRESENTATIVES , DISTRICTS AND VILLAGE COUNCILS

Thank you for agreeing to participate in this important study. During the interview, I want to get as accurate information as possible and will therefore be reading you all of the questions. If you don't know the answer, please say you don't know.

INTERVIEW INFORMATION	
Date: (dd /mm /yy)	
Start Time: (hour: minutes)	
End Time: (hour: minutes)	
Total Time of interview:	**Minutes**
District:	
Region:	
The type of Respondent:	**8.** Government Agency **9.** Regulators **10.** District level **11.** Ward level **12.** Village level
Name of Organization:	
Duration in current position	
Interviewer's name:	
Field Supervisor name:	
Checked by PI (name)	

SECTION 1: KNOWLEDGE ON BIOMASS

175	Do you know different types of biomass energy sources?	1. Yes 2. No	
176	What are the main sources of biomass energy that you know? **(Possible to identify multiple sources)**	1. Charcoal 2. Firewood 3. Liquid biofuel 4. Farm residue 5. Biogas 6. Others (Specify)	
177	Are there challenges in the biomass energy sector?	1. Yes 2. No	**If No skip to**
178	Mention the three MAIN challenges that the biomass sector is facing	1. lack of enforced policies/ guidelines 2. Conflicting guidelines/ policies 3. Too many actors 4. Poor technology 5. Lack of capital 6. Unsustainable 7. Corruption 8. High taxes 9. Others (specify)	

179	What opportunities does the biomass sector provide? (**Possible to identify multiple sources)**	1. Employment 2. Income 3. Revenue Government 4. Others (specify)	
180	Can charcoal production be done in a sustainable manner?	1. Yes 2. No 3. I don't know	
181	Are you aware of any methods that are used to produce charcoal in a sustainable manner?	1. Yes 2. No 3. I don't know	**If No skip to**
182	If YES, mention them (**Possible to identify multiple sources)**	1. Basic Earth-mound Kiln (BEK) 2. Improved Basic Earth-mound Kiln (IBEK) 3. Adam Gas Retort 4. Half Orange Kiln (HOK) 5. Casamance Kiln 6. Brick Kiln 7. Other (specify)	

183	Which of the above mentioned methods do you promote? (**Possible to identify multiple sources)**	1. Basic Earth-mound Kiln (BEK) 2. Improved Basic Earth-mound Kiln (IBEK) 3. Adam Gas Retort 4. Half Orange Kiln (HOK) 5. Casamance Kiln 6. Brick Kiln 7. Other (specify)	
184	Can you mention institutions that are supposed to be supervising the biomass energy sector? (**Possible to identify multiple answers)**	1. Central government 2. Local government 3. Government agencies 4. Private sector 5. Others (specify)	

SECTION B: PERCEPTION AND ATTITUDES ON BIOMASS

185	Is it worth investing in biomass technology?	1. Yes 2. No 3. I don't know	
186	Is there any value of formalizing the biomass sector?	**4.** Yes **5.** No **6.** I don't know	
187	Do you think biomass energy is an important source of energy?	**4.** Yes **5.** No **6.** I don't know	
188	Is the biomass energy sector an important source of economic development?	**4.** Yes **5.** No **6.** I don't know	

189	If yes, how	1. Revenue 2. Employment 3. Income generation 4. Others (specify)	
190	What is your opinion on the demand of the biomass energy?	1. Very high 2. High 3. Average 4. Low 5. Very low	
191	Does the current supply of the biomass energy match the demand in the market?	**4.** Yes **5.** No **6.** I don't know	
192	What challenges do you anticipate in introducing multiple sources of energy? (biomass, electricity, gas)	1. Availability 2. Price/ Cost 3. Quality 4. Others (specify)	
193	Of the following what do you consider as the most appropriate source of energy? (**Only ONE source should be identified)**	1. Biomass 2. Electricity 3. Gas	
194	Why is the source the most appropriate one? (**Possible to identify multiple answers)**	1. Cheap 2. Easily accessible 3. Efficient 4. Reliable 5. Others (specify)	
195	Do you think that there is a market for biomass in its different forms as a source of energy?	Type / Yes / No 1. Charcoal 2. Firewood 3. Liquid biofuel 4. Farm residue 5. Biogass	
196	Compared to other sources of energy how do you perceive the price of biomass energy?	1.Very high 2. High 3. Average 4. Low 5. Very low	
197	Do you think the main sources of biomass energy are increasing or decreasing?	1. Increasing 2. Remained constant 3. Decreasing 4. Don't know	

198	What is your opinion on the supply of the biomass energy over the past 5 years?	1. Increasing 2. Remained constant 3. Decreasing 4. Don't know	
199	What is your assessment of the quality of the improved biomass energy sources?	**1.** Very good **2.** Good **3.** Indifferent **4.** Poor **5.** Very poor	
200	How reliable is the supply of the biomass energy?	**1.** Reliable **2.** Unreliable **3.** I don't know	
201	Which of the following can improve the biomass energy production?	**8** Legislation **9** Policies **10** Acts **11** Technology **12** Value chain	
202	Do you think current biomass production technology is good for the environment?	**4.** Yes **5.** No **6.** I don't know	
203	Do you think that "certifying" charcoal (e.g., where it is produced, from what sources it is produced, whether it is sustainably produced, etc would be a good thing?	**4.** Yes **5.** No **6.** I don't know	
204	Who do think are the key players in the biomass energy sector? (Possible to have more than one answer)	1. Government agencies 2. Local government 3. Private sector 4. NGOs/ CBOs 5. Others	
205	Of those you mentioned, who do you perceive as the most powerful key player? (Only one actor source)	1. Government agencies 2. Local government 3. Private sector 4. NGOs/ CBOs 5. Others (specify)	

206	What is your assessment of the performance of these institutions in the management and governance of the biomass energy sector		Good	Average	Poor
		1. Government Agencies			
		2. Local government			
		3. Private sector			
		4. NGOs/CBOs			
		5. Others (specify)			

207	What are the gaps in the management and governance of the biomass energy sector?	1. Weak policies/ legislations 2. Lack of coordination among actors 3. Lack of investment in the sector 4. Others (specify)	

FOLLOW UP QUESTIONS

1. What are your primary responsibilities with regard to biomass sector? (e.g., village land management, agriculture, licensing, regulation, etc.)?

2. How are the mentioned responsibilities backed up by national laws and policies?

3. How do you assess the implementation of your mandates as provided by laws, regulations and policies governing the biomass energy sector? (Probe: the consistence, inconsistence of the laws and policies)

4. What challenges do you face in implementing biomass energy related policies or and reinforcing laws and regulations in your area of jurisdiction? (Probe: issues of resource – both financial and human resources, infrastructural, administrative/institutional dynamics)

5. What are the main initiatives championed by your MDA to promote a biomass friendly governance of the energy sector?

6. What are the key policy and legislative gaps that prevent the promotion of a biomass friendly governance of the energy sector?

7. What are the main government initiatives to promote a biomass friendly governance of the energy sector?

8. What are the main barriers and challenges in scaling-up the sustainable biomass energy production and consumption practices?

9. Please list three things that you would want to change to make the biomass energy sector work better overall?

10. What are the competing interests in the biomass sector?

Thanks for your participation in this research and we highly appreciate for your valuable information

Appendix 7: Tool 4: In-depth Interview: Representatives from Donors/ Organizations

Number	Background Information	
01	**Name of the organization the interviewee is representing**	
02	**Designation**	
03	**Duration in the position in Tanzania**	
04	**Area of focus in Tanzania**	

05. General assessment of the biomass sector in Tanzania (Probe: opportunities and challenges)

06. What does your organization focus on with regard to biomass sector? (E.g. research, advocacy, capacity building etc)?

07. How do you assess the role of the government of Tanzania in biomass energy sector
    - How do you assess the existing laws, policies and regulations that guide biomass energy sector?
    - The institutions responsible for governing the biomass energy production
    - Probe for their effectiveness
08. What are the major challenges facing charcoal energy?
    - probe on the value chain, institutional set up, policy environment etc
09. What is the real and potential contribution of the biomass energy sector?
10. What is your perception towards the current governance structure of the biomass energy sector?
11. Who are the key actors in the biomass energy sector?
    a. Are those in charge trustful?
    b. The best ways that the government can address the loss of revenue
    c. It is said that the biomass energy in Tanzania is largely operate on informal bases. Why is this case?
    d. How to make it formal?
12. What is your preferences in terms of the types of biomass energy sources and in relation with other energy sources
    a. Why switching to alternative energy sources remains a challenge in Tanzania?
13. How can the sector be made more cost effective and environmental friendly?
14. What is your perception on the availability, affordability and acceptability of biomass energy sources?

15. Do market options available for the biomass energy sector?
16. What efforts should be done to make biomass energy sector sustainable?

18. What challenges do you face in implementing biomass energy related policies or and reinforcing laws and regulations in your area of jurisdiction? (Probe: issues of resource –both financial and human resources, infrastructural, administrative/institutional dynamics)

19. What are the main initiatives championed by your organization/country to promote a biomass friendly governance of the energy sector in Tanzania?

20. What are the key policy and legislative gaps that prevent the promotion of a biomass friendly governance of the energy sector? (Probe: aspects of production, trade, transportation, etc)

21. What are the main barriers and challenges in scaling-up the sustainable biomass energy production and consumption practices?

22. Please list three things that you would want to change to make the biomass energy sector work better overall? (Probe: certification –charcoal)

23. Is biomass energy an important source of energy? (Probe its contribution to economic development-revenue, employment, income generation etc)

25. Compared to other sources of energy how do you perceive the price of biomass energy? (Probe: reliability, trends in supply/demand -increase or decrease and reasons for the pattern)

26. Do you think biomass energy to be good for the environment? (Probe for reasons)
27. Who are the key players in the biomass energy sector in Tanzania? (Probe which ones are the most powerful players-and why; their performance)

28. How do you perceive the current governance structure of the biomass sector (Probe: room for participation of all stakeholders,)

29. Any other reflection about the biomass energy sector

Thanks for your participation in this research and we highly appreciate for your valuable information

Appendix 8: GUIDING QUESTIONS FOR FGD

1. What do you understand by biomass energy
   a. Probe on: meanings, different forms?
   b. Probe on the most important and potential sources of biomass energy
2. What is your preferences in terms of the types of biomass energy sources and in relation with other energy sources (Probe for charcoal, firewood, liquid biofuel, farm residues and biogas)/ electricity and gas
   a. Why switching to alternative energy sources is a challenge?
3. Who are the key actors in the biomass energy sector (make sure that participants list all biomass stakeholders)
   a. Are those in charge trustful
   b. The best ways that the government can address the loss of revenue
4. What is your perception on the availability, affordability and acceptability of charcoal as a source of energy?
5. What are the market options available for the biomass energy products?
6. What are the major challenges facing charcoal energy
   a. probe on the value chain
7. How does the biomass energy contribute
   a. The national
   b. The District
   c. The household economy
8. What is the role of the Government in biomass energy sector
9. How do you assess the existing laws, policies and regulations that guide biomass energy sector?
   a. What need to be done to improve the performance of the actors
   b. The institutions responsible for governing the biomass energy production
   c. Probe for their effectiveness
10. What is your perception towards the current governance structure of the biomass energy sector?
11. Why is the sector so unmanageable
    a. How to make it formal
12. How can the sector be made more cost effective and environmental friendly
13. What efforts should be done to make the biomass energy sector sustainable?

Thanks for your participation in this research and we highly appreciate for your valuable information