Policy Note

Moving towards a Sustainable Charcoal Sector in Tanzania

DRAFT Version 2.00
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Abbreviations

BAU Business As Usual
CBFM Community Based Forest Management
CHAPOSA Charcoal Potential in Southern Africa
COFO Committee on Forestry
CSO Civil Society Organization
DDP District Development Plans
DED District Executive Director
DFO District Forest Officer
DoE Division of Environment
ESD Energy for Sustainable Development
FAO Food and Agricultural Organization
FCPF Forest Carbon Partnership Facility
FBD Forest and Beekeeping Division
GDP Gross Domestic Product
GOT Government of Tanzania
HBS Household Budget Survey
HH Household
IFM Independent Forest Monitoring
JFM Joint Forest Management
LPG Liquefied Petroleum Gas
MEM Ministry of Energy and Minerals
MNRT Ministry of Natural Resources and Tourism
NFBKP National Forest and Beekeeping Program
NFP National Forest Policy
NFI National Forest Inventory
NGO Non-Government Organization
NRM Natural Resources Management
PES Payment for Environmental Services
PFM Participatory Forest Management
PFMRP Public Finance Management Reform Project
PMO-RALG Prime Minister’s Office – Regional Administration and Local Government
REDD Reduced Emissions from Deforestation and (Forest) Degradation
RPTES Regional Program for the Traditional Energy Sector
RWEDP Regional Wood Energy Development Program
SEF Sahel Eco- Farm
SSA Sub-Saharan Africa
TANESCO Tanzania Electric Supply Company
TaTEDO Tanzania Traditional Energy Development Organization
TASAF Tanzania Social Action Fund
TFCMP Tanzania Forest Conservation and Management Project
TFWG Tanzania Forest Working Group
TNRF Tanzania Natural Resource Forum
TOF Trees outside Forests
TShs Tanzania Shillings
VAT Value Added Tax
VEC Village Environmental Committee
VPO Vice President’s Office
WB World Bank
WWF World Wide Fund for Nature
Acknowledgements

This report was co-authored by Christian Peter (AFTEN) and Klas Sander (ENV). A background report was provided by Jeff Felten (ESD Tanzania). The team benefitted from input, comments and contributions from Herbert Acquay (AFTEN), Marjory-Anne Bromhead (AFTEN), Thomas Danielewitz (AFTP2), Peter Dewees (ECSSD), Kathryn Hollifield (AFCCM), Hans Hoogeveen (AFTP2), John McIntire (AFCE1), Stephen Mink (AFTSN), Robert van der Plas (MARGE Consult) and Steve Sepp (Eco Consulting Group).

The analysis and thinking contained in this Policy Note represent the experience and perspectives of a large number of people involved in the charcoal sector in one way or another. The World Bank wishes to express its strong appreciation to the many people in Tanzania who offered information, ideas, comments, and critical points of view over the course of developing this Policy Note. In particular, we wish to thank the Government of Tanzania for providing leadership in the process and to the necessary follow up action. The team is particularly grateful to Dr. Felician Kilahama (Director, Forest and Beekeeping Division, Ministry of Natural Resources and Tourism) and Mr. Ngosi Mwihava (Assistant Commissioner, Renewable Energy, Ministry of Energy and Minerals), as well as their staff.

The Policy Note was prepared under the general supervision of Marjory-Anne Bromhead (AFTEN), peer reviewers were Tom Blomley (FBD/Danida), Frank Byamugisha (AFTAR), and Rasmus Heltberg (SDV). Stakeholder consultation and workshops would have not been possible without the contributions of Francis Songela (ESD Tanzania), Felix Mallya (Consultant), and Faith-Lucy Matumbo (AFCE1).
Executive Summary

Woodfuels (fuelwood and charcoal) are the most important energy source in Tanzania. An estimated 90% of the country’s energy needs are satisfied through the use of woodfuels. Today, an ever increasing number of households rely on woodfuels as a source of energy. Charcoal is especially important for cooking in urban areas of the country. With about 500,000 tons Dar es Salaam accounts for about half of the total annual domestic charcoal consumption.

The present Policy Note provides decision-makers in Tanzania with a summary of the fundamental characteristics of the charcoal sector in the country and presents policy options to address the “charcoal challenge”. Many of the options presented have been proposed before, but implementation has focused on isolated segments of the value chain. The Policy Note argues that changes to the trend of ever increasing charcoal utilization can be introduced, if they are integrated along the entire value chain of charcoal production and consumption. It is expected that this could turn the charcoal sector into a driver of sustainable forest management and utilization as well as the economy as a whole.

Even though fuel switching alternatives as well as the adoption of fuel-efficient stoves for charcoal burning are being promoted through private initiatives and government programs, overall impact seems yet inadequate: According to the latest Household Budget Survey, the number of households in Dar es Salaam using charcoal for cooking has increased from 47% to 71% between 2001 and 2007. The total annual revenue generated by the charcoal sector for Dar es Salaam alone is estimated at US$350 Million, generating employment and direct/vital income several hundred thousand people.

Due to the following reasons, charcoal demand and production is forecasted to continue well into the future:

- With an estimated population increase of 2-3% per year Tanzania’s population will double in about 20-25 years.
- An increase in urbanization leads to an increasing use of charcoal; this increase in demand for charcoal implies an increase in the quantity of wood harvested for energy purposes.
- Rising prices for alternative fuels such as LPG, natural gas, or electricity also causes people to continue using charcoal – even despite rising incomes.

The structure of the charcoal chain is complex, comprising of many different stakeholders with different objectives and economic potential. Currently, the largest share of charcoal comes from natural forests, while plantations, woodlots, or trees-outside-the-forest (e.g. in agro-forestry systems, along roads and around fields) play only a negligible role for charcoal production.

Revenues along the charcoal value chain are distributed unevenly. The charcoal producer can earn as little as 20% of the final retail price of charcoal paid by the urban consumer, whereas traders generally earn a considerable higher percentage. Reasons for this include: (a) large supply of unskilled labor; (b) producers have little negotiation leverage; (c) transport and wholesaling is organized by cartel- or monopolistic-type structures; (d) lack of market influence for retailers.
The charcoal sector in Tanzania operates within a complex and multi-layered regulatory context. The people and processes along the value chain interact with several government bodies, policies and laws, operating at national, local and village levels. Although there is no comprehensive, targeted policy or strategy or legal framework in Tanzania addressing the charcoal sector, there is an existing set of policies, legislation, and regulations which influence on how charcoal production and consumption is managed.

The Government of Tanzania is committed to decentralized local government, including fiscal decentralization. Local councils are responsible for the delivery of public services. As a result of a tax reform in 2003, it was found that at the district level, charcoal is often the most important contributor to revenues. However, due to limited capacity at the district level this revenue represents only a fraction of potential revenues. Changes in the policy and institutional framework should ensure that more resources are being targeted and/or retained at the district level to improve capacity as well as ownership. In the long term, this will bring considerable improvements in the effectiveness of revenue collection and therefore in district public finance.

On the supply side, sustainable wood production from natural forests has to be increased by means of decentralized forest management approaches involving local stakeholders. Given Tanzania’s positive experiences with Participatory Forest Management, investments must be particularly targeted at scaling-up these management approaches with focus on charcoal production, especially in areas adjacent to urban charcoal markets. In addition, sustainable wood supply from natural forests must be complemented with investment programs promoting tree-plantations at the community or household level, especially on degraded lands. Lastly, Trees-Outside-Forests resources, such as agro-forestry systems, should also be encouraged as a complementary measure to increase sustainable wood supply.

Trade in charcoal is conducted by formal as well as informal actors. One commercialization chain begins with government-issued licenses for the exploitation of the forest resources. The product is transported and traded by officially licensed transporters and traders who pay the necessary duties and taxes. A second commercialization chain begins without official authorization, which is essentially an informal or illegal activity. Charcoal travelling through this informal chain is transported and traded clandestinely in attempts to avoid authorities, taxation and eventual penalties.

Besides organizational improvements and the formalization of charcoal production and marketing, charcoal making technologies are the most important driving forces to reduce the amount of biomass required for the transformation process. Therefore, policy options that can promote the adoption of improved kiln technologies are essential means to achieve sustainable charcoal production. Furthermore, if the entire charcoal chain is reformed in a comprehensive manner, adoption of improved and widely accepted kiln technologies should be part of revised regulatory frameworks in form of standards for kiln technology to be applied.

By linking rural production sites with urban consumers, the charcoal trading and wholesaling part of the charcoal value chain becomes a key point of intervention for regulatory and fiscal policy measures. Especially fiscal incentives can provide an attractive policy option, discriminating against unsustainable charcoal production while
providing a monetary incentive to invest in sustainable forest management practices, such as PFM, or tree-plantations at the community and household level.

A necessary prerequisite to the introduction of any of such policy options is a strategic communication campaign informing all relevant stakeholders about their rights and responsibilities. The charcoal sector has to be turned from informal business into an informal part of the national economy. What needs to be avoided is the re-introduction of top down control and command systems, rather than reaching out to local stakeholders informing about rights and obligations.

On the consumption side, programs promoting alternative fuels as well as the adoption of fuel-efficient charcoal stoves should be further strengthened. A simple simulation model showed, however, that these two policy options may only have the potential to buffer against future increases of charcoal consumption caused by general population increase, while absolute consumption levels are expected to remain high.

Promoting alternative fuels, in contrast, should also always be evaluated against its potential to create domestic employment as well as their import dependency. While charcoal already provides a livelihood base for many people, especially the rural and urban poor, it is expected that formalizing the charcoal sector would further increase this potential, especially for sustainable wood production.

The Policy Note advocates a combination of clear rules, transparent enforcement, strong incentives and awareness-creation/capacity development. Key stakeholders and the general public need guidance by way of information campaigns, training, and demonstration projects to ensure that awareness-deficits or false perceptions do not curtail policy implementation. The bureaucratic and administrative barriers e.g. overcomplicated forest management planning requirements, complex fiscal systems and land tenure procedures may inhibit development and thus warrant critical reflection. The regulatory framework needs to integrate externalities in order to promote adequate pricing of charcoal, and thus enhance regional economies.

Charcoal strategies are specific to framework conditions at national, regional and local levels. Developing charcoal policies means to address two intervention levels at the same time: policy formulation and enforcement/practical implementation. In order to promote substantial and sustainable growth in the charcoal sector, policies must be predictable in the long term, have the potential to account for locally specific circumstances, and promote concrete, local-level projects. Charcoal policies need to be designed within the context of a sustainable development approach, and principles of local control and participation adhered to in the planning process. It is also important that mandates and responsibilities of national-level public agencies (e.g. the national forest service) will be partly transferred to private institutions, non-governmental organizations and legitimate local governments, e.g. districts and villages.
Introduction

Background – Why a Policy Note?

Facing the challenge of continued and increasing pressure on forest resources for charcoal utilization (see Box 1), the Government of Tanzania (GOT) asked the World Bank to provide decision-makers in Tanzania with a Policy Note summarizing the fundamental characteristics of charcoal use in the country and presenting policy options along the entire value chain of charcoal production and consumption which could address this challenge and turn charcoal utilization into a sustainable sector of forest management and the economy as a whole. The Policy Note builds on experience from both Tanzania and other Sub-Saharan African countries with a similar socio-economic and environmental context.

Box 1: Five Facts about Charcoal Utilization in Tanzania

1. National Economy: The total annual revenue generated by the charcoal sector for Dar es Salaam alone is estimated at US$350 million and generates employment and cash income several hundred thousand people. Coffee and tea are estimated to contribute only US$60 million and US$45 million to the national economy, respectively. Foreign Direct Investment for Tanzania was estimated at US$470 million in 2004.

2. Revenues: Unregulated and unregistered activities in charcoal utilization lead to an estimated revenue loss of about US$100 million per year. The Forest and Beekeeping Division (FBD) of the Ministry for Natural Resources and Tourism (MNRT) has a financing gap between expenditures and revenues of about US$2.0 million.

3. Cooking Behavior: From 2001 to 2007 the number of HH in Dar es Salaam using charcoal for cooking has increased from 47% to 71%. Use of LPG has declined from 43% to 12%. In other urban areas the share of HH using of charcoal for cooking remained at 53%, while the share of fuelwood use increased from 33% to 38%. The use of electricity for cooking is below 1%.

4. Charcoal Production: Total annual charcoal consumption in Tanzania is estimated at 1 million tons. Annual wood need for charcoal production is estimated at 30 million cubic meter. It is estimated that as many as 160,000 charcoal kilns are operated each year – or 438 per day. An average annual loss of forest area of about 100,000–125,000 hectares can be accredited to the charcoal sector.

5. Urbanization: The share of the urban population is 33% (21% in 2001). With a growth rate of 4.3% Dar es Salaam is one of the fastest growing cities in Sub-Saharan Africa. In 2005 the population was estimated at 3 million. 36% of the total population lives below the poverty line, 44% of the population is below the age 15, and life expectancy at birth is 52 years only. One study estimates that a 1% increase in urbanization leads to a 14% increase in charcoal consumption.


Woodfuels (fuelwood and charcoal) are the most important energy source in Tanzania. An estimated 90% of the country’s energy needs are satisfied through the use of woodfuels. The latest Household Budget Survey for Tanzania indicates that even today an increasing number of households rely on woodfuels as a source of energy. Despite
increasing investments in improving access to electricity and other energy sources, the number of households in the country using charcoal for cooking has increased by 7% since 2001 (National Bureau of Statistics, 2008). Charcoal demand and production is forecasted to continue well into the future. For example, for the districts around Dar es Salaam a simple model suggests that area under natural forest (Miombo Woodland) could significantly decrease and disappear in the next decade under the assumption that the population of Dar es Salaam will continue to grow at current rates and charcoal utilization and consumption will equally continue with current practices\(^1\).

The continued demand for woodfuels constitutes one of the main drivers of deforestation and forest degradation, particularly in the periphery of the currently unregulated sprawl of urban centers. The following factors explain why the demand for charcoal will continue to increase over the next years:

- With an estimated population increase of 2-3% per year Tanzania’s population will double in about 20-25 years.
- An increase in urbanization leads to an increasing use of charcoal; this increase in demand for charcoal implies an increase in the quantity of wood harvested for energy purposes.
- Rising prices for alternative fuels such as LPG, natural gas, or electricity also causes people to continue using charcoal – even despite rising incomes

In contrast, estimates indicate that charcoal utilization in Tanzania generates higher revenues to the national economy than other sectors, which puts charcoal among the core sectors of the country’s economy\(^2\). For Dar es Salaam alone it is estimated that the charcoal sector provides opportunities for labor and cash income for several hundred thousand people, especially among the poorest that have no alternative livelihood options\(^3\).

However, due to its informal nature the charcoal sector is generally neglected in formal economic analyses and, thus, its role and potential for economic development is systematically underestimated. Despite the current reliance on woodfuels and the forecast that charcoal demand and production is to continue well into the future, woodfuels are not yet part of a national energy strategy.

This development has negative impacts at different scales: for example, at the local and regional level, degradation of watersheds has in the recent past created problems for hydroelectric power generation. The economic costs associated with unreliable power supply have been estimated at about US$330 million for the whole year, about 2% of GDP (World Bank 2006). Lost revenues to the government (e.g. Value Added Tax on electricity consumption) was further estimated at about US$3 million this year. As an immediate response, political decision-makers had implemented a complete ban of

\(^1\) The model and its parameters are briefly presented in Annex 2.
\(^2\) Van der Plas (2008) reports similar evidence from Rwanda, where the charcoal sector is estimated at an annual volume of US$ 77 million. According to ESD (2007) total income from charcoal in Kenya is estimated at US$ 450 million, which is equivalent to the country’s tea industry.
\(^3\) Sepp (2008a) estimates about 700,000 people working in the charcoal sector in Kenya. For Malawi, Kambewa et al. (2007) estimate about 100,000 people regularly supporting their livelihoods through charcoal production, transport, and retailing. For Uganda, ESD (2007) estimates the figures to be around 200,00 permanently earning money from charcoal. However, estimating employment in a largely informal sector is difficult and is assumed to lead to an underestimation of the true figure.
charcoal production and use in 2006 that triggered significant social unrest leading to an eventual reversal of the charcoal ban after only a short period of time.

At the international level, unsustainable charcoal production undermines the country’s efforts to meet its objectives for participating in an international regime to Reduce Emissions from Deforestation and Degradation (REDD). A pro-active consideration of the charcoal sector is also necessary to meet the country’s commitment to meeting the Millennium Development Goal related to poverty alleviation and environmental sustainability.

Taking into consideration the wider implications of unsustainable charcoal utilization at the local, national, and international level, this Policy Note will serve as an input to the development of a Woodfuel Action Plan, which is currently under preparation and should be available in mid 2009. This Woodfuel Energy Strategy is intended to feed into a review of the overall Energy Strategy for Tanzania.

**Objectives of the Policy Note**

This Policy Note will put forward and discuss a range of policy measures along the entire charcoal value chain in Tanzania. This comprehensive approach is expected to provide decision-makers and stakeholders in Tanzania with a tool that supports them in the identification of efficient and effective policies addressing the charcoal challenge in a pro-active, inclusive, and forward looking manner. Given the vast range of literature addressing this charcoal challenge particularly for Tanzania and Sub-Saharan Africa (compare Box 2), this Policy Note does not engage in any kind of primary data collection and research. It does, however, make use of a simple bio-economic model to simulate charcoal supply and demand and how different policy options may impact the outcome of forest management. Given the data limitations of this Policy Note, this model should only be regarded as providing guidance rather than forecasting future charcoal supplies and demand in detail. A detailed description of the model is provided in Annex 2.

In the past, the Government of Tanzania has responded to the charcoal challenge by introducing policy measures at isolated segments of the charcoal utilization chain that have led to inadequate results only. Most of these policy interventions can be described as being of a re-active and ad-hoc nature and where introduced without prior consultation of stakeholders. Many of these policy measures were thus met with a certain degree of reservation by stakeholders and only implemented at a rather low rate. As experiences from other countries have shown, a comprehensive, forward looking and inclusive approach is required to design successful policies taking all parts of the charcoal value chain into consideration.

The development of this Policy Note benefited from a range of studies on charcoal utilization that was recently accomplished for Tanzania (see Box 2). These allowed the authors to build on a sound basis of analytical work and give particular attention to evaluating alternative policy options rather than spending much time and resources on generating primary data. With many analytical studies being published in Tanzania in the recent past, one additional objective of this Policy Note is also to consolidate their findings and translate their main findings into practical policy advice to the Government of Tanzania. Targeted complementary analyses and modeling was carried out in support
of policy options analysis, for example to forecast alternative scenarios for revenue collection, fuel switching, or investment needs to achieve sustainable charcoal utilization.

**Box 2: Key Analytical Work on Charcoal Utilization relevant for Tanzania**

2. Lund, J. (2007): *Decentralized Forest Revenue Collection: Evidence from Tanzania*; Development Briefs - Policy; Faculty of Life Science, University of Copenhagen, October 2007

*partly financed by the World Bank – WWF Alliance for Forest Conservation and Sustainable Use

Furthermore, this Policy Note reflects outcomes of four stakeholder workshops the Ministry of Natural Resources and Tourism (MNRT) organized together with the World Bank in Dar es Salaam between October 27 and 30, 2008. The purpose of the workshops was to discuss specific policy measures with relevant stakeholders ranging from charcoal producers, traders, district officials, representatives from different ministries (MNRT / MEM), NGOs, and development partners. A summary of each of these workshops is provided in Annex 3.
Box 3: World Bank Support to the Energy Sector in Tanzania

For the Energy Sector World Bank focus in the medium term is expected to include: updating the energy sector strategy and the power Investment Master Plan (WB is financing consultants to update the Plan); advice on possible private sector roles and pricing mechanisms; institutional support for TANESCO; support for further development of natural gas, where Tanzania may have considerable untapped reserves, including gas pricing formulae; expansion of the distribution network; help to explore and exploit renewable energy, and expand connectivity, including rural connectivity.

In 2006, President Kikwete asked the Bank to take the lead among development partners in the energy sector.


The recommendations expressed in this Policy Note are embedded in existing World Bank support to Tanzania as regards sustainable natural resource management and improving overall energy supply and sustainability. It also takes account of the country’s self-defined strategies and priorities related to poverty alleviation, sustainable development, and economic growth (see Box 4). By testing alternative policy options, this Policy Note deliberately establishes links between different sectors, such as the forestry and energy sector, but also with forestry and agriculture and forestry and transport.

Box 4: Principles of Sustainable and Equitable Development, Tanzania
National Strategy for Growth and Poverty Reduction

The operational starting points of these principles include the following:

1. **Renewable resources should be exploited on the bases of maximizing profits and sustaining yields.** Resources should not be driven to extinction, regardless of the dictates of present value maximization. Hence, harvesting rates should not exceed regeneration rates and waste emissions should not exceed absorptive capacities.

2. **Nonrenewable resources should be exploited at a rate equal to the creation of renewable substitutes.** Revenue from the exploitation of nonrenewable resources should contain an income component and a capital component. The capital component should be used to invest in building up a new renewable asset to replace the nonrenewable one at the point of its exhaustion.

3. **Revenue generated from natural resources should be shared equitably, in particular with the rural communities on whose land these resources are located.**

Source: The National Strategy for Growth and Poverty Reduction of 2005

The remainder of this Policy Note is structured as follows: The next section summarizes recent experiences as regards charcoal utilization in other Sub-Saharan African countries. Even though the charcoal challenge also exists in other regions, e.g. South Asia and Latin America, this section will focus exclusively on Sub-Saharan Africa. It will

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4 Especially the implementation of the World Bank financed Tanzania Forest Conservation and Management Project (TFCMP), but also sustainable land management and agriculture.
be demonstrated that the recommendations expressed in this Policy Note can potentially also be applied to other countries in SSA that face similar challenges. Following a brief though detailed overview of charcoal utilization in Tanzania is provided mainly building on the reports listed in Box 2. This analysis gives particular attention to the policy framework for charcoal utilization in Tanzania. Policy options for addressing the charcoal challenge will be discussed. This will be followed by estimating the scale of potential investments that may be required for implementing associated policy measures. The Policy Note will also provide further guidance to decision-makers and stakeholders by sketching out possible next steps in the policy process. The Policy Note will conclude by summarizing key recommendations related to charcoal utilization in Tanzania and sketching out possible next steps in the policy process.
Experiences from other Countries: Literature Review

At the global level, the number of people living with less than $1/day is about the same as the number of those lacking access to commercial energy: 2 billion people (FAO COAG 2005). Woodfuels are the world's most important form of non-fossil energy. Today, hundreds of millions of people remain completely reliant on upon wood for energy and can't anticipate any rapid transition to other energy sources in the near future. Developing countries consume about 77% of the world’s supply of woodfuels, which in turn accounts for 15 percent of their total primary energy consumption (FAO 2008, Matthews 2000).

Figure 1: Share of Woodfuels in National Energy Consumption

For most countries of Sub-Saharan Africa, Central America, the Caribbean, tropical Asia and the small islands of Oceania, woodfuels constitute the major source of energy and are used mainly to meet household energy needs. Woodfuels provide more than 70 percent of the energy needs of 34 countries in these regions (FAO 2008). In some countries such as Cambodia, Nepal in Asia, and Burkina Faso, Cameroon, Cape Verde, Rwanda, and Uganda in Sub-Saharan Africa, woodfuels provide 80 percent or more of total energy requirements (World Resources Institute - PAGE, 2000). In fact, woodfuels in Africa, Asia and Latin America account for 89 percent, 81 percent, and 66 percent of their respective total consumption of wood. In Bangladesh, Cambodia, Nepal and Pakistan this share goes up to 98%.

5 Unfortunately, the map has incomplete data for some of the most important countries using woodfuels, notably Tanzania, Madagascar, and Uganda. Nevertheless, the map provides a good enough general overview about dependency on woodfuels at a global scale and clearly indicates Sub-Saharan African countries as those with the highest dependency ratios (compare also Table 1).
Despite this significant reliance on woodfuels, national forest policies all too often remain silent on how to achieve sustainable woodfuel production and supplies, while energy policies tend to label wood-based fuels as a “backward” and “primitive” source of energy – one that is to be replaced with fossil fuels or electricity at the earliest possible convenience. In consequence, the issue is commonly overlooked – even discriminated against – in forest and (national) energy policies alike.

From the mid 1970s to the late 1980s, researchers and development partners alike identified the use of woodfuels as the main threat to sustainable forest management and as the main driver of deforestation with a projected trend towards a quadrupling of urban woodfuels consumption (RPTES, 1996). These warnings about the impacts of charcoal triggered an uncounted number of research studies and donor-funded projects all over the world.

Table 1: People Relying on Traditional Biomass (’000)

<table>
<thead>
<tr>
<th>Region</th>
<th>2004</th>
<th>2015</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>575</td>
<td>627</td>
<td>720</td>
</tr>
<tr>
<td>North Africa</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>India</td>
<td>740</td>
<td>777</td>
<td>782</td>
</tr>
<tr>
<td>China</td>
<td>480</td>
<td>453</td>
<td>394</td>
</tr>
<tr>
<td>Indonesia</td>
<td>156</td>
<td>171</td>
<td>180</td>
</tr>
<tr>
<td>Rest of Asia</td>
<td>489</td>
<td>521</td>
<td>561</td>
</tr>
<tr>
<td>Brazil</td>
<td>23</td>
<td>26</td>
<td>27</td>
</tr>
<tr>
<td>Rest of Latin America</td>
<td>60</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2528</strong></td>
<td><strong>2640</strong></td>
<td><strong>2727</strong></td>
</tr>
</tbody>
</table>


Due its limited mandate this Policy Note will in this section only focus on some key elements of charcoal utilization in Sub-Saharan Africa. This is important, because many of the findings presented in this Policy Note apply more generally in the Sub-Saharan context. In other countries, such as in South Asia or Latin America, the environmental, socio-economic, socio-cultural and institutional context may be quite different and policy options to address unsustainable utilization of woodfuels may look quite different. Selected country and project experiences are cited in the subsequent parts due to their relevance for the situation in Tanzania.

**General Aspects – Charcoal Utilization in Sub-Saharan Africa**

The 47 countries comprising Sub-Saharan Africa depend more on their natural resource base for economic and social needs than any other region in the world. Two-thirds of the people in this region live in rural areas and rely on agriculture and other natural resources for income. At the same time, Sub-Saharan Africa has one of the world's fastest growing populations (approximately 2.2% a year), and is expected to be home to over a billion people by 2025. The International Energy Agency predicts that by 2030, biomass energy in Africa will still account for an estimated three quarters of total residential energy (International Energy Agency 2006).
Energy consumption in Sub-Saharan Africa varies dramatically, with noncommercial fuels, such as wood and animal waste, dominating fuel consumption. The use of woodfuels is predominant in both rural and urban locations accounting for approximately 70% of total energy use and 90% of household energy use in Sub-Saharan Africa. Many studies have demonstrated that it is especially the rural population and the urban poor who rely on woodfuels as their prime source of energy. Furthermore, it is quite common for a large number of traders to be involved in buying, transporting, and re-selling woodfuels and this is often where most of the value-added is obtained in the informal sector.

As a consequence, with one of the primary causes of deforestation being wood utilization for fuel, the loss of forests is one of the most pressing environmental problems faced by almost all Sub-Saharan African nations. It is estimated that if current trends continue, many areas will experience a severe shortage of fuelwood by 2025. Deforestation also has negative implications for the local environment (increased erosion and loss of biodiversity). The highest rates of deforestation occur in areas with large growing populations such as the East African Highlands and the Sahel.

Although woodfuels are often considered ‘non-commercial’, they are widely traded. Particularly in urban areas, where woodfuels are most relevant, markets for fuelwood and charcoal are thriving. As presented in detail for Tanzania, many people, both in urban and rural areas, earn their main income from the woodfuel business. This applies equally to other SSA countries and can involve growing, harvesting, processing, trading, transporting, retailing and stove production.

**Wood Production for Charcoal**

In most developing countries, access to wood for charcoal production is not regulated in practice, much less managed in a sustainable manner. Where firewood and charcoal are sold, market prices almost entirely reflect extraction costs. Landless domestic migrants and the poorest segments of urban populations typically spearhead the commercialization of charcoal, because they have few other choices left. Middlemen and retailers play a catalyst role, mostly in larger cities. Under such conditions, the only limit to woodfuel “production” is the occurrence of trees within an economically tolerable distance from the place of consumption.

Three broad regimes for wood production and harvesting can be differentiated: a) natural forest resources, b) plantations, including small-scale woodlots, and c) trees outside forests (TOF), notably agro-forestry systems and trees along roadsides, fields and rivers. Charcoal produced from wood coming from natural forest resources generally requires only investments in physically labor, because the raw material comes for “free” to the charcoal producer. This is mainly due to the fact that – even though natural forest are *de jure* under some kind of property regime – they are *de facto* open-access resources and no regulation of wood extraction for charcoal production is

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6 This hypothesis was, for example, confirmed by Sander (2004) in an empirical analysis among rural households in Madagascar. Using principle component analysis, the data set of about 500 households was differentiated as regards different income levels into three strata – the better-off, the poor, and the poorest. Analyzing economic dependence on charcoal production showed that the poorest households depend significantly more on charcoal production to sustain their livelihoods compared to the better-off households among rural populations which have better access to other income such as agriculture and off-farm income.
applied. In contrast, plantations and TOF require some sort of upfront investment into wood production and, thus, make the raw material for the charcoal producer more expensive than trees mined from natural, open-access forest regimes.

Following, some basic principles for each of the forest management regimes will be briefly described, complemented by a discussion of some examples from Sub-Saharan African countries.

**Natural Forests**

The preferred regime for managing natural forests for charcoal is close-to-nature, multi-purpose forest management. Forest management and utilization according to this concept is a highly complex and challenging undertaking, one that typically yields a highly diverse scope of products and services. Woodfuel production in the context of natural forest management happens in three principle ways: As a by-product of some other wood extraction, harvesting of wood resulting from changing forests to other land-uses, and shift and burn agriculture, or targeting wood cutting for charcoal production.

**Box 5: The Wajib approach to Community-Based Forest Management in Ethiopia**

In Ethiopia, the approach to NRM differs from many other Participatory Forest Management (PFM) approaches in Africa, because the number of participating households is limited to the forests' carrying capacity and economic potential. The approach called “WAJIB” requires a binding agreement between the local forest user groups and the district forest office with clearly stated rights, duties and obligations of both partners. The underlying assumption is that households will only invest in forestry operations if they can make a living out of sustainable forest management. Thus, the forest in a given village is subdivided into forest blocks with an average minimum size of 360 ha (scale-management). Based on the forest carrying capacity of e.g. 12 ha per household, each block is managed by a WAJIB group of not more than 30 households. Each WAJIB group has its own by-laws (internal regulations), which govern the use, protection, and rights and responsibilities of each household within the block. The main duty of the forest administration is to provide technical advice to the WAJIB groups on how to develop and utilize the forest on a sustainable basis. One risk that was identified for this approach is that well-off households benefit disproportionately from additional income, and that the poor and landless (who formerly profited from uncontrolled charcoal-making) are excluded.

*Source: Sepp (2008a)*

Most charcoal related management challenges occur in arid or semi-arid regions of Sub-Saharan Africa with low and erratic precipitation. Such regions are typically characterized by savannah-type vegetation. Savannah woodlands of this type are not suited to produce high value timber, although their contribution in terms of non-timber forest products may be substantial, such as fodder, gums, resins, etc.

Successful sustainable management approaches of forests for woodfuel production, especially savannah woodlands, are often achieved through Participatory Forest (PFM) or Community-Based Forest Management (CBFM) approaches. PFM, for example, is a forest management system where forest stakeholders and government services jointly define rights and responsibilities of forest resource use and agree on adequate benefit
sharing mechanisms. In recent years CBFM approaches gained considerable momentum in the context of decentralization processes. Many African countries seek to devolve management responsibilities to local actors with a view to increasing participation by local communities. Box 6 summarizes some examples describing charcoal production under CBFM in Africa.

Box 6: Community-Based Forest Management for Woodfuel Production in Senegal

In Senegal, the forest code creates opportunities for rural communes to formally claim possession of hitherto state-controlled forests adjacent to their community territory, and to manage them in accordance with a publicly approved forest management plan. Additionally, state forests may also be allocated to communes for co-management. Communes in turn enter into contracts for the purpose of granting use rights on the village level. Detailed, inventory-based management plans are prepared, which also reflect and harmonize locally perceived needs and expectations. Each village established a management committee and households interested in utilization of certain forest products form respective user groups.

The following benefit-sharing formula has been consensually adopted among stakeholders: 55% for the producer groups, 25% for a communal forest management fund, and 20% for the communal development fund.

An analysis of the three pilot forests revealed the following issues:

- The obligation to develop full-fledged management plans prior to any formal utilization of the forests can only be met entirely through external support. As a result local people’s capacities and understandings of forest management are often overloaded.
- Management plans often assume investments beyond the forest resources’ economic potential. Forest administrations tend to impose requirements that they themselves could never hope to meet if they were to manage the forests. Consequently, forest management suffers from low profitability or a net loss to local communities.
- The economic viability of natural forest management highly depends on the initial condition of the forest resources. Some forests contribute only little to the woodfuel supply but provide substantial non wood forest products. To cover costs of required forest investments, all forest resources need to be valued to increase management revenues.
- Forests in densely populated areas are often overexploited, and economically of minor value for the neighboring communities. Incentives are lacking to invest and thus to prevent a gradual transformation into agricultural lands.

Source: Sepp (2008a)

Observing some real case examples, SEPP (2008a) concludes that if done sustainably, natural forest management yields only modest profits even under the best of circumstances. In many cases forests earmarked for community allocation are degraded/overexploited and in need of rehabilitation and investment (enrichment planting, protection from fire and/or cattle etc.). This fact further diminishes the economic prospects of village communities. Because many of the problems observed are due to policy and market failures, a more holistic approach with interventions along the entire wood-fuel production chain seems to have a greater impact than approaches solely focused on sustainable forest management.
Plantations
Planted forests, if managed responsibly, have a particularly important role to play in providing a renewable and environmentally friendly energy resource. In countries with significant areas of marginal and/or degraded public land, establishing plantations at the community or household level privatization of land for the purpose of tree-farming may be an option. Such schemes have the potential to preserve/ameliorate land and to augment wood-fuel supplies at the same time. Box 7 summarizes key characteristics of a best-practice example of promoting woodfuel plantation management at the household level from Madagascar.

Box 7: Household Tree Plantations for Charcoal Production in Madagascar

A village based approach in Madagascar facilitated through bilateral technical assistance and implemented by local NGOs places local people in the centre of planning and implementation of plantation management for sustainable charcoal production. It is based on voluntary participation of communities eager to rehabilitate degraded lands by means of voluntary reforestation. In a first step, an afforestation area is identified by the community and legally registered as a “Réserve Foncières pour le Reboisement (RFR)". A village based participatory approval process allocates individual woodlots to interested households, along with defined use-rights and obligations. Each plot is demarcated, mapped, and documented with the communities’ approval. Technical assistance is provided by specially trained NGOs through a three-stage approach with a total implementation period of 21 months.

Aside from institutional and technical support, the only substantial external input is mechanized soil preparation. Tractors must be used to break up compact layers in degraded soils, so as to increase percolation of rainwater and ensure higher survival rates of seedlings. Nursery operation, plantation and maintenance are the plantation owners’ responsibility. An overall GIS based monitoring system provides data for every plantation plot, including productivity figures, income generated etc.. The establishment costs are estimated at 225 Euros/hectare, of which 147 Euros (75% for mechanized soil preparation) is borne by technical cooperation and 78 Euros by the households in form of labor input. Up to now more than 4500 ha have been planted providing an annual increase in income by more than 20% for more than 1,500 rural households. The monitoring system further revealed that 34% of the poorest and landless people got involved and 22% of women enrolled as woodlot holders. In addition, the uncontrolled exploitation of natural forests in the vicinity of the villages substantially decreased, as did the incidence of fires.

Source: Sepp (2008a) and GTZ-GREENMAD (2006)

Forest plantations should not be established on forest areas in a natural or semi-natural state. Hardwood species have the greatest potential for wood-fuel. Species selection depends on both site conditions and users’ preferences. Silvicultural techniques should be simple and adapted to the capacities of rural people⁷. Experiences in many countries have shown that secure land and tree tenure is the single most important incentive for participants to invest in plantation establishment. Although tenure regimes can be both formal and informal, a formal recognition and enforcement of

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⁷ To balance the social, cultural, environmental and economic dimensions of plantation management and support their contribution towards sustainable livelihoods and land use, FAO has coordinated a multi-stakeholder process to prepare guidelines for planted forests. These guidelines [5] are voluntary and reflect the needs and perspectives of governments, public- and private-sector investors, policymakers and planners.
tenure rights is preferable. Sustainability depends not only on social and ecological viability, but also on significant returns on investments for the concerned plantation owners. As long as the market prices for wood-fuel do not reflect production costs, substantial external investments are necessary to initiate wood-fuel plantations.

Box 8: Outgrower Schemes

Through outgrower schemes companies (or other entities) with inadequate forest holdings or access to public forests seek to secure additional supplies to meet their demand for raw material. Forestry outgrower arrangements between growers (or co-operatives) and processors may be characterized as:

- Partnerships in which growers are largely responsible for production, with company assurance or guarantee they will purchase the product;
- Partnerships in which the company is largely responsible for production, paying landholders market prices for their wood allocation;
- Land lease agreements in which landholders have little involvement in plantation management; and
- Land lease agreements with additional benefits for landholders.

Under outgrower partnerships, growers allocate land and other resources to the production and management of trees and sometimes other forest products, for a processing company, with the company providing a guaranteed market. The varying responsibilities of each partner are defined by contract.

The incentives for forest processors to develop outgrower schemes include increased supply of wood resource, access to productive land, resource security without the need to purchase land, diversification of supply, and increased co-operation with local communities. For growers, the advantages include an alternate and additional source of income, a guaranteed market for products, reduced market risks and, in some cases, financial support for enterprise development.

Existing outgrower arrangements vary considerably in their ability to be mutually beneficial, achieve sustainable forest management, and meet the social, technical or economic goals of the partners. Not all out-grower partnerships are viewed as successful and poor grower industry links are regularly identified as one of the major constraints to forestry development throughout the world.

Source: FAO (2001)

One possible approach to sustainable charcoal production that provides economic incentives and benefit scheme sharing schemes to local households are so-called outgrower schemes. Box 8 summarizes key features of such arrangements (compare FAO 2001). There are long-term experiences from outgrower schemes, especially as regards pulp and paper production. The potential for outgrower schemes in the context of sustainable charcoal production needs is further discussed below.

Trees Outside Forests

In the African context the contribution of TOFs to energy supply remains still largely underestimated. Statistics on woodfuel supply do not adequately capture this resource, even though a major part of the rural household supply is already covered by TOFs. Existing policies concerning rural development still neglect TOFs as one of the most
important woodfuel supply resources besides natural forests and plantations. Some countries consider it as a responsibility of ministries responsible for agriculture, while others attribute it to forestry or environment.

Trees outside forests (TOFs) include all trees found on non-forest and non-wooded lands, i.e. trees on agricultural lands, in urban and settlement areas, along roads, in home gardens, in hedgerows, scattered in the landscape, and on pasture and rangelands. Most of the knowledge on TOFs derives from the experiences made in agro-forestry.

**Box 9: Trees-Outside-Forests (TOF) in the Sub-Saharan Context**

The Sahel Eco-Farm (SEF) approach has been developed with the support of ICRISAT and provides a good example of an agroforestry based system which combines ecological advantages (microclimate and soil protection) with income generation. It thus improves the livelihood of the rural poor in vulnerable regions such as the Sahel. The SEF is based on an alley cropping system in which trees and/or shrubs are intercropped with annual crops.

Another noteworthy example is the raising of woodfuel tree-crops as part of an improved fallow system, whereby nitrogen-fixing trees that can be harvested for fuel-wood or charcoal after 3-4 years are planted (or sown) on fallow fields. Examples from western Kenya demonstrate that considerable amounts of wood (sufficient to supply the fuel-wood needs of a typical rural household with 6–7 members for 6–8 months) can be obtained from improved fallow on the bases of one hectare of improved fallow.

*Source: Sepp (2008a)*

Although TOFs fulfill a multipurpose function and are part of an integrated land-use system, wood-fuel can be a main product. According to FAO over two-thirds of the energy demand in the Asia Pacific region is supplied by woodfuels from non-forest sources.

TOFs for charcoal can occur in various places and ways: In home-gardens or as replacement or enhancement of natural fallow vegetation. To control soil and water erosion trees and shrubs can be planted along the contour-lines on slopes or on terraces. Living fences planted as tree-lines on farm boundaries or on pasture plots, animal enclosures, or around agricultural fields can also contribute to the energy supply of local households.

The species mostly used for wood-fuel should preferably be fast growing hardwoods which can be harvested as coppice after 4-6 years. They should adapt well to the site conditions and have nitrogen-fixing properties. As for plantations, management procedures must match the capacities of rural populations. It is imperative to use

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8 Agro-forestry is the practice of growing trees and agricultural products on the same area at the same time. Agro-forestry helps farmers create more integrated, diverse, productive, profitable, healthy and sustainable land-use systems.
species resilient to grazing by livestock or wildlife, so as to minimize costs for forest protection\(^9\).

It has to be kept in mind that the socio-economic and ecological advantages of agro-forestry outweigh by large any expensive, ill-conceived tree plantation program because agro-forestry can be developed at a fraction of the cost compared to plantations (and engenders greater local participation and a wider diversity of goods and services for the local and national economies). The major constraint to wider dissemination of agroforestry approaches often arises from complex land tenure systems in Africa.

**Charcoal Production**

The conversion of wood to charcoal has been observed to be a small, but decisive factor in the charcoal value chain. In most instances traditional kilns are used resulting in low conversion efficiencies.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Traditional Phase</th>
<th>Transition Phase</th>
<th>Semi-Industrial Phase</th>
<th>Industrial Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional Kilns</td>
<td>Improved Kilns</td>
<td>Semi-industrial Kilns</td>
<td>Industrial Kilns</td>
</tr>
<tr>
<td>Conversion Technology</td>
<td><img src="image1" alt="Traditional Kiln" /></td>
<td><img src="image2" alt="Improved Kiln" /></td>
<td><img src="image3" alt="Semi-Industrial Kiln" /></td>
<td><img src="image4" alt="Industrial Kiln" /></td>
</tr>
<tr>
<td>Efficiency</td>
<td>8-12%</td>
<td>12-18%</td>
<td>18-24%</td>
<td>&gt;24%</td>
</tr>
<tr>
<td>Emissions</td>
<td>CO(_2): 450 - 550</td>
<td>CH(_4): ~700</td>
<td>CO(_2): ~400</td>
<td>CH(_4): ~50</td>
</tr>
<tr>
<td></td>
<td>CO: 450 - 650</td>
<td></td>
<td></td>
<td>CO: ~160</td>
</tr>
</tbody>
</table>

Sources: Sepp (2008b)

Many projects have tried to overcome this challenge by promoting more efficient kilns for charcoal production, but the adoption rate has been limited. The reasons for this are mainly found in the informal – and often illegal – nature of charcoal production as frequently described throughout this paper. Higher material costs, increased labor input, but also lack of knowledge all represents disincentives for charcoal burners to adapt improved technologies in situations where they are not rewarded with increased prices.

Table 2 summarizes kiln technologies and their associated conversion factors and emission rates. It clearly shows that significant efficiency gains can be achieved by

\(^9\) The World Agroforestry Centre maintains freely accessible databases providing information on the management, use and the ecology of a wide range of tree species which can be used for fuel-wood purposes in agro-forestry.
applying improved kiln technologies and that this needs aspect needs to be considered for designing appropriate policies for sustainable charcoal utilization.

**Charcoal Trade**

The charcoal trade – i.e. the transport of the product from the rural areas to the urban centers and the distribution through a chain of wholesalers to the consumer – is very similar in most Sub-Saharan countries. As outlined in Figure 2 it generally involves large-scale and small-scale transporters and wholesalers. Especially large-scale wholesalers are often also transporters at the same time.

**Box 10: Experiences with Fiscal Incentives for Sustainable Charcoal Production in Sub-Saharan Africa**

Most likely the first country to attempt to better manage the supply situation of charcoal by means of fiscal incentive measures was Niger, where in 1989 the Government created “rural markets”, or well marked locations where firewood was sold by villages from locally managed wood resources. These markets were officially created and approved of by the government. Management systems were based on knowledge of the local resource base and development of a long-term plan for sustainable harvesting. The two important elements for success were:

(i) Villages operating a rural market were allowed to levy a tax, which remained largely in the village. This was additional and non-negotiable revenue for the village belonging to the whole population rather than those involved in the woodfuel business; and

(ii) The tax level depended on a number of variables: (a) how far the market is from Niamey with higher tax levels the closer the market is; (b) whether it is sustainably produced wood near the rural market (lower taxes); (c) or from a zone with excess wood where wood harvesting is allowed; or (d) wood illegally cut (highest tax level).

In this way, transporters had an incentive to visit rural wood markets rather than open access areas. At the same time, villages had an incentive to get approval for operating a rural wood market, for which several conditions existed: (i) delineation of village borders; (ii) map of wood resources, including dead wood; (iii) simple woodfuel harvesting management plans; and (iv) establishment of a management committee. Once all conditions fully satisfied, villages were allowed to sell wood and levy the tax. A mechanism with coupons existed that indicated the origin of the wood and the quantity transported. Around Niamey a control system was set up verifying whether wood transporters had already paid their tax. If not, they were assumed to have obtained wood from a non-managed zone and paid a tax accordingly. Even though the tax payment compliance mechanism no longer exists, the rural markets still function and a tax is still levied, but now directly by the village. The main problem is Forestry Department staff, some of whom reverted back to their old habits of harassing the population.

In Mali, Senegal, and Madagascar similar systems were set up in the late 1990’s, with limited success.

*Source: van der Plas (2008), compare also Chomitz and Griffiths (1997)*

As discussed earlier for the case of Tanzania, the charcoal business often displays a decidedly oligopolistic structure: Profits are usually concentrated in the hands of a few intermediaries, mainly engaged as transport agents or wholesalers (see Figure 2). Furthermore, this setting is also been observed to be heavily biased against women, who often bear the heaviest workloads (wood harvesting/collection, kiln operation, small-scale retailers). Instead of equitable revenue-sharing along the entire value chain,
revenue circulates in a loop between traders and consumers. Marginal cash flows to the charcoal burners – and virtually none to those communities, whose forest areas are being depleted in the process. Such oligopolistic structure are often caused – or reinforced – by local being active in the charcoal business elites such as government officials, police, army, or their respective family members.

Figure 2: Share of Value-Added within the Charcoal Value Chain

<table>
<thead>
<tr>
<th></th>
<th>Tanzania</th>
<th>Senegal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burner</td>
<td>33%</td>
<td>19%</td>
</tr>
<tr>
<td>Input supplies</td>
<td></td>
<td>22%</td>
</tr>
<tr>
<td>Loader</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair</td>
<td></td>
<td>17%</td>
</tr>
<tr>
<td>Truck owner</td>
<td>50%</td>
<td>54%</td>
</tr>
<tr>
<td>Truck driver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholesaler</td>
<td></td>
<td>7%</td>
</tr>
<tr>
<td>Transporter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laborer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retailer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transporter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Taxes and fees (both legal and extra-legal) are not separated out.

Sources: van Beukering (2007), Sepp (2008b)

There is anecdotal evidence that few traders obtain required papers on a regular basis and that bribes are offered whenever controls are executed. This may be due to a number of reasons such as high transaction costs, i.e. traveling to the nearest forest service representative and waiting for the license to be issued, and lack of resources for obtaining permits such as for paying the license plus potential bribes to the license issuing public service representative. Consequently, the difficulties to obtain a license seem to lead to illegal production and marketing of charcoal.

Looking at existing literature, it is obvious that trade and marketing is probably the least regulated aspect of the charcoal value chain, although it technically provides a good opportunity to introduce financial incentive and regulatory mechanisms. In Tanzania, this can be explained in part with the constrained capacity at local and district levels to address this situation. Besides, district forest officials, who are responsible to levy fines and penalties for illegally transporting and trading charcoal, have no incentive to do so, as these charges have to be submitted in full to Central Government. Changing the

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10 Minten and Sander (forthcoming) make similar observations for Madagascar. For Chad, van der Plas reports that a sustainable charcoal model was discontinued due to vested interests of local elites. Similar market structures are also observed for other countries, e.g. Mauretania (Sepp (2008), personal communication).

11 For their econometric analysis of primary data of the charcoal trade in Madagascar, Minten and Sander (forthcoming) conclude that vertical integration and knowing more government officials increase the efficiency of the trader. This last determinant does not grow over time and is therefore inherently linked with the personality of the trader or manager of the firm. These results are in contrast with the determinants of legal trade. Depending on government officials in the legal trade sector is of no benefit to the trader, but may actually be a sign of low flexibility and market adaptation.

12 Kambewa et al. (2007) estimate for Malawi that such bribes amount to 15-20% of the final charcoal price.
latter as well as the fact that penalties are currently below the market price of charcoal, would improve the incentive structure and increase the availability of additional funding.

**Charcoal Consumption**

The conventional view is that economic growth will trigger a reduced demand for wood and other biomass, with consumers – and countries – shifting towards the use of commercial fuels, such as LPG, natural gas, and other fossil fuels\(^{13}\). This behavior is generally referred to as the energy ladder or energy stack. The energy stack as depicted in Figure 3 suggests that fuel substitution is not perfect and that households often use multiple fuels alongside one another while their socio-economic status improves. The energy stack theory has implications for woodfuel use: it seems that even with economic development woodfuel use will not necessarily decline. In fact, biomass consumption often still increases under economic development, because in many developing countries fossil fuels are simply added to the energy mix, not substituted for woodfuels (compare Matthews 2000).

**Figure 3: Comparison of the Energy Ladder and Energy Stack Theory**

As a response to the charcoal challenge, donor-funded projects started already as early as the mid 1970s to approach the charcoal challenge in Sub-Saharan countries by attempting to reduce charcoal consumption rates, especially promoting fuel-efficient stoves or providing incentives to promote fuel switches. For both, success has been limited. Many studies independently conclude that higher investment costs for improved

\(^{13}\) Compare also Box 13 for a discussion of characteristics of alternative fuel sources in Tanzania.
stoves is still the single most reason for households not to invest in improved stoves or to contemplate fuel switching (compare for example Schlag and Zuzarte 2008, CHAPOSA 2002, Gill 1985).

Other reasons are the perceived fragile nature of improved stoves and, thus, the shorter lifespan (CHAPOSA 2002) and the mismatch between the felt needs of the user and the assumptions of the institutions and individuals designing and promoting improved stoves. Stove users in a number of developing countries are concerned about speeding cooking whilst stove programs emphasize fuel savings. In any case, traditional cooking stoves and fireplaces are not inherently inefficient for cooking. In the literature, most of the claims that traditional cooking stoves are inefficient appear on inspection to be anecdotal. Not all improved stoves have been more efficient than traditional designs. Moreover, traditional modes of cooking serve a number of socio cultural and practical functions which have been neglected in stove programs to date.

Stove efficiency is contingent on variables within four broad categories: a) fuel types and characteristics, b) combustion efficiency, c) heat transfer efficiency, and b) behavior of the user. In a study evaluating stove efficiencies in Uganda (USAID 2007) different ways of measuring efficiency were applied, mainly a water boiling and a controlled cooking test. These tests revealed that under different situations different stoves proved to be most efficient. These aspects have to be equally considered when a fuel switch to alternative fuels is promoted on the basis of improved efficiencies, e.g. for LPG. Often traditional cooking behavior is most efficient when using traditional stoves, but would result in overall higher energy consumption – and energy costs – when modern energy sources are used. The mix of traditional cooking and modern usages of energy also contributes to the fact that the wealthier households tend to rely on a mix of energy sources, such LPG for quick usage (boiling water for a tea, warming up a meal) and charcoal for meal preparation and water boiling for hygienic reasons.

Table 3: Commonly used Stoves for Fuelwood and Charcoal Combustion

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Traditional Phase</th>
<th>Transition Phase</th>
<th>Semi-Industrial Phase</th>
<th>Industrial Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustion Technology</td>
<td>3-Stone Fire</td>
<td>Improved Stove (First generation)</td>
<td>Improved Stove (Second generation)</td>
<td>High Efficiency Stove</td>
</tr>
<tr>
<td>Efficiency</td>
<td>8-12%</td>
<td>20-25%</td>
<td>25-35%</td>
<td>&gt;35%</td>
</tr>
</tbody>
</table>

Source: Sepp (2008b)

Socio-cultural preferences also play their role: new stoves may require new utensils households do not have or the adoption of new cooking habits. For example, food

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14 The water boiling test was divided in three parts: water boiling with a cold stove, water boiling with a pre-heated stove, and maintaining water at simmering temperatures.

15 In Tanzania charcoal consumers commonly use first generation improved stoves or less efficient stoves.
preparation in developing countries often requires food to simmer for many hours on a small flame and combine different activities, e.g. cooking and boiling drinking water. Wealthier households also tend to have a maid for cooking who have no personal interest in fuel efficiency or fuel switching since energy expenses are borne by the patron and not the maid. Often women also are not in power as regards economic decision-making of a household and, thus, they do not have an input in the households stove or fuel choice.

Lastly, the use of modern fuels is also frequently associated with providing important health benefits, because inefficient and incomplete combustion of woodfuels releases a number of pollutants for example carbon monoxide, sulfur, and other particle manner. Commonly observed diseases resulting from indoor air pollution are, for example, incidence of chronic respiratory diseases, including pneumonia, tuberculosis, acute respiratory infection (ARI) and chronic obstructive pulmonary disease, low birthweight, cataracts, cardiovascular events and all-cause mortality both in adults and children (Fullerton et al. 2008). Women and children are exposed to these pollutants at significant levels and for longer periods of time (compare also Schlag and Zuzarte 2008, Ezzati and Kammen 2002, Zhang et al. 1999). In contrast, there is anecdotal claim that a reduction in indoor air pollution increases the risks of malaria infections due to higher numbers of mosquitoes. However, Biran et al. (2007) conclude from their literature review that there is currently no evidence that smoke from domestic fuel use provides effective protection from mosquitoes and malaria.
Charcoal in Tanzania – An Overview

Socio-Economic Considerations

Charcoal is the main energy source for Tanzania’s urban population, and even more so for the urban poor. Low-income households have a higher per-capita consumption of charcoal, accounting for roughly three-quarters of the energy expenses. Although electricity and gas are the principal energy sources among wealthier households, these households still use considerable quantities of charcoal. Most urban institutions in Tanzania (bars, restaurants, schools and hospitals, etc.) also use charcoal as their principal source of energy for cooking.

Figure 4: Sources of Energy for Cooking in Tanzania (1991/92, 2000/01, 2007)

The total expenditure share of wealthier households for charcoal is obviously lower than for poorer households. However, because wealthier households can afford buying charcoal in bulk, unit prices are significantly lower than for poorer households. Constraint by their often unreliable and oscillating cash-flow, poorer households purchase in smaller quantities and on a regular basis, sometimes daily or even multi-daily basis.

16 Matthews (2000) analyzes that due to economic development the use of fossil fuels increased in developing countries, but that the absolute amount of biomass used as a source of energy increased, too. It is concluded that in many cases new energy sources are simply added to the energy mix causing overall energy consumption to rise, but biomass is not substituted.

17 Kambewa et al. (2007) make similar observations for Malawi.
Between 2004 – 2007 prices of charcoal at production sites have increased sharply by 160% from around TSh3,000 per bag to TSh8,000 per bag. Similarly retail price of charcoal in Dar es Salaam recently increased rapidly, from below TSh5,000 in 2003 to over TSh20,000 in 2007. During market observations in October 2008 it was noted that market prices at vendors had again risen up to over TSh25,000.

These price increases are especially noteworthy, because of the parallel increase in households using charcoal for cooking as discussed before (compare Figure 4). This indicates highly price inelastic demand for charcoal, which can be explained as follows: a) while prices for charcoal are rising, so are prices for substitute energy sources; b) with simply no reliable energy alternative for cooking households must pay whatever the price is to meet their need for cooking fuel to prepare daily meals for their families.

Figure 5: Charcoal Prices at Productions Site (2004 – 2007) and in Dar es Salaam (2003 – 2007)

In total, Tanzanians consume more than 2,650 tons of charcoal each day, or roughly one million tons per year. To produce that quantity using traditional methods, the daily wood raw materials input requirement would be equivalent to that held in 342.5 hectares of forest.\footnote{This is based on a 10:1 ratio between wood and charcoal and 80 tons of wood per hectare. This is a conservative estimate. Some forest can house as little as 40 tons of wood. Average wood production from Miombo woodlands is estimated at 35 tons per hectare. A Principal Engineer from the Ministry of Energy and Minerals gives a figure of 91,000 hectares deforested annually as a result of expanded charcoal and agricultural production.} A full year of this consumption equates to more than 125,000 hectares of forest destroyed, or twelve square kilometers.\footnote{Tanzania has 33 million hectares of forested land.}

About half of the total consumption goes to Dar es Salaam with an estimate 1,500 tons each day. At current demographic trends and consumption rates it is estimated that within the next 20 years, charcoal consumption for Dar es Salaam alone would more than double with about 3,300 tons of charcoal consumed per day. Assuming that unsustainable forest management practices and inefficient carbonization processes will...
continued, natural forest cover within the 3 districts nearest to the city can be expected to almost disappear within the next decade, leaving only highly degraded forest resources to sustain people’s livelihoods (compare also Figure 6).

Figure 6: Simulated Results for Charcoal Consumption in and Deforestation in 3 Districts adjacent to Dar es Salaam

<table>
<thead>
<tr>
<th>Years</th>
<th>Natural Forest Area in Hectares (million)</th>
<th>Bags of Charcoal (thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1.8</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>1.6</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>1.4</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>1.2</td>
<td>40</td>
</tr>
<tr>
<td>6</td>
<td>1.0</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>0.8</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>0.6</td>
<td>70</td>
</tr>
</tbody>
</table>

Source: Own Simulations

Charcoal bags (56kg) consumed in Dar es Salaam per day

Similar to other countries, several tens of thousands of rural and urban entrepreneurs in Tanzania earn direct vital income from the production of charcoal. Figure 7 illustrates the wide range of beneficiaries along the charcoal value chain without taking into account more indirect benefits, such as selling gas to charcoal transporting trucks, retailers selling / repairing tools necessary for tree felling and kiln preparation, or even the use of cell phones for communication between different actors. Government is mentioned where royalties, license fees or taxes are charged. Again, indirect effects such as employment for government officials or taxes charged on other products, e.g. stoves, is not considered.

20 The model results should be considered as indicative only. The model takes into account only forest area that is available and usable for charcoal production. The model indicates that under a “Business-as-Usual” scenario, the forests will be significantly degraded and disappear in the 3 districts adjacent to Dar es Salaam where most of the charcoal for the city is currently produced. Under this scenario, it can be assumed that supply will also shift to districts farther away, thus, complete deforestation is not likely to occur, but usable and accessible natural forest area (Miombo woodland) will disappear (compare also Matthews 2000). This assumption is justified given that Malimbwi et al. (2007) state that the forest area in the 3 districts near Dar es Salaam are already suffering from degradation and agricultural encroachment. For degraded Miombo woodland near urban centers wood stocks ranging between 0.3m$^3$/ha near road sides to 15m$^3$/ha on public lands are reported. In comparison, stocks of undisturbed Miombo woodland are ranging between 35m$^3$/ha and 47m$^3$/ha (CHAPOSA 2002, Luoga et al. 2002). Other tree resources that will remain in the area are trees outside forests (e.g. agroforestry) which will, for example, continued to be used for fuelwood collection, but also forests in protected area or other conservation sites.

21 Kambewa et al. (2007) estimate employment for about 93,000 people in the charcoal industry in Malawi.
The Tanzanian charcoal industry is estimated at about one million tons per year. This is four times larger than estimated for Malawi (Kambewa et al. 2007) and double the volume for Uganda (ESD 2007), but only about 60% the volume estimated for Kenya (ESD 2007). In financial terms the Tanzanian charcoal market is valued at US$650 million, nearly ten times the Malawian market due to the higher prices prevalent in Dar es Salaam.

Figure 7: Beneficiaries in the Charcoal Value Chain in Tanzania

The structure of the charcoal chain is complex, comprising of many different stakeholders with different objectives and economic potential (see Figure 7). The vast majority of charcoal comes from natural forests. Plantations, woodlots, or trees-outside-the-forest (e.g. in agro-forestry systems, along roads and around fields) play only a negligible role for charcoal production. Charcoal producers can either be contracted by wholesalers or transporters or work on their own selling their product individually. They either consider charcoal production as their main economic activity or engage only occasionally in it for ad-hoc cash generation, especially in case of unexpected expenses such as medical charges, death, bad harvest, marriage, or school fees. These producers sell their product to their patrons or individually to large- or small-scale transporters. Some of the large-scale transporters are also wholesalers. These wholesalers then pass the charcoal on to smaller-scale retailers and consumers.

Trade in charcoal is conducted by formal as well as informal actors. One commercialization chain begins with government-issued licenses for the exploitation of the forest resources. The product is transported and traded by officially licensed transporters and traders who pay the necessary duties and taxes. A second commercialization chain begins without official authorization, which is essentially an informal or illegal activity. Charcoal travelling through this informal chain is transported and traded clandestinely in attempt to avoid authorities, taxation and eventual penalties. It is estimated that nearly 80% of charcoal arriving in Dar es Salaam follows this second path (Malimbwi et al. 2007). With Tanzania’s charcoal consumption conservatively-estimated at about US$630 million23, the government fails to collect taxes of at least $100 million annually24.

22 These resources are rather used for firewood collection.
23 An exchange rate of TSh 1,280 to the US$ was applied.
24 For Kenya, revenue losses from clandestine charcoal production and trade are estimated at KSh 5.1 billion or US$ 65 million (ESD 2007).
The first commercialization chain engenders direct and indirect costs that are avoided under the second chain, especially transaction costs for obtaining licenses and the fees charged. Even though forests in Tanzania are de jure owned by the government, lack of resources for monitoring and controls makes them de facto open-access resources. Clandestine harvesting of trees also leads to an economic under pricing of the raw material, because the tree is considered as a free resource. Similarly, government charged royalties and fees are often lower than the true opportunity cost of the resource leading equally to and under pricing of the resource and, thus, socially inefficient utilization. Systematic under pricing of the raw material also eliminates incentives for making investments into sustainable tree production, both at the private and public level.

Revenues along the charcoal value chain are distributed unevenly (compare also Figure 2). The charcoal producer can earn as little as 20% of the final retail price of charcoal paid by the urban consumer, whereas traders generally earn a considerable higher percentage. This may be due to several reasons: a) the supply of unskilled labor is large; b) independent producers are not organized and, thus, cannot exercise any negotiation power; c) transport and large-scale wholesaling is organized by cartel- or monopolistic-type market structures; d) retailers are again not organized and lack market influence. The reason for producers and retailers not to organize in interest groups or cooperatives is likely due to the fact that many operate illegally. There is anecdotal

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25 Man-year is a method of describing the amount of work done by an individual throughout the entire year. The man-year takes the amount of hours worked by an individual during the week and multiplies it by 52 (or the number of weeks worked in a year). The man-year calculated will be different for various industries depending on the average number of hours worked each week and the number of weeks worked per year.
evidence that public sector employees and authorities are commonly believed to be dominant actors in the illegal transport and trade of charcoal\(^{26}\).

**Figure 9:** Structure of Forest Exploitation for Charcoal Production and Trade

![Diagram of charcoal trade structure]

* can be a license holder; there is evidence that often does not have a license
** generally does not have a license

Source: Own discussion with stakeholders

Lastly, comparing the charcoal trade in Tanzania with the one in Rwanda, it is noted that the price of charcoal in Dar es Salam is similar to the one in Kigali, Rwanda. This is surprising, as in Rwanda charcoal is produced almost exclusively from private and public plantations and this is necessarily more expensive than charcoal mined from natural forests through open access, as is the case in Tanzania. This indicates that it should be possible to induce efficiency improvements along the supply chain in Tanzania without large price changes for the end consumer.

**Policy and Fiscal Framework**

The charcoal sector in Tanzania operates within a complex and multi-layered regulatory context. The people and processes along the charcoal value chain interact with several government bodies, policies and laws. These operate at the national, local and village levels. At the national level, several different national policies, laws and government ministries have relevant authority.

There is no comprehensive policy or strategy or legal framework in Tanzania addressing the charcoal sector. Four ministries share responsibility, including the Ministry of State

\(^{26}\) For a case study in Madagascar analyzing variables to success in illegal trade applying regression analysis, Minten and Sander (forthcoming) conclude that a licensing system to manage wood and charcoal production seems to result in illegal trade behavior, with unsustainable forest management outcomes and in negative welfare effects for the poor due to the lower prices for producers and the inequitable distribution of the rent.
for Environment in the Vice President’s Office (VPO), the Ministry of Energy and Minerals (MEM), the Ministry for Natural Resources and Tourism (MNRT), and the Prime Minister’s Office-Regional Administration and Local Government (PMO-RALG).

On the supply side of wood fuel production, at present the Forestry and Beekeeping Division (FBD) of the MNRT is the primary policy lead at the national level. Due to recent legal changes, district government offices and increasingly village governments play a central role in forestry policy and practice.

**Box 11: Framework of Forest Policy and Legislation for Charcoal Utilization in Tanzania**

1. Guidelines for Sustainable Harvesting and Trade in Forest Produce; MNRT-FBD, 2007
2. New Royalty Rates for Forest products, MNRT-FBD, November 2007
3. Community Based Forest Management Guidelines, MNRT-FBD, April 2007
5. Charcoal Regulations, 2006
6. Environmental Management Act, 2004
7. Forest Act; MNRT 2002
8. Subsidiary Legislation to the Forest Act; MNRT 2002
12. National Environmental Policy

As wood is converted to and then used for energy, policy responsibility becomes more complicated. The FBD remains responsible for managing charcoal transportation and trade, while the MEM becomes involved as the primary policy lead on energy use. The Division of Environment (DoE) – the responsible agency of the VPO-Ministry of State for Environment – has authority to oversee and coordinate the aforementioned line Ministries to ensure protection of the environment, including through the requirement for environmental impact assessments. In addition, the DoE is the Designated National Authority for all issues on climate change.

The PMO-RALG, through its regional and district offices, is tasked with implementing policy on the ground. As mentioned above, village governments play an increasingly important role in both the management and production of charcoal. In the charcoal context, village governments possess important independent powers, and should not be seen merely as a level of government subsidiary to regional or district governments.

To assess the policy context within which the charcoal industry is evolving, four sector policies were studied. These include the National Energy Policy of 2003, the National Forest Policy of 1998, the National Land Policy of 1997, and the National Environment Policy of 1997.
National Energy Policy

The National Energy Policy (first approved in 1993 then revised in 2003) devotes significant attention to the biomass energy sector and policy statements include encouraging efficient end-use technologies (i.e. stoves) and a wider application of alternative sources of energy for cooking (such as solar, biogas and LPG).27

In a separate section devoted to renewable energy, the National Energy Policy commits to promoting “efficient biomass conversion and end-use technologies in order to save resources; reduce the rate of deforestation and land degradation; and minimizing the threats of climate change”.28 The section goes on to state, “Biomass, particularly wood fuel, should be conserved through efficient conversion and end-use technologies which could be complemented by tree growing at household level and beyond.” 29

The Ministry is also developing a rural energy policy (still in draft form). The Ministry has not yet begun work on a biomass energy strategy, but is considering addressing biomass energy within the context of a Biomass Energy Strategic Plan.

The National Forest Policy

The Ministry of Natural Resources and Tourism produced the National Forest Policy (NFP) in 1998. This policy, combined with the Participatory Forest Management strategy and The Forest Act of 2002, form the foundation of all community-based forestry initiatives. It is currently under revision, a revised version will be available in early 2009.

Like the National Energy Policy, the National Forest Policy makes a short reference to the need for efficient wood conversion technologies and the promotion of alternatives to wood fuels. Under section 4.2, Forest-based Industry and Products, policy statement number 9 states: “Establishment of private woodlots and plantations for wood fuel production will be encouraged and supported through research, extension services and financial incentives.”30 The policy is, however, principally focused on growing and managing forests, not managing the use of forest products for household energy.

The National Forest Policy gives power to village governments to manage village forest reserves; “Village forest reserves will be managed by the village government or other entities designated by the village government for this purpose. They will be managed for production and/or protection based on sustainable management objectives defined for each forest reserve. The management will be based on forest management plans.”31

28NEP, at 35.
29NEP, at 36.
30NFP, at 25.
31NFP, at 21.
National Forest Program

In order to implement the National Forest Policy, the Forest and Beekeeping Division drafted a comprehensive National Forest Program (NFP) (MNRT 2001).

The NFP includes several sections covering issues related to wood fuel demand, supply and conservation. For instance:

- “For the foreseeable future, it is forecasted that woodfuel will continue to be the major source of energy to the majority of people in Tanzania.” (p.28)
- “Fuelwood supply in most of the rural areas is regarded as a free good, and only cost input being labor spent to collect it and in the predominantly surplus rural areas, the opportunity cost of such labor is almost zero.” (p. 28)
- “Formulation of the woodfuel strategy must take into account existing development strategies for the other energy sources in Tanzania mainly electricity, coal, natural gas, petroleum products and renewable energy sources (solar, wind, biogas, etc.). The challenges of the forestry and energy policies will be to stimulate greater use of improved woodfuel technologies and facilitate increased availability of improved energy services in rural areas.” (p.29)
- “In both rural and urban areas, for instance, wood-based energy consumption is estimated to account for about 92% of total energy consumed in the country. The estimated contribution to the Gross Domestic Product (GDP) in 1998 was 3.3% (including some wildlife related services)... The sector employs about 3% of paid labour and even a bigger proportion of people in the informal forestry related sector activities.” (p. 19)
- “Another study by Monela et al (2000) concluded that sampled households in Dodoma and Morogoro regions derived more than 50% of their cash income from sale of forest products, such as charcoal, honey, wild fruits and firewood, with the peri-urban households deriving almost 70% of their cash income from the woodlands.” (p. 45)
- “Majority of consumers purchasing fuelwood and charcoal has low income and consider the prices of charcoal in Dar es Salaam high. If the price of royalty of wood harvested for charcoal production would be included in pricing, the current price of charcoal and fuelwood would double. Higher prices would encourage wider use of efficient woodfuel utilization methods to reduce consumption. In addition, tree growing in private woodlots and on farmlands would become more profitable and the Government could increase the revenue from fuelwood harvesting and charcoal production.” (p. 44-45)

The National Forest Policy and the NFBKP led to the enactment of the Forest Act, 2002 and associated regulations and policy guidance handbooks. These documents have sought to implement community-based forest management through the use of Participatory Forest Management principles; they are discussed more below.

Charcoal Regulations

In 2006, the FBD issued short charcoal specific regulations, largely aimed at the trade in charcoal, but also related to the harvesting of trees for charcoal. These regulations are brief and not entirely clear in their scope.
The Charcoal Regulations require that a Harvesting Committee be established at the District level. This committee is to include participation by village representatives for areas where charcoal production is occurring (§ 4(c)). The responsibilities of the Harvesting Committee include:

- Developing District Harvesting Plans (§ 4(c)). No guidance is given in the regulations as to how a district should develop such a plan or what lands it should cover.
- Receiving and determining applications for permits to harvest forest products (including charcoal) (§4).
- Section 7 also defines standards for granting permits to produce charcoal. It is unclear whether permits for “harvesting” forest products, which the committee has authority to require, and a permit to “produce” charcoal are the same.
- Considering and issuing licenses for charcoal “dealers” § 5.
- District and village governments are to create registries of charcoal dealers.
- Helping “local area authorities” develop special areas for charcoal production (§ 4). It is unclear whether these “local area authorities” include village governments.

The scope of these regulations and associated powers of the district harvesting committees are unclear. They could be read to cover all village forest lands, extending control over the harvesting and production of charcoal in these areas to district committees rather than village governments. This reading of the regulations would undermine local, village control (and CBFM) established in the Forest Act, 2002, and so is not the best reading to ensure consistency with the underlying law. Otherwise, the regulations would have to be read to apply – at least with respect to the harvesting provisions – only to central- and district-government-controlled forest reserves. Several provisions, including registries and licenses for charcoal dealers, could apply regardless of the origin of the forest products without undermining the CBFM provisions of the Forest Act.

**Taxes and Fees**

There is anecdotal evidence that few traders – especially among the small-scale, bicycle traders – ever obtain the required papers and that bribes are offered whenever controls are executed\(^\text{32}\). This may be due to a number of reasons such as high transaction costs, i.e. traveling to the nearest forest service representative and waiting for the license to be issued, and lack of resources for obtaining permits such as for paying the license plus potential bribes to the license issuing public service representative. As a consequence of the illegal and informal nature of the charcoal business, it is estimated that the government fails to collect taxes of about US$100 million annually. Similar conclusions relative to their national economies have been presented for neighboring countries Kenya\(^\text{33}\), Uganda, Malawi\(^\text{34}\), and Rwanda.

\(^{32}\) Kambewa et al. (2007) estimate for Malawi that such bribes amount to 15-20% of the final charcoal price.

\(^{33}\) For Kenya, revenue losses from clandestine charcoal production and trade are estimated at KSh 5.1 billion or US$ 65 million (ESD 2007).

\(^{34}\) For Malawi, Kambewa et al. (2007) estimate the charcoal industry at about MK5.78 billion a year with a potential to collect about MK1.0 billion annually in revenues.
The Government of Tanzania is committed to decentralized local government, including fiscal decentralization. Local councils are responsible for the delivery of public services. The bulk of the funding for these services comes from central government, as also do the salaries and emoluments of council civil servants. The pre-reform tax system was characterized by multiple and complex taxes, some of which were distortionary. Variable market fees and dues distorted relative prices, small start-up businesses were taxed arbitrarily, collection costs were high relative to amounts collected, taxes were seen as unfair (the flat rate development levy was self evidently regressive), there was little transparency regarding amounts collected and disbursed, and citizens saw little connection between tax paid and the provision of public services.

Central government intended to address these shortcomings the tax reforms in 2003 and 2004. The main elements were the abolition of the flat rate development levy in 2003 along with “nuisance taxes,” and the abolition of business license fees for enterprises below a certain size—and capping of those fees for larger enterprises—in 2004. After the reform, there was some uncertainty regarding the compensating payments by central government to local councils, and the steps that councils were permitted to take to develop new revenue alternatives.

Box 12: Poverty and Social Impact Analysis (PSIA) of Tanzanian Tax Reform 2003 / 2004

A Poverty and Social Impact Analysis (PSIA) of the tax reform implemented in 2003 and 2004 was conducted in 2006. For forest products the PSIA fund that after the reform taxes and fees were paid at significantly increasing levels.

The impacts of the reforms varied among groups but were broadly progressive. On average, households recorded a very small decrease in overall tax payments. Nevertheless, the impact of the reforms across social groups was steeply progressive. Total taxes paid by the better off increased by 14%, decreased by 2% for the middle well-being category, and decreased by 34% for the poorest.

Businesses recorded a 14% decrease in tax burden overall. Within this, medium businesses recorded 11% less tax, small businesses 36% less tax, and micro-businesses (under Tsh54,000 turnover) 11% more tax. The increased payment by micro-businesses probably results from their nonpayment of previous business license fees, coupled with the wider use of other taxes by councils after the reform: these were all imposed on micro businesses with greater vigor than were the defunct license fees.


Lund (2007) analyzed forest revenue collection decentralized to the lowest level of government in Tanzania – the village – among 14 villages in Iringa district. The study noted that decentralization of rights contributed to an increase of revenue collection. Charcoal was by far the most important contributor to revenues followed by dry firewood. The data suggests that forest revenue may contribute to the public finances of villages with varying natural resource endowments and socio-economic characteristics and decentralized revenue collection may benefit a large number of villages in Tanzania.35

35 During field visits in October 2008, district officials confirmed that one of the most important incomes sources in support of the budget are revenues from fees and taxes charged in the charcoal chain.
Therefore, decentralization of rights to collect and retain forest revenues to the village level brings about considerable improvements in village public finance.

At the district level, charcoal is often the most important contributor to revenues. However, due to limited capacity at the district level this revenue represents only a fraction of potential revenues. Changes in the policy and institutional framework should ensure that more resources are being targeted and/or retained at the district level to improve capacity as well as ownership. In addition to including natural resource management in the district development planning processes, this will bring considerable improvements in the effectiveness of revenue collection.

**Fuel Efficiency and Alternative Energy Sources**

Firstly, understanding the charcoal value chain and designing appropriate policies to address the challenge of unsustainable charcoal production and consumption requires first and foremost a sound understanding of the socio-economic framework in which end consumers make their choices as regards charcoal or alternative sources of fuel. Secondly, in times with rising energy prices, persisting high poverty rates – especially in rural areas of World Bank client countries, mounting national budget deficits, budget gaps at decentralized government levels, and concerns related to impacts resulting from global climate change, it deserves a second look whether promoting a switch to fossil fuel based energy sources is in fact desirable for developing countries in general and Tanzania in particular. This latter question will be further discussed in this Policy Note.

Addressing the first question, Palmula and Beaudin (2007) provide data from a recent household survey from the capital Dar es Salaam: Consumers using firewood have the lowest income level, with 80% living on less than US$77 per month. Charcoal and kerosene consumers are more often lower middle income households and users of LPG have the highest income level, with over 90% of the households earning over US$155 per month. Electricity users appear to have higher income levels than firewood, charcoal and kerosene users, but electricity is also used more often than LPG in lower income families. A statistically significant relationship exists between income and energy choice, although no further explanatory variable were considered in the analysis.

Firewood users are characterized by the lowest education level, with nearly 80% having no education at all or having completed only primary school. Charcoal and kerosene users have similar educational profiles, most people having completed at least secondary school. However, 13% of charcoal users have a university degree, indicating that charcoal is often used in a mix of energy sources even when it is used for the same purpose such as cooking. In a survey among 700 households in Dar es Salaam CHAPOSA (2000) observes 88% of households use more than one energy sources, while the remaining 22% combine more than two energy sources for domestic use (compare also Schlag and Zuzarte 2008, Sander 2004, Matthews 2000). This observation needs to be considered when the data on reasons for using a certain fuel source as presented in Table 4 is evaluated.

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36 Prior to 1995, the Tanzanian government discouraged the use of LPG due to limited foreign exchange reserves (ESD 2007).
Table 4: Reasons for using different Fuel Sources*

<table>
<thead>
<tr>
<th>Reason</th>
<th>Fuelwood</th>
<th>Charcoal</th>
<th>Kerosene</th>
<th>LPG</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inexpensive</td>
<td>89%</td>
<td>71%</td>
<td>23%</td>
<td>53%</td>
<td>2%</td>
</tr>
<tr>
<td>Easy to purchase</td>
<td>33%</td>
<td>52%</td>
<td>27%</td>
<td>22%</td>
<td>28%</td>
</tr>
<tr>
<td>Easy to use</td>
<td>19%</td>
<td>28%</td>
<td>71%</td>
<td>42%</td>
<td>70%</td>
</tr>
<tr>
<td>Traditionally used by household</td>
<td>19%</td>
<td>12%</td>
<td>n/a</td>
<td>n/a</td>
<td>9%</td>
</tr>
<tr>
<td>Low initial investment costs</td>
<td>15%</td>
<td>12%</td>
<td>21%</td>
<td>8%</td>
<td>2%</td>
</tr>
<tr>
<td>Gives high heat / cooks fast</td>
<td>15%</td>
<td>5%</td>
<td>48%</td>
<td>61%</td>
<td>48%</td>
</tr>
<tr>
<td>Safe to use</td>
<td>n/a</td>
<td>20%</td>
<td>2%</td>
<td>8%</td>
<td>26%</td>
</tr>
<tr>
<td>Food tastes better</td>
<td>n/a</td>
<td>10%</td>
<td>n/a</td>
<td>n/a</td>
<td>4%</td>
</tr>
<tr>
<td>No negative health effects</td>
<td>n/a</td>
<td>6%</td>
<td>n/a</td>
<td>14%</td>
<td>26%</td>
</tr>
<tr>
<td>Clean to cook with</td>
<td>n/a</td>
<td>2%</td>
<td>6%</td>
<td>47%</td>
<td>59%</td>
</tr>
</tbody>
</table>

*Multiple answers were possible

Source: Palmula and Beaudin (2007)

LPG users have the highest level of education. Since it can be assumed that education and income levels are correlated this finding is in conformity with previous findings. Charcoal users are mainly lower middle income families. The average family size of charcoal using households corresponds with the average family size in Dar es Salaam: 44% have 3-4 people in the household and 43% have 5-7 people.

According to the survey, the low cost of charcoal is the main reasons for using it. Secondly, easy availability involving low transaction costs of purchase is important for more than half of the respondents. The majority of users tend to buy charcoal several times a week in small quantities from traders that are only a few minutes away from their house. This is confirmed by CHAPSOA (2000) observing in another survey among charcoal consumers in Dar es Salaam that 36% of consumers obtain charcoal from a variety of charcoal stores located near their homes, while 26% buy from local kiosks that also sell other items, such as vegetables and other food items. 24% buy charcoal from larger retailers, while only 12% buy from larger road-side retailers. A small portion of 1% obtains supplies outside the city.

CHAPSOA (2000) also observed that charcoal is easily accessible. For 67% of respondents it takes between 1-5 minutes to get to a selling point, 21% take 6-10 minutes, and 12% between 15-60 minutes. Those taking between 1-5 minutes generally buy in very small quantities, such as in small tins or heaps.37

Charcoal users report to be cooking an average of 4 hours a day compared to only 2 hours for LPG users. This indicates that cooking behavior is an important determinant in the fuel-switching component of a household. Boiling drinking water is another essential use of charcoal in a household.

37 There are only approximately 120 LPG sales points in Dar es Salaam. Retailers hesitate to add LPG to their product line because they do not believe that the households in their neighborhood want or can afford to buy it. Households do not buy LPG because retailers in their neighborhood do not stock it. Insufficient competition amongst the limited number of retailers is reported to lead to occasional price gouging.
Fuel-efficient stoves have now been promoted in Tanzania for more than fifteen years and promoters claim that 40% of charcoal-reliant households use these improved stoves. A recent research report is less optimistic claiming market penetration rates nearer to 20% (Palmula 2007). Almost none of the institutional charcoal users (schools, hospitals) is reported to use fuel efficient stoves. Other initiatives encouraged consumers to switch from the use of charcoal to alternatives such as kerosene and LPG. The main characteristics of the most common alternative fuels currently promoted in Tanzania are summarized in Box 13 and Table 4 presents data on reasons for using different fuel sources.

Box 13: Summary of Current Initiatives for Promoting Alternative Fuels in Tanzania

Interest in liquid biofuels is surging in Tanzania. Some biofuels not only have the potential to be used for cooking, but also in generators for generating electricity. Current initiatives focus on developing bioethanol from sugarcane, cassava or sorghum, and biodiesel from either palm or jatropha oil. There is currently no biofuel production in Tanzania, but a good deal of land clearing and planting is underway, mainly to develop biofuels for transport. Currently there are no guidelines for biofuels investments in the country.

Kerosene is a flammable hydrocarbon liquid, also sometimes referred to as paraffin and supplies fuel for both lighting and cooking. Kerosene is used as domestic energy by about 25% of urban Tanzanians, but not for the most part as their primary energy source. Kerosene smokes and has an unpleasant taste and odor, thus, many people find cooking with kerosene disagreeable.

LPG (liquefied petroleum gas) is butane and propane liquefied under pressure. They are colorless, flammable gases, found in natural gas, light crude oil, and gases that are formed when heavy oil is refined to produce gasoline. In 2006, the GOT exonerated LPG cylinders and gas from all forms of taxation. Taxes remain on cookers, hoses and other accessories. In the following six months, industry stakeholders claim a market increase of 50% which has stabilized since.

A compressed biomass briquette is a black, brittle substance that can be used as a direct substitute for charcoal. Briquettes can be made from a number of different substances, including waste products. A number of businesses in Tanzania currently produce briquettes, which are used in almost an identical manner to charcoal. Prices are currently less than half the price of charcoal.

Ethanol gel is a renewable form of energy made by mixing ethanol with a thickening agent and water. It is easy to use and burns with a carbon-free flame, so it does not cause respiratory problems such as asthma, which can be caused by emissions from paraffin, coal and wood fuel. Though the product is relatively new, its introduction on the Dar market and marketing have been rapid and successful.

Second generation biofuels, such as wood plantations for the production of ethanol, have not yet received ample attention in Tanzania, but could provide a viable option in the future.

Source: ESD (2007)

Economic and financial analyses of energy use and fuel switching also frequently mention that charcoal is not as cost-efficient as the use of LPG and other alternative

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38 Although institutional-size ceramic-lined stoves are not generally sold on the market, they can be special ordered from stove manufacturers.
fuels. However, instead of investigating factors that influence the intrinsic household economic analysis in favor of charcoal, these studies generally suggest that the households have to "learn" that alternative fuels are most cost-efficient. If successful polices are to be designed to address the charcoal challenge and achieve poverty alleviation and economic development, the true economic considerations of charcoal users need to be identified. Low adaptation rates of improved stoves and alternative fuel sources should have been a sufficient indicator that past analyses failed to address the costs and benefits of charcoal utilization from the consumers’ viewpoint, taking into account their socio-economic constraints and efficiency calculations.

Box 14: Cost of Charcoal and LPG Consumption: the Consumer Viewpoint

Assessments of costs of alternative fuels are generally made ex-post as total cost calculation, i.e. after the consumption has taken place. The costs of consumed amounts are added together for a given time-period and compared against each other. However, this ex-post analysis does not take account of the intrinsic valuation of costs of a household, especially as regards its rate of time preference, which is generally expressed as a discount rate. Disregarding initial investment costs – which were estimated at USD$83 for LPG and USD$3 for a conventional charcoal stove – a household has a consumption choice between total monthly cost of about USD$18 for a refill of LPG (after abolishment of VAT and import tariffs) or about USD$20.8 for purchasing charcoal. The advantage of charcoal is that the household can phase its purchases, for example every 2 days, while the expenses for LPG have to be made up-front. It can be seen that at rather low positive rates of time preference charcoal purchases become preferable over LPG purchases. As other studies of analyzed, rates of time preference for poor households in developing countries are rather high, easily reaching up to 100% and more (compare Lutz 1994 and Sander 2003). In theory and based on this simplified calculation, the advantage of charcoal would diminish the more flexible households could make their consumption choice as regards LPG.

Some other factors not considered in calculation:
- Initial investment costs
- Maintenance costs
- Replacement costs
- Risk of unavailability of LPG at time of required refill
- Price fluctuations of LPG
- LPG with VAT and import tariff
- Uncertainty of availability of cash income for poor households

<table>
<thead>
<tr>
<th>Energy expenses in US$</th>
<th>Days</th>
<th>Monthly Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Charcoal</td>
<td>1.3</td>
<td>0.0</td>
</tr>
<tr>
<td>LPG</td>
<td>18</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Box 14 provides an example how poor households make consumption choices as regard charcoal, given their own objectives and constraints. It demonstrates in a simplistic manner that merely comparing total periodic costs of alternative energies is insufficient to understand choices over energy consumption of poor, urban households in Tanzania and, thus, is inadequate for developing innovative, successful polices to promote the adoption of energy efficient stoves or alternative sources of energy.

Analogous consumption behavior can be observed for cellular phone usage in developing countries: while consumers in industrialized countries who can rely on a steady stream of income favor long term contracts, cell phone users in developing countries generally prefer to use cell phones on a pre-paid basis, even though total costs over a given time period may exceed potential monthly upfront costs of a longer-term contract. However, the flexibility of making expenses as regards cell phone uses is better adapted to uncertain, oscillating income streams of many income groups, such as taxi drivers, traders, small restaurant owners, but even government officials who can better economize their cell phone usage.

Lastly, Sanga and Jannuzzi (2005) also conclude for their study of charcoal users in Dar es Salaam that charcoal substitution by LPG or kerosene will occur not for economic reasons, but for individuals’ desire to improve quality of life.
Policy Options for Charcoal Utilization in Tanzania

General Aspects

It is not the first time that policy options are proposed to address the charcoal challenge in Tanzania. This may be caused by two principle reasons: Either previous studies ended up on the shelves of government institutions and development partners without being considered for implementation or previously proposed policy options have been implemented only with limited success and the deforestation and forest degradation effect of charcoal consumption in forests surrounding urban areas has been underestimated.

Figure 10: Framework for Charcoal Policy Design

At the moment, the framework for forest management in Tanzania is changing rapidly, particularly in the context of rising energy prices and climate change. While household’s reliance on woodfuels is predicted to continue and possibly increase, Tanzania’s potential to participate in international carbon regimes related to reducing emissions from deforestation and forest degradation (REDD) has been recognized at the international level. Through this newly emerging national and international dialogue on
forests the urgency to address the woodfuel challenge in Tanzania has resurfaced on the daily agenda of government, development partners, and other relevant stakeholders.

One reason for limited success up to date is seen in the fact that in the past the Tanzanian government has responded to the charcoal challenge by introducing policy measures at isolated segments of the charcoal utilization chain that have led to inadequate results only. Most of these policy interventions can be described as being of a re-active and ad-hoc nature and were introduced without prior consultation of stakeholders. Many of these policy measures were thus met with a certain degree of reservation by stakeholders and only implemented at a rather low rate. As experiences from other countries have shown, a comprehensive, forward looking and inclusive approach is required to design successful policies taking all parts of the charcoal value chain into consideration.

According to Sepp (2008b) shaping charcoal policies requires reliable baseline information as a precondition for making informed, rational decisions when appropriate policy measures are designed. Key information required to analyze the extend and urgency for addressing the charcoal challenge are, for example, population growth, urbanization dynamics, and fuel switching behavior of consumers.

Unsustainable charcoal utilization is increasingly regarded as being rooted in more systemic, site specific deficits related to land tenure, fiscal and incentive policies, urban energy markets, and misallocation of forests and crop-land. All problems arise along the charcoal production chain. Sepp (2008b) suggests applying a framework as presented in Figure 10 for developing and evaluating alternative policy options addressing the charcoal challenge.

Pulling together precise data along the charcoal value chain provides an excellent entry-point for shaping sound policy frameworks. This offers an opportunity to the various stakeholders to add knowledge, innovation capital and technology at each step or link in the value chain. As regards this Policy Note, this first step has been executed in detail during the months September and October 2008, when background information was collected through review of current literature and stakeholder consultations in Tanzania. A detailed summary of the findings are presented in the previous sections of this Policy Note. In addition, four targeted workshops were organized with relevant stakeholders in the same time period to discuss specific aspects of charcoal utilization and its associated policy options to reform this sector.

Based on this detailed data compilation, this section discusses possible interventions along the charcoal value chain that provide the potential to achieve sustainable utilization of forest resources for charcoal production in Tanzania.

**Charcoal Production**

At a national scale, the exploitation of forests for charcoal production alone often does not provide a summary explanation for ongoing deforestation. It does, however, create problems around the urban centers of the country, notably Dar es Salaam, where the
use of charcoal has triggered degradation of forests and subsequent conversion to other land-uses.

At the moment, wood for charcoal production is mainly harvested from natural forests under de facto open-access management regimes. In this context, four policy options are identified to promote sustainable wood production in Tanzania:

1) Using the full potential of sustainable harvests from natural forests through decentralized forest management approaches involving local stakeholders;
2) Increasing sustainable wood supply through tree-plantations at the household level;
3) Increasing incentives of Trees-Outside-Forests, for example agro-forestry; and
4) Increase efficiencies of wood harvesting techniques and wood conversion to charcoal.

A necessary pre-condition that applies universally to all three policy options is that forest management plans must be simple and short and should be developed in a participatory fashion, so as to remain accessible for communities with low literacy levels. In order to foster local “ownership” of such a management plan, the contents of the plan must also include the knowledge, experience and expectations of the local community vis-à-vis their forest.

**Natural Forest Management**

By adopting Participatory Forest Management (PFM) under the National Forest Policy and the Forest Act, 2002, Tanzania has made considerable progress with the decentralization of forest management to local level stakeholders. This has considerably increased the rights and responsibilities of local level stakeholders for managing forests as well as their potential to directly receive and manage associated revenues. Because sustainable management of forests has been observed to be more likely to occur under community management, PFM appears to offer a good mechanism for a comprehensive approach to forest management for charcoal production.

In Tanzania PFM is associated with two types of decentralized forest management: Joint Forest Management (JFM) and Community-Based Forest Management (CBFM). Under JFM, agreements for the shared management of forest resources on central government-owned land are established between village communities and central or local governments. Under CBFM, village governments designate forest areas within their Village Lands and implement forest management plans over these areas, largely outside of any direct control of the central or local government authorities.

Taking account of the main features of JFM and CBFM as well as current obstacles as summarized in Box 14 the required policy option as regards natural forest management is to mobilize supplementary investments to further strengthen the PFM approach through capacity building, awareness raising and technical assistance at district government and village levels. During stakeholder consultations it has been observed that even though many of the required mechanisms are in place de jure the de facto implementation is still lacking. For example, for a district visited near Dar es Salaam it was reported that harvesting committees responsible for issuing permits for charcoal production have not met for several months due to lack of resources and staff to
facilitate such meetings and, thus, permits are issued in contradiction to official regulations. In addition, added investments are needed to increase the area under effective PFM, particularly those forests resources around Dar es Salaam that suffer most from increased demand for charcoal.

**Box 14: Participatory Forest Management (PFM) in Tanzania**

In Tanzania, Participatory Forest Management (PFM) was specifically recognized in the National Forest Policy and was legally confirmed in the Forest Act, 2002, and encompasses both joint management of central government-owned forest reserves (JFM) and village and community management of forest areas on Village Land (CBFM).

JFM has been used less frequently and, although improved conservation of forests was achieved, local communities have seen few economic or development benefits from involvement in JFM.

CBFM has been more widespread and represents a more fundamental shift in land ownership and control over forest resources. With the passage of the Village Land Act, “general lands” shifted to village ownership and control (approx. 20 million ha of woodlands fall under village lands). The FBD supports the notion of CBFM through the implementation of guidelines and model forest management plans. Implementation of CBFM has not been without its problems and stumbling blocks are identified:

a) Local awareness and understanding of powers, responsibilities, opportunities and benefits of CBFM remains low. This applies at the District Government as well as village government level. District government officials are reported to remain reluctant to recognize or defer to the new independent powers of village governments.

b) Lack of adequate resources to adequately facilitate the development and implementation of forest management plans.

c) Villages not yet fully exercise their rights to demarcate and establish land use plans for village lands under the Village Land Act.

d) Realizing financial and economic benefits to CBFM in addition to conservation values

e) Lack of promotion of CBFM beyond project level.

*Source: ESD (2007)*

Initial investments are expected to be mobilized through outside resources, although it is expected that based on fiscal reforms with the objective to improve revenue collection at the national but also at the district and village level will have the potential to cover costs of PFM without having to rely on external support.

**Plantation Management**

Although natural forest management through PFM will continue to play an important role in meeting future demands for charcoal, natural forests will not be able to meet these demands in a sustainable manner, at least under the assumption of increasing or stagnating demands in the future. Therefore, PFM approaches in natural forests need to be reinforced through complementary tree plantations. Building on the PFM approach that is well embedded in Tanzanian forest policy, the promotion of new plantation-type forest areas as smallholder woodlots or plantations on village lands outside of existing
natural forests under Community-Based Forest Management is a key policy option for promoting sustainable charcoal utilization (compare Box 14).

Planted forests, if managed responsibly, have a particularly important role to play in providing a renewable and environmentally friendly energy resource. In addition, plantations can play a very positive role in: (i) provision of ecosystem services (e.g. erosion control, carbon storage, etc.) (ii) reduction of pressure on natural forests (iii) restoration of marginal or degraded land (iv) provision of rural employment and development.

Table 5: 3-Phased Approach to Plantation Establishment under Community-Based Forest Management

<table>
<thead>
<tr>
<th>Phases</th>
<th>Duration</th>
<th>Tasks</th>
</tr>
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</table>
| Awareness raising and social mobilization | 3 months | ➔ Constitution of a “village afforestation body”  
|                                |          | ➔ Identification of afforestation site                   |
|                                |          | ➔ Issuing legal title                                   |
|                                |          | ➔ Training in raising seedlings, nursery management and planting |
| Training, planning and implementation | 8 months | ➔ Planning of work organization                         |
|                                |          | ➔ Allocation of individual plots & registration         |
|                                |          | ➔ Soil preparation (mechanized input)                   |
|                                |          | ➔ Plantation of trees                                   |
| Self-management               | 10 months| ➔ Internal and external evaluation                      |
|                                |          | ➔ Organizational and technical advice                   |
|                                |          | ➔ Creation of sense of responsibility                   |

Source: Sepp (2008a)

Two main principles have to be followed to fully capture the potential of plantations for sustainable charcoal production:

➔ No natural forest area should be converted for plantations to be established. Even for degraded natural forests it is preferable to improve production potential through enrichment planting rather than full conversion to plantations or woodlots.

➔ Plantations have to provide direct pecuniary benefits to rural households in order to divert pressures from natural forests. One of the main reasons for rural households to engage in unsustainable charcoal production is their need for cash income, which is almost exclusively provided by the charcoal business.

Preferably, plantations are established on degraded lands. Furthermore, rural people should not be forced to engage in plantation establishment. Promotion of plantations at the community level can only be successful if based on voluntary participation of communities eager to put unused land under production by means of voluntary reforestation.

Table 5 outlines a 3-phased approach of establishing plantations at the community level over a 21-months period. It indicates that the clarification of land and tree tenure is key
to successfully promoting plantations at the community level. Local level NGOs are often best suited to facilitate the process as outlined in the Table. External support should only be provided in terms of technical advice, dialogue with regional and national level government, and resources.

**Box 15: Benefit Sharing through a Deposit-Account System in Vietnam**

Subsistence farmers usually do not have access to capital. Poverty often contributes to environmental degradation resulting in a progressive depletion of natural resources. Therefore, it requires innovative mechanisms to invest capital in the rehabilitation of natural resources, in particular in the establishment and management of forests. These funds should be directly channeled to the participating smallholders.

An innovative approach to promoting afforestation among rural households which builds on the active participation of smallholders in the entire environmental rehabilitation process was developed for Vietnam. Funds for investments are directly transferred to deposit accounts established under the names of participating beneficiaries at a local bank. Three preconditions have to be fulfilled that smallholders can participate in these investments:

1. The proof of land tenure security for a piece of forest land;
2. All land of the village is subject to participatory land use planning; and
3. Participating farmers follow the guidelines governing the respective investments.

Only when these prerequisites are met, the smallholder can open an account at a rural bank. In addition, the farmer receives special training, seedlings and fertilizer free of charge. Depending on the size of the forest land and the volume of his investment, a fixed amount of money will be credited to the farmer’s account. This is to compensate smallholders for their labor input and as an incentive to gain his long-term participation. After planting and final approval of the responsible authorities the farmer can withdraw fifteen percent of the paid-in capital from his account. The following year he can withdraw another fifteen percent provided the plantation is managed according to the technical guidelines. Moreover, the account accumulates interests which can also be withdrawn. For a total of eight years farmers are able to withdraw from their deposit accounts, provided they manage and protect their forests according to the guidelines. After nine years the first products can be harvested from the forests, mainly in terms of fuelwood, poles, and non-timber forest products.

*Source: GFA Consulting Group (www.gfa-group.de)*

It would be expected that in the medium- to long-term fiscal reforms targeted at the charcoal sector will mobilize sufficient resources to make plantation establishment self-sufficient as regards external financial inputs. In this context, it can be drawn from best-practice examples of innovative financial incentives that provide incremental financing for afforestation and reforestation where private incentives are not yet sufficient for rural households to engage in tree planting. Similar financing mechanisms should be tapped as much as possible to increase the economic viability of plantations and increase direct income streams generated through plantations. The higher the benefit streams will be from plantations the more likely it is that households will decide to engage in plantation establishment as an economic activity rather than other land-uses. An example how direct payments are used to trigger tree-planting behavior at the household level using a deposit account system is summarized in Box 15. At present, innovative financing mechanism are increasingly linked to carbon payments either through the voluntary market or the Clean Development Mechanism established under the Kyoto Protocol.
Scholz’s (forthcoming) analysis of carbon-based payments’ contribution to afforestation and rural development in Tanzania is summarized in Box 16.

**Box 16: Carbon-Based Payments as Incentives for Tree Planting at the household Level – Experiences from Tanzania**

Development benefits of carbon-based payments for afforestation and reforestation activities can occur at several different levels, e.g., positive effects for project participants, positive effects for both, participants and non-participants, or even wider development benefits for the host country. A particularly thoughtful design of the institutional structures is essential to foster rural livelihoods and natural resource management.

For example, a pilot program in Tanzania was aiming to channel the carbon finance payments to the participating local villagers through a voucher-based system by using a network of rural banks throughout the country. However, bank accounts to deposit the program’s vouchers could often only be opened in larger rural villages, while farmers exhibited high immobility due to prohibitive opportunity costs of transport in remote rural areas. As a result, the vast majority of farmers participating in the pilot program ran into difficulties when not being able to travel to the next branch of the rural bank on time criticizing that vouchers – once expired – can no longer be deposited.

Nine out of ten farmers were found to visit the next larger village with a rural bank branch only once per year. This was most often during Christmas time with the purpose to visit relatives. However, none of the banks operating in the research area was open during Christmas. Therefore, farmers were often unable to receive the payment they were rightfully expecting for their activities. This resulted in an increasing lack of trust in the program design and its institutions.

The situation described above demonstrates that the benefit-sharing mechanisms must be very carefully designed to address the specific constraints of farm households in remote rural areas. Exploratory household surveys and rapid appraisals may be applied to find out about location specific constraints in order to set up an adequate payment system. For example, non-expiring vouchers would allow for more time and flexibility for the household members to deposit the voucher at the nearest local bank at their convenience.

Source: Scholz (forthcoming)

According to Sander (2003) further economic advantages of tree-planting as potential investment assets for rural households have to be recognized: once trees have reached a merchandisable age, the potential liquidation period extends over several years or even decades. This gives the household flexibility for reacting on either spontaneous demand for cash or more long-term investment decisions. Furthermore, and in contrast to the annual agricultural harvest, households can liquidate tree resources independently from fixed harvest-cycles trying to optimize harvests whenever market prices are highest. The benefits of such flexibility is further supported by the fact that tree “assets” are an inflation free investments and that if the resource is not liquidated at an early stage the continuous growth achieves an accumulation of assets. Lastly, and in contrast to traditional means for saving resources such as livestock, trees are a relatively low maintenance asset once they have reached a certain age. These characteristics are important for rural households to achieve a diversification of its income portfolio.
Plantations and woodlots at the community level can also be promoted through outgrower schemes (compare Box 8). Although outgrower schemes are hardly known in the context of charcoal production in Sub-Saharan Africa supplying to domestic markets, it is theoretically possible that a private entity invests in modern, industry type carbonization technology (compare Table 3), but sources its raw material through contractual relationships with smallholders. Such a set-up would also provide adequate benefit-sharing incentives to rural households that are necessary to motivate households to engage in tree planting instead of alternative land-uses.

**Trees-Outside Forests (TOF)**

Although TOF will always only play a minor role for meeting the demand for wood for charcoal production, their contribution can still cover a vital part of the supply. As urbanization and agricultural production area continues to grow in Tanzania, forests are pushed further and further away from the urban centers. According to van Breukering et al. (2007) charcoal production sites for Dar es Salaam had changed from a 50km radius in the 1970s to about 200km in the 1990s. For the rural population closer to the urban areas, charcoal production is not a regular business, but only one part of an income portfolio that is largely dominated by subsistence agriculture.

With charcoal being one of the few possibilities to generate cash income, increased promotion of TOF can therefore provide an important contribution to diversifying farmers incomes and to create positive spillover effects as regards rural development and income security, but also agricultural production and environmental conservation.

One possible way to implement programs with the objective to increase TOF in rural areas in the periphery of urban centers is through agricultural extension services that work on promoting the adoption of agroforestry or soil conservation techniques. TOF can also be promoted working with various civil society groups at the district and village level, such as schools, churches, and prisons, but also other village based interest and representative groups, like farmers associations and women groups.

**Promotion of Efficient Kiln Technology**

Besides organizational improvements and the formalization of charcoal production and marketing, charcoal making technologies are the most important driving forces to reduce the amount of biomass required for the transformation process. Therefore, policy options that can promote the adoption of improved kiln technologies are essential means to achieve sustainable charcoal production. The common types of traditional kilns are often earth or pit kilns with efficiencies ranging between 8 and 12 %. Although parameters like the humidity of the used wood, kiln size and process control play an important role the relative gain of an improved technology ranges between 5 to 50% (compare Table 3).

Gains of improved kiln technology can also considerably improve the profitability of sustainable forest management investments, as the increased output in charcoal positively impacts the internal rate of return of investments. But despite intensive capacity building and training, many charcoal burners eventually abandon improved kiln technology. This is, for example, also the main reason why the improved and superiorly efficient Casamance kiln has been disseminated throughout Africa since 20 years without much long-lasting success.
This indicates that even though it is strongly recommended that policy options should further strengthen efforts to promote the voluntary adoption of improved kiln technologies through training and capacity building (e.g. building / strengthening forest extension services), these measures have to be complemented by other policy interventions addressing comprehensively the entire charcoal value chain, for example fiscal incentives. The underlying reasons for continuing the use of traditional kilns is that investment costs for improved kilns do not pay off as long as wood remains a free resource. Furthermore, if the entire charcoal chain is reformed in a comprehensive manner, adoption of improved kiln technologies should not only be left to voluntary participation, but stricter regulatory frameworks in form of standards for allowed kiln technology to be applied. Nevertheless, whatever these regulatory frameworks could look like, it is recommended to design such policy measures through participatory and consultative process with affected stakeholders.

Due to the increased costs of improved kiln technology, seed funding in form of input subsidies may also be considered as a policy option, although subsidies are not a preferred policy option due to the reliance on external inputs and the risk of misuse or misallocation of funds.

**Charcoal Trade**

By linking rural production sites with the end consumer living in the urban centers of the country, the charcoal trading and wholesaling component of the charcoal value chain become the key point of intervention where regulatory and fiscal policy measures to achieve sustainability of charcoal production can be best implemented. In addition, it is proposed to invest in an improved infrastructural framework for the charcoal trade, including:

- Building fixed charcoal trading sites, both at the intermediary level in the rural areas and in the urban areas where charcoal is supplied to the end consumer
- Charcoal markets in urban centers through which all of the charcoal needs to be transported,
- Increasing the number of fixed control posts,
- Introducing mobile control units

An improved infrastructural framework as proposed above will help to facilitate the implementation of new policy measures, for example:

- Introducing innovative fiscal incentives,
- Delivery of Payment for Environmental Services (PES) schemes,
- Issuing and controlling permits,
- Collecting taxes and fees,
- Providing targeted capacity building elements,
- Generating improved knowledge as regards market structures, quantities traded and consumed

One policy options that is frequently proposed is the introduction of special bags for charcoal transport that help identify those charcoal quantities that are produced in a
sustainable manner. The price for those bags would include the transport fee for the charcoal, thus avoid other charges for the charcoal transport once the bag is sealed. While such a system would not only facilitate monitoring of charcoal transport from sustainable production, it would also ease the payment of charges and issuing of permits. In addition, as the consumer would have to destroy the seal/bag when accessing the charcoal, multiple use of the bag and resulting evasion of transport fees would be prevented.

A necessary prerequisite to the introduction of any of such policy options is a concerted communication campaign informing all relevant stakeholders about their rights and responsibilities. Charcoal business has to be turned from informal sector into a formal part of the national economy. What needs to be clearly avoided is that reforms in the charcoal value chain lead to a further strengthening of the old-style control and command systems, in which local stakeholders were hardly ever informed about their rights and, thus, frequently harassed by government officials to pay bribes for declared wrongdoing without having the possibility to challenge such behavior.

The introduction of new policy measures – especially when it comes to ways of enforcing rules and regulations – should be developed in consultation with stakeholders as much as possible.

**Box 17: Financing of Natural Resource Management at District Level**

While central and village governments are relatively well funded, as they either (a) generate own revenues or receive funds transfer from the district level (in the case of the former) or (b) have the right to retain collected revenue (in case of the latter); cost recovery mechanisms at district level are less favorable.

District councils collect natural resource revenues from a range of different sources – most of which is remitted back to central government (including all levied fines and penalty charges), but some of which is retained by the district council. The retained revenue is an important source of internal, unconditional financing. It can be allocated to local priorities without the usual sector earmarking from central government on conditional grants. Levies and taxes that local governments place on natural resources retained at the district level include (a) forest harvesting permits for forest produce (including charcoal) and (b) transport levies placed on natural resource products. While these charges can potentially result in substantial revenues, a number of studies have pointed to massive under-collection of these revenues, resulting in significant losses to the income base of local councils.

Further to this there is no provision of central government financing in the forest sector to local governments on a routine basis or as part of the annual budget and planning cycle. This means that these local government departments have small budgets with subsequent capacity constraints.

*Source: INDUFOR (2007), Pfliegener et al. (2008)*

Furthermore, it is recommended that powers to enforce rules and regulations as well as collecting taxes and fees, should be decentralized analogous to management rights and responsibilities over forest resources. Current constraints at district levels are outlined in Box 17. Delegating much of responsibility for managing the charcoal (and ultimately
natural resources management) trade to the district level, will initially require investments in capacity development and strengthening as well as infrastructure. As focus would be given to improve revenue collection and incentive structure, over time, the income base from charcoal (NRM) at district level will be broadened. This would provide incentives and financial resources to sustain the proposed investments in the long term.

However, as collected revenues will be captured in the “General Pool of Funds Account”, which does not allow earmarking of funds, mechanisms need to be developed which ensure that management and monitoring of natural resources is being routinely incorporated in District Development Plans (DDPs). In addition, some (if not all) fines and penalties should be retained at the district level to provide incentives for improved monitoring and enforcement.

To operationalize functional institutional frameworks at district and village level to oversee planning, implementation and monitoring clear guidelines have to be developed to specify the responsibilities of each and every member within the local management structure.

**Charcoal Consumption**

All of the above discussed policy options would cause an increase in the final price of charcoal to the end consumer due to higher production and marketing costs. This calls for targeted dissemination of fuel-efficient technology (i.e. fuel saving stoves) with the aim of mitigating disproportionate and unintended social hardships. At the same time, fuel substitution or fuel switching becomes more attractive for those who can afford it – without the need for costly long-term state subsidies. Therefore, current efforts to promote fuel efficient stoves should be further strengthened and scaled-up.

The promotion of fuel efficient stoves is of particular importance, because the energy loss during the charcoal making process is compensated during end use, due to the higher efficiency of charcoal stoves compared fuelwood stoves (average efficiency of 30% for charcoal stoves against only 10-15% of untended open fire or tripod). Tables 2 and 3 provide information on the amount of energy loss in when improved stoves are introduced.

In addition, it has to be kept in mind that especially traditional charcoal production is an extremely green house gas (GHG) intensive activity because it is essentially wood pyrolysis with the gaseous products vented to the atmosphere. In order for biomass fuel cycles to be GHG neutral, they must be renewably managed and harvested, as well as have close to 100% combustion efficiency (which most small scale applications do not).

Complementary to promoting the adoption of fuel efficient stove, efforts in promoting fuel switching should continue, although it should be acknowledged that fuel switching alone does not provide the answer to achieving sustainable charcoal consumption. It is, therefore, strongly recommended to evaluate current subsidy structures as regards poverty impact and financial sustainability. At the moment, substitute fuels such as LPG must be highly subsidized to be competitive\(^\text{40}\). The need for substantial subsidies creates a long-term foreign exchange burden and negatively influences the country’s

\(^{40}\) At the moment LPG is exempt from any VAT and import tariffs.
trade balance. Furthermore, only the wealthier segments of society benefit from subsidies, because substitute fuels continue to remain too expensive for the poorest households, especially because of the substantial initial; investments and maintenance and replacement costs. State subsidies for substitute fuels send wrong market signals, further discouraging investment into tree planting or forest management by communities or the private sector.

Instead of focusing strongly on fossil-fuel based substitutes charcoal, it is recommended to further evaluate the promotion of substitute fuels based on biomass that would also provide a higher degree of domestic value-added. A poor country like Tanzania can simply not afford to loose a significant number of employment and income opportunities which provides rare occasions for rural people to generate cash income.
Synthesis of Policy Options

It was demonstrated throughout this paper that the charcoal value chain is complex and that policies addressing charcoal production and use are interlinked with policies in many more sectors, including energy, forestry, agriculture, transport, and even health. Hence, shaping a charcoal policy is no isolated exercise, but requires a comprehensive approach that not only targets the entire value chain, but also requires inter-agency communication and cross-sector coordination. This does not happen spontaneously, but requires instigating a policy dialogue within a country regarding adequate institutional settings promoting favorable procedures and administrative frameworks within a country.

Measurable impact on the ground depends just as much on how a charcoal policy is implemented, as it depends on the issues raised above. In this sense, shaping charcoal policies means to deliberately promote adequate selection and use of governance instruments (laws and regulations, incentives, planning and information). As policies change over time, shaping charcoal policies must be regarded as a learning process. This calls for flexibility in implementation, continuous observation of changing circumstances, and impact-monitoring. It likewise requires capitalizing on past experience and lessons learnt, also including those from other countries.

Designing successful policies also means to give attention to the views and opinions of the various actors involved in and affected by the policy at different levels, the roles they play, the ways they relate to each other, and their networks of information exchange and learning. Under such a process, it is acknowledged that a policy in general is not only formulated and implemented, but also interpreted, contested and resisted, repelled and potentially modified. This underlines the characteristics of a policy process rather than being a single standing, one-time intervention.

So far, this Policy Note has presented the current state of charcoal utilization in Tanzania, summarized experiences and lessons learned from other Sub-Saharan African countries with a similar framework as Tanzania, and discussed individual policy options that can contribute to turning the current informal, unsustainable utilization of charcoal in a sustainable, formal sector of the economy. In this section of the Policy Note the individual policy options will be looked at in an integrated manner, drawing attention to their potential impacts, interactions and interdependences. Building on a simple model, policy interventions at different entry points of the charcoal value chain as consistently applied throughout this Policy Note (production, trade, and consumption) will be evaluated. This analysis also includes forecasts of potential amounts of resources that may be generated by government through improved revenue collection (benefits), as well as potential investment needs to achieve sustainable charcoal production (costs).

Particular attention will be given to discuss fiscal incentives as a policy option, because the aforementioned interactions and interdependences with other interventions are probably most apparent. Using an illustrative example it will be discussed how fiscal incentives can be creatively used to generate mutual synergies between previously disconnected policy options. Last but not least, a qualitative assessment of changes in

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41 The structure and parameters of this model are explained in detail in Annex 2.
employment opportunities will be presented, building on the assessment as presented in Figure 8 before.

**Changes in Future Charcoal Use – Impacts of Policy Options**

Building on a “Business-as-Usual (BAU)” example developed for the case of charcoal utilization in Dar es Salaam, different policy options along the charcoal value chain are evaluated as regards their potential to achieve sustainable charcoal utilization.

On the consumption side, two principle interventions can be identified to reduce the quantity of charcoal used by end consumers: promoting a fuel switch to alternative fuels for cooking and promoting the adoption of improved, fuel-efficient stoves. As discussed before, both of these policy options have been tried in a range of circumstances with varying success. Nevertheless, relatively optimistic assumptions have been applied to the model, assuming a 5% annual rate of households switching to alternative fuels and a 5% annual rate of households adopting fuel-efficient stoves. Both rates have been assumed to decline by 15% annually to account for decreasing switching and adoption rates, which is justified considering real experiences in Sub-Saharan African countries.

![Table 6: Simulated Impact of Fuel Switch and Adoption of Improved Stove on Charcoal Consumption for Dar es Salaam](image)

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business-as-Usual</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HH using Charcoal</td>
<td></td>
<td>71%</td>
<td>71%</td>
<td>71%</td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>Volume of Charcoal</td>
<td></td>
<td>27,298</td>
<td>32,581</td>
<td>40,646</td>
<td>63,259</td>
<td>bags / day</td>
</tr>
<tr>
<td><strong>Fuel Switch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HH using Charcoal</td>
<td></td>
<td>71%</td>
<td>59%</td>
<td>48%</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>Volume of charcoal</td>
<td></td>
<td>27,298</td>
<td>27,171</td>
<td>27,281</td>
<td>27,501</td>
<td>bags / day</td>
</tr>
<tr>
<td><strong>Fuel Switch + Improved Stoves</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume of charcoal</td>
<td></td>
<td>27,298</td>
<td>26,088</td>
<td>25,074</td>
<td>23,638</td>
<td>bags / day</td>
</tr>
</tbody>
</table>

**Assumed Parameters for Fuel Switch (FS)**

- Annual rate of FS: 5%
- Annual reduction of FS rate: 15%

**Assumed Parameters for Adoption of Improved Stoves (IS)**

- % households adopting IS: 5%
- Annual reduction of adopting IS: 15%
- Stove efficiency (Traditional Stove vs IS): 25%

*Source: Own Simulations*

From the results as presented in Table 6, two important observations can be made:

- Compared to current consumption levels, no huge reduction of charcoal use can be achieved. While switching fuel alone only results in a reduction of about 3%
compared to current consumption levels, fuel switching plus the adoption of improved stoves combined only leads to an overall reduction of about 13%.

- Compared to the Business-as-Usual (BAU) scenario, where charcoal consumption would continue as currently observed with 71% of households using charcoal, the achievements are significant with reductions of about 56% and 63% for fuel switch and fuel switch combined with adoption of improved stoves, respectively.

This demonstrates the important impact population growth has on absolute consumption levels. Even though fuel switching and the adoption of improved, fuel-efficient stoves can be successfully introduced, much of the effect will be offset by population growth as regards absolute charcoal consumption levels. Therefore, it can be concluded that only focusing on these two policy options will not achieve the desired effects of reducing the pressure on forest resources in absolute terms, but can probably be expected to only buffer against future increases of charcoal consumption.

A third possible policy intervention that was discussed before is to improve kiln efficiency so that more charcoal can be produced with a given quantity of wood. At the moment, kiln efficiency in Tanzania is very low, estimated at only 19%. For the simulation model, it was assumed that kiln efficiency could be increased by 15%.

### Table 7: Impact of Improved Kiln Technology on Forests

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forest Area under BAU Scenario</strong></td>
<td>1,887,369</td>
<td>607,640</td>
<td>0</td>
<td>0</td>
<td>hectare</td>
</tr>
<tr>
<td><strong>Forest Area with Policy Intervention</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A) Traditional Kiln</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel Switch</td>
<td>1,887,369</td>
<td>838,982</td>
<td>0</td>
<td>0</td>
<td>hectare</td>
</tr>
<tr>
<td>Fuel Switch + Improved Stoves</td>
<td>1,887,369</td>
<td>886,701</td>
<td>0</td>
<td>0</td>
<td>hectare</td>
</tr>
<tr>
<td>B) Improved Kiln*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel Switch</td>
<td>1,887,369</td>
<td>1,474,745</td>
<td>921,141</td>
<td>0</td>
<td>hectare</td>
</tr>
<tr>
<td>Fuel Switch + Improved Stoves</td>
<td>1,887,369</td>
<td>1,508,616</td>
<td>1,215,381</td>
<td>0</td>
<td>hectare</td>
</tr>
</tbody>
</table>

*Applied Conversion Parameters

- Kiln Efficiency (traditional Kiln): 10%
- Assumed Annual Increase in Kiln Efficiency: 20%
- Maximum Kiln Efficiency Assumed for Improved Kiln: 15%
- Conversion Factor Wood Weight => Volume (ton => m³): 0.85
- Assumed Forest Parameters Natural Forests (Miombo woodland)
  - Stock per hectare: 10
  - Growth per hectare per year: 2.5

Source: Own Simulations

With the three policy option combined, Table 7 presents simulation results as regards the impact on forest area if one or a combination of these policy options is applied. It can be seen that improved kiln technology – although only increasing efficiency from 10% to 15% has a significant positive impact on forest resources. The relatively larger impact of improved kiln technology on forest management compared to policy...
interventions at the consumption side can be explained with the fact that production side measures are not off-set by population growth and, thus, have a more profound impact.

Lastly, Figure 11 presents a graphical comparison of forest developments for the simulation area also considering afforestation as a mean to compensate for decreased supply from natural forests. It indicates that in the simulated 20 year time period, afforestation of almost 800,000 hectares would be necessary to compensate for the loss of natural forests. However, as mentioned before, the parameters influencing forest developments in reality are highly complex and the simple model presented here can only attempt to illustrate in an abstract way the impact of some of the policy options discussed before. The most important shortfall of this model is certainly that it cannot consider supply shifts to locations farther away from the model area, but also other land-use changes, such as agricultural expansions.

**Figure 11:** Simulated Forest Cover Development under Alternative Policy Options to Satisfy Charcoal Use from Dar es Salaam

![Graph showing simulated forest cover development](image)

In summary, it can be concluded from the simulation of future charcoal demand and supply that only the comprehensive intervention at different points of the charcoal value chain can achieve satisfactory results as regards sustainable forest management. The model indicates that increased kiln efficiency plays an important role for achieving a reduction of overall wood quantities needed for charcoal production, while the promotion of fuel switch will mainly buffer against a further increase in demand due to an increase in population. Given the current levels of charcoal use in Dar es Salaam, the model also indicates that afforestation would be needed to compensate for a continued loss and degradation of existing natural forests. One way to promote increased afforestation and tree planting activities in rural areas is through fiscal incentives which will be discussed in the next part.
Following the above presented analysis, it becomes evident that even under the most positive assumptions charcoal will continue to play an important role to satisfy energy needs of urban people. Acknowledging its huge potential for generation additional revenues in form of taxes and fees, sustainable charcoal utilization can become a driving force behind sustainable natural resource and land management in Tanzania.

**Fiscal Incentives for Penalizing Unsustainable Practices**

Despite growing scarcity of wood, charcoal generally remains underpriced by more than 20 to 50%, relative to its economic cost in most African countries. This is mainly caused by insecure land-tenure, which leaves many forest areas open to free and unregulated access and use. In consequence, market prices of wood-based fuels reflect only the opportunity cost of labor and capital required for harvest, carbonization, and transport. Costs of tree planting and investing in sustainable forest management practices, such as silviculture, development of management plans, and monitoring, are not compensated for. This undervaluation translates into wasteful and inefficient production and consumption practices and creates an alarming disincentive for forest management and tree growing.

The following example – which again is only an abstract illustration of a complex issue – illustrate the consequences and suggests how fiscal incentives can be applied to compensate for costs associated with forest management. It will also demonstrate how different policy options at different points of the charcoal value chain are displaying their full potential when applied in a mutually supportive and complementary manner while only having a minor impact when applied individually.

**Figure 12:** Fiscal Incentives for Sustainable Charcoal Production (Scenario 1)

<table>
<thead>
<tr>
<th>Scenario 1: Business-as-Usual (BAU)</th>
<th>Production</th>
<th>Exploitation &amp; Carbonization</th>
<th>Transport</th>
<th>Market Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Sustainable Scenario</td>
<td>0</td>
<td>120</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td>Sustainable Scenario</td>
<td>150</td>
<td>80</td>
<td>20</td>
<td>250</td>
</tr>
</tbody>
</table>

Source: Sepp (2008)

Scenario 1 in Figure 12 presents situation as it exist currently in Tanzania. Market prices only reflect costs for exploitation, carbonization and transport, but not for sustainable wood production in natural forest management or through tree planting. Charcoal produced sustainably requires receiving a higher market price which is not competitive on the market, because consumers prefer to buy the cheaper product.

To overcome this imbalance a sustainability tax can be introduced to discriminate against charcoal that is made by means of unsustainable forest management. If the tax is equal to the costs involved in sustainable wood production the market price would be equal and sustainable charcoal would become competitive on the market. This scenario is depicted in Figure 13.
Figure 13: Fiscal Incentives for Sustainable Charcoal Production (Scenario 2 & 3)

**Scenario 2: Introduction of Sustainability Tax**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Production</th>
<th>Exploitation &amp; Carbonization</th>
<th>Transport</th>
<th>Taxes</th>
<th>Market Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Sustainable</td>
<td>0</td>
<td>120</td>
<td>40</td>
<td>90</td>
<td>250</td>
</tr>
<tr>
<td>Sustainable</td>
<td>150</td>
<td>80</td>
<td>20</td>
<td>0</td>
<td>250</td>
</tr>
</tbody>
</table>

**Scenario 3: Promotion of Fuel-Efficient Stoves**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Production</th>
<th>Exploitation &amp; Carbonization</th>
<th>Transport</th>
<th>Taxes</th>
<th>Charcoal Savings</th>
<th>Market Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Sustainable</td>
<td>0</td>
<td>120</td>
<td>40</td>
<td>90</td>
<td>-40%</td>
<td>160</td>
</tr>
<tr>
<td>Sustainable</td>
<td>150</td>
<td>80</td>
<td>20</td>
<td>0</td>
<td>-40%</td>
<td>160</td>
</tr>
</tbody>
</table>

*Source: Sepp (2008b)*

The downside of a sustainability tax is that it increases market prices for consumers. As it is the case for Tanzania, consumers are already suffering from high market prices for charcoal, leaving little room – especially for the poorest households – to adjust their consumption patterns. Therefore, an increase in market price has a direct, negative impact on the poorest that can only adapt to increasing prices by a reduced consumption, i.e. reduced food intake, or a change in eating habits. With alternative fuels not being available or being more expensive, this demonstrates the inelastic character of the demand side.

One measure to compensate for increased market prices, however, is the use of fuel-efficient stoves. As illustrated in Scenario 3 (Figure 13), the use of fuel-efficient stoves could theoretically compensate for increases in market prices, resulting in market prices that are equivalent to those under unsustainable charcoal production.

This model exemplifies how different policy measures can be applied at different intervention levels in a mutually supportive way, leading to an overall improvement of charcoal utilization. One impact of this approach which is only indirectly illustrated is that the value-added is now more evenly distributed over the entire charcoal value chain and not concentrated in the hands of transporters and traders only.

Although only an abstract example, the reform process described above already indicates that reform processes with the objective of turning the charcoal value chain into a sustainable and formal sector of the economy cannot be the sole responsibility of the government. In addition to government institutions, such as ministries, district administration, forest service officials, and forest officers, responsibilities have to be shared with and allocated to additional service providers that have a comparative advantage for delivering the assigned tasks. For example, tree planting at the community level may best be facilitated by local NGOs that are present in the target region, while in another context a local CSO like a church may be best equipped to facilitate similar processes. Figure 14 illustrates examples how roles and responsibilities can be shared between government institutions and service providers. Also, training and tax collection could be executed through a service provider. This would leave the
government with its main tasks: developing, implementing, and enforcing a supportive and transparent legislative framework.

**Figure 14:** Sharing of Roles and Responsibilities between Government and Service Providers for implementing Policy Reforms

![Diagram of Roles and Responsibilities]

**Beneficiaries of Policy Reforms**

Formalizing the charcoal value chain also carries the potential to increase its economic importance by creating additional income opportunities for rural households. As presented in Figure 15, newly emerging beneficiaries can be identified along the entire compared to the present situation. Additional beneficiaries emerge along the entire charcoal value chain, but particularly related to tree-growing.

Similarly to the pre-reform scenario, no indirect beneficiaries are accounted for, although is expected that those would increase as well. The additional income opportunities provided at the rural level are of particular importance, because rural households often have only very limited opportunities for cash income to pay for education and health services, both vital components for economic development and poverty alleviation.
In addition, proposed changes will carry the potential for achieving a more even distribution of benefits among all stakeholders involved in charcoal production, trade, and marketing. However, this may equally be one of the largest barriers that need to be overcome, as strong vested interests by local elites benefiting disproportionately from the status quo are not easily broken. Additional revenues should be used to support capacity building and incentive structures at district level improving transparency as well as law enforcement and governance of the sector.

Last but not least, charcoal operators may be reluctant to formalize their businesses as they cannot perceive the benefits. The reasons are: (i) transaction and other costs of formalization are high and arbitrary; (ii) procedures are complicated and time consuming; (iii) contact with local and central government officials (many of whom are suspected of corruption) is generally frustrating and humiliating.

Table 8 summarizes the key aspects of the policy options discussed in this paper.
<table>
<thead>
<tr>
<th>Policy Option</th>
<th>Impact on Charcoal</th>
<th>Opportunities</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumption</strong></td>
<td>• Reduces the amount of charcoal household use to satisfy energy needs for cooking;</td>
<td>• Households can save expenses for charcoal when prices are increasing</td>
<td>• Adoption rates have been reported to be low in the past</td>
</tr>
<tr>
<td></td>
<td>• househodls will continue buying charcoal</td>
<td>• Domestically produced It will continue to support local economy</td>
<td>• Factors were: costs, durability, handling of stove, etc.</td>
</tr>
<tr>
<td></td>
<td>• Households will stop using charcoal</td>
<td>• Can buffer against population increase</td>
<td>• Overall charcoal consumption may still increase depending on demographics</td>
</tr>
<tr>
<td>Fuel Switch</td>
<td>• Charcoal consumption will significantly decrease</td>
<td>• Charcoal consumption will significantly decrease</td>
<td>• Alternative fuels have to be imported</td>
</tr>
<tr>
<td>Trade</td>
<td>• Charcoal trade will be trade within clearly defined structures and infrastructure</td>
<td>• Revenue collection will increase providing resources for re-investment at district / national government levels</td>
<td>• Dependence on international market prices increase</td>
</tr>
<tr>
<td></td>
<td>• Charcoal operators will cease operating in a “grey” zone of unclear rights and regulations</td>
<td>• A regularized trade is a precondition for introducing fiscal incentives</td>
<td>• Alternative fuels do not have the same employment opportunities for rural, poor people</td>
</tr>
<tr>
<td></td>
<td>• Fiscal incentives encourage investments in sustainable forest management and tree-planting</td>
<td>• Monitoring of trade can be improved with positive FLEG* impact</td>
<td>• Forests will loose value to rural people</td>
</tr>
<tr>
<td>Fiscal Incentive</td>
<td>• Those investing in tree-planting and sustainable forest management will be compensated for their investments</td>
<td>• Charcoal operators will cease operating in a “grey” zone of unclear rights and regulations</td>
<td>• Resistance by vested interest groups fearing a loss of market power, market shares, and rents</td>
</tr>
<tr>
<td></td>
<td>• Unsustainable practices will be penalized, but not prohibited</td>
<td>• It will become easier for small-scale wholesalers / traders to participate</td>
<td></td>
</tr>
<tr>
<td>Conversion</td>
<td>• Reduces the amount of wood needed for producing charcoal</td>
<td>• Improved kiln efficiency has a high impact on reducing pressure on forests</td>
<td>• Resistance by vested interest groups fearing a loss of market power, market shares, and rents</td>
</tr>
<tr>
<td>Improved Kilns</td>
<td>• Improved kiln efficiency has a high impact on reducing pressure on forests</td>
<td>• Relatively easy practices, no complicated technology</td>
<td>• Labor intensive</td>
</tr>
<tr>
<td></td>
<td>• Requires good monitoring for compliance</td>
<td></td>
<td>• Additional costs only feasible under a regularized charcoal sector</td>
</tr>
<tr>
<td></td>
<td>• May also require fiscal incentives to justify higher investments</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Comparison of Alternative Policy Options Discussed in the Policy Note
Table 8: Continued from previous page

<table>
<thead>
<tr>
<th>Production</th>
<th>Participatory Forest Management (PFM)</th>
<th>Plantations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The potential of natural forests will be increased to produce charcoal sustainably through management plans, management interventions, and controlled access</td>
<td>• Increased wood production through intensively management plantations, incl. small-scale woodlots</td>
</tr>
<tr>
<td></td>
<td>• Tanzania has a good track record of PFM</td>
<td>• Increased revenue for rural people</td>
</tr>
<tr>
<td></td>
<td>• Anchored in national forest management strategies</td>
<td>• Introduction of sustainable land management techniques on degraded areas</td>
</tr>
<tr>
<td></td>
<td>• Knowledge is available</td>
<td>• Increase in efficiency of wood production</td>
</tr>
<tr>
<td></td>
<td>• Capacities too low to achieve PFM at a scale that is needed given the extend of charcoal production (administration, districts, communities)</td>
<td>• Unclear land and tree tenure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Investment costs (may only work in line with fiscal incentive system)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May require external financial input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Low capacity as regards technical input through extension services</td>
</tr>
</tbody>
</table>

*FLEG = Forest Law Enforcement and Governance
Estimating the Scale of Targeted Investment

This section presents rough estimates of targeted investments along the charcoal value chain to change the current unsustainable use of forest resources for charcoal utilization into a sustainable, formal sector of the economy.

Table 9: Indicative Investment Costs for a Sustainable Charcoal Program

<table>
<thead>
<tr>
<th>Component</th>
<th>Activities</th>
<th>Estimated Amount (in US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Management</td>
<td>Scaling-up of participatory forest management (PFM) in natural forests in districts affected by charcoal production for Dar es Salaam (about 2 million hectares)</td>
<td>12,000,000</td>
</tr>
<tr>
<td></td>
<td>Inventories of forest areas in districts near Dar es Salaam</td>
<td>3,000,000</td>
</tr>
<tr>
<td></td>
<td>Establishment of management plans for sustainable annual harvests</td>
<td>500,000</td>
</tr>
<tr>
<td></td>
<td>Facilitation the work of Harvesting Committees</td>
<td>500,000</td>
</tr>
<tr>
<td></td>
<td>Promotion of reforestation / afforestation activities (40,000 hectares at USD 250 per hectare; 8000 hectares per year)</td>
<td>10,000,000</td>
</tr>
<tr>
<td></td>
<td>Promotion of agro-forestry systems and trees-outside-forests resources</td>
<td>1,500,000</td>
</tr>
<tr>
<td></td>
<td>Establishment of Capacity Building program at community level (through local NGO)</td>
<td>1,000,000</td>
</tr>
<tr>
<td></td>
<td>Development and implementation of communication program as regards charcoal</td>
<td>1,000,000</td>
</tr>
<tr>
<td></td>
<td>Intensify monitoring of management plans and harvesting</td>
<td>1,000,000</td>
</tr>
<tr>
<td>SUB-TOTAL</td>
<td></td>
<td>28,500,000</td>
</tr>
<tr>
<td>Carbonization</td>
<td>Review existing rules and regulation as regards kiln technologies</td>
<td>200,000</td>
</tr>
<tr>
<td></td>
<td>Scaling-up capacity building about improved kiln technologies</td>
<td>1,000,000</td>
</tr>
<tr>
<td></td>
<td>Intensify monitoring efforts to comply with rules &amp; regulations</td>
<td>750,000</td>
</tr>
<tr>
<td>SUB-TOTAL</td>
<td></td>
<td>1,950,000</td>
</tr>
<tr>
<td>Trade &amp; Wholesaling</td>
<td>Construction/improvement of permanent checkpoints along main roads leading to Dar (2 at each main road =&gt; 6 total)</td>
<td>600,000</td>
</tr>
<tr>
<td></td>
<td>Construction of central marketing posts in each district</td>
<td>1,000,000</td>
</tr>
<tr>
<td></td>
<td>Construction of charcoal market infrastructure (3 markets in each district in Dar es Salaam =&gt; 9 in total)</td>
<td>1,800,000</td>
</tr>
<tr>
<td></td>
<td>Piloting fiscal incentive scheme (e.g. non-reusable bags, vouchers)</td>
<td>2,000,000</td>
</tr>
<tr>
<td>SUB-TOTAL</td>
<td></td>
<td>5,400,000</td>
</tr>
<tr>
<td>Consumption</td>
<td>Program to improve stove technology</td>
<td>500,000</td>
</tr>
<tr>
<td></td>
<td>Intensify dissemination / marketing campaigns of improved stoves</td>
<td>1,500,000</td>
</tr>
<tr>
<td></td>
<td>Intensify dissemination / marketing campaigns of fuel switching</td>
<td>1,500,000</td>
</tr>
<tr>
<td></td>
<td>Market research as regards alternative energy sources</td>
<td>250,000</td>
</tr>
<tr>
<td></td>
<td>PSIA of fuel switching alternatives</td>
<td>200,000</td>
</tr>
<tr>
<td></td>
<td>Scaling up capacity building of alternative fuel options and usage</td>
<td>500,000</td>
</tr>
<tr>
<td>SUB-TOTAL</td>
<td></td>
<td>4,450,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>40,300,000</td>
</tr>
</tbody>
</table>

Source: Own calculations
As mentioned throughout this paper, a comprehensive approach is needed with coordinated and mutually supportive interventions along the entire charcoal value chain ranging from sustainable wood production to increasing efficiencies at the final charcoal consumer. Accordingly, targeted investments are required at different points along the charcoal value chain. As discussed in preceding sections, these investments often depend on each other for their success, for example, the promotion of plantation establishment at the community level has to go hand in hand with increasing the costs of natural forest exploitation.

The above mentioned investments are indicative estimates only and should serve as a basis for discussion. The figures stated in the table are based on discussions with charcoal energy experts and local stakeholders that have taken place in the context of the workshops organized in Tanzania in October 2008 and have been verified with the ongoing Tanzania Forest Conservation and Management project (TFCMP). Once a prioritization of investments has been made, a detailed cost analysis has to be undertaken.

Investments should be mainly done through decentralized entities of the government, such as districts and communities. In other countries, the facilitation of community level work has been outsourced to local NGOs with good success. Similarly, the monitoring of compliance with rules and regulations may be partly outsourced to local NGOs, potentially working hand in hand with local level government entities.

The estimations are made for an initial 5 year period, although it becomes clear from the analysis of the simulation model that a period of 10 years and more may be needed to fully address the charcoal challenge. However, in an initial five year period the main components of a comprehensive reform package can be initiated leading to increased revenue collection by the government that can be re-invested in further addressing sustainable charcoal production.
Conclusions
The discussion and analysis presented in the previous chapters of this Policy Note, show that charcoal can provide sustainable, affordable and clean energy for households, institutions and private sector. To seize the potential of charcoal for poverty alleviation, energy security and economic development, policy makers and institutions in Tanzania need to recognize that charcoal should be seen as natural resource produce which can and should be produced and traded legally. Interventions should therefore focus on promoting enabling framework conditions hence create business opportunities for a wide range of service providers, as well as foster local employment and income. This would also take into account that sustainably produced charcoal contributes to carbon-neutral energy supplies, promotes environmental benefits as well as stimulates sustainable land-use systems and land-use planning.

With an objective of ensuring a sustainable supply of charcoal for as long as needed; and managing the entire value chain efficient, from the production of trees through the conversion, transport and use of it as a fuel, the following issues can be summarized and should be considered with a vision to address the charcoal challenge.

Charcoal is a modern energy source, with potential for sustainable energy supply in the future. Charcoal provides an affordable source of energy for the urban population, at least relative to the alternatives. The alternatives are either less convenient (such as firewood, and agricultural residues) or experience difficulties in equitable availability and distribution (e.g., electricity and LPG). Considering all factors, the two latter sources of energy are not being good alternatives to charcoal (and wood-fuel) after all, since (i) electricity is expensive and its generation capacity is limited; (ii) petroleum fuels need to be paid for in foreign currency. In addition, both do not generate the same volume of (rural) employment.

For energy security reasons it is important that the largest source of energy used in the country is renewable and does not depend on external market influences. Keeping this in mind and the fact that industrialized countries increasingly look at wood based sources as part of their own energy supply (particularly given rising prices for fossil based fuels), Tanzania’s plan to modernize its energy supply by switching from wood to fossil fuels and electricity should be re-evaluated.

As it has (again) been demonstrated in the latest Household Budget Survey, the public debate in Tanzania has to acknowledge that the ever increasing consumption of charcoal is a fact, and that it should be proactively used to instigate economic developed in rural areas. Charcoal should be considered just another farm product, tree plantation product, or product from a managed forest, for which production, transport and use is sustainable. As such it needs to be actively considered in the National Energy Strategy.

Focus needs to be on improving the competitive conditions for stakeholders willing to invest in sustainable production and trade as compared to those (over-) exploiting and degrading open access areas for short-term gains and at the expense of the general public. Enabling, transparent and equitable framework conditions must be created, and targeted support measures applied to various links of the value chain.
A holistic approach is needed. Policy interventions (and financing) need to be designed over the entire value chain of charcoal utilization, considering aspects of production (Participatory Forest Management, tree growing, carbonization), transport, and consumption (e.g., improved stoves, promoting fuel switching).

As in most African countries, charcoal in Tanzania is underpriced by up to 50% relative to its economic cost. The main cause is the availability of forest resources in General Land – accounting for about more than half of all forest lands – which can be accessed freely and unregulated. Consequently, market prices of charcoal only reflect the opportunity costs for harvesting and transport and do not reflect the costs for producing wood.

It is therefore important to contain unregulated wood exploitation, which calls for the introduction of regulations and improved enforcement measures, including the introduction of differential incentive/taxation schemes combined with efficient revenue/tax collection. These schemes can provide benefits for good and disadvantages for poor behavior. For example, a differential tax, which provides fiscal incentives for traders to use markets where sustainably produced woodfuels are readily available, rather than continue obtaining their supplies from illegal/unsustainable sources from natural woodlands. Another option would be to introduce fiscal incentives for wood owners if they manage their resources sustainable rather than exploit these.

Ensuring that the market price reflects all expenditures related to the efficient and sustainable production and trade of charcoal, will ultimately lead to the increase of the price. This situation can provide incentives for farmers/communities to invest in reforestation and/or sustainable forest management, in particular in areas where secure and clear long-term land tenure and/or access rights for forest resources is being assured. Taking into account the success of promoting PFM in Tanzania, sustainable charcoal production (including improved and acceptable kiln technologies) should be integrated into already ongoing programs. To increase raw material through fuel-wood plantations at the household level, successful PFM experiences should be used in combination with the promotion of afforestation/reforestation at community level.

Nonetheless, increases in charcoal can put additional financial burden on already resource strapped consumers. Therefore support needs to be provided on the demand side of the charcoal chain by continuing the promotion of improved energy-saving stoves, mitigating disproportionate social hardship. This would in turn also provide incentives for behavior changes, using wood fuel more sparingly, and/or taking into consideration viable alternatives for fuel switching (especially briquettes, but also LPG).

The status-quo requires change. In order to turn charcoal utilization into a sustainable energy supply, changes to the status-quo of policy implementation, institutional arrangements and technology usage are needed. Although many of the necessary policies and legislation are in place, no comprehensive strategic or legal framework in Tanzania exists, which addresses the charcoal sector specifically. At present the sector operates within a complex and multi-layered regulatory context, with several government bodies at the national, local and village levels. At the central Government level, several ministries (in charge of Finance, Natural Resources, Energy, Environment and Local Government) have relevant authority, but unclear responsibilities and insufficient coordination between institutions thwart adequate policy formulation, prevent policy coherence, leading to contradictory regulations.
To overcome this situation, a review of the policy, legal and institutional framework should be undertaken as part of the MNRT-led development of a Woodfuel Action Plan and Strategy. This work should clarify (current or future) roles and responsibilities for each level of government as well as develop mechanisms for improved coordination and collaboration. 

There is additional information needed to improve the baseline information for policy formulation: As many problems arise along the charcoal production chain; therefore, precise data on the charcoal value chain would provide an excellent entry-point for shaping sound policy frameworks. Required information includes: (i) access and user rights; (ii) forest management and tree growing systems; (iii) wood-fuel resource base; (iv) market information; (v) household demand and supply data; as well as (vi) options, potential and possible advantages of a fuel-switch.

Considering the recent release of the 2006/07 Household Budget Survey, further analysis should be undertaken on changes in fuel use. This work should assess (i) changes over time, (ii) the characteristics of different users (including geographic and incidence analysis) and (iii) provide an analysis of those switching between fuel types.

**Paradigm shift is needed to provide targeted support to district governments.** To guarantee coherent implementation, a change in the current institutional set up should be considered. Experiences from other countries (e.g., Mali, Chad, and Ghana) exist, where the establishment of specialized agencies has been recommended or is under implementation. While this is not proposed for Tanzania, there are benefits in tasking one single agency or level of government with the mandate to act on supply as well as demand side. Having these institutions acting as coordinating bodies, has demonstrated to improve management efficiency, charcoal-industry promotion, and a more sustainable wood-fuel supply.

Mainly due to the institutional set up and mandates, sectoral/central government institutions have not been able to address the charcoal challenge effectively in the past. Considering the maturity of decentralization in Tanzania, much of the coordination across the different sectors relevant for a sustainable charcoal chain should therefore be undertaken at the district level. This would take advantage of the fact that all relevant sectors are required (at least on paper) to coordinate planning and budgeting at the level of the District Council.

Yet, taking this responsibility will require that capacity constraints at district level will have to be addressed as a matter of urgency. It should be accompanied by investments provided to PMO-RALG, rather than a sector ministry, including adequate funding for (i) training of district officials and officers, (ii) development innovative performance based salary schemes, (iii) introduction of checks and balances as well as (iv) initial investments to establish an efficient control infrastructure.

To formalize the charcoal business, current regulations (including by-laws) should be reviewed, simplified and made available in Swahili. Existing rules, regulations and user rights have to be clearly communicated to all stakeholders; using well established lines of communication (radio, newspapers, etc.).
Natural Resource Management Planning needs to be an integrative part of Local Government Decision Making. Enduring links to sectoral ministries mean that key staff remain outside the “mainstream” of local government planning and decision making. For that reason mechanisms need to be developed to ensure that management and monitoring of natural resources is being routinely incorporated in District Development Plans (DDPs). This would help to justify priority investments in natural resource management (which in many rural districts provides the bulk of revenues).

Over time, improved capacity for revenue collection is expected to improve and reinvesting resources necessary to sustain and improve earlier investments made targeting improvements in revenue collection and incentive structure, mainly to broaden the income base from charcoal (and ultimately for natural resources management).

This would be supported by the ongoing development of land-use planning exercises currently undertaken by the National Land Use Planning Commission as well as different NGOs/CSOs. In addition, some (if not all) fines and penalties should be retained at the district level to provide incentives for improved monitoring and enforcement.

Implementation of policy options cannot follow a “one-size-fits-all approach”. For many parts of Tanzania the utilization of charcoal and woodfuels can still be considered sustainable (demand equals supply from forests). Nevertheless, at a regional scale, in particular around urban centers this situation changes, being clearly unsustainable and a major driver of land-use change.

While the policy options described are valid for the country as a whole, the recent Household Budget Survey shows, that focus to address the charcoal challenge in Tanzania should been on urban centers. Considering population increase, charcoal utilization (about 50% of all charcoal consumed) and, other land-use conversion pressures around the city, activities should target Dar es Salaam first. This would also take into account the possibility to collaborate with other partners active in the sector, e.g. WWF and the Tanzania Natural Resources Forum (TNRF). An extension of activities should then focus on Dodoma and other urban areas.

New and innovative Financing Mechanisms are available and should be used. One of the principal barriers to a more rapid expansion of producing charcoal in a sustainable way is the perceived lack of incentive by rural populations to engage in a sustainable and formal charcoal sector. However, while payments for environmental services (including carbon financing) can only be considered as a top up, rather than a solution, it can provide additional incentives for behavioral change in the way charcoal is produced. In addition, new initiatives under the UN Reduction of Emission from Deforestation and Forest Degradation (REDD) as well as World Bank’s Forest Carbon Partnership Facility (FCPF), for can help to strengthen necessary capacity and access new markets, so that participatory forest management as well as sustainable charcoal production become economically viable and attractive for rural stakeholders.
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Annex

Annex 1: Misconceptions about Wood Energy (RWEDP)

The importance of wood as a sustainable energy supply option and the problems associated with it are largely undervalued by planners and policy makers. Various widespread misconceptions hamper the development of the wood energy sector. The following are some examples:

<table>
<thead>
<tr>
<th>Misconception</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood is not very relevant as an energy source</td>
<td>In fact, wood supplies about 30% of total energy consumption in the Regional Wood Energy Development Program in Asia (RWEDP) member countries.</td>
</tr>
<tr>
<td>Woodfuels are phasing out</td>
<td>No. In all RWEDP countries the consumption of wood and other biomass fuels is still increasing in absolute terms, even when their share in national energy consumption is decreasing.</td>
</tr>
<tr>
<td>Woodfuel has little value</td>
<td>The total value of woodfuels amounts to some US$30 billion per annum for the RWEDP countries together.</td>
</tr>
<tr>
<td>Only poor and rural households use woodfuel</td>
<td>Surveys have shown that in many towns and even in some metropolitan areas woodfuels are widely used by both low- and high-income groups.</td>
</tr>
<tr>
<td>Woodfuel is a traditional commodity only</td>
<td>Generally not. Modern applications use modern fuels, which largely complement traditional fuel use.</td>
</tr>
<tr>
<td>Woodfuels are being substituted by modern fuels</td>
<td>At present, modern technologies are increasingly being applied to woodfuel development. Many industrialized countries are deliberately increasing wood energy use, for environmental and socio-economic reasons.</td>
</tr>
<tr>
<td>Most fuelwood originates from forest lands</td>
<td>This conflicts with many survey results revealing that some 2/3 of all woodfuels originate from non-forest land.</td>
</tr>
<tr>
<td>Fuelwood is collected for free</td>
<td>Some is, but a lot is not!</td>
</tr>
<tr>
<td>Woodfuels are a gift from nature</td>
<td>Many people, particularly in Asia, treat fuelwood as a commodity which can be, and indeed partly is, produced and harvested like rice or wheat, though with a much longer gestation period.</td>
</tr>
<tr>
<td>Woodfuel production is a marginal sub-sector</td>
<td>Woodfuel businesses are the main source of income for about 10% of rural households, supplying about 40% of their cash earnings. Woodfuel use generates at least 20 times more local employment than energy from oil products (per unit of energy).</td>
</tr>
</tbody>
</table>
Continued from previous page:

| **Wood energy cannot be planned because of lack of data** | Indicative planning does not require a full set of data. This type of planning can support policy making. |
| **Burning wood adds more CO2 to the atmosphere than oil** | Sustainable re-growth of woodfuel captures the CO2 back from the atmosphere. The net effect on the global atmosphere is zero, unlike that of fossil fuels. |
| **With respect to renewable forms of energy, R&D should focus on solar, wind and hydro energy** | Wood energy is renewable. Of the various renewable sources of energy wood provides by far the largest share! |

*Source: RWEDP (1997)*
Annex 2: Structure of the Simulation Model used in this Policy Note

A simple spreadsheet model was developed using MS-Excel to simulate how household demand for cooking energy impacts on forest resources and how different policy interventions may change the current situation. The model was developed for Dar es Salaam, for two principle reasons:

- Reliable data availability from secondary sources;
- Dar es Salaam accounts for over half of Tanzania’s charcoal consumption and charcoal production is frequently reported as one of the main drivers for deforestation and forest degradation in the regions adjacent to the city from where the charcoal supply originates.

Figure Annex 2.1: Conceptual Framework of the Simulation Model
The objective of this modeling exercise was to simulate impacts of different policy options on overall forest cover developments, i.e. deforestation. The flowchart presented above summarizes the main variable and parameters of the model and how they are interlinked. Variables – which cannot be changed through policy intervention – are shown in rectangles, while parameters – which can be changed through policy interventions – are in circles.

The model’s main basic variable is the number of households (HH) in Dar es Salaam. This number is influenced by three parameters: population growth, urbanization trends, and average household size. Because these parameters are exogenous to the discussion of this Policy Note they are shown in grey.

At the moment, a certain share of HH is using charcoal, others using alternative fuels. This share can be influenced by the rate with which HH switch to alternative cooking fuels but charcoal. This parameter is again a function of several factors, such as HH income, education, availability of alternative fuels, up-front investment, and HH size. Due to the complexity of the impacts of and interactions between these factors, the rate of fuel switching was not modeled, but only an average representative number was assumed.

The share of HH that uses charcoal has again a choice between using a traditional stove for charcoal consumption or an improved, fuel-efficient stove. Again, this adoption rate is a function of many others factors, but similar to the fuel-switch rate, an average representative number was assumed that is justifiable based on market observations. The efficiency increase of improved stoves compared to traditional stoves was assumed based on data presented in literature.

Until this point, the model considers variables and parameters influencing the aggregate of charcoal consumed by HH in Dar es Salaam. The next step is to simulate how charcoal quantities translate into amount of wood and eventually hectares of forest exploited. In this context, the parameters assumed for the carbonization process play an important role regarding the outcome of overall simulation results.

The model differentiates between the carbonization efficiency of traditional kilns and improved kilns. It is frequently stated that kiln presently used in Tanzania are the most basic, and hence the most inefficient, with efficiencies not greater than 10%. Increased efficiency rates for improved stoves were assumed according to data provided in the literature.

The last step in simulating the impact of charcoal consumption on deforestation looks at the productivity of forest resources. These can be either natural forests or planted forests. Three parameters are identified – area (m2), stock (m3/ha), and growth (m3/ha/year) – that can be altered through policy intervention. For example, the promotion of participatory forest management (PFM) can positively change the stock and growth of natural forests. Raining and capacity can also improve managing techniques for planted forests increasing overall yields and harvestable stocks. For all of these parameters reliable data is found in the literature on Tanzania. It should be noted that for planted forests growth parameters for fast-growing tree species, such as eucalyptus or pine, are considered, because farmers have been observed to prefer those compared to slower growing indigenous species due to their superior economic performance.
In summary, there are 7 parameters considered for this model that all influence the outcome of the simulation and which all can be altered through policy intervention. In addition, 3 parameters influencing the number of households in Dar es Salaam are considered. Although these parameters are not subject to the policy interventions, they also impact overall simulation results. While the impacts of some of the parameters compensate each other to a certain extend, other parameters have been observed to create multiplier effects. For example, efficiency increases in kiln technology is reported to have a larger effect on sustainable charcoal production than fuel switching or adoption of fuel-efficient stoves, because the effect of the latter is partly off-set by population increases.

The deforestation simulated in this model is assumed to originate solely from the exploitation of wood for charcoal production. This is a large simplification, since other – more permanent – land-use changes also occur in parallel, such as the extension of agricultural production area or growing settlement areas. Modeling these effects would have added a level of complexity that would have been beyond the scope of this policy note. Therefore, the results generated through this model should be considered as indicative only, serving as a basis for discussion when evaluating the rational for applying different measures under the umbrella of a comprehensive policy approach.

**Caveat:** The model, its parameters and projections, rest on a large number of assumptions. Projecting future developments is always constraint by the difficulty to justify the plausibility of projections based on historical data. Also, many other factors and parameters – which are unknown today or at least not yet analyzed sufficiently – are not considered in this model. These variables and parameters may have a significant influence on overall simulation results. For example, one might expect significant price increases due to increasing demand coupled with decreasing availability of wood for charcoal production near urban centers. Evidence, however, is ambiguous and market price changes have rather been associated with other effects, for example the increase in transport costs.

In this context, a number of authors have in the past and still today questioned the conventional wisdom of receding woodland frontiers due to their exploitation for energy. Only small changes in natural regeneration rates, incomplete inventory of all wood resources available, also considering trees-outside-forests, inventories of standing exploitable stocks, etc., may all be reasons why the exploitation of forests for charcoal production may not lead to deforestation rates as indicated in this model.

However, even though it is clear that charcoal production will never lead to a full conversion of forests to other land uses, evidence clearly indicates that the degradation of forest resources for charcoal production is only the first step in introducing other land-uses. Degradation is often much more difficult to observe through aerial photo interpretation and analysis, but still has significant negative impacts on rural livelihoods and the supply of environmental services. The importance of forest degradation in addition to complete deforestation has recently been acknowledged in the context of climate change mitigation by designing programs targeted at reducing emissions from deforestation and forest degradation (REDD).
Table 2.1: Summary of assumptions for model parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual population growth</td>
<td>4.0%</td>
<td>Conservative estimation based on various studies indicating growth rates between 3.5% and 5.0% for Dar es Salaam</td>
</tr>
<tr>
<td>Urbanization</td>
<td>-</td>
<td>Included in assumption for population growth</td>
</tr>
<tr>
<td>Average HH size</td>
<td>4.5</td>
<td>Household Budget Survey 2007</td>
</tr>
<tr>
<td>Share of HH using charcoal</td>
<td>71%</td>
<td>Household Budget Survey 2007</td>
</tr>
<tr>
<td>Annual rate of fuel switching</td>
<td>5%</td>
<td>Assumed; contingent on success of policy measures; optimistic assumption given that over the past years no effective fuel switch has been reported</td>
</tr>
<tr>
<td>Annual reduction of fuel switch</td>
<td>15%</td>
<td>Assumed</td>
</tr>
<tr>
<td>Share of HH adopting improved stoves</td>
<td>5%</td>
<td>Assumed; contingent on success of policy measures; optimistic assumption given that over the past years it was observed that HH resist investing in improved stoves</td>
</tr>
<tr>
<td>Annual reduction of adopting improved stoves</td>
<td>15%</td>
<td>Assumed</td>
</tr>
<tr>
<td>Efficiency of improved stoves</td>
<td>25%</td>
<td>Assumed; see Table 3</td>
</tr>
<tr>
<td>Kiln efficiency of traditional kiln</td>
<td>10%</td>
<td>Assumed; see Table 2</td>
</tr>
<tr>
<td>Annual increase in kiln efficiency</td>
<td>20%</td>
<td>Assumed</td>
</tr>
<tr>
<td>Maximum improved kiln efficiency</td>
<td>15%</td>
<td>Assumed; see Table 2</td>
</tr>
<tr>
<td>Stock of natural forests</td>
<td>10 m3/ha</td>
<td>CHAPOSA (2002), Luoga et al. (2002),</td>
</tr>
<tr>
<td>Growth rate of natural forests</td>
<td>2.5 m3/ha/year</td>
<td>CHAPOSA (2002), Luoga et al. (2002), Hofstadt (1997)</td>
</tr>
<tr>
<td>Growth rate of planted trees</td>
<td>50 m3/ha/year</td>
<td>Based on growth rates of fast growing eucalyptus plantations</td>
</tr>
</tbody>
</table>
Annex 3: Workshop Proceedings

Proceedings Summary
“Sustainable Charcoal Workshop Series”
October 27 – 30, 2008
Dar es Salaam

As part of the elaboration of the “Policy Note on Sustainable Charcoal Production in Tanzania”, a series of four one-day workshops was carried out. Each of the four workshops was organized as a stand alone event, with a different theme/topic and changing participants. This approach was designed to engage with as many stakeholders as possible across the entire charcoal value chain, while at the same time keeping the workshops manageable to enable group discussions and active participation of every participant. To this end the presentations and discussions were conducted in both English and Kiswahili. The discussed topics were:

(i) Promotion of sustainable Charcoal Production through community level Approaches.
(ii) Charcoal Demand management and options for fuel-switching.
(iii) Financial Incentives as policy tools for sustainable charcoal management.
(iv) Creation of a formal and sustainable charcoal sector.

Participants included decision makers from different level of Government (Ministry of Natural Resources and Tourism, Ministry of Energy and Minerals, Prime Minister’s Office-Regional Administration and Local Government, Village Environmental Committees), representatives from public charcoal consuming institutions (e.g., schools, hospitals, prisons), charcoal producers, dealers (wholesale/retail), traders, NGOs, producers of alternative fuels (such as LPG, charcoal briquettes), and others.

Each of the workshops followed the same structure, starting with a provision of background information regarding the objectives of the workshop and theme of the day, followed by a presentation of external speakers, sharing experiences from outside Tanzania. The presentation and subsequent Question and Answers sessions enabled workshop facilitators to derive targeted questions for further discussion in break-out groups. After the groups concluded the discussions, presentations of the findings were presented to the plenary. Once the presentations were concluded the World Bank team summarized the discussions and conclusions of the day.
Workshop 1: “Promotion of sustainable Charcoal Production through community level approaches”

The workshop discussions were kicked off by a presentation of Steve Sepp, Eco Consulting Group, focusing on Experiences and Lessons Learned from other Sub-Saharan Countries. The presentation discussed the current and future role of charcoal, stressing because of rising costs for fossil fuels, and growing disenchantment over the negative side-effects of agro-fuels, wood based energy will for several decades remain an important pillar in the energy mix of African countries, struggling to meet an ever growing demand.

The presenter outlined challenges and barriers of existing policy framework conditions, stressing issues such as unsustainable production, land tenure, user and access rights, as well as insufficient capacity and oversight. He shared examples of community level approaches from Madagascar, Senegal, Ethiopia, Mali, Niger and Chad, concluding that different approaches are appropriate for particular situations and framework conditions with no single solution for Tanzania. However, taking existing experience in implementing these approaches successfully, there is sufficient evidence to conclude that charcoal can be produced sustainable.

The Q&A session focussed mainly on questions regarding the application of the presented case studies in the Tanzanian context.

The workshop participants formed three working groups; (a) local community stakeholders, (b) district officials, and (c) donors and NGOs. Each group was given a subject to discuss and reflect upon, followed by a presentation on deliberations to the larger group.

The following questions were addressed by the local community stakeholders group: In Tanzania, do rural households benefit economically from charcoal production? Are these benefits sustainable into the future? If not, what can be done to increase the benefits to households and future sustainability?

Benefits from and sustainability of charcoal production:

The group of local community stakeholders found that, communities benefit, but the money is small as compared to the transporters and dealers. Transporters earn Tshs.10,000 per bag while the producer gets 6,000, out of a current final price of Tshs.26,000.

The group felt that the current system is not sustainable, as it requires too much physical labour and time and there are potential health risks. An additional concern expressed was that trees are disappearing at an alarming rate.

What to do? GOT and stakeholders need to provide extension service on improved charcoal production, environmental protection, and the formation of charcoal producer groups for marketing and improved price negotiation.

Increasing taxes on charcoal production and trade only decrease the prices paid to the charcoal producer. The trader tries to maintain the market price and to do so he subtracts any taxes from the money he/she pays to the producer.
A participant asked why charcoal producer groups have not been formed in the past. The group responded that the idea of forming producer groups is a new one (formed spontaneously at this workshop – however TaTEDO has worked on forming producer groups). The group feared that forming groups could lead to increased costs. Currently, charcoal production is ad-hoc and anarchic, the producers do know little about sustainable charcoal methods and drastic government policy changes are perceived to threaten livelihoods.

Another participant asked about the cost of production from a producer’s perspective and whether the producers are registered (working legally). The spokesperson of the group responded that the cost of production is not known exactly, but the time spent. The price of charcoal is established by the trader, not the producer. Producers are not registered; producers are too poor and cannot afford to go to the district and register. (Theoretically, producers are to register at the village level, with the village submitting to the District lists of registered charcoal producers.)

A participant asked about land rights and whether they were clear enough at the village level to allow for villages to effectively profit from tree planting extension services. The spokesperson said that tree planting extension can be focused on village land or private farmer’s land. Villages and individuals allocate land for tree planting currently in some places. In other places people do not plant trees due to ignorance.

Group two – made up of District officials – discussed the following questions: Frequently, one finds in Tanzania that well-developed policies and legislation exist, yet they are not implemented effectively. Why is this? What can be done? (An example is the quarterly meetings of the district harvesting committees that are very rarely held.)

Effective implementation of policies and legislation:

The group of district officials found that working facilities and resources (fuel, human resources, etc) are lacking. Not enough forest officers. There is also a lack of cooperation between the district and village levels. Village government leaders collude with illegal charcoal traders, as they do not see any gain to the village in a trader paying his permit with the District. Village governments also collude with companies conducting illegal charcoal business in the form of undocumented harvesting of forest resources. They do this for personal benefit.

Other reasons for the ineffective implementation of policies and legislation sited were:

- Some district employees are not honest, and they circumvent laws for personal gain;
- The sharing of financial resources between levels of the government is not conducted in a transparent fashion, and many believe that the prescribed ‘split’ between national, district and village government is not equitable;
- Fines for violating laws are too small and, thus, they don’t serve as an effective disincentive to breaking the law;
- Community members don’t know the policies and laws;
- Policies and legislation are complicated to implement;
- Pit kilns (as prescribed in the charcoal producers’ manual) are too expensive;
- Top down approaches to resolving charcoal issues are too common.

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What to do? In the opinion of the group, FBD needs to provide more resources and money toward district-level implementation of policies and legislation. Community members and district employees need to be educated and their roles and responsibilities made clear. Revenue sharing between the central government and district government needs to be more transparent, with a greater share going to the district in order to carry out effective forest management and the application of policies and legislation. Fines need to be increased to serve as real disincentives. More effort needs to be made to promote appropriate efficient kilns. Finally, policies and legislation need to be developed from the bottom-up, not top-down.

One participant remarked that the Forest Act had not yet been translated into Kiswahili. Another mentioned that the district councils’ commitment to managing forests is lacking. In some cases vehicles are provided for forestry but the councils do not use the vehicles for the correct reasons.

The 5% that a district gets from the MNRT for forest resources harvested in their jurisdiction (they get nothing from the fines) is not used for forest management. Instead, it is just returned to general fund for district-level development activities of all kinds.

Group three – made up of donor and NGO representatives - was asked: ‘Charcoal demand is going to increase in the future no matter what is done policy or strategy-wise. Supply will likely decrease over the same period. How will Tanzania reconcile increased demand with decreased supply?’

Reconciling future charcoal supply and demand:

The group of donor, private sector and NGO representatives found that interventions needed to come in support of both increasing sustainable supply and suppressing demand. Specifically, Participatory Forest Management needs to be strengthened. Village forest tenure needs to be secured and village land use plans developed, increasing the area and number of village forests. More revenue for PFM should go directly to communities. Resources need to be provided to support the implementation of sustainable charcoal production models, including the planting of trees and the use of efficient kilns.

One participant suggested that the workshop stakeholders review the case of the Mgari Forest in Singuida, where they are sustainably harvesting, planting trees, and using efficient kilns.

On the demand side, the group believes that the focus should be on more efficient stoves and fuel switching. The government should use economic tools to make sustainable charcoal more attractive (subsidies or tax exemptions) and unsustainable charcoal less attractive. Campaigns should be conducted to raise awareness and advocate for better practices.
Participants Workshop 1:

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Workshop 2: “Charcoal Demand management and options for fuel-switching”

In order to stimulate discussions on the second day, a presentation, by Francis Songela, ESD Tanzania, focused on the charcoal sector in Tanzania, its size and importance for low-income households as well as past attempts to address reduce charcoal consumption (including the promotion of improved stoves). The presentation discussed currently available alternative energy sources (including electricity, kerosene, LPG, ethanol gel, and charcoal briquettes) and challenges these fuels face in the market place, such as cost, packaging and retail network.

The Q&A session focussed mainly on issues regarding opportunities for increased use of the presented alternative fuels, barriers and penetration rates.

The workshop participants were divided into two working groups, the first representing the demand side of the charcoal market, the second representing the supply side. Each group was given a subject to discuss and reflect upon, after which they were requested to report on their deliberations to the larger group.

The demand side group was asked, *Will charcoal remain an important energy source? What are the barriers for acceptance (socio-cultural, economic) of alternative fuels? How can these be overcome? It seems as if charcoal is not the cheapest option. Although price is the main factor for deciding between different fuel sources, why do people continue paying more for charcoal than switching to a different source?*

**Barriers to fuel switching**

The demand side group concluded that charcoal will likely remain an important energy source long into the future because it is cost effective and available in appropriate quantities.
Barriers preventing fuel switching away from charcoal include the traditional cultural way of cooking in Tanzania. The group believe that this constraint can be overcome via education and demonstrations. A second barrier is the inadequate regulatory framework and the non enforcement of laws that discourage the use of charcoal. This barrier can be overcome via formulating and enforcing laws. Some participants believe, however, that the policies and laws exist but that people don’t follow them. A third barrier to fuel switching is ignorance and generally low education levels. Education and awareness campaigns can help in surmounting this barrier. Poverty is also a barrier to fuel switching, as is poor infrastructure (for delivery of LPG cylinders, for example). On the consumption side there is no legal framework to regulate how charcoal is used.

The group reflected on why people continue to buy charcoal? Most importantly, they believe that consumers find charcoal cost effective and available in convenient packs. It is also readily available everywhere. Perhaps households do poor budgeting (no household expenditure analysis). Also, households considered charcoal to be safe.

The supply side group discussed: *What needs to be done to replace (or reduce) the use of charcoal? What are the barriers relative to different alternative fuels?*

**Reducing dependence on charcoal**

The supply side group found that what needs to be done to reduce the country’s dependence on charcoal is to actively promote use of alternatives and promote efficient use of charcoal. Villages of charcoal producers need to be taught the techniques of efficient charcoal production.

The group identified viable alternatives as LPG, biogas, bio-fuel, electricity, bio-waste, solar thermal, coal briquettes, biogas, and biomass briquettes. These should be promoted via awareness creation, establishing retail networks and subsidies. In the case of LPG, companies need to guarantee supply and ensure price stability.

How to promote efficient use of charcoal? This can be achieved through awareness creation campaigns. Also, stove makers need to establish sufficient supplies of good quality efficient stoves and repair centres for stoves. There should be quality control standards.

In order for charcoal producers to engage in sustainable and efficient production of charcoal they, too, need to be the object of awareness creation campaigns. They also require training. At the district level demonstration centres can be established. Producers could be organized into production groups.

The group agreed with the presenter, that barriers to the switching to domestic energy alternatives include the high initial investment cost, the need for a change in mind set (fear of LPG burns). Also, alternatives to charcoal are not as versatile and cannot be use for nyama choma (traditional barbeque), for example. Generally, the population is lacks information about alternatives.

The barriers to the efficient use of charcoal include the high initial investment cost for the efficient stove), while barriers to efficient charcoal production include the high investment
cost of the kiln, the need for a change in mind set (people are used to traditional kilns) and a lack on knowledge and awareness.

A participant commented that any economic activity in rural areas produces a negative impact on the environment. The importance is the degree of that impact.

With urbanization and population growth, the problem is growing and the country needs to look forward and begin developing a solution.

**Participants Workshop 2:**

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**Workshop 3:** “Financial Incentives as policy tools for sustainable charcoal management”

As in the previous presentations, the importance of charcoal for SSA was stressed by Robert van der Plas (MARGE Consult), who outlined the use of financial incentives/taxation as a tool to achieve a sustainable woodfuel and charcoal value chain. The latter was stressed, to avoid the perception that a tax would be applied simply for revenue raising purposes, rather than to manage its impact on the economy. This is important as charcoal is a low-cost fuel used by the poor and middle class population who might find a price increase resulting from an applied tax difficult to accept. The presentation discussed an example in which such a taxation scheme can provide benefits for good and disadvantages for poor behavior. A differential tax, which provides fiscal incentives for traders to use markets where sustainably produced woodfuels are readily available rather than continue obtaining their supplies in an uncontrolled fashion from natural woodlands. Another option would be to introduce fiscal incentives for wood owners if they manage their resources rather than exploit these.
Mr. van der Plas concluded by presenting an example from Chad, where the World Bank financed “Household Energy Project” achieved (at least for some time) (i) sustainable production of woodfuels using a community-based natural resource management system in selected villages providing energy to the capital, (ii) capacity strengthening of relevant public institutions, as well as the introduction and implementation of institutional reforms in the household energy sector.

The Q&A session clarified issues with respect to differences between PFM in Chad and Tanzania, set up of institutions and responsibilities for tax collection.

As per the other days, the workshop participants formed working groups, the first representing charcoal producers and traders, the second representing district and municipal officials, and the third representing central government officials, and representatives from NGOs and the private sector. Each group was given a subject to discuss and reflect upon, after which they were requested to report on their deliberations to the larger group.

The charcoal producers and traders were asked, *How can villages/local government benefit financially from charcoal sustainably produced? And should these financial benefits be shared with other levels of government?*

**Benefits of sustainable charcoal production**

The charcoal producers and traders agreed that villages will use less wood to make more charcoal due to efficiency. There is an assumption that the market for the sustainable product will be strong and unsustainable charcoal will be discouraged. The village government can earn fees from charcoal producers. There will be less deforestation, enough rain, fresh air, and improved firewood collection. At the district level, the district will collect more revenue from charcoal when it is produced sustainably, which will make it easier to manage the local forest resources.

The group believed that the financial benefits resulting from sustainable charcoal shouldn’t be shared with other levels of government. Already the central government collects too much. Instead the central government should give more money back to the village/district governments.

Questions were posed to this group by other workshop participants.

First, a central government official refuted that the MNRT charges Tsh 4,000 per bag. He clarified that the central government charges Tsh 2,000 per 28kg bag, or Tsh 4,000 per 56kg bag.

*Question: Why is charcoal not produced sustainably currently if it has all these advantages?*

The group responded that there is a lack of education and awareness on how to do it, and that the communities have to decide collectively. There is also a conflict between community problems versus individual problems. The advantages of sustainable charcoal are communal yet the costs are individual. The group believed that there is a need for a government system to facilitate the process of moving toward sustainable charcoal, including government funding for kilns, tree planting, etc. There is currently no
guiding policy on charcoal in Tanzania (but that’s the objective of this workshop). Unfortunately, rural people depend on forest products and poverty drives them toward overuse of the forest resources; this, once again, points to the conflict between collective versus individual problems. Unsustainable charcoal production is a result of poverty and the lack of alternative income generating activities.

The group of district and municipal officials was asked, District officials have roles and responsibilities yet do not have sufficient resources to fulfil these roles. What needs to be done to address this issue? How can this be reconciled in a sustainable way? What are the core functions of district forest officers in addressing the charcoal challenge?

Insufficient resources to fulfil roles and responsibilities

The group of district and municipal officials found that there is a need to increase the number of experienced extension foresters. These foresters need more working facilities (vehicles, phones) and enough money. There needs to be more accountability among district and municipal employees and these district and municipal employees must be ready to change.

Sustainability, long term capacity building programs are required for extension agents. The approach toward forestry needs to be participatory and include all stakeholders. There needs to be an increase in revenue collection in the district, better law enforcement, and frequent reviews of the policy and legal environment.

The group believed that the core functions of a district forest officer is to provide environmental education to the community, to facilitate the preparation of forest management plans, to provide extension services on efficient charcoal production, and to collect and provide data on natural resources in the district in order to inform government decisions and policies.

The larger group had a one question for this group.

Question: Can there be a link between the need for increased financial resources for forest management and revenue collection from charcoal?

Group: There is a lack of capacity and a lack of funding, so there needs to be a budget allocation. Taxes collected from charcoal are important contributors to district budgets, but district councils do not reinvest that money into sustainable charcoal and forest management issues. They have other priorities, such as infrastructure, health care, water and sanitation and education.

The group made up of central government, NGO and private sector representatives was asked, Should charcoal produced sustainably receive a financial incentive? How could a differentiation be made to distinguish between sustainable and unsustainable charcoal? How can villages/local government benefit financially from charcoal sustainably produced? What can be done to improve the transparency of an improved system of incentives/payments?

Incentives for sustainable charcoal
The group made up of central government, NGO and private sector representatives found that a higher percentage of royalties collected on forest products should go to the village government and a percentage of the royalties should be used for tree planting. Illegal charcoal producers should be removed. The use of efficient kilns and stoves should be made mandatory.

Regarding financial incentives, the group believed that financial incentives should be given to encourage sustainable charcoal production. Ultimately this could come from a better distribution of forest resource royalties. Sustainable versus unsustainable can be differentiated by special bags.

On improving transparency, the group concluded that the government, producers and consumers should trust each other. There is a need for business development services (training) for charcoal producers. Too few villages have clear forest management plans. The number of plans needs to be dramatically increased.

Comments and questions resulted from this group’s presentation.

First, in order to change the distribution of the royalties paid for forest resources, the 5% return of royalties to the communities would need to be revisited in the Forest Act. Community members have to be the driving force to demand that these percentages be changed. Parliament could change the percentage, but the changes need to be consistent with village by-laws. Currently, central government is imposing this tax structure on villages, from the top down.

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Workshop 4: “Creation of a formal and sustainable charcoal sector”

Taking into account the discussions over the previous days, the last workshop tried to conclude the issues at stake by sketching out a feasible way ahead towards a sustainable charcoal sector in Tanzania. This was provoked by Steve Sepp's presentation in which he outlined a Road Map based on four general recommendations: (i) Improving baseline information for policy formulation, (ii) strengthening policy formulation and coherence, (iii) improving governance capacity to reorganize the charcoal production sector, and (iv) assisting local actors to introduce efficient technologies and forest management systems.

Mr. Sepp concluded by outlining the different phases (traditional, transition, semi-industrial and industrial) for each of the characteristics of the charcoal chain (supply chain, planning of woodfuel supply, type of management, type of exploration and products).

The Q&A session discussed issues related to the enabling framework to implement the road map (e.g., timeframe, political commitment necessary, funding required, sustainability, etc.).

The workshop participants were divided into two working groups, the first representing charcoal producers, traders, CBOs and MKURABITA, the second representing government employees.

The first group of community-level stakeholders was asked, Would charcoal producers engage in the business if they would have to purchase the raw material? Would the producers be interested in replanting trees (woodlots)?

Costing wood and tree planting
The group believed that individuals would continue to produce charcoal even if they had to pay for the wood. In fact, many do currently pay the village government a fee. In one case a producer paid Tsh 100,000 to harvest on one acre, and another paid Tsh 15,000 for the right to harvest trees.

The charcoal trader is theoretically a formal sector actor. A charcoal trader/transporter has an annual license to buy, transport and sell charcoal, as well as a license to produce charcoal. He pays registration with FBD (like a permit to deal in forest products), a business license with the district (payment now to TRA but license delivered by district),
tax clearance with the TRA (TIN), and a transit pass with FBD’s district natural resources officer.

Tsh 44 billion is collected annually for transit passes (one billion kilos of charcoal / 50 = 20 million bags x Tsh 2,200 per bag = 44 billion, or $36.6 million).

The charcoal producers would also be willing to invest in tree planting. They wish that they money that they paid for different taxes was reinvested by the government into reforestation or afforestation. For village-based fees this should be included in the land use by-laws.

In order to plant trees, however, the communities need extension services provided to them to the need to learn how to raise seedlings and manage growing trees.

A few comments were made to this group.

The government guidelines on charcoal production say that producers should invest in tree planting, but it doesn’t say how. Should he pay a tax, or should he plant a tree. Because of this lack of clarity, nothing is done.

District forest harvesting committees are supposed to meet quarterly, with FBD committing to paying for the meetings. Unfortunately these meetings are almost never held.

The group made up of government employees was asked, What needs to be done to bring the woodfuel challenge to the relevant policy/GOT level? What prevents the establishment of formal sector production and transport of charcoal?

Raising the importance of the charcoal issue

The group of government found that what is required is to create awareness among government through seminars and meetings, brochures, demonstrations, drama, the use of media (paper, radio and TV), and participation at festivals. There is a need to mobilize MPs from the communities. Press releases are also effective.

What prevents formalizing the charcoal sector? Most actors are not aware of the technologies available and they think that they are probably expensive. Obtaining licenses and other bureaucracy takes time and money; it’s easier just to pay the bribes and go ahead. Corruption is the inevitable result.

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<td>Harvey Kombé</td>
<td>BFO</td>
<td>MKURABITA</td>
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<tr>
<td>Saidi Simbambili</td>
<td>Member - VEC</td>
<td>Kisarawe</td>
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<tr>
<td>Nurdin Chamuya</td>
<td>Asst. PC-TFCMP</td>
<td>MNRT</td>
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