BIO-ENERGY IN NAMIBIA: OPPORTUNITIES, THREATS AND INSTITUTIONAL CHALLENGES FOR RURAL DEVELOPMENT AND FOOD SECURITY

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Executive Summary
A lot of attention has been devoted to the impacts of bio-energy, particularly biofuel production on developing countries. However, analysis is often done from a global perspective and/or with a focus on developed country bio-energy policies, regarding developing countries as passive receptors of actions in the North. The perspectives of developing countries are neglected, particularly the impact of active local (national) bio-energy policies and local production on local conditions.

This study wants to contribute to shedding light on the impacts of bio-energy production in developing countries by looking at potential opportunities and threats of bio-energy for poverty alleviation, food security and rural development in Namibia. It does so by assessing bio-energy value chains and potential impact chains for (a) Jatropha curcas production for biofuels (vegetable oil, bio-diesel) and (b) conversion of woody shrubs (bush) into bio-energy (charcoal, pellets, biogas for electrification) in the northern parts of Namibia. Both value chains are in the early stages of development, but their potential volume is considered very high, their political and economic relevance important at the national level. It analyses the instruments (policies, institutions) needed and available to regulate, guide and possibly support bio-energy production in the different sectors and policy domains, and makes recommendations how to improve this institutional framework.

The major finding is that the type and level of potential impact varies extremely with the type of value chain model chosen for producing any kind of bio-energy. These emerging models cover everything from small-size local production and consumption by local communities through medium size commercial farming up to very large scale plantations for exports. Economic impacts are mostly assumed to be positive, though dependency on individual investors, weak labour regulations and large project failure pose risks for workers and small-holder contract farmers in commercial bio-energy value chains. Food security in general is not threatened at least according to conceptional design and business plans, in particular because Namibia is already highly dependent on food imports and has relatively well-organized food markets and food distribution systems. Indeed, all models even assume increased food production. However, food security effects of bio-energy production, particularly large-scale, must be monitored.

Social and political tension may well increase, particularly where migration is induced or fostered and in the very large plantation models where disputes about land allocation, natural resource use rights and political power games touch large parts of the population. Ecological impacts vary from a positive contribution of bio-energy to biodiversity, water and soil conservation (particularly bush value chains if properly managed) to very problematic cutting of large chunks of natural vegetation in plantation models. The costs for different
models and the role of the state are very different, from a high dependency on state interven-
tion in the small community models to relative independence and high supply of capital and
technology in the large investor models (which also bear the highest risks and costs of
failure).

Important explanations for this general assessment are that land in Namibia is relatively
abundant, it is water, labour, technology, credit and particularly output markets which pose
problems for farmers and which can be (partially) overcome by bio-energy investments,
particularly those with strong external capital and technology development components.
However, strong regulations and institutions are needed in all models, but in very different
areas and with very different purposes. Namibia’s regulatory and institutional framework is
not yet sufficiently developed to guide the emerging bio-energy economy, and needs much
more proactive policies and actions to reap the full benefit and prevent the negative impacts
that loom in this new branch. Observations and recommendations are grouped around seven
policy areas: food security, rural development, agriculture, labour, land, output markets and
policy coordination

1  Introduction

Bio-energy production has attracted enormous attention worldwide over the last years,
particularly liquid biofuels for transport.1 Its promotion in many industrial countries, but
increasingly also in many developing countries, is essentially motivated by three lines of
arguments: i) improvement of the balance of greenhouse gas (GHG) emissions of energy
use, particularly in the transport sector (de Castro 2007); ii) increasing energy security, often
by tapping natural resources; and iii) improvement of incomes, employment and rural
development through introducing new demand for agricultural products, creating entirely
new value chains and fostering investment in rural areas (cf. FAO 2005, FAO 2008).

However, there are also critical voices over bio-energy, and they have become louder over
the last year. They base their concern on one or more of the following considerations: i)  the
GHG balance of bio-energy might be less positive than expected depending on production
mode and input use, but particularly on the induced land use changes (WBGU 2008); ii) food
prices may rise as a consequence of competition for feedstock, land, water and other
resources (cf. Faaji 2008, FAO 2008); iii) a massive increase of land use for bio-energy
production intensifies the pressure on natural resources such as soil and water, exacerbating
land-use conflicts, and can pose risks to biological diversity (cf. IEA 2008); iv) the distribu-
tion of revenues from the production of bio-energy could result in losses or only marginal
advantages for stakeholders in rural areas compared to the gains of agro-industries, and
could irreversibly destroy rural livelihoods.

This conference paper is based on a research study recently conducted in Namibia. With a
population of only about 2 million and a surface of over 800,000 km² (though under often

1 As defined in this paper, bioenergy is the final product derived from biomass whereas biofuel is the energy carrier. Adopting the FAO
definition, biofuel also includes biogas and solid materials (such as fuelwood, charcoal and wood pellets) (FAO 2008).
very dry conditions), bio-energy is considered to have a high potential, and government and private sector actors are struggling to find the right ways to bring this potential into use. Several initiatives, some of them very large scale, are under way to establish modern bio-energy production value chains, in addition to the widespread traditional use of biomass as firewood. The research focuses on the two most promising modern bio-energy feedstocks in Namibia: Jatropha curcas production for straight vegetable oil (SVO) and bio-diesel and the conversion of woody shrubs (bush) into bio-energy (charcoal, woodgas for electrification and woodfuel briquettes):

1. In recent years, Jatropha curcas has received a lot of attention as a highly promising bio-energy crop for developing countries. Jatropha is a shrub with a high oil content in seeds allowing to produce straight vegetable oil and bio-diesel for transport, lighting, cooking or mechanization. Jatropha is often considered a low input crop that requires little water, nutrients and labour, making it a suitable crop for arid and semi-arid regions and promising less fierce competition for resources with food production and less negative ecological effects than conventional energy crops. However, doubts have come up in recent years regarding the validity of these assumptions in situations where high yields are targeted (Jongschaap et al. 2007).

2. Bush encroachment by native species is a particular problem in livestock production systems of the southern African savannas. In Namibia alone bush covers an areas of approximately 26 million ha which shows the enormous potential for bio-energy production. So far little energetic use is in place. Energetic technologies considered in Namibia for using bush are the extension of already existing charcoal production as well as new value chains based on woodgas for electrification and woodfuel briquettes.

Despite the large potential of bio-energy production in Namibia and the many initiatives deployed since several years to realise this potential, not much has been put on the ground yet. Many question remain open, and the Government is hesitant to fully engage in its promotion (or block it). The most important uncertainties rank around the effects of bio-energy production on local and national food security and rural development, including ecological aspects which are taken very serious in the country (Namibia is the first country to have included the protection of the environment into its constitution). These are the most important reasons why a binding bio-energy policy or supporting mechanisms are not (yet) in place.

In sight of these concerns, which are reflecting concerns of many African countries, this study specifically aimed at assessing the local dimensions of bio-energy production, i.e. the opportunities and threats from local/national bio-energy production for local/national food security, poverty alleviation and rural development. It further assessed instruments (policies, institutions, organisations) necessary to support bio-energy production and shape its effects on rural development and food security, assuming that the effects of bio-energy production are not entirely predetermined but can be shaped to some extent through policy measures and institutions in order to prevent or reduce negative effects and create or foster positive ones.

The conceptual background and methodological approach are described in chapter 2. Chapter 3 describes the context in which the value chains take place, i.e. the rural development and food security challenges and bio-energy provision in Namibia, followed by an assessment of the two bio-energy value chains (chapter 4 and 5). Based on the findings, chapter 6 presents the synthesis to come up with key institutional challenges for Namibia.
2 Theoretical Background and Methodology

The empirical analysis followed an iterative empirical approach based on grounded theory (see below). It started from the generally known mechanisms through which bio-energy production inside a country can positively and negatively, directly and indirectly, affect rural development, poverty reduction and food security of developing countries. Since no modern bio-energy production is already fully established in the country, we had to rely on interviews with stakeholders, pilot schemes and key informants assumed to be knowledgeable either on (one or more aspects of) bio-energy value chains, similar value chains or on the hypothesised mechanisms. Based on the collected information, hypotheses were refined and/or extended and new interviewees or evidence was searched for in order to validate or reject these. Some more methodological details are provided subsequently.

Theoretical Background

The first step of the study was to design a conceptual framework for classifying (and later detecting and analysing) the effects of bio-energy on local/national rural development and food security. The introduction of a bio-energy value chain in a developing country can have positive and negative effects on rural development and food security. Designing this framework, it is important to distinguish but also relate the various levels and concepts (see Figure 1).

As mentioned, the focus of this study is the national level, in particular the rural areas. Although the large Jatropha producers were inspired or directly targeting the energy markets of developed countries, the related trading institutions such as standards and norms as well as the effects of international price changes on Namibia’s agricultural and food markets and subsequent effects on producers and consumers are excluded (i.e. the effects above the dotted line).

Figure 1: The relations between global and local bio-energy production, rural development and food security
Concerning rural development, 3 dimensions were distinguished: economic dimension, ecological dimension, and social as well as closely related political dimension. The dimensions are not independent, and are composed of various factors. For bio-energy production in Namibia, the most important ones are depicted in Figure 2. In the empirical investigation, it was tried to figure out the potential effects of local/national bio-energy production on those dimensions.

**Figure 2: Potential effects of bioenergy production on rural development**

The repercussions of bio-energy on rural development will, in turn, affect the food security of a region (BMZ 2001), though questions of food security effects of local bio-energy production exceed the rural areas, particularly if food security is understood in a modern way that goes beyond the local production of food. Food security is a key policy goal of the Namibian (as well as most developing countries’) government and the most important issue when discussing bio-energy policy, particularly after the 2008 food price crisis. But although food security is high on the Namibian agenda, it is often used in a very fuzzy way, without clearly distinguishing between food security and food self-sufficiency or between household or national level. For analytical clarity and politically fruitful debate, this is unsatisfactory and misleading (and the findings of this study proved that clarity is of high relevance for bio-energy policy making).

A widely accepted definition of food security is: “all people, at all times, have physical, social and economic access to sufficient amounts of safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.” (FAO 2009a). Following this definition, FAO distinguishes four pillars of food security, namely availability, access, stability and utilization (ibid.). This definition extends the concept of ‘food self-sufficiency’, which merely looks at household, local or national crop production. The empirical investigations thus looked for signs and plausible arguments how the food security pillars, in particular pillars 1-3, could be affected by local/national bio-energy production.
Methodological Approach

In order to assess the potential impacts of bio-energy on rural development and food security in Namibia and to derive policy measures, the study analysed the respective impact channels of bio-energy value chains as well as institutions that shape the benefits and risks for the rural poor.

The research broadly relied on the value chain approach which assumes that the entire profitability as well as the distributional effects of a given bio-energy technology will be dominated (apart from prices which are considered external) by the efficiency of the internal organization, the costs of production and processing determined by technology, the institutional arrangements of production and exchange as well as bargaining power of the involved actors (cf. Kaplinsky & Morris 2001).

Whereas the focus of value chain analysis is on actors within the chain, important effects of bio-energy production on rural development and food security are assumed to happen outside the value chain. Thus, an impact chain approach was used to figure out ways in which bio-energy production would most likely affect rural development, food markets and the rural poor.

Institutions play a key role since they influence the production and transactions costs and thus the incentives to initiate value chains (the economic efficiency-issue). In addition, they determine the distribution of costs, benefits and risks among stakeholders and thereby shape the first-round effects on the poor and disadvantaged within a value chains (the equity or pro-poor issue) (Eaton & Meijerink 2007). Finally, institutions shape how second-round development effects take place (Dorward & Kydd 2005). The study therefore identifies institutions and actors at all levels that determine the effects in the various policy areas as well as leverage points to shape bio-energy production in a pro-food security and pro-poor rural development way (compare Figure 3).

Figure 3: Conceptual framework of the study

Source: Authors’ design (2009)
Since the study looks at bio-energy production in the context of partly not yet established value chains it relied on a qualitative and iterative approach (Grounded Theory) (c.f. Mayoux 2003, Vermeulen et al. 2008). The potential value chains were analysed regarding expectations and perceptions about their impacts, the reasons for projects failures and obstacles to their functioning as well as relevant institutions. Where possible, experiences from value chains or projects with traits similar to those to be expected in the bio-energy value chains (e.g. cash crops, rural finance, extension, investment projects) were analysed to gain insights into issues touched by the bio-energy value chains under investigation.

130 expert and/or key informant interviews using semi-structured interviews were conducted. Single interviews and group discussions were conducted with the potential target groups (farm workers and small scale farmers). Obtained information in the course of the research was cross-checked (triangulation, c.f. Chambers 2000, Mikkelsen 2005) in order to both confirm and/or follow up on problems areas.

3 Rural Development, Food Security and the Bio-energy Context in Namibia

Rural Development and Food Security Challenges

Namibia is classified as a middle-income country but has one of the most unequal income distributions of the world (Gini coefficient: 0.7) (World Bank 2008). Overall unemployment is high at a rate of 36.7 per cent with pronounced rural-urban disparities (44.7 per cent in rural versus 29 per cent in urban areas) (NPC 2008a). Accordingly, only 6 per cent of the urban population is considered poor, whereas 45 per cent of the rural areas and even 50 per cent or more in the northern part of the country fall under the poverty line (Odendaal 2006).

In its Poverty Reduction Strategy and Vision 2030 the Government of Namibia (GRN) envisages becoming a highly urbanized country in the long term (NPC 2004). However, the big discrepancy in wealth is recognized as an immediate short term challenge. Whereas in the long-term Namibia’s agricultural base is considered to be too weak to offer a sustainable basis for prosperity, in the short and medium term, smallholder crop cultivation is seen as an important means of poverty reduction.

With a mean annual rainfall of approximately 270 mm, Namibia has the driest climate in Sub-Saharan Africa. There is, however, wide regional variation, from less than 20 mm in the western Namib and coastal zones to more than 700 mm at the eastern end of the Caprivi strip in the northern area (Odendaal 2006). Mahangu (local pearl millet), maize and sorghum are the dominant rain-fed cereals grown as staple foods. Due to climatic reasons these are mainly produced in the northern communal areas and used for home consumption and rarely sold to the market. However, the majority of households regularly does not meet their basic food needs from subsistence farming and relies on food purchases for a considerable time of the year (NPC 2006). The total annual production of cereals has averaged 98,800 tons over the past 15 years, while an additional average of 174,000 tons need to be imported each year to meet Namibia’s cereal requirements (Mendelsohn 2006). Most staple foods available on markets and in shops are produced by commercial farmers elsewhere in Namibia or imported from South Africa (Ashley & LaFranchi 1997). In general, food markets are well developed, reliable and with relatively low price variability, except in the commercial farmer areas where no markets exist due to low population density and during sporadic periods of inundation in some northern areas. In summary, due to domestic production and food imports, availability of food is not a problem in Namibia at the national level and in almost
all areas. However, affordability is a problem for many rural households.

Agriculture is the largest employer in Namibia supporting, directly or indirectly, 70 per cent of the population, despite contributing only around 6 per cent to the national GDP. An alternative land use activity in Namibia is tourism, the third largest foreign exchange earner of the country. Enhancing income from tourism and enabling communities to benefit from natural resources in a sustainable manner has been a prime governmental motive by creating conservancies (common wildlife protection areas) and community forests (Mendelsohn 2006). Nevertheless, an underperforming agricultural sector in the north and an overall lack of employment alternatives has exacerbated rural poverty in the north (cf. NPC 2008, UNDP 2004, Mendelsohn 2006).

Although with more favourable agricultural conditions and about half of Namibia’s population, the northern areas north of the red line (see below) only contribute 24 per cent to the total agricultural production in Namibia (Mendelsohn 2006). A key factor for agricultural development is the unequal access to land. Land in Namibia is divided into so-called ‘commercial’ farmland with freehold tenure (44 per cent of the country), communal areas (41 per cent), and state land including conservation areas (15 per cent) (Odendaal 2006). Basically, the dualism of communal and commercial land tenure dates back to the first land policy for the territory implemented by the German Colonial Authority in 1892 with the so-called “red line” which separated white owned, commercial lands in the cattle pest free southern zone from the pest burdened, black owned communal lands north of it. Still today, less than 10 per cent of the country’s population live on the commercial farmland with an average size of 5,700 ha whereas some 65 per cent (95 per cent of the country’s farming population) live in the communal areas of the north without freehold property (SEEN 2008).

Whereas the commercial farming sector is well developed, capital-intensive and export oriented (mainly cattle and wildlife tourism as well as some wheat and fruit production), the communal farming sector is dominated by agro-pastoral subsistence farmers with average cropping plots of 1-4 ha (Mendelsohn 2006). Main agricultural inputs in the communal areas are labour and draught power for ploughing. The use of more advanced technology and inputs (fertilisers, irrigation, tractors), on the other side, is low due to limited availability and affordability and a low-risk approach (‘low-input low-output’) (ibid.; Ashley & LaFranchi 1997, Mendelsohn & Obeid 2007). Large parts of fields are left fallow because of declining fertility after some years of production (Mendelsohn 2006).

Water scarcity is another extremely important limitation for Namibia’s agriculture. Irrigation is only used on some commercial farms based on pumping up groundwater, with a very few exceptions in the North where some government-owned green schemes and very few communal (groups of) farmers pump water from rivers. Food security considerations in Namibia advise the use of scarce water resources only for food crop production.

During the last decades, severe bush encroachment has become a major obstacle to farming activities in large areas of the medium to higher rainfall savannas (cf. de Klerk 2004). De Klerk (2004) defines bush encroachment as “the invasion and/or thickening of aggressive undesired woody species resulting in an imbalance of the grass-bush ratio, a decrease in biodiversity, and a decrease in carrying capacity”. Approximately 26 million ha of woodland savannas in the country are degraded by bush thickening (de Klerk 2004), and close to 50 per cent of the commercial ranching areas in Namibia are affected by bush encroachment. Although Sweet (1998) states that bush encroachment is not much of a problem in communal areas, Namibian national authorities (de Klerk 2004) have acknowledged the negative effects of invader bush on communal development affecting an estimated 6 million ha of communal lands.
Bush encroachment has severely limited the grazing potential for cattle and sheep in the affected areas cutting job opportunities and income in the rural agricultural sector (Hager et al. 2008, de Klerk 2004). The carrying capacity declined from one large stock unit (LSU) per ten ha to one LSU per 20 or 30 ha (SADC 2006). The economic loss of more than N$700 million per year has had a direct impact on the livelihoods of 65,000 households in communal areas and 6,283 commercial farmers and their employees (cf. de Klerk 2004). Bush encroachment also has negative impacts on biodiversity, water-use efficiency and underground water tables (ibid.). The Government of Namibia (GRN) has set the goal of reducing the areas encroached to 22.1 million hectares (NPD 2008, Draft Bush Encroachment Management Policy cited in Hager et al. 2008).

Energy Provision and Bio-energy Production in Namibia

With regard to energy, Namibia relies to a great extent on imports from South Africa (RSA) from where it receives 100 per cent of its fuel and over 50 per cent of its electricity. Rural areas in Namibia, however, are not yet fully served by the national electricity grid and have only limited access to fuel and energy resources (Metzler 2006, NPC 2008a). 70 per cent of Namibia’s primary energy is consumed in the national transport sector.

The need of creating higher energy security through domestic energy production was already underlined in the White Paper on Energy Policy of 1998 (MME 1998) and received recently high attention in the course of supply shortages from RSA and expected price increases. The importance of renewable energies and the sustainable use of Namibian resources as part of a diversified energy mix was also recognized in the White Paper on Energy Policy. In 2000, the Rural Electrification Master Plan was completed and revised 2005 identifying the need for further developing on- and off-grid infrastructure (Interim Bio-energy Committee 2006). The Ministry of Mines and Energy (MME) strives for providing all households with access to affordable and appropriate energy supplies. Attracting investors is seen as one way of reaching this goal. MME also wants to move towards the sustainable use of natural resources for energy production (MME 2009).

When it comes to fostering a bio-energy industry inside Namibia, the most important recent document is the National Bio-Oil Energy Roadmap published by the Namibian Agronomic Board (NAB) in August 2006 (cf. Interim Bio-Energy Committee 2006). Whereas an inter-ministerial and inter-agency technical committee (NOCEC) was established to coordinate the implementation of the roadmap (MAWF not date), the importance currently given to the Roadmap is rather weak. In order to determine a clear governmental position a cabinet committee was formed in 2008 but hasn’t yet taken measures.

The economic potential of converting invader bushes into biomass energy has been widely recognized within Namibia. SADC (2006) recommends the conversion of bush resources either on a ‘household cooking fuel level’ or on a larger scale, for instance electricity, charcoal, wood chip blocks or ethanol production. In an assessment undertaken by the Technical Research Center of Finland, Leinonen (2007) calculates a Bush-to-Energy potential of 40.8 TWh (Terra Watt hours) per year, which by far exceeds Namibia’s total energy need (12.6 TWh in 1999).

Livelihoods of the Target Groups

The key target group of this study is the poor rural population of Kavango, Caprivi and the Owambo Regions, situated in the northern part of the country. Approximately 295,000 people (15 per cent of total population) live in Kavango (208,441) and Caprivi (86,437),
which have been identified as prime locations for Jatropha production. Also for the Bush-to-
Energy value chains, most of the directly affected poor people, the wood workers, are
migrant workers from the Kavango and the Ovambo-Regions (population of 805,000).

Agricultural incomes for households living on communal land are very low (Odendaal
2006), due to the reasons explained. Thus, although almost all rural households engage in
small-scale dryland agriculture, agriculture is not the only and often even not the dominant
source of income of rural households (in Kavango for only 42 per cent) (NPC 2006).
Household food security largely depends on various off-farm cash income sources in form of
wages and salaries, pensions, remittances and non-farming business activities (ibid.).

As mentioned, typical wood workers who are employed in the Bush-to-Energy value chains
are migrants. No statistical data are available on this group of people. To provide at least a
minimum of information on their living conditions, farm workers may serve as a basis of
comparison because they come from the same regions and circumstances, though they do not
have the same working conditions as the wood workers: About 35,000 wage labourers work
on commercial livestock farms affected by bush encroachment (de Klerk 2004). Generally,
farm and wood workers belong to the most marginalised parts of Namibian society. Live-
stock farm workers are mainly full-time employees, while wood workers are temporarily
employed as independent contractors. Farm workers on white owned farms often perma-
nently reside on the farm and are granted the right to use a small plot of land for personal
farming activities or livestock keeping (Karamata 2006). This does not apply to wood
workers. According to a study by the Labour Resource and Research Institute (ibid.), less
than 40 per cent of farm workers are registered as members of the social security scheme.
They have little voice as over 60 per cent of workers know little to nothing about the
existence and the purpose of labour unions, for example. Access to public or private health
facilities is also difficult due to lack of transport means (ibid.). Male workers are mainly
engaged in farm work while women are employed for household activities (Werner 2002).
Their average age is 20-29 years. The average farm worker earns about 350N$ per month
with the earning on white owned farms being slightly higher than on black owned farms.
Wood workers earn about 300-400N$ per ton of charcoal produced. However, even though
Namibia has introduced a minimum wage, only slightly more than half of all farm owners
have implemented the new regulation (Karamata 2006).

4 Assessment of Bush-to-Energy Value Chains in Namibia

In general, biomass from plant matter or biological waste material can be converted into
solid, liquid or gaseous fuel. Consequently, bush can be used either in its raw form as
cooking fuel or be processed into either charcoal, briquettes made of fines, wood fuel
briquettes, pellets, woodgas or liquid biofuel. As to the former four products, value chains
already exist in Namibia, pellets and woodgas are subject to investigative trials, whereas
liquid biofuel production is not (yet) considered. The relevance of the former product group
is underlined by Namibia’s Biomass Energy Conservation Strategy (MME 2003 in Hager et
al. 2008), stating that “the use of charcoal and briquettes produced from invader bush
should be widely promoted to Namibians, especially in communal rural areas, because it
would reduce bush encroachment and deforestation and result in a number of other bene-
fits”. Considering the focus of our study, only the processing steps for charcoal (and
briquettes made of fines), woodfuel briquettes and biogas are assessed in this study.

However, as already indicated Bush-to-Energy activities are very often part of a wider set of
rangeland management activities. Thus, the motivation for cutting bush ranges from creating
additional income to regaining rangeland and improving rangeland quality by combining
debushing with planting grass. In the latter case, carrying capacity can increase two to threefold. In the former case, not much attention is paid to actually debush the invader bushes and regain pasture, instead, charcoal producers make use of the stronger trees delivering better quality charcoal. If the aim is to regain rangeland, care is concentrated on removing all bushes sustainably, often employing herbicides to prevent bush regrowth, whereas larger trees may be spared as shadow trees. In addition, the law restrict the total clearing of bush and protect certain species. Under Namibia’s Forestry Act, farmers need a permit to debush their land (for areas exceeding 15ha).

Up to now, all Bush-to-Energy value chains have in common the very laborious activities around harvesting of bush. They can be divided into five main activity blocks, namely making strip roads, felling, compounding, drying, and road transport. Felling or cutting crews usually comprise four to eight men. The crews cut the bush manually with axes and drag them to a strip road, where the harvest is piled and left for drying. However, for the different products, and according to the main motivation for cutting bush, the details of harvesting can differ considerably.

4.1 Description of Bush-to-Energy Models in Namibia

Bush-to-Charcoal Model

Charcoal production is a thermo-chemical process, where heat is used to separate volatile material from the wood matter, producing four different primary products, namely gas, oils, charcoal and charcoal fines. In Namibia, only the latter two products are used hitherto (but see next section on Bush-to-Woodgas).

Namibia’s charcoal business has the following features: The farmer or a specialised charcoal producer employs a team of charcoal workers who manually chop the trees. The charcoal workers burn the wood to charcoal in mobile kilns near to a camp in the bush, and in some cases also at the farm house. Extraction is about 20% (charcoal/dry wood). The charcoal is sold screened or unscreened, packaged or loose to a retailer mainly for export and also for national sales. The major export markets are Europe and RSA. Selling prices in the last years were 800-1,100N$ per ton. Currently, exports to a silicon factory in RSA scores a better price (around 1,000N$ per ton) when compared to Namibian retailer prices of 850N$ per ton, but this may change. Charcoal fines are only 200N$ per ton. The use of the Forest Stewardship Council (FSC) certification is common among bigger producers that have an interest in stable markets. The most important cost elements are labour and transport costs, supervision is a challenge.

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2 Charcoal fines are a secondary product of the charcoal business. They are left-over ‘crumbs’ from charcoal production, typically about 5-20 mm in size. They are collected after charcoal production, bound together with starch and then compressed into briquettes. They have about the same caloric value as charcoal. Charcoal fines are commonly exported to South Africa where they are processed into briquettes, rather than this taking place in Namibia itself.
Workers are commonly contracted as self-employed personnel, not as farm employees who would be covered under the Namibian Labour Act. Contracts are generally oral agreements. Under these arrangements, the worker is himself responsible for social security, and does not benefit from provisions guaranteed under the Labour Act. Wood workers are usually organised in teams but paid on an individual basis. The Namibian Charcoal Producers Association has agreed with labour unions to pay 40 per cent of the selling price to the labourers. This means that at a current selling prices a charcoal worker receives around 350-400 N$ per ton. Prices and wages vary depending on the size of charcoal and on the markets. On average, one worker can produce two to four tons of charcoal per month, i.e. he can expect 700-1400 N$/month which is clearly above minimum salaries. However, numbers vary considerably as they depend on the worker’s motivation, strength, tools used and on the wood species, size and additional demand for bush clearing. Workers are provided with kilns, but in most cases, all other work tools have to be bought from the farmer on loan. This means that the worker only starts earning after he has repaid the initial expenses. Usually, this is a period of one to two months. Other expenses that are deducted from the wage are food from the farmer’s food shop, medical expenses and, in some cases, transport to and from the farm. It is important to note that the wood workers usually work and live in areas which are very remote, next villages with commercial activities or social services can be dozens to hundreds of km away.

Typically, smaller commercial farmers employ a small number of wood workers (5-10). For some commercial farmers, charcoal production has become an essential part of farm business. Those bigger charcoal producers use additional land from neighbouring farms (mostly against a fee) to produce charcoal or to place their cattle. Some employ up to several hundred charcoal workers. Farmers on communal land also engage in the charcoal business, either as an income diversification strategy or as the main source of income. The communal charcoal producers also employ labour teams and pay to debush on other people’s land.

The charcoal is sold to a few bigger Namibian buyers or directly to Europe or RSA (SADC 2006). There, it is used for conventional heating purposes and braais (barbecues), but also as fuel in power plants. In comparison, the Namibian charcoal market is rather small, only absorbing a minor part of total production. There are few retailers in Namibia. Jumbo Charcoal as the biggest one buys about one quarter of Namibia’s overall production. As others, they use FSC standards for the biggest share of their production because they have an interest in secured overseas markets, even if temporarily they receive better prices in RSA. Mobile phones have made markets much more transparent.

Bush-to-Woodgas Model

Biomass gasification is based on pyrolysis producing biogas. In a pyrolysis gasifier, biomass

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3 Under the Namibian Labour Act, an agricultural employer has specific obligations concerning social security (registration and payment), provision of food (food shops: no more than 1/3 of wage can be given as credit), accommodation (provision of adequate accommodation also for dependants), and general obligations concerning minimum wages/remuneration, hours of work, leave, termination of employment as well as health and safety (GRN 2007).
is first exposed to heat which causes the gases to be released. These are then captured and can be used for controlled combustion, for example in an electricity generating plant. Charcoal production is 60% less than under classic charcoal production and of a slightly different nature. Leftover waste products from pyrolysis and gasification of bush (about 5 per cent of the biomass burned) are labelled char-ash or agrichar, and can be used as crop fertilizer binding carbon into the ground (Lehmann 2007).

The Desert Research Foundation of Namibia (DRFN), a local NGO, has initiated a pilot project (CBEND) financed by EU grants that tests feasibility and viability of gasification plants and electricity production in Namibia based on bush material. An independent power producer (IPP) is expected to operate a 250 KW electricity generator. The project would use sustainable harvesting methods in order to ensure regrowth rates of five to eight years (Hager not dated). The gasifier plant will consume about 50 tons of dry, chipped woody biomass per week and continuously run and produce electricity. About 30 workers, most of them for cutting bush, would be employed. Higher skilled labour is needed in limited number for transport and particularly for maintaining the gasifier. The electricity is intended to be fed into the national grid. It would be the first independent commercial electricity feeder in Namibia. The business model is currently being developed, the first pilot is expected to run from end 2009 on. Major unknown elements in the technical process are the physical and chemical properties of the wood chips and the quality of the gas, in particular the content and type of volatile tars and the need to wash them out, so that actual profitability under Namibian conditions is still unclear.

For a typical medium size farmer, operating the power plant would signify an important addition to his overall business. As of now, electricity production would work alongside the bush harvesting for charcoal. It is, thus, an income and risk diversification strategy for the farmer.

Bush-to-Briquettes Model

In order to produce woodfuel briquettes, harvested bush is fed into a chipper. After chipping, the woodchips are hammer-milled 8 mm size, dried by hot air and introduced in an extrusion press. The press bonds the material together into long logs that can then be cut to smaller sizes. Thermo-chemical conversion is not part of processing. Just as in the case of charcoal, briquettes are used for heating purposes, braais and fuel.

An existing example of the above model in Namibia is the Cheetah Conservation Fund (CCF), located in central Namibia. The NGO is the owner of CCF Bush Pty Ltd, a company established to harvest, manufacture and market wood fuel briquettes under the label “Bushblok”. CCF’s primary objective is not the briquette production, but ensuring the long-term survival of the cheetah on its special conservancy. In the pursuit of this objective, the NGO designed a habitat improvement programme with the help of donor funding. Keeping the savannahs open is essential for cheetahs, so debushing down to an ecological optimum is one of the key elements of the programme.

Since debushing is costly, the idea came up to utilise bush as a productive resource and cover as much of the costs through the commercial production of wood-briquettes (CCF 2009). The harvested biomass is not converted into the end product on the spot but transported to a processing factory in the next town, which sensibly raises overall production costs (but which is not an essential part of the value chain model). CCF’s farm comprises 40,000 ha in total, amounting to 410,000 tons of available woody biomass. The targeted buyers for “Bushblok” are retailers and organic niche markets in Europe (UK, Germany) and South African. In Namibia, CCF sells either briquettes, raw chips for high efficiency chip
burning stoves or logs for braais (ibid.). FSC certification is an integral part of the business model. However, bush regrowth is not wanted due to the key motivation and prevented through use of permitted contact herbicide. It is very likely that the relatively high price of the briquettes which is presently taken and needed to achieve profitability is only feasible through the positive image of CCF – thus, it is not a model replicable by any commercial producer.

Table 1 presents an overview of the three bush models in comparison.

**Table 1: Summary Description of Bush-to-Energy Models**

<table>
<thead>
<tr>
<th></th>
<th>Bush-to-Charcoal</th>
<th>Bush-to-Briquettes</th>
<th>Bush-to-Woodgas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Stakeholders</td>
<td>Commercial/Communal farmers, wood workers</td>
<td>NGO, donor, wood workers</td>
<td>Commercial farmer, NGO, donor, wood worker</td>
</tr>
<tr>
<td>Production, Processing, Marketing</td>
<td>Bush chopped on farmer’s land or on leased land&lt;br&gt;Wood is burned to charcoal on site&lt;br&gt;Wood worker paid per output&lt;br&gt;Charcoal sold directly or through retailers on national and international markets</td>
<td>Bush chopped in special conservancy&lt;br&gt;Wood is chipped&lt;br&gt;Chips are (transported to factory and) pressed to briquettes&lt;br&gt;Wood workers are paid per output&lt;br&gt;Briquettes sold directly on national and international markets</td>
<td>Wood workers chop the bush on farmer’s land&lt;br&gt;Wood is chipped&lt;br&gt;Chips are fed into the gasification plant&lt;br&gt;Plant powers generator&lt;br&gt;Electricity fed into the national grid</td>
</tr>
<tr>
<td>Facts &amp; Figures</td>
<td>Overall in Namibia: 50,000 t charcoal p.a.&lt;br&gt;35,000 wage labourers on affected farms</td>
<td>Per unit: 6,000 t p.a.&lt;br&gt;20 wage labourers</td>
<td>Per unit: 0.25 MW-generator&lt;br&gt;30 wage labourers</td>
</tr>
</tbody>
</table>

*Source: authors' design (2009)*

4.2 **Obstacles of Bush-to-Energy Value Chains**

Whereas some Bush-to-Energy value chains are already fully operational (at least on a pilot base), several obstacles were encountered during the research that pose challenges for a viable existing and future value chain operations.

A major challenge regards the labour issue. A recent problem is the demand of unions for payment of 700N$ per ton which according to farmers could not be covered at current prices. A more principle problem is that the self-employment modus is highly disputed by the Ministry of Labour claiming that wood workers need to be treated as workers under the Labour Act. Farmers argue that this would threaten the profitability of production because a payment per hour arrangement would not provide sufficient incentives, given that the work is difficult to control and standardise. Therefore, they insist on more flexible work relations. Negotiations between the charcoal producers association, unions and government representatives including the Ministry of Labour have been going on for years but so far no agreement could be found. The Woodland Management Council, which currently only exists in an interim form, is seen as a forum of discussion. Prospects of the council assuming full operation are, however, dim.
Another major obstacle is the lack of communication and understanding by the stakeholders which hampers the negotiation process. Farmers have criticised, for example, that political negotiating partners do not have sufficient knowledge of the realities of the charcoal business and therefore cannot understand the farmers’ possibilities and constraints. In addition, capacities of unions, namely the Namibian Farm Workers’ Union (NFWU), are weak, both in reaching out to the people they claim to represent and in negotiating power. Indeed, most workers do not know the unions. Farmers have also expressed serious concerns over the legitimacy of NFWU to represent wood workers while having little knowledge of their conditions and needs. Keeping in mind that CBEND as a pilot project carries the poverty reduction banner, making bush-to-electricity an economic opportunity and not an exploitative business is essential. The outcome of labour contract negotiations will therefore highly influence the impact of the gasification project on employment.

Many farmers also employ Angolans in addition to Namibian charcoal workers. Commonly they are illegal as they do neither possess identity cards nor work permits. Farmers have expressed the wish to regulate their status. However, the government shows little interest in the issue as the political goal is to create employment for Namibians first. The question of labour is also connected to more practical or even emotional concerns: Many farmers do not want to have a large number of strangers on their land, who are thought to be the cause for insecurity, illegal actions such as poaching, hygiene problems, fires and theft. They thus prefer other, non-labour intensive methods to fight the bush problem (compare de Klerk 2004).

In the communal areas, charcoal production is hampered due to the communal land tenure system. The consequence of the “problem of the commons” is that those who do debush do not actually clear land to strategically restore rangeland, but they cut down trees in order to produce charcoal as a mere income generation activity.

Access to capital is another handicap for debushing. Some farmers claimed that they would like to productively use bush but do not have access to capital in order to get debushing started. This is matched by Agribank stating that they were not able to serve total demand for special debushing loan schemes in 2008.

A crucial aspect for economic viability in the Bush-to-Woodgas Model is the existence of a high enough feed-in tariff. So far, feed-in tariffs of the national electricity company (Nampower) are at 0.11 N$ per KWh which is extremely low compared with feed-in tariffs in industrial countries. An IPP, such as a gasification plant could sell power to Nampower or to a Regional Electricity Distributor. There are indications that the basis of negotiation for the project feed-in tariff will be about four times higher than the current tariff. However, it was indicated that tariffs should be six to eight times higher in order to make renewable energy production viable in Namibia. Beyond the pilot project, viability becomes even more important as the revenue needs to cover investments costs. This means not only tariffs are crucial. Also, the financial foundation of the IPP needs to be stronger and more stable than in a subsidised project. According to present calculations provided by the CBEND project, the break even point would be only after 13 years.

For the other value chains described, market access in general and, in particular, to FSC markets, is a challenge for small scale producers. They often cannot afford high transport costs and higher investment costs for FSC production.

The question of knowledge and skills transfer is particularly relevant for communal areas and emerging farmers. While emerging farmers might get support from their white neighbours and also from government support programmes, the common extension service has not embarked on training communal farmers in rangeland management, neither has a lot
of research taking place on bush encroachment in communal areas. On the technical side of Bush-to-Woodgas, interviewees have expressed concerns over the local availability of technical know-how necessary to run a gasifier plant. Expertise on the subject is low in the country and particularly difficult to attract into a rural environment.

If the main aim is to debush the farm for graze land recovery, the decision of a farmer whether or not to produce charcoal also depends on the availability and viability of other options. Herbicide spraying is preferred by many farmers as it requires very little labour and has almost immediate effects. On the other hand, it has negative ecological consequences (indiscriminate application) and high capital costs.

Table 2 below resumes the three bush models regarding the obstacles that hinder their implementation.

**Table 2: Main obstacles for Bush-to-Energy Models**

<table>
<thead>
<tr>
<th></th>
<th>Bush-to-Charcoal</th>
<th>Bush-to-Pellets</th>
<th>Bush-to-Woodgas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>Wood workers are in a grey area. No clear regulations existent</td>
<td>Negotiations between government, farmers and unions are stalled</td>
<td>Unwillingness of farmers to have strangers on their land</td>
</tr>
<tr>
<td>Land Tenure</td>
<td>“Problem of the Commons” in communal areas</td>
<td>Insecurity about Land Reform process</td>
<td></td>
</tr>
<tr>
<td>Markets</td>
<td>Instability of prices</td>
<td>Problem of Economies of Scale (esp. when serving stable niche markets like FSC)</td>
<td>Feed-in tariff regulation unclear</td>
</tr>
<tr>
<td>Capital</td>
<td>Indebtedness and cash-flow problems of commercial farmers</td>
<td>Access to credit in communal areas</td>
<td></td>
</tr>
<tr>
<td>Other Options</td>
<td>Application of herbicides is faster (but more expensive and not sustainable)</td>
<td>Development of land prices</td>
<td></td>
</tr>
<tr>
<td>Knowledge and Skills</td>
<td>Insufficient knowledge transfer for communal and black emerging farmers</td>
<td>Insufficient knowledge and skills for operating power plant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of management skills</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: authors’ design (2009)*

### 4.3 Potential Development Impacts of Bush Models

The most relevant economic effect from Bush-to-Energy value chains is the additional income created for wood workers, mainly for that male part of the rural poor from the Kavango and Ovambo regions which are illiterate and unskilled and need such type of low qualified jobs regardless whether in urban or rural areas. Estimates for charcoal production from invader bush, for example, show that 4.5 times more labour is needed in comparison to simply clearing land (de Klerk 2004). Rural development effects in the communal areas can also be expected from remittances. Another direct effect on the poor will derive from selling bush feedstock or charcoal by small scale communal farmers operating in Bush-to-Energy areas.

In the medium to longer run, regaining rangeland for livestock production and subsequent
increase of animal production would secure employment and income of farm workers. This assumes that additional cattle can be bought or natural herd growth remains on the farms, which is not only dependent on grazing area but also capital and water. Labour demand and thus additional income could also result for members on the processing and distribution side.

On the other side, wood and farm labourers are often highly dependent on their employing farmer as sole provider of cash income, food and other goods on the usually remote farms. Although wood workers with high production outputs earn more than normal farm workers under minimum wage, wages are rather low after deduction of loan repayments for food and tools. In fact, many workers abandon the job after a few weeks. Besides, wages are very inconstant since work arrangements are informal and the work is seasonal, thus, not securing workers with cash income throughout the year.

More mechanised bush harvesting techniques using motor saws etc. are discussed for the future. They require skilled labour, would increase labour productivity and would lead to better payments and working conditions but would also negatively the demand for unskilled labour. For the time being, this skilled labour force is neither available nor have farmers sufficient confidence in the long-term development of the bush-to-energy markets to engage in long-term training and hiring.

The additional income could have a significant impact on access to food and thereby food security since household figures in Namibia suggest a very high spending in the relevant northern regions on food consumption (NPC 2006). A study conducted by the LaRRI (Karamata 2006) found that farm workers on white-owned commercial farms spent over 50 per cent of their wages on food and another 22 per cent was send home. Interviews with wood workers have confirmed this pattern. On the other hand, the availability of food depends on factors that are not directly influenced by Bush-to-Energy production. On a national level, increased carrying capacities in the commercial areas through rangeland restoration can enhance meat availability whereas increased cattle production in the communal areas directly increases food security on the local level. Wood workers also benefit from in kind payments (meat and milk for example) to which farmers are obliged under the Labour Act. Negative effects for food security could stem from the dependency of farm workers in remote rural areas on the farmer as sole food supplier. Workers borrow from shops and are often heavily indebted with the farm owner. Besides, prices in the shops are higher than market prices due to transport costs and profit making objectives on the farmer’s side through food shops. Also, if migration reduces labour capacities in the rural areas, this could compromise local food production on household level though this is usually done by women who are rarely engaged in wood work.

Reducing bush encroachment has positive impacts on water tables, as it significantly reduces evapotranspiration of trees. Especially in a drought prone country like Namibia, water is an essential asset for agriculture and livestock keeping. The entire scope of the ecological impact depends, however, on the degree of bush removal. Complete clearing, for example, leads to loss of soil nutrients. Therefore, the goal usually is to thin out bush infested areas and not completely remove it (JPC 2008). In contrast, some species requiring browse or dense cover for predator evasion and several bird species would be negatively affected by bush control. In summary, however, effects for biodiversity are expected to be positive. In any case, the impact on each species depends on the extension and intention of bush control measures (de Klerk 2004). A sustainable bush resource use is questionable if an area is completely cleared and roots are taken out. Also, herbicides used for killing invader bush might negatively affect the environment. So far, debushing permits issued by the DoF only regulate the protection of endangered species. Only FSC production ensures sustainable
harvesting.

The effect of Bush-to-Energy on GHG emission is unclear and under researched. Positive climatic effects can be expected if coal-fired industries are replaced by charcoal or briquettes as has been argued by European companies using Namibian charcoal to replace coal. However, harvesting invader bush means the reduction of a carbon sink, either temporarily (if bush rotation is envisaged) or permanently (if grasslands are restored).

Positive socio-political effects might arise from increased income spending on health services, school fees, and clothing leading to benefits for the broader part of the community. Employment creation is commonly argued to help reduce the widespread problem of alcoholism in Namibia by giving people a task and sense. If employed under formal arrangements, workers would benefit from Namibia’s social security scheme. From a gender perspective, debushing mainly gives work to men. Some women are, however, employed in the charcoal packing. Finally, due to remote location, extremely harsh working conditions without proper use of protective clothing and little control by the labour inspectorate, wood workers are exposed to high health risks.

Table 3 below resumes the three Bush-to-Energy models according to their effects on rural development as well as food security.
<table>
<thead>
<tr>
<th>Impact</th>
<th>Specification</th>
<th>Charcoal</th>
<th>CBEND</th>
<th>Bushblok</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>Income</td>
<td>Need for unskilled labour for debushing and burning charcoal, loading and unloading, packing</td>
<td>Need for unskilled labour for debushing and chipping, loading and unloading, packing</td>
<td>Need for unskilled labour for debushing, chipping and transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Need for semi-skilled labour along the value chain (truck driver, supervisors)</td>
<td>Need for semi-skilled labour along the value chain (truck driver, supervisors)</td>
<td>Need for semi-skilled and skilled labour in the production factory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential need for semi-skilled labour if mechanised harvesting</td>
<td>Potential need for semi-skilled labour if mechanised harvesting</td>
<td>In both cases, however, less labour needed than in the case of charcoal and CBEND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More income through restoration of rangeland</td>
<td>Need for skilled labour to operate the plant</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remittances make up big part of expenditures, Kavango and O-Regions benefit from it</td>
<td>Remittances make up big part of expenditures, Kavango and O-Regions benefit from it</td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td></td>
<td>Additional leasing of land possible, either for increased charcoal production or for placement of cattle</td>
<td>Additional leasing of land possible in order to reach necessary feedstock quantity</td>
<td>No significant changes expected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In communal areas ‘problem of the commons’ hinders debushing</td>
<td>In communal areas ‘problem of the commons’ hinders debushing</td>
<td></td>
</tr>
<tr>
<td>Opportunity Costs</td>
<td>Subsistence farming (labour force engaged in debushing instead)</td>
<td>Subsistence farming (labour force engaged in debushing instead)</td>
<td>Subsistence farming (labour force engaged in debushing instead)</td>
<td></td>
</tr>
<tr>
<td>Special Risks</td>
<td>Market uncertainty (exchange rate, FSC vs. non-FSC charcoal demand)</td>
<td>Economic viability unclear, so far donor-funded</td>
<td>Economic viability unclear, so far donor-funded</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High capital costs, especially when scaled up</td>
<td></td>
<td>More cheetahs might increase loss of cattle or game</td>
</tr>
<tr>
<td>Socio-political</td>
<td>Health &amp; Education</td>
<td>Increased expenditures on education and health, but still little access</td>
<td>Increased expenditures on education and health, but still little access</td>
<td>Increased expenditures on education and health, access possible due to proximity to urban area (possible perception of farmers)</td>
</tr>
<tr>
<td>Ecological</td>
<td>Social Structure &amp; Power Relations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biodiversity</strong></td>
<td>Reduction of social problems resulting from unemployment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased responsibility of the farmer for belongings of his workers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Work opportunity mostly form men, women stay behind in the rural communal areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social impact small, given the scale of production and employment generation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Work opportunity mostly form men, women stay behind in the rural communal areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>Bush-grassland equilibrium is restored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduced evapotranspiration and restoration of water tables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduced evapotranspiration and restoration of water tables, though smaller scale than in the case of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>charcoal and CBEND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Soil</strong></td>
<td>Reduced evapotranspiration and restoration of water tables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss of nutrient supply if woody biomass is removed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effect mitigated if FSC standards are applied.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carbon sink</strong></td>
<td>If not harvested sustainably, carbon sink is being destroyed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carbon sink restored due to revolving “cultivation” and harvesting system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carbon sink destroyed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Availability</strong></td>
<td>Increases through farm shops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Possibly decreases if production in communal areas is affected by lack of work force</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td>Limited by low wages and, if applicable, by restriction of lending from shops by Labour Act</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td>Dependence on farmer’s service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dependence on farmer’s service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No significant changes expected</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Authors’ compilation (2009)*
5 Assessment of Jatropha-to-bio-diesel value chain in Namibia

As mentioned, the Namibia “Bio-fuel road map” identified Jatropha curcas to be the best bio-oil option due to the limitation of water availability both for rainfed and irrigated agriculture. A minimum of 450-600 mm rainfall per year is required for reasonable production yields (Henning 2003), conditions found in the communal areas of Kavango and Caprivi which were therefore identified as major potential cultivation areas (Interim Bio-Energy Committee 2006). Indeed, Jatropha is widely found in urban and rural areas of northern Namibia, basically as living fences and ornaments, for medical and pharmaceutical use, but not as an energy plant.

The processing stage comprises two major steps. During oil extraction, SVO is produced which can be consumed locally for powering specific stationary diesel engines, lighting, and cooking purposes. Also, it can be fed into a second processing stage called trans-esterification. Jatropha oil first separates into three free fatty acids and glycerin, and in a second step combines with methanol, converting it into Fatty Acid Methyl Esther (FAME), i.e. bio-diesel (GTZ 2007). Oil extraction can be done with a variety of technologies which differ in their scale of operation and extraction rates. With a reported oil content ranging between 25 and 35 per cent and hand presses extracting 60 to 80 per cent of the oil, four to six kilograms of seeds would be required to produce one liter of oil (cft. Henning 2000, Metzler 2006). Given the range of reported yields, this results in 0.2 to 5 tons of oil per ha. Trans-esterification usually takes place in centralized plants. Bio-diesel can then be sold to the national or international transport fuel market, whereas the by-products enter various other markets.

5.1 Description of Jatropha-to-Bio-diesel Models in Namibia

Jatropha projects in Namibia have started along with the Bio-oil Roadmap (see above). Large foreign and national investors have tried to enter into contract farming arrangements (Contract Farming) or tried to acquire large pieces of land to grow Jatropha (Plantation Model). Also, first attempts exist to implement Jatropha schemes within communities for local use (Community Model).

Plantation Model

In the Plantation Models in Namibia, an investor leases an ample piece of communal land to grow Jatropha on a large scale. The investor employs farm workers for cultivation, harvesting and processing and sells the produce to national and/or international markets. Several projects of this business model have been started in Namibia in the recent past. Whereas MAN tried to set up a plantation in Kavango (and a contract farming scheme in Caprivi) and apparently stopped their activities, two other investors are currently trying to establish plantations in Caprivi Region: Lev Leviev Biofuels (LLB) and Caparo Investment (cf. Etango 2008, EnviroDynamics 2009).

LLB’s first obtained a leasehold from the town council of Katima Mulilo to set up a small test farm to detect suitable varieties of Castor-oil plants, Jatropha, and food crops. In the second step, the company currently approaches communities in order to get a leasehold for communal land of plots supposedly ranging between 20,000 and 300,000 ha. Caparo is also still in a planning phase but tries in a first step to directly obtain a leasehold over ca. 150,000 ha on which to grow Jatropha and food crops. Initially, ten per cent of the area was
envisaged for food crops. This allotment was increased to over 40 per cent in the recent past. 25,000 ha of land are planned to be irrigated with water extracted from the Zambezi River whereas Jatropha will primarily be planted on the non-irrigated land. 2,000-2,500 skilled and unskilled jobs are promised to be created in the long term. Caparo has had Social and Environmental Impact Assessments conducted and included various positive impacts on the community in their business plans. Currently, the company is trying to obtain leaseholds. Both companies envisage to sell the food crops to local and regional markets. Also, both companies are planning to process Jatropha products in the Caprivi region but cannot yet (or do not want to) specify which markets they will sell the Jatopha-oil and bio-diesel to (ibid.).

Contract Farming Model

Contract farming refers to “a system where a central processing or exporting unit purchases the harvests of independent farmers and the terms of the purchase are arranged in advance through contracts” (Baumann 2000). The contractor or investor often acts as a service provider to the smallholders and is usually overseeing the initial operations, advising smallholders, providing input and know-how and assisting with the marketing (Mendelsohn 2006, GTZ 2006). There are plans and first steps taken to establish contract farming schemes in Namibia in order to produce bio-energy. There were three projects of this scheme found during the research in Namibia, run by either national or foreign companies, namely Prime Investment (Pty), Namib Bio-energy Investment and MAN. Whereas these projects were either in an early stage of execution, one had apparently shut down operations.

One of the projects is based on the idea to contract 8,000-13,000 farmers in Kavango to plant Jatropha on 70,000-130,000 ha of deforested land. The seed cake would provide for 19 per cent of income, bio-diesel for 33 per cent and carbon credits for 48 per cent (Christian 2006). For the project, it is crucial to identify those sites that have been cleared prior to 1990 to claim carbon credits. Farmers who have such land at their disposal qualify for participation in the project and are potentially contracted to grow the trees on part of their land (either replacing maize or mahangu cultivation or using fallow lands) (ibid.). The farmers would thus maintain control over their land but in accordance with the requirements of the Kyoto Protocol may not clear new lands in order to compensate. The farmers mainly contribute their land and labour to the project whereas the investor sets up nurseries and provides seedlings, fertiliser, other materials and training for planting. In addition, as Jatropha trees take several years to mature the investor also subsidises the farmer with food and cash during this time. Farmers then sell the harvest from the trees to the investor who processes it further within the region. In addition, a farmers association is established to represent the interests of farmers. This association would hold shares in the project companies and after 2014 these shares would increase to 100 per cent of the farming company and 49 per cent of the industrial company (Christian 2006).

Other contract farming models did not take into account Carbon credits. Investors calculated that yields of 3-5 t/ha would be sufficient to make production viable without even selling the cake. One reportedly had tested intercropping of local Jatropha seeds and food crops (Mahangu, maize) and found good results. However, some evidence also suggested that some farmers faced serious problems with initial drought and pests. Nevertheless, the investor group had already raised 1,5 million seedlings ready for distribution when the financial crisis hit the financial partner and the project came to a sudden stop.

Description of the Community-based Model

Another model proposed for Jatropha value chains in Namibia follows a decentralized
community-based approach. Jatropha seeds, in this model, are not sold to outside markets but rather processed and used locally for providing remote communities with access to energy for electrification and water pumping and improved livelihood activities. Whereas community models with Jatropha SVO are running successfully in various other Southern African countries (cf. FAO 2009b), no such model exists in Namibia presently. One university, however, has conducted laboratory research and plans to go into field trials. A local NGO has started to promote Jatropha among disadvantaged women in the north of Namibia to provide improved livelihood options.

During other interviews potentials of such a Community Model for Namibia were highlighted: Locally extracted oil could power generators for pumping water, for grinding, or electricity provision. Alternatively, SVO can be used for improved cooking stoves, lighting or production of alternative products. In addition, bio-gasification plants were mentioned as a use for Jatropha residuals for a community to produce energy. The Bio-oil Roadmap (2006) further mentions the potential for using Jatropha oil as bio-diesel component within hybrid off-grid systems of which one prototype is already implemented by DRFN in Tsumque.

Table 4 summarizes the different modes of the Jatropha models.

**Table 4: Summary of Jatropha-to-Bio-diesel Models in Namibia**

<table>
<thead>
<tr>
<th>Direct Stakeholders</th>
<th>Plantation</th>
<th>Contract Farming</th>
<th>Community Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community, investor, workers</td>
<td>Community, investor, workers</td>
<td>Community, NGO/ government institution/ academic institution, farmers</td>
<td></td>
</tr>
<tr>
<td>Production, Processing, Marketing</td>
<td>Production and processing by employees, International or national market</td>
<td>Production by communal farmers, Processing maybe by community, International or national market</td>
<td>Production, processing and consumption by community</td>
</tr>
<tr>
<td>Facts &amp; Figures</td>
<td>2 investors, 150,000-300,000 ha (food crops and Jatropha) each, Thousands of jobs</td>
<td>3 investors, 63,000 ha together, 8,000-13,000 families involved</td>
<td>Trials on small scale, Experiments by Polytechnic (University)</td>
</tr>
</tbody>
</table>

Another potential way of organising the Jatropha value chains not described so far involves commercial farmers who plant Jatropha on their own land to use the seeds on-farm or sell them to off-grid generators or other markets (Interim Bio-Energy Committee 2006). At the time of research, trial plots existed already in the Maize Triangle. The currently largest Jatropha plot exists in Kavango at a government farm. 14,000 Jatropha trees were planted here with seed production already take place in the first year (Commercial Farmer).

5.2 Obstacles of Jatropha-to-Bio-diesel Value Chains

During the research there was no Jatropha scheme yet fully operational in Namibia. Whereas the reported investments are in an early implementation stage, other projects had already
failed. From the interviews conducted several reasons explain the difficulties for setting up Jatropha schemes.

One of the major obstacles found in the plantation and contract farming models regards decision-making processes on land use and the legal problems of communal tenure system. In one case, land promised to the investors was already gazetted for alternative use in livestock production by the government several years ago. Violations of the Communal Land Act were reported since communities were not included in the decision making process and negotiations took place only between the investor and the Traditional Authority leading to resistance of parts of the communities (cf. Mitchell 2009). In one contract farming model claiming carbon credits, conflicts arise about the legal status of the land planted with Jatropha trees: Whereas the investor initially demanded formalised long-term leaseholds in order to prevent conflicts over ownership of trees, communities as well as the government rather feared to loose long-term land security. The Jatropha Farmers Associations expressed the view that leaseholds will make land rights less secure for farmers since customary rights are already recognized by law whereas converting them into leaseholds puts farmers into risk of loosing their land once they are unable to pay lease fees (e.g. in case of project failure). In the plantation models communal farmers were also worried about losing the rights to their land for many decades. At the same time, formal registration of communal land in Kavango is currently not always possible as some Traditional Authorities have resisted supporting the registration process. In addition, there is general distrust with foreign investors who target land acquisition. Regarding CDM, it further seems to be unclear whether Jatropha planted on unregistered land poses an obstacle for claiming carbon credits.

The lack of a clear government position on Jatropha further creates uncertainty among investors and community which makes a long term planning very risky. In some quarters, there is still fear of invasiveness and toxicity, although Jatropha is spread in Northern Namibia since a long time and thorough EIA (though financed by investors) have not found any sign that would support these fears. However, no government financed systemic EIA has been conducted so far as to reject or support the reservations. Communities and regional government insist on proves of technical viability before dedicating own land to Jatropha cultivation and appear to be very hesitant since information of functioning reference Jatropha projects of this kind anywhere in Africa is missing. Some communities have already made bad experiences with other cash crops, such as cotton, and are now worried about the viability of the project and hidden objectives of the investors. The little information on Jatropha cultivation in Namibia has been a further obstacle. Clear information on potential yields in Namibia as well as information on input requirements are still missing.

Community-based models on the other hand, while not facing problems of land ownership or conflict with investors, face two major challenges: reaching economic sustainability at local level and scaling-up to national level (cf. Dubois 2008, FAO 2009b). Since the entire value chain is managed within the community, coordinating the interdependent steps in the context of a target group lacking know-how is very burdensome. High investment cost (inputs, machines, human capital) for setting-up relatively small community-based models, e.g. as a hybrid-system or stand-alone solution, demand high public financing. Recovery of the start-up and running costs through the community is improbable. Financing mechanisms (subsidies, feed-in tariffs), however, are not envisaged a Jatropha based local bio-energy system.

Low labour requirements for cultivation allow integrating in into existing production systems without neglecting food production. However, especially in the first years and during harvesting, labour input can be quite substantial in high-yielding environments (Jongschaap et al. 2007). After 3-5 years under dryland conditions Jatropha is expected to
reach its full production potential (Metzler 2006). Harvest is complicated by the fact that Jatropha flowers and ripens continuously over a longer period. Mechanical harvesting methods are not (yet) available; consequently Jatropha needs to be harvested manually. When cultivation is done on a larger scale (plantation model) to benefit from economies of scale for instance in irrigation, wages for hired labour are important cost drivers. Alternatively, Jatropha can be planted by smallholders on their own land that employ family labour (contract farming model). Whereas opportunity costs of labour are usually low in small scale farming, there might be risks of reduced capacities for food crop production when labour capacities are scarce during certain labour peak times. Integrating Jatropha and food crop production through intercropping has been tested in some places, reportedly with success, but hard data over a longer observation period are not available.

Reliable information on potential yields would be important to assess the viability and income potentials of Jatropha cultivation. Data on yields of seeds and oil of real-size Jatropha plots is one of the biggest unknown in Namibia. This reflects worldwide situation: In literature, a very large range of yield figures is found, varying from 0.6 t/ha up to 15 t/ha (Jongschaap et al. 2007). However, particularly yield data under marginal land or sub-optimal conditions do not yet exist. With regard to cultivation and harvesting, Jatropha is said to require less nutrients and fertiliser than annual crops. However, chemical or organic fertilisers strongly enhance crop growth. Besides, applying organic or chemical pesticides have been found necessary in Namibia due to its unexpected susceptibility to some local attacks - whereas all over the world the toxicity of the plant has led to its use as hedge around food crops, some wild animals (kudu, porcupine) in Namibia were found to browse especially young Jatropha trees in the Maize Triangle. Investors reportedly base their farm models on yields of 3-5 t/ha, but also much higher expectations have been expressed. Whereas some investors perform research on Jatropha varieties in Namibia, one even with international consultancy and on a very large scale, hardly any public research is taking place to find most suitable seed varieties for smallholder farmers.

The Jatropha industry depends largely on the existence of key output markets and the ability of the producers to meet the demand which mostly is highly specific through a number of standards and norms. Two different potential output markets are the transport fuel market and the rural energy market. As engine manufacturers warranties are mostly valid up to a blending of five per cent (B5), the potential market size for bio-diesel can be derived by assuming five per cent of all fuel consumption to be supplied with bio-diesel. For Namibia, this leads to a market of 22.7 million litres per year (Interim Bio-Energy Committee 2006). SVO can be used directly in rural diesel generators to produce off-grid electricity of. According to the Interim Bio-Energy Committee (2006), approximately 9 MW of diesel generator capacity exists across Kavango and Caprivi Regions, more off-grid capacity is scheduled in the Rural Electrification Master Plan.

The profitability at this stage depends on the conventional diesel price as well as bio-diesel production costs. The FAME plant size exerts strong influence on unit costs due to economies of scale. According to the Interim Bio-Energy Committee (2006) a small (on-farm use) FAME plant requiring 200 ha of Jatropha plantation leads to 84 US-cents/liter of production cost. Medium-sized FAME plants with 20,000 ha of plantation produces at 62 US-cents/liter. Thus, both plant sizes would be economically profitable with conventional diesel prices at US$60-70, whereas at prices below US$50 a small plant would be unprofitable (Interim Bio-Energy Committee 2006).

Profitability of Jatropha production may be raised when additional by-products can be sold. There are potential additional uses stemming from the by-products such as glycerin (e.g. for soap production) and particularly the cake which in principle can be converted into animal
feed after detoxification or used as organic fertilizer. However, special additional transformation steps are required, some of which only feasible (up to now) on a large scale (e.g. detoxification), and the markets are not yet established, particularly for larger volumes.

In addition, profitability of Jatropha production may be raised by selling carbon credits within the CDM (Clean Development Mechanism) or on voluntary carbon markets, either for reforestation (if Jatropha is grown on old deforested land) or for the substitution of fossil fuel. Again, these are highly complicated, expensive and unknown procedures so that most investors (though not all) do not take these potential revenues into account.

Table 5 summarises the analysis regarding the obstacles for implementing and running Jatropha models in Namibia.

### Table 5: Obstacles for Jatropha Value Chains in Namibia

<table>
<thead>
<tr>
<th></th>
<th>Plantation</th>
<th>Contract Farming</th>
<th>Community Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Tenure</strong></td>
<td>Econ. of scale require large piece of land</td>
<td>Problems with obtaining leasehold</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conflict with other uses and interests</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Labour</strong></td>
<td>High costs of hired labour</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long period of harvesting, no mechanisation yet</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lack of Support by Government</strong></td>
<td>Fear of threatening household and national food self sufficiency</td>
<td>Fear of invasiveness</td>
<td></td>
</tr>
<tr>
<td><strong>Insecurity of Community</strong></td>
<td>Lack of knowledge on Jatropha and alternatives</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fear of losing control over their land</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fear of project failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Part of the community is left out in the negotiating process</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Capital &amp; Skills</strong></td>
<td>Less money by mother company for projects due to economic crisis</td>
<td>High costs while waiting for final government decisions</td>
<td>Financial support and knowledge transfer crucial for pilot projects and scaling-up</td>
</tr>
<tr>
<td><strong>Markets</strong></td>
<td>Economically viable? Missing information on yields and prices of oil and by-products</td>
<td>Problems, risks and ignorance with CDM market</td>
<td></td>
</tr>
</tbody>
</table>

*Source: authors’ design (2009)*

### 5.3 Potential Development Impacts of Jatropha Models

The research conducted in Namibia on Jatropha value chains in Namibia shows that different modes of organizing value chains strongly determine the potential development impacts.

A major economic impact from the large-scale schemes analysed (plantation and contract farming model) are the massive employment generation potentials (1,000 – 15,000 in the plantation model and 8,000 – 13,000 families employed in the contract farming schemes) in
regions that are characterized by a high unemployment rates (Mitchell 2009, Mendelsohn 2007). Wider industrialization and employment effects could further result from the enormous increase of cash circulating in the regions and direct large-scale project investments (building roads, pump stations, pipelines, factories for processing).

On the other side, embarking on agricultural projects of such a size would increase the exposure of the regions to project risks. The paramount economic and socio-political threat is the failure of the entire project for example due to market failure (global price changes), mismanagement or natural crop failure. If the investors decide to pull out after a while, the communities are left with huge opened lands or Jatropha fields. Even if these are mostly non used lands such as in the Caprivi and inner Kavango (already due to almost complete absence of water in the earmarked areas which makes even livestock rearing impossible), the damage is long-term and is costly and lengthy to remedy (for instance, it is often charcoal production sites from pe-indeedence that today are intended to be reforested with Jatropha). Social and political unrest of large project failure are to be feared even more, as has been shown by often cited industrial project failures in Namibia.4

Positive socio-political effects include an improvement in education and health status due to increased spending by households (as far as they profit from production or second round effects), potential social investments of the company or secure electricity in the communities’ education and health facilities. Whereas the availability of formal wage employment might increase and general expectation is that prevailing youth problems would decrease, there were also fears expressed that alcoholism might well increase due to additional cash income (Mitchell 2009, Mashi TA). Further potential for conflicts lies in an increased number of work-migrants from neighbouring countries.

Another substantial risk of the large plantation projects is the unequal spread of benefits and the non-respect of minorities. Projects of such size attract high politicians and pressure groups that take position for personal and/or common interests. On the other hand, minorities and vulnerable groups such as small ethnic groups, women collecting non-timber forest products, migrant livestock herders and other risk to be overseen, unheard, their rights not or under compensated. During some (though not all) negotiations over communal lands, problems within the communities could already be observed. Traditional authorities are under extreme pressure, never having experienced a similar run on their land and not having knowledge, experience or capacities to deal with such large projects.

Once kicked off, another key point lies in the contractual modalities that link companies to smallholders, and in mechanisms for ensuring that these are respected by both parties. Here, the communities face the risk that a company exploits its monopoly position and not fully complies with promises made, without the communities having enough power to force companies to do so.

4 The prominent case of the Malaysian textile producer Ramatex left Namibia after five years apparently leaving large environmental damage behind. In the agricultural sector an Indian investment planned to establish a cotton ginery in Rundu (Kavango) never materialized.
Extremely high expectations, unclear land rights, delegated negotiation power, rivalling ethnic groups, bad communication infrastructure and habits, long procedures and government anxieties combine to a politically and socially explosive mix. Even the successful establishment of such large projects will create such problems, since not all parties will benefit in equal terms, and not all politically influential persons will be happy if such “success” is happening (probably on their rival’s behalf).

The community model does not know these large scale risks. However, it is very costly to establish at a scale that really dents into rural poverty. For the time being, there are no government or NGO-actors and activities visible which seem to be able to bring about such change.

The potential effects on food security of the Jatropha models were found to be in general positive, however, depending on several conditions. Sceptics from the government side towards large-scale plantation models led to a shift towards integrating large-scale food production in all business models. This could contribute to an increased availability of food especially in the Caprivi region (with high irrigation potential) and, thus, potentially to food security, however, depending on where the food crops are sold. The increase in food production within the contract farming models might arise if improved skills in farming techniques (e.g. intercropping), Jatropha seed cake as fertilizer, additional capital availability and credit access due to higher and stable market access and incomes are used for the enhancement of food production. However, food crop production might decrease if the incentives to devote land and labour to food production even under better technology conditions are not fulfilled. On the other hand, as mentioned above, most families in Kavango already rely for a large part of their food needs on buying food. Additional cash income from the Jatropha projects can thus play an important role in enhancing food security if incomes increase for all (or at least not decrease). This is providing that the local food markets function well, which was confirmed for most of Kavango and Caprivi regions.

Environmental effects from the Jatropha production vary substantially between the different models, too. The large scale plantations analysed would unavoidably lead to widespread loss of biodiversity and carbon sink through debushing activities and monocropping. Although the investors promise to make provisions for intercropping and maintain natural vegetation and wildlife corridors in their plans, these efforts only reduce the negative ecological impacts of a plantation. Furthermore, space for some herders during the rainy season would be reduced leading to more pressure on land from grazing elsewhere. Also, irrigation changes the natural water cycle, and fertilizers and pesticides may pollute water and soils. In contrast to the plantation models, contract farming schemes in Kavango partly focus on land already cleared before and degraded, so that no carbon sink is lost but rather soil may be rehabilitated. Whereas currently no evidence exists of Jatropha being invasive in Namibia, the lack of experiences on a larger scale, though, make it difficult to finally assess the effect. A special risk of the contract farming scheme is the big number of independent producers making seed distribution particularly hard to control. In fact, though not widely known, a moratorium has been placed on the topic.

Table 6 below summarizes and compares the study findings regarding the potential rural development (economic, socio-political, ecological) as well as food security effects of the different Jatropha models.
<table>
<thead>
<tr>
<th>Impact</th>
<th>Specification</th>
<th>Plantation</th>
<th>Contract Farming</th>
<th>Community Model</th>
<th>Commercial Farmer Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>Income</td>
<td>Lots of unskilled wage labour in production and processing (permanent and seasonal) (1,000-15,000)</td>
<td>Cash income from subsidies and selling seeds (8,000-13,000 families in Kavango)</td>
<td>Long-term upgrade of livelihoods (access to energy, productivity increases) for selected communities</td>
<td>Wage income for additionally employed farm workers? (Direct effects of this model on target groups can be expected to be minimal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some skilled labour in production and processing</td>
<td>Wage labour in factories, nurseries etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remittances to neighbouring regions &amp; countries</td>
<td>Potential share of community in production company</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Opportunity Costs</td>
<td>Subsistence farming (heavy competition for labour)</td>
<td>Subsistence farming (some competition for labour and land)</td>
<td>Conventional crop cultivation (e.g. mahangu) (little competition for labour and land if Jatropha planted as hedges)</td>
<td>Commercial food production? (Some competition for labour, land and capital)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alternative land-uses (conservancies, livestock, small-scale commercial farming, forestry)</td>
<td>Pasture (former fallow and mahangu land used for Jatropha plantation not usable for grazing anymore)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spill-overs &amp; Trickle-down</td>
<td>Potential productivity increase from know-how &amp; access to inputs</td>
<td>Potential productivity increase from know-how &amp; access to inputs (use of seedcake as fertilizer or/and purchase)</td>
<td>Potential productivity increase from know-how &amp; access to inputs</td>
<td>Contribution to R&amp;D Innovation diffusion to late adopters (small-scale farmers)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased employment on subsistence farms</td>
<td>Increased employment on subsistence farms</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Higher purchasing power</td>
<td>Higher purchasing power</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land</td>
<td>Loss of customary ownership/control for community (long-term leaseholds for investors)</td>
<td>Farmers keep customary ownership of land but conflicts may arise due to conflicting claims</td>
<td>Customary ownership remains within community</td>
<td>Cultivation on freehold or long-term lease</td>
</tr>
<tr>
<td>Category</td>
<td>Special Risks</td>
<td>Health &amp; Education</td>
<td>Socio-political</td>
<td>Ecological</td>
<td></td>
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<tr>
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<tr>
<td></td>
<td>Risk of project failure: Market uncertainty (conventional fuel price, biofuel policies), harvest uncertainties</td>
<td>Reduced (youth) unemployment</td>
<td>Conflicts between TAs and communities</td>
<td>Debushing of natural vegetation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High costs of project failure (recovery of cultivated land and unemployment of wage labourer, market failure)</td>
<td>Increased expenditures on education and health</td>
<td>High dependency on investors (low negotiation power of workers)</td>
<td>Monoculture with high threat to biodiversity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduced/Increased alcoholism?</td>
<td>Changing gender relations depending on employment policies</td>
<td>Risk of invasiveness?</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Risk of long-term loss of confidence in external projects in case of failure or conflict</td>
<td>Risk of invasiveness?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Social and political tensions from migration</td>
<td>Risk of invasiveness?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High costs of setting-up &amp; coordinating scheme</td>
<td>Increased expenditures on education and health</td>
<td>High dependency on investors (low negotiation power of farmers)</td>
<td>Reduced deforestation if Jatropha planted as hedges and oil is used to replace fire wood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High costs of scaling-up</td>
<td>Reduced/Increased alcoholism?</td>
<td>Potential self-organization of communities</td>
<td>Small risk to biodiversity if invasive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Risk of long-term loss of confidence in external projects in case of failure or conflict</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Self-organization and empowerment of communities</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No significant changes expected</td>
<td>No significant changes expected</td>
<td></td>
</tr>
<tr>
<td>Soil</td>
<td>Pollution through fertilizer</td>
<td>Restoration of degraded soils?</td>
<td>Restoration of degraded soils?</td>
<td>No significant changes expected</td>
<td></td>
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</tr>
<tr>
<td>Carbon Sink</td>
<td>Initial loss of carbon sink through debushing</td>
<td>Carbon capture if planted on already cleared land</td>
<td>Carbon capture if planted on already cleared land</td>
<td>Possible replacement of conventional fuels</td>
<td></td>
</tr>
<tr>
<td>Carbon Sink</td>
<td>Possible replacement of conventional fuels</td>
<td>Possible replacement of conventional fuels</td>
<td>Possible replacement of conventional fuels</td>
<td>Possible replacement of conventional fuels</td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td>Net-effect depends highly on food markets and food production on plantation</td>
<td>Net-effect depends highly on food markets</td>
<td>Second-round effects from increased productivity</td>
<td>No significant changes expected</td>
<td></td>
</tr>
<tr>
<td>Access</td>
<td>Increased cash-income Decrease of household self-sufficiency</td>
<td>Increased cash-income Decrease/Increase of household self-sufficiency (intercropping?)</td>
<td>Increased cash-income (from second-round effects)</td>
<td>No significant changes expected</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>Cash-income partially seasonal Depending on stability of food markets</td>
<td>Depending on stability of food markets</td>
<td>Depending on stability of food markets</td>
<td>No significant changes expected</td>
<td></td>
</tr>
</tbody>
</table>

*Source: authors’ design (2009)*
6 Key Institutional Challenges for Supporting and Regulating Bio-Energy Value Chains in Namibia

In previous chapters, potential opportunities and threats of bio-energy production in Namibia were discussed and analysed. Whether the opportunities materialize and threats are minimized depend on variety of institutions. Most of them have been mentioned in the various models, obstacles and impact discussions. They will now be further analysed in a generic way in order to derive recommendations for policy makers to direct, regulate and support pro-poor, food-security enhancing bio-energy value chains. An overview of the various institutions identified as important for bio-energy is provided in Figure 4 for Bush-to-Energy and in Figure 5 in Jatropha value chains.

They have been classified into eight key policy areas. These key areas were named food security, rural development, agriculture, land, labour, environment, output markets and policy coordination. In each area institutional challenges for bio-energy production exist, since either policies or regulations are missing or not functioning to shape bio-energy production in a pro-poor way. Very often, these challenges and the respective institutions are not specifically valid for bio-energy only, but for many aspects of rural development and food security. However, it is with the modern bio-energy options that these challenges are animated, being the first massive wave of investment and production option that is directed towards rural areas of Northern Namibia for decades.

6.1 Food Security

As mentioned before, food availability in general is not a problem in Namibia because the country produces and imports sufficient food commodities. However, many households cannot afford to buy enough food and are not able to meet their basic food needs by subsistence farming. An aggravating factor is that Namibia is frequented by droughts and floods which result in regular governmental food aid for a large part of the population.

Vision 2030 recommends focusing on food security and not food self-sufficiency – meaning that every Namibian should have enough to eat whether or not food crops are produced by him/herself or even inside the country. The Vision stresses the trade-off between increased agricultural production and environment protection. It puts a particular emphasis on the need of saving scarce resources such as water (NPC 2004). NDP 2 tried to reach the goals set by the Vision by fostering the productivity in subsistence agriculture which involves the broad mass of the population. This, however, did not prove to be successful such that NDP 3 states: “the lesson is that subsistence agriculture is not an appropriate means to reduce poverty in Namibia” (NPC 2008). In consequence, NDP 3 recommends to expand the livelihoods of rural communities and to reach food security by diversifying and improving their agricultural production and income generally (ibid.).
Figure 4: Bush-to-Energy Value and Impact Chain and Institutions Affecting Impacts

Source: Authors’ compilation (2009)
Figure 5: Jatropha-to-Energy Value and Impact Chain and Institutions Affecting Impacts

Source: authors’ design (2009)
In recent years, government support initiatives did not explicitly focus on subsistence / communal farmers (section agriculture). The Namibian Government subsidizes large-scale irrigated food production in form of the Green Schemes with the objective of black empowerment, national food security and local employment (Grimm & Werner 2005). These Schemes promise a high potential for national food production through irrigation. However, they rarely fulfil this objective and offer very limited employment effects for the rural poor and food insecure. Government recently also built up several silos in the northern regions in order to create a market for local grain producers and a storage for food aid (AZ online 2008). Moreover, white maize, wheat and more recently mahangu were gazetted as 'controlled crops'. This means that import and export barriers as well as floor prices were established for all three crops. Additionally, a market is guaranteed for mahangu (NAB 2009). However, most of the country’s poor are net food buyers. Consequently, they do not necessarily benefit from these measures and, in the worst case, suffer from higher prices.

The initiatives taken by the Namibian Government show a certain incoherence with the Vision 2030 objective of focussing on food security and not food self sufficiency. Policy action does not seem to follow policy documents. A strong tendency towards the wish of “Namibia being able to feed itself” could also be noticed in many interviews conducted during the research phase. One major reason often cited was the global food crisis and the resulting fear of depending on international food markets. Indeed, the question of food-self-sufficiency cannot be responded to on a purely economic base, the unacceptable costs of food import failure, unpredictable long-term uncertainties and political considerations make this question genuinely political.

Yet, there are big differences between the bush and the Jatropha value chains:

- If invader bush is removed, grazing area will be restored and, consequently, increased number of cattle, more income and employment can contribute to both national food security and food self sufficiency. At the same time, the cash income for migrant labourers improves their economic access to food – an effect passed on to the communal areas through remittances. The positive effects depend to a large extent on wages, food stores and markets as well as on the opportunity activities of and costs for migrant workers.

- Concerning Jatropha, the international debate on ‘food vs. fuel’ seems to have overwhelmed Namibia. Though most models offer strategies of diversifying from subsistence farming to own cash-crop production or employment without a priori harming food production, the potential competition for land, labour, water and capital seems to overshadow this. The same competition has not prevented the Namibian government form supporting other cash crops, such as cotton, but for biofuel production the considerations seem to differ. Of course, the models may not be correct, but at least for plantation and community model the Government can do a lot (by negotiating clauses in the leasehold contracts and by training and advice for small community farmers) to make them become real (even if this would possibly not be the most efficient way of creating food security). In the contract model, market incentives and accompanying measures to attract food production are key for maintaining or raising food production if this is the wish of the Government.

The major problem is that it is unclear if Namibia wants food security or food self sufficiency – the country does not have a food security strategy. If Namibia opts for food self sufficiency, clear guidelines for entrepreneurs and investors are necessary. At the moment, decision making processes are not transparent. It is not clear if cash crop production is wanted at all and if it is obligatory to combine it with food crops.
If Namibia opts for food security as stated in Vision 2030, a decision on the role of agriculture is crucial. The agricultural sector is an important employer in the rural areas but it is not clear if investment in this sector, and especially in cash crop production, is desired. The competition with nature conservation as underlined in the Vision might play an important role in the decision making process. However, tourism is only one employer in the northern regions, distributions of conservancy income are very low on a per capita base, and there are not many other sources of cash income. A high dependence of the population on governmental food aid might continue if high unemployment in the North prevails. Thus, food security is intrinsically linked to poverty reduction and development strategies in and for rural areas.

6.2 Rural Development

The role that bio-energy can play in rural development in Namibia highly depends on the goals and strategies that the country sets for developing its rural areas and how it manages to integrate bio-energy production.

Key national development objectives of Namibia mentioned before include the reduction of poverty and food insecurity. However, there are also other objectives to be regarded: The biggest and most controversial competition for land in Namibia exists between productive land uses and nature conservation. Preserving natural habitats is a rural development goal in its own right. It also provides income to local communities from tourism and wildlife, but benefits from these sources for individuals seem to have been rather limited so far as reported in various interviews with communities. Alternatively, agriculture including bio-energy, livestock or forestry can be more productive land uses with higher effects for food security and rural employment. These carry, however, more negative effects for the environment involved depending on the specific kind of productive use. In addition, conflicts and trade-offs exist between different agricultural uses of the rural areas, i.e. use for livestock versus agriculture, small-scale versus large-scale agriculture and food-crop production versus cash-crop production, such as bio-energy. Hence, bio-energy production as a form of commercial agriculture is one potential land-use besides many others and needs to be assessed in the context of these alternative uses and their comparative impact on rural development objectives. The answer for this, as explained in the last section, highly depends on the role agriculture should play in the overall development strategy.

Looking at the long term, Namibia aims at becoming an industrialized knowledge-based society, and this seems logical when regarding to the bad natural conditions for farming, particularly water availability. This requires a fundamental transformation of the country’s economic structure with the objectives of a mainly urban population, keeping only mining, tourism and probably extensive livestock keeping and forestry in rural areas. Whether a highly productive modern agricultural sector should complement this modernisation depends particularly on the importance attributed to food self-sufficiency (see above) (NPC 2004). The challenge of maintaining the sustainability of natural resources is different for any development path, without agriculture it is certainly easier to handle than with it.

However, in the short and medium term agriculture has to play a very important role in overcoming food insecurity and rural poverty as it is by far the largest employer in rural areas. 67 per cent of the Namibian population and 85 per cent of the poor live in rural areas (NPC 2008). At the same time, the livelihoods of the rural poor depend to a great extent on the quality of the natural resource base requiring an integrated approach of reducing rural poverty and conserving nature (Grimm & Werner 2005, NPC 2004).

A key challenge is thus to reach the long-term objectives without neglecting short- to mid-
term problems. This is an extremely difficult task, but it must be tackled in order not to spoil scarce resources. At the moment, perceptions among different stakeholders on preferable uses for land in Caprivi and Kavango range from leaving the natural resource ‘untouched’ to large-scale intensive agriculture. It seems to be fairly unclear which immediate and mid-term strategies (e.g. food security strategy) for the rural areas, including its population and land use, Namibia opts for in order to reach the goals set in Vision 2030 and especially which role agriculture will have to play.

Depending on which strategy Namibia embarks on, the implications for bio-energy production can be very different since trade-offs between different land uses exist. But not all bio-energy value chains are equally at stake. For the Bush-to-Energy value chains, there is a win-win-situation with regard to poverty, food security on the one hand and most aspects of environmental protection on the other. Its future basically depends on economic feasibility, and – if this is not the case - weather there are better options to subsidise the ecological and employment effects. For Jatropha production, controversies are stronger. Particularly small scale and contract farming models seem to be options for the medium run only since these types of heavy manual labour depending models are not compatible with Namibia’s long-term visions of labour markets. In the medium term, however, they take the right direction by integrating small scale farmers successively into formal labour and product markets. Short-term, the compatibility with present farming system practices is the key which seems to be the case. Jatropha plantations are long-term compatible with vision 2030 only if most work can be mechanised.

These fairly abstract considerations neglect that long term rural development planning is hardly feasible for a developing country. “In the long run, we are all dead”, and “information on long term trends is not available”. Governments have to plan rural development under high uncertainty, temporary contradicting targets, and will in many cases only be able to make second-best decision for guiding boards and preventing harm. In addition, under democratic conditions an integrated approach is needed including local population in rural planning, including for land use planning as one of the key resources of rural areas (compare Chapter 6.5, land).

To conclude this chapter which is more about principles than concrete options, migration plays an important role as a strategy for fighting rural poverty both in the short-term and as a pre-requisite for achieving Namibia’s long-term vision of becoming an urban society. Regarding bio-energy value chains, however, immigration is taking place between rural areas. This is certainly due to push-factors (strong poverty and lack of options in the northern rural areas) as well as due to lack of alternatives in Namibia’s urban centres so far, at least for low skilled persons. One pull-factor obviously is that bio-energy production is setting incentives for migration through cash income opportunities, as already proven in the Bush-to-Energy value chains. In case of Jatropha production being profitable, the same would most probably happen, particularly if permanent plantation jobs would be offered. However, in the medium term such jobs are not adequate and designing strategies for migration by supporting the right skills and creating the right incentives and regulations for more and better employment of migrant workers in the bio-energy value chains should be considered (see Chapter 6.4, labour). One potential to increase the economic effects of migration to rural areas is by designing micro-finance schemes that enhance the efficiency of remittances.

6.3 Agriculture

According to time-sensitive frameworks and decisions to be taken for rural development in
general and bio-energy in particular, and according to where which bio-energy model is developing or to be developed, different supporting strategies must be pursued in the agricultural sector to support and regulate bio-energy production in favour of the poor. These can be structured into the following classes, abstracting from the different models of bio-energy production previously described: i) increasing productivity within the existing subsistence oriented farming system, and ii) diversifying through rural agricultural activities (own cash-crop production, working on plantations).

The challenges for institutions supporting pro-poor agriculture are specifically acute in the communal areas, and for small scale resettlement farmers. Previous initiatives to introduce cash-crops in the communal areas (i.e. sugar and cotton) did not prove viable due to market problems, lack of domestic processing, high transport costs and low world market prices (NDC). Jatropha cultivation, on the other hand, could be more successful as large markets already exist (see Chapter 6.6, bio-energy output markets) and investors are there to build up local processing. However, their high potentials for employment and food security might come along with risks discussed above, depending on the different Jatropha models.

**Direct Support to Small-Scale Farmers**

Direct support to small-scale farming systems include productivity enhancing measures and assistance in accessing markets by trying to overcome various market failures separately. On the positive side, input markets are relatively well established in Namibia, particularly through the cooperative AGRA. For instance, at an early stage of Jatropha production AGRA imported Jatropha seeds from India for small scale trials. Commercial (white) farmers are key for this situation which is unusual in SSA, which also means that these services are better developed in the southern areas. However, in the North there are some branches, although distances can be very long for farmers to get there.

In contrast, access to financial capital is difficult, particularly for small-scale communal farmers, to either increase the yield on existing fields or for the expansion of their land. Most credit policies require conventional collateral such as land, houses or other fixed capital and do not take into account the reality of small communal farmers with customary land rights and little other assets (see Chapter 6.5, land). Many are thus trapped in a vicious circle. Especially the lack of capital to acquire inputs such as fertiliser, irrigation, debushing tools and other equipment was named as a main obstacle for agricultural development in communal areas. Another challenge for developing financial markets in rural areas is the problem of long distances combined with a lack of good infrastructure. Lending and repaying is thus more costly and difficult than in urban areas. Whereas micro-finance usually fills in this gap as it does not require traditional forms of collateral, there is a lack of micro-finance schemes in Kavango and Caprivi. Renewable energy technologies are mainly funded through the Solar Revolving Fund (SRF), however, merely for solar systems not covering decentralized energy systems based on biomass. The CDM mechanism for small-scale renewable energy projects might provide a financing option for sustainable agricultural projects, but even the conditions for small-scale projects require highly specialised know-how and the building up of new capacities within the MAWF and in the private and NGO sector to support this kind of projects.

The access to knowledge of agricultural practices, suitable crop options and markets is a condition for productivity enhancements and commercialization. Interviews showed that there are general weaknesses of support for small-scale farmers through the extension system and governmental research, and for bio-energy options is particular. Currently, the various agricultural support areas of extension, research and training do not seem to be integrated
very well, as to various key informants. This hinders the introduction of new crops, such as Jatropha, or of sustainable technologies, for instance FSC charcoal production, to small farmers.

It must be recalled, however, that especially Jatropha production not linked to investors is not suited for individual farmers but at best for farmer groups in the communal model. Thus, an integrated support to such groups is required, including for common cash and group management, local bio-energy production and use. This exceeds the knowledge of any regular extension officer and can only be handled in the frame of larger institutional support through a full-fledged local development project.

Linking Small-Farmers to Large Bio-energy Companies

A different approach focuses on integrating small-scale farmers and/or rural unemployed into value chains coordinated by large private companies (FDIs or domestic investments). Whereas this approach helps to overcome various market failures simultaneously and brings many potential benefits to communities, as previously explained, there are high risks involved (see above).

The research pointed to a general challenge with a completely new value chain: Since bio-energy value chains span across various sectors, setting up entire industries requires cooperation between different ministries and agencies - for the case of bio-energy this seems to be lacking (see Chapter 6.8, policy-coordination).

Similar widespread challenges are communication between investor and communities, lack of transparency of government decision-making and general uncertainties attached to the lack of legal land rights. All of this leads to uncertainties for the investor and at the same time to the fear of moral hazard behaviour on both sides. A major problem thus seems to be the lack of an appropriate mediation body between investors, the government and communities that incorporates Namibia’s development priorities, support decision-making of the communities and is aware of the requirements to attract FDIs in rural areas.

With regard to the role of the agricultural ministry, a central problem encountered during the research is that there seems to be a lack of processes regarding handling new crops, such as Jatropha. Industry development requires clarity and transparency for investments to be secure. Thus, timely decision-making on the overall framework for new crops (for instance regarding environmental effects) is required to avoid misplaced investments and influences of individuals (politicians or pressure groups). Currently, there is no institutionalized process to declare new crops invasive or environmentally harmless.

Once accepted, information on yield potentials and requirements for new crops, such as Jatropha, as a decision support for small-farmers as well as investors currently does not exist. Although international investors may have enough funds to conduct such research on their own, it requires a lot of time and makes government depending on investor information. Even if starting small might be an appropriate solution until most negative effects are known, to harness the potentials of FDIs, there is a required scale of operation for investments to be profitable (Interim Bio-Energy Committee 2006). In consequence, investors feel squeezed between the wish to testing small scale and the fear that in the meantime others grab the land that they would require to scale up, urging them to rapidly trying to occupy very large pieces of land without being sure whether they really want or can use it. The land is occupied for years, if it is not denied due to the fears around the large risks of large investments (see Chapter 5). This lack of better planning information, thus leads to extremely high transaction cost.
In addition, large investors are not interested in technologies that are best implemented on the smaller scale such as the Bush-to-Woodgas model. However, normal commercial farmers would be overcharged with such technology testing. In addition, private research neglects public goods such as environmental effects or labour-intensity.

Another challenge is to reduce risk of large scale project failure for the communities. The creation of trust funds, as they are found in the mining sector, to cover for the risk of project failure and environmental damage, is discussed as a solution to this problem.

Contract farming with direct knowledge transfer between farmers and investors does not completely eliminate the need for public extension services and credit facilities, but modifies it toward new challenges and opportunities. Additional support from extension service tailored to the new crops can help farming communities to build up the capacity in managing the crop themselves and becoming more independent from one investor. Capacity development is also needed for group management, negotiations with investors and using new cash incomes for developing the entire farming system. Independent credit access reduces the dependency of farmers vis-à-vis agro-industries, improves their negotiation position and contributes to achieve fair benefit sharing.

6.4 Labour

One of the Namibia’s biggest challenges, as described before, are the extremely high levels of unemployment in rural areas and high income disparities. In addition, labour conditions of unskilled jobs and informal employment in the agricultural sector pose social, regulatory and enforcement challenges.

The Labour Act (Act No. 11 of 2007) (GRN 2007) regulates the rights and duties of employers and employees in Namibia. The Act provides for enhanced protection and rights of employees. These rights concern, among others, social security regulations, the prohibition of labour hire companies\(^5\), food shops (no more than 1/3 of wage as credit), accommodation (provision of adequate accommodation if on agricultural land, also for dependants), minimum remuneration, hours of work, leave, termination of employment and health and safety. Negotiations between stakeholders are complicated by Namibia’s recent Apartheid experiences which make the treatment of employees and workers an especially sensitive issue.

As most bio-energy business models depend on the availability of unskilled labour for on-farm work, the policy framework and legal conditions are particularly relevant. In turn, an upcoming bio-energy industry can potentially work as a catalyst to help solve long existing problems.

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\(^5\) Some provision of the Act (namely Section 128 concerning the prohibition of labour hire companies) are legally challenged. The decision of the Supreme Court is pending.
Economic Viability vs. decent Working Conditions

The general dilemma with labour regulation is the following: Under international human rights standards, every employed person is entitled to decent working conditions that do not endanger his/her wellbeing. At the same time, guaranteeing decent working conditions is often associated with additional economic costs that jeopardize the economic viability of the enterprise. It is, however, also acknowledged that safe and economically attractive working conditions promote commitment of the employees and have therefore positive repercussion on production output. The Government has a double role: In its policies it has to accommodate its interest in creating favourable economic conditions for employers and its responsibility to protect the interest and well being of the employees. In Namibia, as it is a developing country, the use of cheap labour has particular relevance: Unemployment rates are high and most unemployed are unskilled. From a global perspective, cheap labour can be considered as a comparative advantage.

Namibian labour legislation is trying to offer special protection to farm workers in the rural areas. It is designed to account for their extremely low level of education and high poverty level, the remoteness of commercial farms and their limited access to food and other goods and services. However, it does not account for the different types of work requirements and arrangements (e.g. seasonality, piece work, foreign labourers) that exist in the farming sector and that are relevant for bio-energy production. Due to the nature of their work and the farmer’s economic and social situation, wood workers, for example, do not enjoy formal protection under the Labour Act. Because of little flexibility in the legal provisions, a lack of agreement between the stakeholders and little knowledge of the other’s situation, wood workers are left in a grey area.

Concerning differences in economic size of the enterprises, it is much more difficult for a small scale communal farmer to abide by labour legislation than it would be for a big commercial farmer or an investor. Informal labour often results from the economic need to by-pass strict labour regulations (not excluding the fact that this also happens arbitrarily). Or, as is often the case in rural labour arrangements between small farmers, informal employment is a coping strategy. In Namibia’s communal areas, family or community members are often employed on a casual basis to help with the work on the field (weeding, ploughing). These arrangements are relevant for contract farming schemes and for any small scale farmer who wants to employ casual labour on his/her field. Regulating those informal arrangements would not be in the interest of the employer. It is most likely that the employer would not have the financial and administrative capacity to comply with labour regulations. It is also not in the short term interest of the employee as we can assume that the creation of additional income through casual labour makes him/her better off than before.

Control and Enforcement of Labour Legislation

Even if labour legislation did take into account the realities of labour in the agricultural

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6 There are currently exceptions for some businesses like hotels and the building sector.
sector, control and enforcement are decisive for their effectiveness. In its current state, the Ministry of Labour does not have sufficient personnel and financial capacities to implement the Labour Act and to carry out adequate labour inspections. Complaint mechanisms exist but the majority of farm and wood workers do not have the means to make use of them. Also, labour unions, who could act as arbitrators and representatives are not strongly active in the rural areas. Hence, the farm worker or wood worker remains at the mercy of the farmer. If breaches of the labour law are noted by the respective authorities, there is a mechanism in place to make farmers comply. The scope of those mechanisms is, however, limited (cf. MLSW Annual Report 2007).

**Bridging Short and Long Term Employment Goals**

While in the short term Namibia wants to promote labour intensive value chains to create employment for its abundance of unskilled labour, the long term vision is a knowledge-based economy and large scale agricultural production. In the short term, income and employment policies thus need to set the right incentives for investors and the potential employee. The agricultural support measures can be designed to support labour intensive methods but at the same time create incentives for labour enhancements, such as the subsidized debushing loan schemes of Agribank if labour-intensive methods are used.

At the same time, it needs to work hand in hand with relevant education and training institutions in order to make sure the right supply of skilled labour is secured in the long term. Also, even if Namibia strives for a knowledge-based economy, the need for unskilled labour will not disappear (though lessen). Here, labour migration policies play a big role. If, in the long run, work force from outside the country is to substitute in-country work force, adequate migration and work permit regulation have to be developed.

As described in chapter 4, there is an abundance of unemployed unskilled young people in the rural areas. However, there seems to be no national policy that addresses this problem. NDP 3 plans the improvement of education and income diversification in rural areas but implementation lacks behind (see NPC 2008).

**6.5 Land**

Land tenure issues impact on bio-energy projects in two different ways. Insecurities in land rights might prevent investors from implementing the project. No additional benefits can occur for the community in this case at all. On the other hand, land rights and the allocation process play a role in shaping the impacts an implemented project has for rural development and food security.

Land is an extremely sensitive issue in Namibia, not at least due to the apartheid legacy. In chapter 4, current land reform efforts were described. Challenges to these efforts have been widely discussed in literature and reports (Mendelsohn 2008, LAC 2005, Fuller 2006, Werner 2003). This paragraph will focus on those challenges Namibian local and national government institutions face if they want to ensure that land tenure helps to maximize positive impacts of bio-energy projects.

**General Problems with Land Rights and Reform**

It is the aim of the Namibian land reform to “contribute to the alleviation of poverty in Namibia by empowering more citizens with land or access to land, and by providing beneficiaries with the necessary attributes to use the land to generate a sustainable and
meaningful livelihood” (MLR 2007). As indicated, lack of access to credit continues to be a limiting factor and reason for low productivity for both resettlement and communal farmers. One reason behind this is land tenure. Commercial banks have indicated that neither communal land rights nor the 99-year leasehold obtained by resettlement farmers suffice as collateral for credit. Several Agribank special loan schemes cannot fully compensate for this, and neither does Agribank itself recognize communal land titles as collateral.

In communal areas farmers additionally face the ‘problem of the commons’. Most farmers graze their cattle on land they have no exclusive rights to and from the use of which they cannot exclude others by putting up fences. Thus, communal farmers not only lack capital for investment (such as debushing or fencing), but can neither be sure to benefit from their efforts fully and, thus, also lack the incentive for investing or managing areas sustainably.

In commercial areas, on the other hand, farmers face the problem of being uncertain about which farms might be expropriated as areas earmarked for resettlement are not clearly defined. While this uncertainty reduces incentives for freehold farmers to invest in their land, resettlement farmers lack access to capital for it.

As a result, few farmers in communal and commercial areas are willing or able to allocate resources to clearing their land from invader bush in a sustainable way. What is more, this lack of debushing poses a threat to the success of the land reform as a whole as it leaves less productive land available for redistribution.

Land use planning

As mentioned in Chapter 6.2. on rural development planning, an integrated and participatory approach to land use planning is lacking in Namibia. The lack of such a land use planning seems to have slowed down the implementation of bio-energy projects in Kavango and Caprivi considerably (e.g. the case of double-gazetting the same land in Caprivi for cattle farming through MAWF and natural conservancies through MET).

The MLR as decision maker of last resort in the land allocation process is waiting for line ministries to come to terms on the above mentioned issues. As for now, it remains unclear whether areas are to be earmarked exclusively for nature conservation or food production (in the case of Caprivi and Kavango not only for local consumption but to feed the nation). However, without an integrated and inclusive land-use planning any development can be blocked

Capabilities and Transparency in Land Allocation

The lack of coherent and foresighted land use planning puts enormous pressure on decision-makers in land allocation on the local level. Traditional Authorities (TAs) and Communal Land Boards are faced with multiple requests for unprecedented amounts of land and must act as mediators between different interests in the same areas.

For these challenging tasks, TAs in Kavango and Caprivi not only lack the technical capacities for administering formal land allocation processes, such as trained clerical staff and equipment (Mendelsohn 2008) but also the expertise. The majority of land rights that TAs allocate are customary use rights for residential and subsistence farming purposes. Rights are granted on the basis of the level of relatedness and familiarity of the person to the community, on personal character and the need to avoid future disputes. Other factors like the availability of water and pastures are usually not considered. Knowledge on other forms of use rights, like leaseholds, is also limited within TAs (ibid.).
Funding and equipment of Communal Land Boards is inadequate, too, which is reflected in a shortage of human and material resources and budget for activities. Skills and knowledge are poor (GTZ 2004). What is more, there is a polarisation between CLB and TAs. Some TAs feel that Land Board members are disrespectful and inexperienced and are possibly a threat to the authority of the TAs (Mendelsohn 2008).

Secondly, conflicts, lack of capacities and policies leave room for exploitation of land allocation processes for personal and political agendas. Formal registration of rights is often denied for political reasons. Political affiliations, border disputes and encroachments by one community onto land held by another community have led TAs to object to registration while technical issues are given as reason for the objections. During the land administration processes for Jatropha projects in Kavango and Caprivi lack of transparency led to conflicts as land was allocated that had already been gazetted for different projects. Middlemen promised land they had no rights to, and local headmen and communities were not sufficiently included in the decision-making process.

6.6 Environment

As discussed in chapters 5 and 6.2, bio-energy production in Namibia can have positive and negative environmental impacts. Environmental aspects of bio-energy are regulated by policies that have a specific environmental focus as well as policies regulating activities that have potential effects on the environment. Amongst those policies, the most relevant are the Environmental Management Act, the National Agricultural Policy, the Drought Policy and Strategy, the Soil Conservation Act, the National Land Policy, the Land Reform Acts, the Namibia Forestry Strategic Plan, the Namibia Forest Development Policy and the Namibia Forest Act (see de Klerk 2004). Namibia’s MET shares the task of dealing and coordinating environmental affairs with other ministries such as the MAWF, which also the Directorate of Forestry belongs to.

Reconciliation of Conflicting Interests

As already mentioned, protection of the environment and natural resource conservation are goals in their own right but compete with productive uses of resources. Similarly, preserving (or increasing) biodiversity and climatic concerns can conflict with the destruction of carbon sinks. These ambivalent interests might hamper the advancement of bio-energy production.

Although the Environmental Management Act of 2007 is not yet fully in place, it is generally expected that all investment projects must undertake an Environmental Impact Assessments (EIAs). Environmentalists argue, however, that the actual power of EIAs to decide on the realisation of a project is low compared to other, pecuniary interests. The major problem is that the agency contracted to do the EIA is financed by the investor that has, of course, an interest in positive results. Hence, there is a risk of not fully independent research and results. Furthermore, EIAs are conducted for single projects only. Although the Act imposes Strategic Impact Assessment (SIAs) which attempt to tackle this problem, the fear is that the accumulated impact of many investment projects will be overlooked. The major obstacles comprise lack of administrative capacity and political will as well as the time lag between project initiation and the reaction of environmental protection measures.

Accounting for environmental degradation caused by productive land use often has negative economic impacts on the local communities. Wildlife conservation in Namibia’s North, for example, has shown that human-wildlife conflicts can cause serious misapprehension of
nature conservation by the local communities. Acceptance of resource management and conservation is, however, the key to the effectiveness and sustainability of economic development of a region without compromising its natural resources.

It can be expected that the debate and new international regulations on climate change will have an impact on Namibia in two ways: First, the CDM will become an increasingly interesting way of financing new value chains in the bio-energy sector (see below). Second, access to donor funding will more and more depend on whether a certain project complies with international climate change mitigation requirements. Currently, policies and political discourse hardly account for these topics.

Knowledge management

Connected to the previous issue is knowledge generation, distribution and management. The issue is particularly relevant for new bio-energy value chains. Generally, research is a precondition for informed decision making. In Namibia, scientific research (of universities and other research bodies) on environmental aspects of agricultural land use seems not always to be well connected to practitioners such as the agricultural extension service. Also, the capacities of government agencies such as the MAWF are too weak to embark on research in new fields like bio-energy production with important systemic and cross-sector implications. While knowledge generation in the case of larger investment projects is required through the EIA, the pertinent question is what happens with this kind information. There seems to be little management and use of such documents, not to mention public information and access.

Enforcement of environmental regulations

Enforcement of environmental regulations is a challenge not only for bio-energy production. It is important in as much as the introduction of a new value chain usually carries more and unknown risks than existing ones. Permits in the case of bush harvesting are issued before the harvesting starts. Control of actual debushing procedures is extremely low due to capacity and legal constraints. Similarly, in the case of Jatropha, an EIA might evaluate and envision probable impacts, but the monitoring, control and action of the project once it is operational is not regulated.

6.7 Bio-energy Output Markets

The implicit assumption when declaring bio-energy output markets an institutional challenge for Namibia is that it is possible for Namibia to influence these markets through policies. Output markets, here, refer both to the national and international market for Jatropha (nuts, SVO/bio-diesel, seedcake, and other by-products) and bush products (charcoal, briquettes, electricity). Three problem areas related to output markets are discussed below.

Domestic Market

First, although NDP 3 (NPC 2008) states that the envisaged outcome in the renewable energy sub-sector is an “increased renewable energy use with increased economic and environmental benefits”, policies supporting this development are not in place. The Namibian market has huge potential for renewable energy, given both its dependency on energy imports and need for further rural electrification, however no targets for renewable energy production or feed-in quantities exist. Also, the Energy Policy White Paper does not mention
concrete targets for renewable energies in Namibia, but merely states that the “government committed itself to promoting the use of renewable sources of energy wherever this is technically feasible and economically viable” (MME 1998, 43). Though these avowals of interest in renewable energies are indeed laudable, they do not compensate for the lack of tangible goals and therewith hamper the development of a broad domestic output market. Especially considering Namibia’s abundant renewable energy resources, particularly bush in this case, this seems a forgone opportunity.

Second, if Namibia decided to actively support bio-energy production and value chains to cater for the domestic electricity market, price and tariff-related initiatives would play an important role. Generally, as it stands now, highly subsidized conventional diesel prices (by South Africa) in Namibia have negative effects on the viability of renewable energy solutions. For on-grid electricity feed-in, various Namibian experts agree that feed-in tariffs are too low at the moment to make such undertakings economically viable. If prices paid by the Namibian government were to be increased, cheap electricity imports from RSA would outcompete domestic production. On the other hand, though, the ECB opines that also South African prices for Namibia will rise in the future, given Namibia’s increasing demand and RSA’s inability to meet it.

As to bio-energy for off-grid solutions, the MME already identified in its Energy Policy White Paper (MME 1998) that “rural electrification using the grid is heavily subsidised, while off-grid household electrification using renewable energy is not”. Although an Off-Grid Rural Electrification Master Plan 2000/2005 is in place and functions as a guiding document, no easily accessible incentive schemes are implemented. What it boils down to, then, is the question whether Namibia wants to go for cheap imported electricity or more expensive locally produced renewable energy, and which of the two would be more conducive for the country’s (rural) development and food and energy security.

A third obstacle likely to be encountered when introducing bio-energy (specifically SVO and bio-diesel) on the domestic market is the so far lacking technical quality standards. Clear warranty schemes are developed in case of conventional fuels, but if a machine, engine or other device breaks because of the use of SVO and bio-diesel, no clear regulations are in place yet. In addition, the question of who is responsible to monitor quality standards onsite is not answered. This topic is not only relevant in case of Jatropha products, but quality standards also apply to Bush-to-Energy initiatives, e.g. should IPPs have to follow standards designed by the government, and how are fluctuations of currents to be handled.

**International Market**

Regarding Namibian bio-energy production destined for the international market, so far only charcoal, briquette fines and “Bushblok” are being exported. This is partly due to the fact that both the access to buyers interested in other products is limited, and that some products are not even being produced at the moment (e.g. Jatropha oil or electricity from bush). However, even if all of the here described bio-energy products were currently available in Namibia and buyers were in the waiting, the necessary economies of scale to satisfy international market demand would be difficult to reach. Especially small farmers in communal areas often do not find a direct market for their product because they cannot reach the quantities demanded. As is often the case in the charcoal industry, small communal farmers would have to sell to bigger producers, adding to transport and transaction costs and consequently decreasing the profit margin. For Jatropha, the major hampering factor for reaching economies of scale is the difficult access to land (see Chapter 6.5).

Second, international quality, social and environmental standards can hamper market access.
This might not only be through rigorously enforced official regulations, but also through private standards or by mere consumer perception. An example of the first would be the new proposal for the EU Directive 2003/30/EC on renewable energy (including biofuels), which states that mandatory blending requirements in the transport sector will be increased to ten per cent until 2020, however adhering to a number of sustainability criteria (e.g. biodiversity and land use impacts, GHG emissions, etc.) (EU 2009). An example of the second is FSC standards for charcoal. As to the third mechanism, consumer perception, there is a notable trend on western markets to opt for products with ‘a social or environmental conscience’, thus if harsh labour conditions or negative wildlife consequences of bio-energy imports became public it could possibly adversely affect marketing opportunities.

**Additional Revenue Possibilities**

In the production process of both Jatropha and bush additional revenue could be generated, either through efficient marketing of by-products or by carbon trading, e.g. using CDM or voluntary carbon markets. Concerning by-products, meat is the key by-product (or main product, according to the main motivation of debushing) of Bush-to-Energy value chains. For Jatropha, glycerine and cake (for fertiliser or animal feed) products would be the main products, but for the time being these do not exist, nor the local markets. In general, combined production seems to be widespread in bio-energy production: also other oil-crops are only economically feasible because of combined products, particularly proteins for animal feedstock for instance in rape or Soya production.

As to the carbon credit market, bio-energy projects in Namibia in theory exhibit vast potential. However, potentials of the carbon market and the procedure to be followed in order to obtain the benefits available seem to be not well known or understood, according to various investors interested in the issue. In general, in SSA no single CDM project for green biomass has so far been certificated except one in South Africa for using biogas from waste disposal. Also, especially in case of bush, it is not quite certain whether going for carbon credits is an option, given that debushing basically destroys a carbon sink. In any case, considering the revenues possible to be obtained from carbon credit schemes, much seems to be possible for Namibia to developing this market.

**6.8 Policy Coordination**

The last institutional challenge to be mentioned is policy coordination. This challenge alludes to the notion that if policies are in place regulating diverse issues, they have to be coordinated in order to be either mutually enhancing or at least not at odds with each other. This is particularly the case for bio-energy value chains which have been identified to cross and touch upon several sectors and markets. As has been mentioned, numerous stakeholders are involved in bio-energy production in Namibia, many of which hold policy making power. Given this situation, policy coordination seems vital in order to guide bio-energy initiatives in the country. In the following, three problem areas hampering policy coordination will be discussed.

The fact that bio-energy is a cross-cutting issue makes policy coordination complicated. There is not ‘the one’ institution in Namibia holding a monopoly on regulating the bio-energy sector. Many Ministries are supposed to play an active role, though it is not completely clear who takes the lead. In the case of Jatropha, for instance, a Cabinet Committee was established in 2008 in order to advance the issue, however it seems like the presiding Ministry, the MME, does not push the issue sufficiently but chooses to wait for other
ministries (MAWF and MET) to come to terms. For bush it looks similar: - the Woodland Management Council merely functions as an advisory council to the Minister and is for the most part inactive, though taking charge of debushing control would ideally be within its mandate. In both cases, no mediator exists facilitating communication between the different stakeholders.

Considering the immediate need for regulations in this field, procedures on ministerial level are generally slow. This could be due to the notion that “in most cases regulation of Bio-energy can be seen to be in a state of flux as competing interest groups argue over the correct direction for different types of Bio-energy development” (Practical Action Consulting 2009, 31). However, even though the competing interest groups exist in Namibia, not much arguing is being done.

Most likely due to the above ‘power vacuum’ no bio-energy policy exists in Namibia. Though provisions for renewable energy development are made in Nampower’s internal strategy papers, MME’s Rural Electrification Masterplan 2000/2005 and Energy Policy White Paper (1998), no national policy exists but only a national commitment (Nampower). The Bio-oil Road Map, though enthusiastically showing ways how to get involved in the emerging biofuel-economy, was never elevated to the status of a policy. Though numerous government officials state that knowledge is insufficient for decision making in case of bio-energy, this general perception is not reflected by initiatives taken to close this information gap. As REEEI puts it, “the challenge with biofuels is that there is a lot of talk and not much action”. So far, it does not seem to be a strategic issue for the country.

A resulting problem area under the headline ‘policy coordination’ is the insufficient and uncoordinated support for bio-energy value chains. Incentives provided for bio-energy production within the existing policies are rather limited when considering the potential inherent in these value chains (as argued above, it is not even clear whether this potential is supposed to be developed at all). Feed-in tariffs and blending targets are discussed but not yet established. The CBEND project is funded under the poverty alleviation scheme of the EU. Meatco, the national meat exporter, supports debushing activities as well as Agribank. But government extension services are not geared towards supporting bio-energy production. Though AGRA has recently set up an ‘agricultural advice section’, their services would have to be paid for.

Support for bio-energy value chains can come from many sides, but if done uncoordinated, it will result in inefficiencies. This poses again the challenge for efficient policy coordination.

7 Recommendations

Based on the findings of the qualitative analyses of the two most promising bio-energy value chains in Namibia, the following recommendations for policy makers are made:

Food Security

- Conduct country-wide **study on food security** and related factors (self-sufficiency, mode of production, food market properties, transfer programmes such as food packages, income patterns and migration) as announced in the MAFW Strategic Plan 2008/9 – 2012/13 (MAWF not yet published, 35) and continuously monitor **food security status**.

- Design a **national food security policy** as announced in the MAFW Strategic Plan (ibid., 30 and 39):
Clarify concept of food security and food self-sufficiency at national, regional and household level with due consideration of communal areas and small farmers.

Critically assess strategic, political and economic need for food self-sufficiency.

Design and implement strategies towards food security for different groups of population. In the case of bioenergy overcome market failures in remote areas that lead to dependencies on a single provider.

Assign role for agriculture in food security, i.e. in its functions as food provider as well as source of income.

On basis of food security strategy, clarify government position towards cash crops (in particular in communal areas) and, due to the immediate need of clarification, especially towards cash crops for bioenergy production.


Clearly define minimum requirements of large agricultural investors for food security (if any).

Promote spill-over effects from cash crop to food crop production.

Propagate the strategy widely so as to sensitise all stakeholders and policy makers.

Rural development

Clarify the role and potential of major land uses in rural areas (agriculture, livestock, forestry and conservation for tourism) for economic, ecological and socio-political development and assess the role of migration for rural poverty reduction.

Derive a realistic strategy for poverty alleviation and rural development, including options for income generation versus transfers and migration.

Clarify the role of rural areas in the long-term vision, including employment generation (particularly focussing on the youth), food production and nature conservation.

Derive strategies to integrate long-term vision and short- to medium-term needs

Assign a realistic role for agriculture in rural development, i.e. as a provider of livelihoods, income and food security, given alternative livelihood sources including migration, and given costs to develop options.

Clarify the role of bioenergy and cash crops in rural development.

Agricultural development

Align the agricultural policy with food security and rural development priorities and available government resources.

Clarify the role of bioenergy feedstock within agricultural development priorities.

Increase information base to assess potentials and threats, by conducting public research on yield potentials and to assess potential environmental risks. Integrate
private sector (commercial farmers and private investors) in research and development on bioenergy.
- Compare bioenergy feedstock to other crop options in the context of rural livelihood challenges and strategies.
- Decide upon a sequencing of introducing a bioenergy industry, e.g. start out small with governmental trials and small plots of private actors with continuous monitoring before introducing large-scale cultivation.

- **Adapt agricultural support systems** to the needs of the rural poor for each model
  - Improve access to capital for rural poor, e.g. design micro-finance schemes for rural livelihoods, design financing schemes for renewable energy projects, clarify potential of CDM for small-scale applications and design support mechanisms.
  - Improve access to know-how and information (about bioenergy and other crop options for diversification) by improving interplay between extension services, agricultural research and training based on communal farmer needs. Increase especially the capacities of extension services and agriculture.

- **Design a clear strategy for FDIs in rural areas**, especially regarding bioenergy
  - Clarify the potentials and threats of FDIs
  - Design incentives and regulations to reduce social costs, e.g. a trust fund to avoid environmental damages (as in the mining sector).
  - Create a “mediating” body between investors, communities and government to integrate development priorities of the country with investors’ needs.

- Improve introduction of **new agro value chains** into the country to increase value addition within the country (recommendation policy coordination)

- Create incentives to commercial farmers for labour-intensive debushing techniques, that respect environmental and labour standards

*Labour*

- **Design labour policies** that take due account of the particularities of the rural economies (seasonality, piece-work wage, remoteness, internal and trans-boundary migration) and carefully balance employment opportunities and job qualities.

- **Build up and support sufficient communication channels** for the unemployed and informal sectors in order to make their concerns heard when formulating labour policies.

- **Improve capacities of existing unions** for them to deal with matters concerning specifically wood workers. This especially concerns their outreach work. Alternatively, support the establishment and functioning of formal representation of certain classes of workers, e.g. wood workers.

- **Improve communication between stakeholders**: workers, unions, employers and government. Operationalise bodies like the Woodland Management Council that can serve as a forum for discussion. Deepen political stakeholders’ understanding of realities on the ground in order to shift to debates based on informed arguments.
• Within the Ministry of Labour, improve financial base, quality and quantity of labour inspections and channel it to rural areas.

• Prepare strategic plan for long-term employment goals. This should include: providing skills for workers to access possible “new” and higher qualified jobs in the emerging bio-economy and related sectors; bringing training opportunities down to the rural areas; offering relevant university courses for highly qualified employees; facilitate and better control the use of foreign workers.

Land

• Clarify disadvantages (lack of access to credit, lack of control/management of the commons, depletion of natural resources) and advantages (safety net for the poor, continuation of traditional leadership) of communal land rights for rural poor. Design policies that remedy the disadvantages so as to bridge the gap between economic opportunities of freehold and communal land.

• Design an inclusive and integrated land and natural resource use policy that also clarifies the space for bioenergy projects. This should support cross-departmental and inter-agency cooperation at national, regional and local levels so as to ensure transparency in the allocation process and to accelerate decision making and implementation.

• Clarify the role of Traditional Authorities and Communal Land Boards with regard to planning and management of natural resources on the local level. Support and invest in capacities at all levels of land administration so as to accelerate land registration processes and help TAs and CLRs to deal with new kinds of request, like large-scale bioenergy projects and international investors. Strengthen communication and dispute resolution structures at local level so as to avoid conflicts and enhance legitimacy of decisions with local communities.

• Better account for economic and ecological principles in the implementation of the Land Reform. Support sustainable debushing initiatives to increase the quality and amount of land available for redistribution. Ensure tenure security for existing farmers and support resettlement farmers in a comprehensive way so as to support sustainable land use and natural resource management.

Environment

• Conduct independent research on environmental issues of bioenergy value chains such as invasiveness, toxicity, water issues, biodiversity. Introduce knowledge management systems to allow informed risk assessment by political decision makers, the public, farmers and investors.

• Design and implement clear regulations for productive use of natural resources, such as bioenergy or for nature conservation.

• Ensure sufficient compensation to rural population for negative economic effects due to environmental regulation (transfers or benefit sharing arrangements).
• **Design integrated land and water use planning** taking due account of environmental impacts.

• Develop **capacities of local communities** in sustainable resource use planning and implementation.

• **Strengthen forestry and environmental authorities** to implement and enforce regulations as well as to provide permits and authorisation. Enable them to control the application of chemicals (e.g. for debushing) and their effects.

**Bioenergy Output Markets**

• **Draw up a National Renewable Energy Policy.** Establish targets for production and use of renewable (bio-) energy so as for Namibia to work towards a conventional/renewable energy mix. Targets can, for instance, be reached by minimum feed-in quantities of renewable energy or mandatory blending requirements.

• **Design incentive schemes to achieve economies of scale necessary for reaching national and international markets.** Schemes can include financing/loans, sufficiently high feed-in tariffs, guarantees, tax rebates, support to R&D coordination and to PPP, contact facilitation, legal and contract assistance, subsidies, among others. All of the above should be made as cost-efficient as possible, for instance through declining funding over time, differentiation according to scale of operation, or include own contributions.

• **Design standards for bioenergy products** (e.g. sustainability criteria, technical and quality standards), aligned with international or at least regional standards to create trust and respectability. Establish a **monitoring system** to assure implementation of standards.

• **Facilitate access to carbon markets,** such as CDM and voluntary markets, by developing the necessary institutions and capacities within Namibia. Lobby for rules adjusted to the needs and capacities of developing countries. Ensure access and benefit sharing systems are in place.

**Policy Coordination**

• **Include Bioenergy in a National Renewable Energy Policy and monitoring system.** Therefore streamline procedures and negotiations and disseminate information effectively to stakeholders. Clearly identify a lead ministry guiding and feeling responsible for implementing the policy.

• **Develop inter-agency knowledge base** in the area of bioenergy. Cooperate with regional bioenergy initiatives in the area of R&D, policies and standards.

• Strengthen or create **mediators that reconcile different interests** and facilitate communication between stakeholders, both at inter-ministerial and local level.

• **Coordinate the formulation and implementation of coherent policies around bioenergy value chains,** i.e. food security, rural development, agricultural development, land, labour, environment and energy.
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