Food and Agriculture Organization of the United Nations

INTERNATIONAL DIALOGUES
ON FOREST LANDSCAPE RESTORATION AND WOOD ENERGY

Preliminary outcomes from multi-stakeholder consultations in sub-Saharan Africa

A project funded by GIZ on behalf of the
Federal Ministry for Economic Cooperation and Development (BMZ) of Germany

In cooperation with:

IEA Bioenergy

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FOREWORD

The Global Bioenergy Partnership (GBEP) was founded in 2006 to implement the commitments taken by the G8 in 2005 to support "modern bioenergy deployment, particularly in developing countries where biomass use is prevalent". The Partnership brings together public, private and civil society stakeholders in a joint commitment to promote bioenergy for sustainable development.

GBEP provides a forum to: foster exchange of information, skills and technologies about sustainable bioenergy through bilateral and multilateral collaboration; inform policy and decision makers, in the context of a low-carbon sustainable development, both at national and regional level, and support bioenergy market development; and promote high-level policy dialogue and facilitate international cooperation on bioenergy and its sustainability.

In this context FAO, which is among the founding members of GBEP, carried out a project entitled "International dialogues on Forest Landscape Restoration and wood energy", a nine-month project implemented in collaboration with the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) and IEA Bioenergy, with generous financial contribution from GIZ on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) of Germany. This project is part of a broader collaboration amongst GIZ, GBEP and IEA Bioenergy on Forest Landscape Restoration (FLR) and Bioenergy, and represents a follow up to two International Dialogues on Sustainable Bioenergy & FLR previously organized (in December 2018 at the Global Landscape Forum in Bonn and in May 2019 at the 27th European Biomass Conference and Exhibition in Lisbon). The main aim of this collaborative effort was to facilitate awareness raising and dialogue amongst FLR and bioenergy stakeholders, both at national and international level, with a view to intensify opportunities for collaboration and to develop a joint agenda for action around these thematic areas. Furthermore, this joint action aimed to sensitize policy makers and relevant stakeholders on the multiple opportunities that sustainable modern bioenergy, with a focus on wood energy, could offer to speed up the achievement of national FLR targets, Nationally Determined Contributions (NDCs) and Sustainable Development Goals (SDGs).

To this end, in the context of the present project, GBEP organized and guided an international interactive session at the Global Landscape Forum (GLF) held in Accra (Ghana) in October 2019 and two "National dialogues on Wood Energy and Forest Landscape Restoration" in Togo and in Ghana in January 2020. The organization of the events was coordinated by GBEP, in consultation with GIZ and IEA Bioenergy, and in a collaborative effort with the FAO's Forestry Department, the Forest and Farm Facility (FFF) and with the contribution of other relevant international organisations (e.g. AFR100, IRENA).

This paper presents the main outcomes of the stakeholder consultations performed within this project. It outlines the identified opportunities to generate enhanced synergies among bioenergy and FLR stakeholders in the continent of Africa, and the identified barriers that prevent a wider adoption of these sustainable FLR and modern bioenergy integrated systems, both at national and at regional level. It then presents the final recommendations – addressed to international agencies actively working on this thematic area and spatial context, and to national policy and decision makers – from the three consultations and ultimately proposes potential follow up activities that will facilitate a gradual transition towards sustainable FLR and modern bioenergy integrated systems, thus accelerating the achievement of common goals.

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Natural Resources Officer - Project Coordinator

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ABBREVIATIONS AND ACRONYMS

AFD	Agence Française de Développement
AFR100	African Forest Landscape Restoration Initiative
AG	Activity Group
AMCC+	Alliance Mondiale contre les Changements Climatiques Plus
AUDA	African Union Development Agency
BMZ	German Federal Ministry for Economic Cooperation and Development
CCS	Carbon Capture and Storage
EC	Energy Commission
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
FAO	Food and Agriculture Organization of the United Nations
FC	Forestry Commission
FFF	Forest and Farm Facility
FFPO	Forest and Farm Producer Organization
FLR	Forest Landscape Restoration
FORIG	Forestry Research Institute of Ghana
GBEP	Global Bioenergy Partnership
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale ZUsammenarbeit (GIZ) GmbH
GLF	Global Landscape Forum
GSI	GBEP Sustainability Indicator
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
IUCN	International Union for Conservation of Nature
LMO	Land mitigation option
LPG	Liquefied Petroleum Gas
MASPFA	Ministère de l'Action Sociale, de la Promotion de la Femme et de l'Alphabétisation

MCPSP	Ministère du Commerce et de la Promotion du Secteur Privé
MEDDPN	Ministère de l'Environnement et des Ressources Forestières
MEF	Ministère de l'Économie et des Finances
MME	Ministère des mines et de l'énergie
MSWG	Multi-Stakeholders Working Group
PALCC	Programme d'Appui à la Lutte contre le Changement Climatique
ProDRA	Program for Rural Development and Agriculture
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SFM	Sustainable Forest Management
SME	Small and Medium Enterprises
SRC	Short Rotation Coppice
SSA	sub-Saharan Africa

EXECUTIVE SUMMARY

This working paper presents the preliminary outcomes of a project that FAO has been conducting in a collaborative effort with IEA Bioenergy and with the financial support of GIZ, to promote "International dialogues on Forest Landscape Restoration and wood energy". The project represents a follow up to a wider cooperation between FAO/GBEP, GIZ and IEA Bioenergy on this thematic area, whose main scope is to bridge the gap between the bioenergy and the Forest Landscape Restoration (FLR) sectors, which usually work "in silos" with a limited or even null cooperation and synergy between them.

This paper focuses on the outcomes of three dialogues on "Wood Energy and FLR" that were organized in sub-Saharan Africa (SSA) in the context of this project, covering both the International (Global Landscape Forum Accra 2019) and the National level (National Dialogues in Togo and Ghana). The three events, whose organization and implementation benefited from the active contribution of various teams within FAO (e.g. GBEP, FFF, Forestry Department) and with other international organizations (e.g. IRENA, GIZ), brought together relevant stakeholders of the two realms, raised their awareness on the activities currently on-going on the same thematic area and spatial context, and created a network among them to enable synergies, thus accelerating the achievement of common goals (e.g. SDGs, NDCs).

The dialogue approach proved extremely constructive and efficient: beyond training and cross-cutting knowledge, it also provided participants with tangible demonstrations of the various strategies, practices and technologies which represent positive linkages between these two realms and offer valuable alternatives to traditional, unsustainable options. The key role of traditional woodfuel value chains, especially charcoal, are undisputed and will probably continue to dominate the energy framework in SSA in the near future. Nevertheless, the severe impacts that its production and use cause on forest landscapes and related ecosystem services have been more recently recognized and are receiving increasing attention at international and regional level (e.g. through the AFR100 initiative). Therefore, a long-term vision should be urgently embraced and put in place to facilitate the gradual transition towards other modern and more sustainable sources of energy, which include more efficient wood energy supply chains and, in the meantime, the adoption of alternative forms of energy.

This project has contributed to highlight, in the international contexts, the importance to act in an inclusive manner and with a coordinated approach, such as in the case of farmers and producers' organizations and associations, women's group and local communities. It was also

the opportunity to create international connections and knowledge sharing, helpful to optimize the allocation of resources and to speed up a long-term sustainable development process to achieve common goals.

The project provided Togo and Ghana with a cross-cutting analysis of their wood energy and FLR sectors, which resulted in tailor-made suggestions and targeted take home messages, ready to be incorporated in their wood energy- and climate-related strategies (e.g. national woodfuel regulation, national reforestation plans and NDCs), which are currently in the process of being reviewed/updated.

Furthermore, the dialogues resulted in the definition of the following highly relevant **follow up activities** that are summarized below.

Participants asked for **the establishment of a permanent National Multi Stakeholder Working Group (NMSWG), to favour participatory processes and ensure a crosscutting approach in defining policy recommendations around FLR and sustainable bioenergy sectors, with a focus on wood energy**. The institution of the NMSWG will give to all interested stakeholders (e.g. public representatives, SMEs, academia, farmers and producer organizations in the rural areas) an opportunity to meet with the relevant authority, share knowledge and ensure transparency in defining national wood energy- and climate-related strategies.

The importance to **create a comprehensive georeferenced dataset** to serve as a baseline on which to develop and measure further progress was highlighted. To this end, it is strongly suggested **to map the domestic bioenergy supply potential at country level** and, in addition to this, also **map all existing bioenergy enterprises currently active in these spatial area** (e.g. biogas plants, SMEs working on the production of improved cookstoves and improved feedstocks – pellets, briquettes, chips; charcoal producers).

The dialogues were recognised as a positive experience that shall be replicated in other SSA countries, primarily the ones that have committed to the AFR100 initiative, to build connections amongst all wood energy and the FLR stakeholders and to deeply analyse the current status of these two realms at local level, thus **setting a more structured and solid basis for the development of sustainable FLR-modern bioenergy integrated systems**.

1. INTRODUCTION

Traditional biomass accounts for more than half of all bioenergy used worldwide (IEA, 2017; Reid, Ali and Field, 2020). It is the main source of energy for cooking and heating water for 2.8 billion people (38 percent of global population) especially in the African Region, where only 17 percent have primary reliance on clean fuels – a situation that has changed little in the last 3 decades (WHO, 2019).

Woodfuel (charcoal and fuelwood) constitutes the main source of energy for many households across the world and especially in sub-Saharan Africa (SSA), where more than 80 percent of urban households rely on charcoal for cooking and heating water and where the wood energy value chain offers employment to millions of people, both in urban and rural areas, thus contributing to alleviate poverty. In SSA, woodfuel demand is likely to increase in the forthcoming decades, driven mainly by population growth.

As a matter of fact, traditional woodfuel use for energy production purposes is not sustainable in the way it is currently implemented in SSA, for various reasons. For instance, traditional kilns for charcoal production are characterized by a very low efficiency, with a production yield between 15 and 20 percent, i.e. 150 to 200 kg of charcoal produced per ton of woody material (Girard, 2002). Further energy loss percent occurs during cooking with charcoal due to the use of inefficient traditional stoves (Carvalho *et al*., 2020). A study published in 2017 found that supplying a household for one year with charcoal produced from sustainable managed forest and used in traditional cooking stoves, can require more than half a hectare of land (Nerini, Ray and Boulkaid, 2017). Another study published in 2018 estimated that charcoal production and use requires 23 times the land of fuelwood (Win *et al.*, 2018). In this scenario, the sustainable supply of woodfuel cannot keep up, leading to deforestation and landscape degradation. In SSA, where the registered deforestation rate is 5 times higher than the world average, overharvesting of wood for energy purposes has been recognized as a major cause of land degradation (IPCC, 2019). The decline of forest resources is seriously affecting the resilience of land and populations, especially rural, in facing the impacts of climate change, and compromises the productivity of forest ecosystems and biodiversity conservation.

Yet, there are options for "greening the charcoal value chains" (FAO, 2017; Jin *et al*., 2017), improving the use efficiency of woody biomass through the adoption of modern technologies, such as improved cookstoves (Carvalho *et al*., 2020; Clean Cooking Alliance, 2019; Rosenthal *et al*., 2018; UNEP, 2019a), switching to the use of alternative feedstock

and/or bioenergy pathways (Rasimphi & Tinarwo, 2020; Subedi *et al.*, 2014).With the aim to reverse the degradation process and increase the contributions of ecosystems and landscapes to livelihood improvement, land productivity and environmental services, as well as to improve the resilience of human and natural systems, Forest Landscape Restoration (FLR) initiatives are currently being implemented around the world, with approaches tailored to specific local contexts (e.g. AFR100; Forest Landscape Restoration; Global Landscape Forum).

In Africa, the African Union Development Agency (AUDA-NEPAD), the World Resources Institute (WRI), the Germany's Federal Ministry for Economic Cooperation and Development (BMZ), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the World Bank launched the African Forest and Landscape Initiative (AFR100) at the XXI Conference of the Parties (COP 21) of the United Nations Framework Convention on Climate Change (Paris 2015), a country-led initiative that aimed to restore 100 million hectares of land in Africa by 2030. Among many targets, AFR100 contributes to achieve the objectives settled within the Bonn Challenge, a global commitment to restore 150 million hectares of land around the world by 2020, the New York Declaration on Forests extends the Bonn Challenge to 350 million hectares by 2030, and the African Resilient Landscapes Initiative (ARLI) promotes integrated landscape management. As of April 2020, 29 African countries adhered to AFR100 and have committed to restore a total area of over 125 million hectares of degraded land by 2030, thus even more than the already ambitious target originally established in Paris in 2015 (www.afr100.org accessed on 4 April 2020).

Unsustainable wood harvesting, transport of charcoal (usually produced in rural areas and then used in urban areas), the incomplete combustion of woodfuel, and the use of inefficient kilns and traditional stoves for charcoal production and use, cause high GHG emissions (e.g. methane, CO_2 and black carbon) with substantial impacts on climate change (FAO, 2017). Beyond environmental concerns, traditional wood energy production and use has debilitating social issues. The smoke produced by the incomplete combustion of fuelwood and by traditional inefficient charcoal stoves causes high levels of indoor air pollution and has being recognized as the main cause for 3.8 million deaths a year (mainly due to respiratory diseases) and blindness, predominantly affecting women and children because of their primary roles in household cooking (WHO, 2018). Furthermore, fuel gathering is a time-consuming activity that exposes women and children to risk of injury or violence whilst preventing them from engaging in other productive activities, such as education, childcare and or highly paid jobs. Therefore, a gradual transition towards sustainable, modern energy systems is urgently needed

as it could substantially contribute to alleviate these environmental, social and economic consequences of the traditional woodfuel value chain.

Bioenergy specialists and, more specifically, wood energy practitioners have tended to operate relatively independently from the Forestry Sector due to often-differing perspectives and priorities. While the users of wood energy are mainly concerned with ensuring that future demands can be satisfied reliably and with sufficient quantities at consistent price and quality, the Forestry sector, more specifically the FLR community seeks to ensure that forest product markets stimulate investment in sustainable forest management (SFM) and in particular the restoration of degraded forest landscapes.

Although their perspectives may differ altogether, the two communities share a common interest in ensuring that value chains for wood energy are sustainable, enhance forest stocks and trigger investment to enhance local incomes for improved livelihoods. Current streams of discussion on these vital aspects of rural development, however, do not focus on collaboration between those who require wood energy and those concerned with enhancing supply of forest products. The overlaying debate on how FLR and Sustainable Landscape Management may contribute to carbon sequestration in functional landscapes certainly call for more cross sectoral dialogue.

The discussion around the relevance and opportunity of sustainable wood energy production and use as a contribution to FLR has been going on for a few years, but productive interaction of stakeholders across sectors and especially between FLR and bioenergy communities has remained scarce.

With the aim to facilitate awareness raising and dialogue among stakeholders from both FLR and bioenergy communities, thus intensifying opportunities for collaboration and seeking for developing a joint agenda for action around sustainable wood energy and FLR, FAO/GBEP, with the financial support of GIZ on behalf of BMZ of Germany and in cooperation with IEA Bioenergy has implemented the project “International dialogues on Forest Landscape Restoration and wood energy”. In the framework of this project, FAO/GBEP has organized and led the implementation of three dialogues on Forest Landscape Restoration and bioenergy, with a focus on wood energy. A first international event was held in Accra (Ghana), in form of an interactive session at the Global Landscape Forum in November 2019. Further two dialogues were held in form of multi-stakeholders consultations at national level in Togo and Ghana. The latest events were organized in collaboration with FAO and GIZ country offices, as well as with FAO Forestry Department, which contributed through the Forest and Farm Facility (FFF) and through the FAO focal point for the AFR100 Initiative in Africa.

The present paper will first discuss the main outcomes of each consultation performed within this project: identified opportunities to generate enhanced synergies among bioenergy and FLR stakeholders in SSA, and barriers that prevent a wider adoption of these sustainable FLR and modern bioenergy integrated systems, both at national and at regional level. The paper will then present the final recommendations – addressed to international agencies actively working on this thematic area and spatial context, and to national policy and decision makers from the three stakeholder consultations. Ultimately, the paper proposes potential follow up activities that will facilitate a gradual transition towards sustainable FLR and modern bioenergy integrated systems, thus accelerating the achievement of common goals.

2. METHODOLOGY

With the aim to bring together relevant stakeholders from the wood energy and the FLR realms and to offer them an opportunity for debate, a dedicated Interactive session at the Global Landscape Forum in Accra (Ghana) and two "National dialogues on Wood Energy and Forest Landscape Restoration" in Togo and in Ghana were organized in October 2019 and in January 2020, respectively. The event organization was coordinated by GBEP, in consultation with GIZ and IEA Bioenergy and in a joint effort with various teams of work within FAO Forestry Department (e.g. FFF and the FAO focal points for AFR100 and FLR Initiatives) and with the contribution of other relevant international organizations (e.g. IRENA, AUDA-NEPAD).

The National dialogues have seen the participation of pre-selected stakeholders of the FLR and the bioenergy sectors (with a particular focus on the wood energy pathway), brought together in a National Multi-Stakeholder Working Group (NMSWG) formed ad hoc for the purpose of this initiative. In both of the beneficiary countries, the NMSWGs were created by building upon the activities carried out by FAO/GBEP in 2018, in the context of the project "Capacity Building on GBEP Sustainability Indicators for Bioenergy in the ECOWAS countries: Togo and Ghana", funded by GIZ (FAO, 2019). In that occasion, NMSWGs were formed in these countries with the aim to raise awareness on the key features of a sustainable modern bioenergy sector and to build and/or strengthen their capacity on the use of the GBEP Sustainability Indicators for Bioenergy (GSI), a tool to assess the sustainability of the bioenergy sector at country level. For the purpose of the present work, the NMSWGs formed in 2018, which initially involved only relevant national stakeholders for the bioenergy sector, were enlarged in a way to include all relevant national stakeholders for the FLR sector, both in Togo and Ghana, thus providing an opportunity to set the basis for a long-term cooperation and coordination between these two sectors. Thanks to this selection process, both of the events saw the participation of representatives of governmental ministries, technical commissions, country representatives of the AFR100 Initiative, private sector (e.g. SMEs, charcoal and farmer producer organizations), academia and research institutes, civil society and NGOs. Beyond the involvement of country stakeholders, both the national dialogues on Wood Energy and FLR also benefited from the contribution of a range of international agencies working on the same thematic area in the same geographic context (e.g. FAO – GBEP with contribution by the Forestry Department and FFF; GIZ; IUCN).

In Togo, the national workshop saw the active participation of around 35 relevant stakeholders amongst which representatives of the government (e.g. Ministry of the Environment, Sustainable Development and the Protection of Nature), international, public and private sector organizations (e.g. GIZ, FFF), NGOs, civil society, universities and research institutes (see Annex I, Table 1). In Ghana, the NMSWG brought together almost 50 members amongst representatives of the government (e.g. Ministry of Energy), international, public and private sector organizations (e.g. GIZ, IUCN, FFF, AFD), NGOs, civil society, universities and research institutes (see Annex I, Table 2).

The agendas of both "National dialogues" were structured in a way to guide participants through all the steps of the wood energy value chains, as implemented at local level. This approach supports the cooperative exploration of all existing plans, strategies, technologies and practices put in place so far by the various actors in the wood energy value chain, that could potentially allow for mutual synergies between bioenergy (with a focus on wood energy) and FLR sectors. All members of the two NMSWGs had the opportunity to share their knowledge and to underline the obstacles that prevent the full implementation, the scaling up and/or the replication of sustainable practices already recognized as promising at local level. Some of these practices, at the time of the workshops, were already under implementation, whilst others have just been put in place at pilot scale. Effective technologies and sustainable practices identified during the three events included: use of alternative feedstock and improved kilns for charcoal production; dedicated Short Rotation Coppice (SRC) on degraded lands; agroforestry techniques; improved agriculture and forest management practices; production and use of improved feedstock (e.g. pellet) from wood residues and waste; improved cookstoves for biomass conversion; microgasification and biochar production as a means for C capture and storage. Beyond efficient technologies and sustainable management practices, new effective collaborative approaches amongst the various actors of the value chains emerged as successful case studies during the workshop, such as forest and farm producer organizations (FFPOs), women's group, local communities and consortia.

3. MAIN OUTCOMES FROM STAKEHOLDERS CONSULTATIONS

3.1 Interactive session at the Global Landscape Forum in Accra 2019

The IPCC, in its Special Report on Climate Change and Land (SRCCL) released in August 2019, recognized reforestation, afforestation, bioenergy with carbon capture and storage (CCS) and biochar as valuable strategies to fight climate change, to achieve C-neutrality by 2050 and to keep global warming under 1.5°C. At the same time, the SRCCL highlighted that all these land mitigation options (LMOs) can have significant sustainability concerns, which are context specific and depend on various aspects, such as the scale of deployment, initial land use, land type, bioenergy feedstock, initial carbon stocks, climatic regions and management regime (IPCC, 2019). To investigate the suitability of various LMOs to specific conditions and to create enabling conditions for adoption of response options, the IPCC has called for a coordinated response across a range of actors, including business, consumers, indigenous and local communities, land managers and policymakers.

With a view to respond to this request, FAO organized, in a joint effort amongst various internal teams of work (e.g. GBEP, FFF, Forestry Department) and with a wide range of international organizations (e.g. GIZ, IEA Bioenergy, IRENA, AFR100), governmental representatives (e.g. Zambia, Ghana) and local NGOs (e.g. ASA Initiative), an interactive session at the GLF held in Accra in November 2019. The event aimed to bring together various actors currently actively engaged in FLR and wood energy sectors across SSA countries, to join forces to facilitate awareness raising and exchange of ideas and information, with a view to intensify opportunities for collaboration and to develop a joint agenda for action among stakeholders from both FLR and bioenergy communities. The interactive session highlighted best practices (see Annex II. Examples of positive practices to mainstreaming

sustainable wood energy in the FLR processes., sections 0; b; and c) and key success factors that have led to a positive contribution of sustainable wood energy value chains to FLR in the continent of Africa, in order to understand which approaches are effective and how and when these can be replicated or scaled up.

The results of the sustainability assessment of the national bioenergy sector through the implementation of the GBEP sustainability indicators at national level in Kenya and Ethiopia

(UNEP, 2019b; UNEP, 2019c), is in line with the preliminary results of an assessment carried out in AFR100 countries which indicates wood energy as one of the key sectors where support is being requested to develop and maintain sustainable management practices. To meet this request, the African Union Development Agency (AUDA) has recently established an energy programme, which is linked to Sustainable Land And Water Management, as well as to forest restoration, and will primarily focus on ten African countries identified as the ones with the lowest access to energy (e.g. Sierra Leon, Burkina Faso, Liberia, Niger and Chad) (Diakhite, 2019)

The dialogue outlined the multifaceted features of the wood energy value chains in SSA and highlighted, once more, that halting woodfuel use, in particular charcoal production, is extremely difficult and in some cases inappropriate, due to the lack of alternative livelihoods and/or affordability of other fuels. The acknowledgement of the key role of woodfuel in SSA has stimulated the definition of innovative approaches, designed to improve the sustainability of wood energy supply chains, thus making them compatible or even functional to the achievement of FLR and other climate-related objectives. Beyond efforts to reduce the considerable amount of energy and biomass losses along the charcoal supply chains, owing to low efficiency of the transformation process and to inadequate transport conditions, innovative approaches have been tuned to support:

1- the establishment and the wider recognition of charcoal, forest and farm producer organisations across African countries through the FFF initiative;
2- the cultivation of marginal, unused and/or less productive lands with SRC addressed to wood energy supply;
3- the adoption of a circular economy principle, with the use of forest residues and waste at the last ring of the chain, for energy purposes, e.g. through the production of improved feedstock such as pellet, chips and briquettes; and
4- the use of biochar, the by-product of woody biomass gasification, as a means of CCS, useful to return nutrients to soil and to stimulate the rehabilitation of degraded and contaminated forest and agricultural lands, thus enhancing their productive capacity and supporting a faster growth of seedlings.

Identifying, gathering and raising awareness on the ample range of opportunities and strategies developed (and already available on the market) to mainstream sustainable wood energy in the FLR process is extremely useful to speed up the modernization of the sector, keeping alive or even enhancing its potential to bring social, economic and environmental benefits to local communities. In this process, the implementation of capacity building

activities (e.g. practical and educative trainings), as well as the creation of dedicated platforms to discuss issues and share experiences amongst stakeholders, is key to support the development of sustainable FLR-modern bioenergy integrated systems, whilst offering opportunities for networking and developing synergies.

The involvement of youth in this process is key to raise their awareness on sustainability concerns, stimulate their future engagement and provide them with the basis for an informed choice amongst the various available sources of energy.

At the same time, diversifying energy sources and practices is essential to enhance the capacity of current and future generations to meet an increased demand of energy, without further compromising forest landscapes and related ecosystems, but contributing to their conservation and restoration through tailor made, holistic and participatory approaches.

3.2 National dialogue in Togo

In Togo, **76 percent of households rely on woodfuel (charcoal and fuelwood) as main source of energy for cooking. This percentage increases up to 99 percent for household in rural areas.** In addition to being used for cooking purposes at household level and in public institutions (e.g., schools, hospitals), woodfuel is also the main source of energy for productive activities, such as food processing industries. Charcoal and butane gas represent the main source of energy for household in urban areas, with a share of respectively 71.4 percent and 15.7 percent. On the contrary, for household in rural areas, the main source of energy is fuelwood (87 percent), followed by charcoal (12.2 percent) and butane gas, the latest having a negligible importance. It has been estimated that 90 percent of wood charcoal production and selling occurs as an illegal activity, therefore being difficult to trace. The national consumption of wood for energy production purposes, both at household level and for productive activities, has been estimated at nearly 8.3 million cubic metres of wood per year in 2017 (Bakabima, 2018). The balance between the woodfuel supply guaranteed through SFM and the current demand is already negative, and this deficit is expected to further increase in the future. In fact, according to an MERF and REDD plus estimation, the woodfuel from SFM will be able to cover only 28 percent and 13 percent of national woodfuel demand in 2030 and in 2050, respectively (Unite de Coordination Nationale REDD+, 2018). These scenarios will cause severe environmental, social and economic impacts for the country, especially in terms of land and ecosystem degradation, biodiversity losses and human poverty, by further negatively affecting the already limited land and population resilience to climate change consequences.

Figure 1: Map of Togo.
©UN Geospatial Information Section.
Adapted from UN ECOWAS map, 2020.

To face these challenges, in 2018, the Togolese government committed AFR100 to restore 1.4 million hectares of forest degraded land by 2030. To achieve this goal, the

government has been defining its “National Reforestation Plan 2017-2030”, which includes measures for the reforestation of 39 prefectures across the country. Nevertheless, as stated by all NMSWG members, all reforestation policies and measures defined so far present a series of issues that limit their efficacy. For instance, the country has not yet defined a dedicated legal framework characterized by a holistic and crosscutting approach, to ensure the traceability and/or the respect of a certain standard of quality/sustainability along the various steps of the woodfuel value chain (e.g. plantation, harvest, transformation and transport). As an example, current restoration plans have disregarded the importance of biodiversity and the use of forest native species with high calorific value that are, indeed, the most suitable source of biomass for energy production purposes. The lack and/or the obsolescence of the regulatory framework, as well as the lack of control and sanctions for violation of the existing (although obsolete) rules, has been underlined by NMSWG members as one of the main factors at the origin of the wider illegal charcoal market that constitutes almost 90 percent of the sector. The lack of traceability and certification keeps the price of charcoal low (and affordable for most). The downside is that this situation slows down the adoption of more efficient technologies for charcoal production and use, and prevents the switch to alternative modern bioenergy options.

These alternatives are already developed and produced by various private enterprises in the country (see Annex II. Examples of positive practices to mainstreaming sustainable wood energy in the FLR processes., sections d and e; Figure 2) but currently have a quite limited market uptake, as a result of not being economically competitive

Figure 2: Demonstration of improved feedstock (i.e. briquettes) locally produced from alternative biomass (e.g. agricultural residues).
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with traditional and unsustainable sources of energy. As of today, Togo has not yet defined any policies and/or measures to promote/support the development of modern bioenergy value

chains and, in particular, of more sustainable practices and technologies that could improve the efficiency of or replace the use of woodfuel, thus reducing the burdening on forest resources and enabling the achievement of the AFR100 objectives. One of the reasons for this is a general lack of knowledge/awareness on the various options that can contribute to creating mutual synergies between modern bioenergy and the FLR sectors, and on the various range of additional benefits that the adoption of these sustainable practices could deliver to local communities.

During the national dialogue, participants recognised the huge added value of the NMSWG established for the purpose of this project, as it facilitated the networking amongst national stakeholders, and the sharing and transfer of knowledge on the wood energy and FLR themes. Furthermore, the NMSWG worked as a platform for holistic discussion and, through its participatory approach, it has given a voice to stakeholders, such as SMEs and FFPOs, who have never had the possibility to talk directly to decision and policy makers and whose needs, for this reason, have often remained unheard. Hence, the members of the NMSWG deemed as relevant to include in the list of the final recommendations of this dialogue, the need to establish a **permanent NMSWG on sustainable wood energy and FLR**, which should include representatives from various regions in the country. This group should work as an official government-supporting body and meet on a regular basis to share data and information on forest and wood energy resources, to get updated on existing options for sustainable practices and technologies as well as on on-going research and funding opportunities, thus providing a scientific base for entrepreneurs, business organizations and practitioners. Furthermore, it will serve to provide guidance and advice to policy and decision makers, for instance to inform possible revisions and adjustments of existing policies, measures, national strategies and plan.

The NMSWG highlighted the importance of **creating a dedicated governmental fund** to support the development of sustainable FLR-bioenergy integrated systems. This fund, together with the design of innovative policies/strategies, should foster a gradual transition from traditional to sustainable modern FLR-bioenergy integrated systems through regulations, laws and soft policy measures (e.g. education at various levels; professional training programme and information campaigns; academic research programmes; fiscal incentives tailored to SFM and private modern bioenergy entrepreneurs). In this context, the NMSWG highlighted the importance of **activating entrepreneurship programmes for forest and wood energy professionals**, for the transfer or accrual of knowledge, skills, and practices through learning mechanisms such as practical training and courses. These mechanisms could develop the required level of know-how to propagate the use of SFM practices (such as the

cascading use of wood), to stimulate the transitions towards modern bioenergy options and favour the cooperation among different value chain actors (e.g. consortia). All these measures will contribute to increasing socio-economic opportunities for farmers, forest-dependent people and enterprises, and facilitate the establishment of sustainable wood energy and FLR integrated systems in the country.

A further recommendation that emerged from this first FLR and wood energy consultation at national level was to **create opportunities for an exchange of results** achieved by research institutes and SMEs and to facilitate the dissemination of these results to the wider public in a view to accelerate the development and the market uptake of innovative technologies and practices. Opportunities for a wider communication should also be created with a view to raise consumers' awareness on the several environmental, social and economic benefits associated with the adoption of these innovative sustainable FLR-bioenergy integrated systems in comparison with traditional practices.

Members of the Togolese NMSWG were so enthusiastic about the knowledge exchange, the discussion held and the results achieved during the National Dialogue, that the Togolese government asked, with an official letter, to become an Observer of GBEP, in order to participate in further dialogues and discussions about sustainable Wood Energy and FLR and to have the opportunity to remain up-to-date on the developments in bioenergy realm as a whole. In light of this **Togo became a GBEP Observer on 12 March 2020**.

A final noteworthy result achieved thanks to the National Dialogue was the initiation, at local level, micro-gasifier production, using the example demonstrated during the practical session of the event. A short report was prepared by the Togolese entrepreneur who started the production process and who is currently engaged in fine-tuning the pilot micro-gasifier. This production will allow to locally use available agricultural residues (i.e. palm oil kernel and cashew shells) as feedstock for clean cooking energy production.

3.3 National dialogue in Ghana

As of today, traditional biomass accounts for 40.5 percent of total country energy consumption in Ghana, with charcoal contributing for almost the 18 percent. It is noteworthy that, although Ghana is one of the African countries with the highest electrification rate, the contribution of charcoal to the total country energy consumption is still higher than the one of electricity, which is limited to 14.9 percent (Togobo, 2020). The energy framework in rural and urban areas of the country is deeply different. Whilst household in rural areas rely mainly on woodfuel for cooking and heating water, in urban areas woodfuel represents just 25 percent to the energy mix, whilst the use of LPG and electricity is wider common.

Figure 3: Map of Ghana.
©UN Geospatial Information Section, 2020

The increase in national population and the fast economic growth that the country has experienced in the last decade have caused deep changes at all levels and severe environmental, social and economic impacts that are plain for all to see. Thanks to a growing purchasing power, households in rural areas have moved away from firewood to charcoal, implying a substantial growth in charcoal demand of 40 percent, from 2008 to 2018 (Togobo, 2020). Furthermore, more households are able to afford charcoal produced from hard wood native species (which has higher calorific value) from the Savannah area in the north of the country. This trend is at the base of the massive degradation of forest landscapes currently on going in this area and substantial losses in terms of native species and biodiversity for the country. Additionally, local charcoal production still uses traditional and inefficient kilns, which require 6-12 kg of fuelwood to produce 1 kg of charcoal. The lack of improvement in charcoal production practices and the increased charcoal demand have resulted in a very high level of wood consumption for energy purposes, currently estimated at 30 million m^3/year, which is an unsustainable figure (GIZ, 2020).

The fear of not being, in the near future, able to meet an increasing demand of wood, both for timber and energy purposes, is leading the Ghanaian government to the adoption of urgent measures to boost the plantation of trees, bushes and grasses and to rapidly provide alternative energy sources. In this search for rapid responses, the long-term sustainability has not always being considered as a primary concern. This was highlighted during the national consultation, where members of the NMSWG presented about FLR activities based on the use of fast-growing species, sometimes invasive, such as Acacia spp. and Chinese bamboo varieties, addressed to wood energy purposes or about the use of timber species, such as teak (unsuitable to charcoal production as stated by NMSWG's members) to repopulate large degraded forest lands. So far, native hard wood species have been omitted, with negative implications e.g. the loss of biodiversity and ecosystem services.

On the energy front, the Ministry of Energy is determined to promote solar panels and LPG to reduce the overdependence on woodfuel through dedicated policies and measures foreseen within the country's NDCs, in line with the Paris Agreement objectives. However, considering the urban-rural dynamic of the country, it would be impossible to achieve a total migration to LPG or even electricity (Togobo, 2020). The measures currently foreseen under the NDCs are required but not sufficient to allow for a wider access to modern energy sources for all, and could contribute to deepen further the already high level of social and economic divergences between rural and urban population. In fact, Forest and Farm Producers' Organizations represented in the NMSWG, stated that rural households have to cover long distances (up to 30 km) to refill their LPG tank, which implies a large burden both in terms of time and money. Furthermore, even if the LPG stoves are provided free of charge by the government (which is indeed planned to be the case under a government scheme to distribute 500 000 LPG stoves by December 2020, with funding from South Korea), the lack of fuel affordability and availability for people in rural areas remains a big concern. On the contrary, if the government supported the diffusion of improved cook stoves and/or micro gasifiers based on the use of forest and agricultural solid residues as fuel, households could locally source the feedstock needed for domestic purposes. Furthermore, the country can already count on the local production of improved technologies, which produce cooking energy and heat at various scales using improved feedstock (e.g. pellets, chips), also locally produced. Supporting the market uptake of these types of improved technologies, by foreseeing dedicated financial or fiscal incentives for local producers, would unlock the full potential of these alternative and modern energy sources. As the situation stands, the market uptake of pellets at local level is quite limited, mainly because of its uncompetitive price compared to fuelwood or charcoal (as

stated by pellet producer SMEs represented in the NMSWG). For this reason, almost all pellets produced in the country are exported to Europe, with substantial (and avoidable) environmental impacts due to the consumption of energy associated with wood pellet transportation over long distances plus an overexploitation of materials from woodlands and forests locally (Magelli *et al.*, 2009).

The national dialogue gave the possibility to local actors to showcase, even through practical demonstration, best forest management and bioenergy practices, such as agroforestry techniques and more efficient kilns for charcoal production, as well as alternative modern bioenergy technologies (e.g. biogas) and by-products (biochar) that can constitute a way to create synergies between sustainable modern bioenergy and FLR systems (see Annex II. Examples of positive practices to mainstreaming

Figure 4*:* Demonstration of a micro-gasifier and of various suitable feedstock available at local level during the National dialogue in Ghana. ©T. Pirelli, 2020.

sustainable wood energy in the FLR processes., section c; Figure 4).

All the above-referred technologies/practices have already been implemented at country level, some of them just at a pilot scale whilst others at large scale. Supporting the diffusion of locally-produced improved cooking stoves (e.g. micro-gasifiers) would allow for the development of an internal market for pellets and/or other improved feedstock (e.g. wood

chips, briquettes), thus reducing the country dependence on imported sources of energy, adding value to local waste and residues and creating new job opportunities.

In Ghana, the Energy and the Forestry Commissions are currently carrying out various efforts to integrate and to complement their actions, towards the achievement of establish FLR and NDC targets. In particular, they have been both involved in the implementation of the project "Forest Landscape Restoration through a Sustainable Wood Energy Value Chain", in cooperation and with the financial support of GIZ. Under the framework of this project, whose activities started at the end of 2019, the country has already put in place activities to rehabilitate a total of 700 ha of degraded natural forests and agroforestry landscapes, and to restore 300 ha of degraded land addressed to the production of wood for energy. The project is also aiming to install improved charcoal kilns in four selected communities and to spread the use of improved cook stoves (GIZ, 2020).

The country's FLR and energy context is evolving very fast, therefore the Ghanaian government has an **urgent need to review/update its energy- and climate-related strategies**. For instance, the Energy Commission, which in 2011 received the mandate to reformulate the national woodfuel regulation, is currently facing the challenge of improving the draft document prepared so far, in a way to enhance the sustainability of the entire wood energy value chain. On this, the EC has requested a coordinated technical support from the various International organizations involved in the NMSWG (i.e. FAO, through GBEP and FFF; GIZ and IUCN). Such a coordinated effort will extend the (still valid) currently foreseen policies and measures (P&Ms) that aim to ensure woodfuel traceability, certification and more sustainable transport conditions, and will enlarge the scope of the document to include support to establish dedicated plantations, adopt SFM practices (e.g. cascading use of wood, agroforestry) and improved and more efficient technologies. To achieve this task, an involvement of all the members of the NMSWG is desirable, to pursue a participatory and holistic approach. This collaboration would also set the basis for long-term cooperation, useful to share data, information and know-how, thus allowing the **development of comprehensive and updated datasets and maps** (e.g. on the distribution of charcoal and other bioenergy producers active in the country).

Beyond woodfuel regulation, Ghana is also under the process of **reviewing its country NDC**, under the supervision of the Environmental Protection Agency (EPA). So far, the NDCs include ample measures to spread the use of improved LPG cooking stoves as an alternative to woodfuel. Nevertheless, it is undeniable that the charcoal value chain is an important income-generating venture for rural households, thus it is of keen importance to foresee P&Ms to support the transition towards a FLR-modern bioenergy integrated system based on the use of

locally available biomass and resources, thus ensuring income opportunities for rural people as well as a wider access to affordable and diversified energy sources. This could be done by foreseeing fiscal incentives and tax exemptions for alternative bioenergy forms (e.g. biogas, pellets, micro-gasifiers), aiming to increase their competitiveness with fuelwood and charcoal, which are currently the cheapest (and thus the preferred) source of energy in the country.

4. TAKE HOME MESSAGES AND RECOMMENDATIONS FOR FOLLOW UP

In line with its intended outcomes, the three events that FAO implemented in cooperation with GIZ – on behalf of BMZ – and IEA Bioenergy, contributed to facilitate thedialogue among stakeholders from both FLR and bioenergy communities, two sectors which work oftentimes in silos, with a limited coordination between them. In particular, the interactive session held in the context of the Global Landscape Forum in Accra and both the "National dialogues on Forest Landscape Restoration and wood energy" held in Togo and Ghana led to the definition of clear take home messages and paved the way for further follow up activities and coordinated efforts amongst the various FAO teams of work, international organizations and NMSWG members who have been actively involved in this first "Wood energy and FLR" joint action. The main results emerging from the aforementioned activities and the related recommendations are discussed below.

The woodfuel value chain in SSA covers a key role to ensure energy, food and livelihood security to local populations, especially in the rural areas of the country and its important contribution to the country energy mix is not expected to decline in the near future. In fact, because of population and economic growth, people in rural areas could shift from fuelwood to charcoal use, thus requiring even greater quantities of wood to meet their energy needs for cooking and heating water. **The traditional charcoal supply chain is not sustainable**, because of various reasons, but mainly due to the extremely low efficiency (usually lower than 15 percent) of traditional kilns used to produce it.

The **policies and measures (P&Ms) adopted so far to support the FLR process are difficult to execute.** This is due to various reasons, the most relevant one being the lack of land tenure and tree ownership characterizing the majority of legal framework in SSA countries. This factor has been identified at the base of the low or even null engagement of single charcoal producers and/or farmers in planting new trees. A measure to overcome this barrier is **to**

encourage the establishment of FFPOs and communities which shall be engaged to plant tree and set up tree nurseries. This approach has already given good results in Togo (i.e. FFPOs) and Ghana (i.e. school yards), as tree nurseries have demonstrated to be a good income generating activity. Furthermore, local government **should urgently foresee the establishment of lots dedicated to wood energy supply in their forest plantations plans**. This type of intervention will contribute to preserve/reduce the overexploitation of slow growing native hard wood species, characterized by high calorific value, which currently constitutes the preferred source of energy (e.g. mangroves for fish-smoking) with irreversible impacts on forest landscapes, biodiversity and ecosystem services.

In this context, **modern bioenergy could offer multiple opportunities to accelerate the achievement of the objectives established in the context of the AFR100 and the FLR Initiatives**, and to set the basis for long-term duration of the results achieved. Therefore, **dedicated P&Ms to support a gradual transition towards sustainable modern bioenergy forms have to be defined and applied as complementary to those of FLR**. These P&Ms could take the form of direct interventions to improve the wood energy supply chain (e.g. improved kilns for charcoal production, improved cooking stoves) or indirect actions to reduce the pressure on forest resources, such as the adoption of alternative energy sources. The latter presents various challenges, most importantly, it risks to result not affordable and available for the poorest people living in rural areas, as in the case of LPG stoves distributed in Ghana. Therefore, it is advised to **support the development of short energy value chains**, characterized by a reduced number of intermediaries between the biomass or the feedstock producer, and the consumer, based on the use of large and locally available fuel. To translate this advice in practical action, a quick approach is to take advantage of the FFPOs already established in various SSA countries in the context of the on-going FFF programme of work, to capitalize these tiered network of farmers and members looking for business opportunities.

During all the events carried out by FAO in the context of this project, it has emerged that there is **a general lack of awareness on the positive linkages between modern bioenergy and FLR**. In light of this, both of the NMSWGs formed and consulted during the implementation of this project, pinpointed the urgent need to be targeted by **information and training campaigns on existing bioenergy systems and on the various environmental, economic and social benefits that these can additionally deliver to local populations**. In particular, representatives of the FFPOs specifically requested more information and technical trainings on the use of alternatives to wood fuels, and on the use of bioenergy by-products (e.g.

digestate and biochar) as well as compost as fertilisers and soil amendment to increase agricultural yield and to rehabilitate degraded forest and agricultural soils.

Furthermore, **the NMSWGs urgently called for stronger technical support by international agencies**, as both countries are now **in the process of reviewing/updating their wood energy- and climate-related strategies**, such as their national woodfuel regulation, national reforestation plans and (I)NDCs. This technical support will boost the use of a comprehensive and crosscutting approach to extend the usually mentioned (and still valid) objectives of pursuing the traceability, quality certification and improved transport conditions for woody biomass and charcoal. Further objectives should be foreseen, such as: the promotion of diversified energy sources (e.g. alternatives bioenergy pathways/biomass); a migration towards more efficient energy pathways; and the adoption of all types of measures that could increase the current production of wood for energy purposes, such as dedicated forest plantations, agroforestry techniques, SFM practices. Furthermore, the review of the NDCs should focus on leveraging the market uptake of modern bioenergy pathways, based on locally available sources of energy and technologies (e.g. pellets, briquettes, micro-gasifiers), thus reducing the dependence on imported forms of energy (LPG), adding value to forest and agricultural waste and residues, and using them to increase energy access for all.

Four highly relevant **follow up activities** were recommended from the discussions held; these are summarized below.

Participants asked to promote and encourage collaboration between the bioenergy and the FLR sectors, thus allowing for an optimal allocation of resources which is functional to accelerate the achievement of common goals. This coordination will be facilitated by **the establishment of a permanent NMSWG, to favour participatory processes and ensure a crosscutting approach in defining policy recommendations around FLR and sustainable bioenergy sectors, with a focus on wood energy**. The institution of the NMSWG will give to all interested stakeholders (e.g. public representatives, SMEs, academia, farmers and producer organizations in the rural areas) an opportunity to meet with the relevant authority, share knowledge and ensure transparency in defining national wood energy- and climate-related strategies.

To start the process towards **mainstreaming modern bioenergy in the FLR process**, it is strongly recommended **to create a comprehensive dataset on currently existing sources and on-going activities in these two sectors**, to serve as a baseline on which to develop and measure further progress. To this end, it is strongly suggested **to map domestic bioenergy supply potential at country level**, such as woodfuel, agricultural and agro-industrial waste

and residues. A georeferenced overview of these resources (e.g. forest and woodfuel inventory, residues from agriculture or timber industry, bamboo, etc.) is key to pave the way for sustainable FLR-modern bioenergy integrated systems in the various areas of the countries. Furthermore, it is key **to map all existing bioenergy enterprises currently active in these spatial area** (e.g. biogas plants, SMEs working on the production of improved cookstoves and improved feedstocks – pellets, briquettes, chips; charcoal producers). This type of information will raise the awareness of the various actors of the value chains, including end consumers, on where to find improved technologies, feedstock and bioenergy by-products to be applied in the field, and will help to identify the most successful practices, thus facilitating their scale up and replicability. Furthermore, the maps will serve as a tool to facilitate the interactions amongst actors and will support the creation of consortia and/or of producers organizations, thus that they can ask for major support from the government. Last but not least, both of the above mentioned maps will indirectly favour the traceability of biomass flows at country level, also by quantifying the amount of biomass exported each year as a bioenergy source.

The dialogues were recognised as a positive experience, as they served **to build connections amongst all wood energy and the FLR stakeholders, to deeply analyse the current status of these two realms at local level and to define room for more structured interventions and synergies**. All these outcomes will be of tremendous help for the definition of a holistic and more precise strategy for technical support, towards the achievement of SDGs, AFR100 and FLR objectives. Therefore, it is strongly advised **to replicate this experience in all the 29 African countries that have adhered so far to the AFR100 Initiatives (AFR100, 2020)**.

5. CONCLUSIONS

Modern bioenergy offers multiple opportunities to accelerate the achievement of the targets established under the AFR100 initiative in SSA. Furthermore, synergic FLR-modern bioenergy systems could serve as a fly-wheel towards the meeting of countries' Nationally Determined Contributions (NDCs), Sustainable Development Goals (SDGs), UN Convention to Combat Desertification (UNCCD), Convention on Biological Diversity (CBD), as well as of other related international goals such as the Bonn Challenge and the New York Declaration on Forests (NYDF). Nevertheless, it is noteworthy that bioenergy development could also be affected by multiple challenges that go far beyond the original "food versus fuel" debate and include issues such as global equity concerns, water scarcity, land use change, and land and biodiversity degradation (Dietz *et al*., 2018).

For these reasons, when talking about sustainable modern bioenergy contributing to the FLR process, we should keep in mind that there is not one size fits all solution. The suitability of each FLR-modern bioenergy integrated system shall be assessed in advance, by considering all environmental, social and economic features of the specific local context. It is not needed to highlight the important role that the GBEP sustainability indicators for bioenergy can play in this context. Furthermore, the equilibrium of these FLR-modern bioenergy integrated systems is dynamic and subject to change, thus it needs regular monitoring and adaptation to meet sustainability requirements at any given time and across different spatial contexts.

Supporting the development of innovative forest- or agroforest-based value chains (e.g. sustainable charcoal, improved feedstock, biochar production and use) can provide rural people with diversified income opportunities in SSA countries, whilst adding value to forest resources, by-products and residues, thus strengthening short forest supply chains by taking into account regional peculiarities, in a circular bioeconomy perspective. In this context, a gradual transition towards modern bioenergy technologies and practices is of paramount importance to unlock the full potential of forest resources, and could be put in place by improving woodfuel use efficiency, e.g. through the local production and use of improved feedstock and more efficient technologies. Further modern bioenergy options (e.g. anaerobic digestion and gasification of agricultural residues) can indirectly act on the wood energy value chains, serving as alternatives to woodfuel, thus reducing pressure on and contributing to preserve forest landscapes and ecosystems.

The role of international agencies, local government, decision and policy makers in leveraging this transition process, is crucial. A coordinated action on various fronts is urgently needed to raise consumer awareness (e.g. via information and training campaigns) on the various bioenergy opportunities available on the local market and on the additional environmental, social and economic benefits that they could bring to local communities. At the same time, dedicated policies and measures should be developed and put in place to promote/support the cooperation among different value chain actors (e.g. SMEs, consortia) in a way to identify new business opportunities and develop new marketing strategies to leverage the market uptake of more efficient and/or alternative technologies. In this context, the establishment of fiscal incentives and other forms of financial assistance to support the diffusion of sustainable practices and attract investment for a transition towards sustainable FLR-modern bioenergy integrated systems is of primary importance.

6. BIBLIOGRAPHY

AFR100. 2020. Available at: http://afr100.org. Accessed on 20 April 2020.

Bakabima. 2018. Power point presentation at the *2eme Atelier national avec les parties prenantes multisectorielles* held in Lomé (Togo) on 21 November 2018 (also available at: http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/2018_events/TOGO_2nd_meetings/1-_Bakabima_-_La_problematique_du_bois_%C3%A9nergie_au_Togo_-_REDD_.pdf)

Carvalho, R. L., **Yadav, P., García-López, N., Lindgren, R., Nyberg, G., Diaz-Chavez, R., Kumar Upadhyayula, V. K., Boman, C., & Athanassiadis, D**. 2020. *Environmental sustainability of bioenergy strategies in western Kenya to address household air pollution. Energies*, *13*(3), 1–17 (also available at: https://doi.org/10.3390/en13030719).

Clean Cooking Alliance. 2019. 2019 *Clean cooking industry snapshot* (also available at: https://www.cleancookingalliance.org/reports/2019-Clean-Cooking-Industry-Snapshot/2019-Clean-Cooking-Industry-Snapshot.html#page=1). Accessed on 16 April 2020.

Diakhite M. 2019. AUDA. Speech at the Global Landscape Forum in Accra on November 2019 (also available at: https://events.globallandscapesforum.org/agenda/accra-2019/day-1-2/interactive-session-6-3rd-dialogue-on-forest-landscape-restoration-flr-and-bioenergy/. Accessed on 27 March 2020).

Dietz, T., Börner, J., Förster, J. J., & von Braun, J. 2018. *Governance of the bioeconomy: A global comparative study of national bioeconomy strategies*. Switzerland. *Sustainability*, 10(9) (also available at: https://doi.org/10.3390/su10093190. Accessed on 16 April 2020).

FAO. 2017. *The charcoal transition: greening the charcoal value chain to mitigate climate change and improve local livelihoods*, by J. van Dam. Rome, Food and Agriculture Organization of the United Nations (also available at: http://www.fao.org/3/a-i6935e.pdf)

FAO. 2019. *Capacity Building on the Global Bioenergy Partnership Sustainability Indicators for Bioenergy in the Economic Community of West African States (Ecowas) Countries*. March (also available at: http://www.fao.org/3/ca3956en/CA3956EN.pdf).

Girard, P. 2002. *Charcoal production and use in Africa: What future? Unasylva*, 53(211), 30–34.

GIZ. 2020. Forest Landscape Restoration through a Sustainable Wood Energy Value Chain. Power Point Presentation by Cisco Aust at the at the *National Dialogue on Wood Energy and FLR in Ghana*, 28 January 2020 (also available at: http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/2020_events/Ghana/2_day/D2.5_GIZ_Ghana_FLR_and_sustainable_wood_energy.pdf).

IPCC. 2019. Chapter 7: Risk management and Decision Making in Relation to Sustainable Development. In IPCC- Special Report on Climate Change and land.

Jin, S. L., Schure, J., Ingram, V., & Yoo, B. Il. 2017. *Sustainable woodfuel for food security. A smart choice: green renewewable and affordable*.

Magelli, F., Boucher, K., Bi, H. T., Melin, S., & Bonoli, A. 2009. *An environmental impact assessment of exported wood pellets from Canada to Europe. Biomass and Bioenergy* (also available at: https://doi.org/10.1016/j.biombioe.2008.08.016).

Nerini, F. F., Ray, C., & Boulkaid, Y. 2017. The cost of cooking a meal. the case of Nyeri County, Kenya. *Environmental Research Letters*, 12(6) (also available at: https://doi.org/10.1088/1748-9326/aa6fd0).

Rasimphi, T. E., & Tinarwo, D. 2020. Relevance of biogas technology to Vhembe district of the Limpopo province in South Africa. In *Biotechnology Reports*, Vol. 25 (also available at: https://doi.org/10.1016/j.btre.2019.e00412).

Reid, W. V., Ali, M. K., & Field, C. B. 2020. The future of bioenergy. *Global Change Biology*, 26(1), 274–286 (also available at: https://doi.org/10.1111/gcb.14883).

Rosenthal, J., Quinn, A., Grieshop, A. P., Pillarisetti, A., & Glass, R. I. 2018. Clean cooking and the SDGs: Integrated analytical approaches to guide energy interventions for health and environment goals. *Energy for Sustainable Development*, 42, 152–159 (also available at: https://doi.org/10.1016/j.esd.2017.11.003).

Subedi, M., Matthews, R. B., Pogson, M., Abegaz, A., Balana, B. B., Oyesiku-Blakemore, J., & Smith, J. 2014. Can biogas digesters help to reduce deforestation in Africa? *Biomass and Bioenergy*, 70, 87–98 (also available at: https://doi.org/10.1016/j.biombioe.2014.02.029).

Togobo W. 2020. Opening speech at the *National Dialogue on Wood Energy and FLR in Ghana*. Business Times Africa, 29 January 2020 (also available at: https://thebftonline.com/2020/business/agribusiness/national-dialogue-on-wood-energy-and-forest-restoration-held/ . Accessed on 27 March 2020).

UN Geospatial Information Section. 2020. General maps. Available at: https://www.un.org/Depts/Cartographic/english/htmain.htm.

UNEP. 2019a. Review of woodfuel Biomass Production and utilization in Africa A Desk Study. 127. http://www.unep.org

UNEP. 2019b. Sustainability of Biogas and Solid Biomass Value Chains in Ethiopia (also available at: http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/AG2/Ethiopia_and_Kenya/GBEP-Ethiopia-Technical-Report-ISBN.pdf . Accessed on 15 April 2020).

UNEP. 2019c. Sustainability of Sugarcane Bagasse Briquettes and Charcoal Value Chains in Kenya (also available at: http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/AG2/Ethiopia_and_Kenya/GBEP-Kenya-Technical-Report-ISBN.pdf).

Unite de Coordination Nationale REDD+. 2018. Etude sur les causes et consequences de la deforestation et la degradation des forets au Togo et identification des axes d'intervention appropries (also available at: http://www.reddtogo.tg/index.php/ressources/rapports/send/8-rapports/64-rapport-etude-causes-et-consequences-de-la-deforestation).

WHO. 2018. World health statistics 2018: monitoring health for the SDGs, sustainable development goals.

WHO. 2019. World health statistics 2019: monitoring health for the SDGs, sustainable development goals. Geneva. Licence*: CC BY-NC-SA 3.0 IGO.* (Vol. 4, Issue 1).

Win, Z. C., Mizoue, N., Ota, T., Kajisa, T., Yoshida, S., Oo, T. N., & Ma, H. ok.. 2018. Differences in consumption rates and patterns between firewood and charcoal: A case study in a rural area of Yedashe Township, Myanmar. *Biomass and Bioenergy* (also available at: https://doi.org/10.1016/j.biombioe.2017.12.011).

ANNEX

Annex I. List of National Multi-Stakeholders Working Groups members in Togo and in Ghana

Table 1 *List of members of the National Multi-Stakeholders Working Group in Togo*

Name	Institution/affiliation
Abalo-Sama Abide	Agence Togolaise d'électrification rurale et des énergies renouvelables (AT2ER)
Aboudoumisamilou Issifou	FFF - FAO Togo
Akakpo-Komi	Université de Lomé
Akoete Komlanvi Katché	Université de Lomé
Akpene Afiwa Dzigbodi	REDD+
Akpoto Komlan	GIZ Togo
Alfa Essodong	ONG – Jeunes Volointaires pour l'Environnement (JVE)
Amah Atutonu	Direction des Ressources Forestières – MEDDPN
Ameganvi Kossi	SYNPA – Togo (OSC)
Awesso Balakiyem	Direction des Ressources Forestières – MEDDPN
Dangbo Fifonsi Ayélé	REDD +
Dansrou Kodjo	SYTREBACT
Dokou Eyram Vaneza Ameyo	MASPFA
Doumbia Moussa	INENSUS GmbH
DZOTSI Koffi	ONG - Mouvement Togolais pour le Salut des Peuples (MTSP).
Eze Komigan Crédo	ONG – Jeunes Volontaires pour l'Environnement (JVE)
Gbandey Gbaty Tiadja	Direction General de l'Energie (DGE) – MME

Gnama Wiyaru	Direction des Ressources Forestières - MEDDPN
Jérémie Kokou Fontodji	Université de Lomé
Jorez Jean Philippe	EURONET Consulting
Kazima Brigitte	EBP-ESL Energie et Environnement
Kondokao Ahihoui	MEDDPN
Kotoko Prosper	INENSUS/PROENERGIE
Koudjagbo Komlan	Fédération de pécheurs – FENUCOOPETO; FFF affiliated
Laré Yendoubé	Départemente de Phisique Université de Lomé
Lidaou Pignozi	GIZ Togo
McQueen Duncan	International Institute for Environment & Development, Edinburg - UK
Nagnango Yakouba	CPC Togo; FFF affiliated
Segla Kossi Novinyo	Université de Lomé
Sophie Grouwels	FFF FAO Rome
Tchaa Tom	Labo GTVD, Université de Lomé
Tchanaté Kolani	Labo GTVD, Université de Lomé
Tchassim Koudjoouféi	Secrétariat général du MEDDPN
Tiziana Pirelli	FAO/GBEP
Van Rompaey Renaat	Consultant Union Européenne
Veronica Agodoa Kitti	ASA Initiative – NGO (Ghana)
Yao Amenyo Yawovi	Coordination Togolaise des Organisations Paysanne et de Producteurs Agricoles (CTOP); FFF affiliated

Table 2 *List of members of the National Multi-Stakeholders Working Group in Ghana*

Name	**Institution/affiliation**

Beatrice Darko-Obiri	CSIR - Forest Research Institute (FORIG) – Kumasi
Charles Nyaaba	Peasant Farmers Association of Ghana (FFF)
Cisco Aust	GIZ- Ghana country office - Coordinator of the project Wood energy and FLR Project
Daniel Benefor	Environmental Protection Agency - Energy Resources and Climate Change Unit – Responsible for NDCs review
Daryl Bosu	A Rocha Ghana
Ellen Graber	Volcani Center ARO – Beit Dagan – Israel (Participation by remote)
Elvis Kuudaar	FAO Ghana and FFF Facilitator
Enoch Kofi Boadu	Assistant Secretary to the Biogas Association of Ghana (BAG)
Ernest Adu	GIZ - Ghana country office
Ernest Foli	CSIR - Forest Research Institute (FORIG) – Kumasi
Ezekiel Chibeze	Strategic youth network for development
Faustina Awuah Baffour	Bamboo & Rattan Unit - Forestry Commission (FC)
Francisca Atuluk	Min of Gender, Women & Social Protection
Gibrilla Ahmed	DCS/Ministry of Food and Agriculture (MoFA)
Gideon Annor	SAFISANA
Hajia Alima Sagito	Savanna Women Integrated Devt Agency
Horlali Yao Haligah	Director / Kalakpa Club (Kalakpa Forest Reserve)
James Korang	CSIR - Forest Research Institute (FORIG) – Kumasi
John Yeboah	Energy Commission
Joseph Asante	Tropenbos Ghana
Joseph Sakyi Baah	Kuapa Kookoo
Joshua Addae	Min of Planning

Julius Nkansah-Nyarko	Energy Commission
Julius Awaregya	ORGIIS Ghana
Kofi Ameyaw Kwakye	Forestry Commission
Kwabena Twumasi	GIZ - Ghana country office
Kwame Agyei Frimpong	University of Cape Coast
Lovans Owusu-Takyi	Institute for Sustainable Energy and Environmental Solutions (ISEES)
Mark Akparibo	Tele-bere VSL Association
Markus Lemke	GIZ - Ghana country office - Internship
Mathias Edetor	FAO Ghana
Merci Owusu Ansah	Tropenbos Ghana
Michael Kweku	INBAR
Musah Abu-Juam	Min of Land and Natural Resources
Nana Kwaw Adams	Abrono Organic Farmers Association
Pragnesh Mishra	Abellon CleanEnergy Ghana Ltd
Richard Sasu	Ghana Statistical Service
Rik Sools	FORM International
Roselyn Fosuah Adjei	Forestry commission - Director, Climate Change - National REDD+ coordinator (FLR)
Saadia Bobtoya Owusu-Amofah	IUCN Ghana
Sebastian Brahene	FAO RAF Consultant
Seth Ken Appia-Kubi	A Rocha Ghana
Soalandy Rakotondramanga	FAO RAF - Programme officer - FOA division
Sophie Grouwels	FAO HQ - Programme Officer FOA and FFF

Steffen Behrle	GIZ - Ghana country office
Tiziana Pirelli	FAO
Veronica Agodoa Kitti	ASA Initiative NGO
Victoria Adongo	Peasant Farmers Association of Ghana
Wisdom Togobo	Ministry of energy - Director of Renewable and Alternative Energies
Yaoline Poline	Agence Francais de Developpement

Annex II. Examples of positive practices to mainstreaming sustainable wood energy in the FLR processes.

The Global Bioenergy Partnership is currently developing a research campaign to gather examples of practices that represent positive relationships between wood energy and Forest Landscape Restoration (FLR) from around the world. The outcomes of this work will be summarised in a dedicated document to be published within the Scope of Work of Activity Group 4 (Towards Sustainable Modern Wood Energy Development) of the Working Group on Capacity Building, under the thematic area of 'Woody biomass for FLR and sustainable livelihoods'.

The dialogues held within this project were the opportunity to share some of the contributions of GBEP partners and observers to this collection's effort with a wider public (see case *a* – IRENA report, below).

Furthermore, the dialogues extend the opportunity to share knowledge and experiences beyond the GBEP partnership, thus giving visibility to and collecting contributions from other international partnerships (e.g. FFF), private sector (SMEs in Togo and Ghana), universities (e.g. Lomé, Cape Coast), NGOs (e.g. ASA Initiative) and local government (e.g. Zambia) currently working to build sustainable FLR and modern bioenergy integrated systems in SSA. All these examples have been reported in this Annex (see cases b, c, d and e) and will constitute themselves a contribution to the final GBEP document on *Positive relationships between wood energy and Forest Landscape Restoration (FLR)*.

The present report represents, therefore, the result of a participatory and inclusive approach which has benefited from a mutual enrichment in the attempt to build crosscutting and wide-ranging knowledge.

a. IRENA Report – Bioenergy from degraded land in Africa (2017)

i.Overview

Geographic location: SSA countries (with country-level analysis for Kenya and Rwanda)

Type of example: Study

Status: Finalised in 2017

ii.Executive summary

As of March 2017, 18 SSA countries had pledged a total of 75.36 M ha under the AFR100 initiative. A study was conducted by IRENA in cooperation with Utrecht University to assess the sustainable potential of biomass for energy from restored degraded land pledged to AFR100.

This study aims to provide a methodology using the Restoration Opportunities Assessment Methodology (ROAM) to estimate the yields of all Bonn Challenge pledges. During a ROAM assessment, different facets of the restoration opportunity are explored. The total magnitude of restoration opportunity in an area is calculated taking social, economic and ecological factors into consideration. The assessment ascertains the different types of restoration and specific sites in a particular country. The costs and benefits of different restoration strategies are evaluated. Finally, ROAM identifies the important stakeholders and the policy, financial and social incentives in place or required to support restoration efforts.

The study concluded that these 75 M ha of restoration pledged under the AFR100 could yield around six exajoules per year of primary bioenergy, assuming that the entire amount of land pledged were dedicated to bioenergy crops, and these pledges were fulfilled on land with the highest potential yield.

After the analysis for SSA as a whole, a country level analysis was conducted for Kenya and Rwanda because the assessments based on the ROAM have been completed for these two countries.

The result of the assessment study was presented in a report entitled *Bioenergy from Degraded Land in Africa: Sustainable and technical potential under Bonn Challenge pledges* in 2017.

iii.Sustainable wood energy and forest landscape restoration relationships

Positive impacts for sustainable wood energy:

The analysis shows that around 6 EJ of primary energy per year could in theory be sustainably extracted from short rotation woody crops (SRWC) cultivated on land pledged for restoration under the AFR100. This proportion would account for 87 percent of total primary energy supply (TPES) projected in 2050 for the 18 countries studied. However, this assumes

bioenergy crops will be planted on the entire pledged area and that the most productive land will be selected to plant such crops. If bioenergy crops were planted on just 63 percent of the area pledged (the average intention in the current country plans), and if the most degraded land were selected instead of the highest yielding, the amount of energy extracted would amount only to around 1.8 EJ per year – 25 percent of TPES.

Positive impacts for forest landscape restoration:

Growing bioenergy crops on degraded land – especially perennial crops – could significantly increase the productivity of the land and would have little negative impact on biodiversity and GHG balance.

Sustainable biomass production for energy could also stimulate the Bonn Challenge and could improve the economic sustainability of projects undertaken while mitigating more GHG by replacing fossil fuels. Furthermore, the extra financial incentive arising from bioenergy crop production could increase the likelihood that the Bonn Challenge succeeds.

Countries that make pledges to the Bonn Challenge usually do this by stating number of hectares to be restored without providing details on the location or type of restoration. Conducting a study using ROAM provides more insight into the possible restoration strategy.

The ROAM reports of Rwanda and Kenya show significant potential of restoration activity that could support bioenergy feedstock production. Kenya identifies 1.8 M ha for agroforestry under a conservative scenario, while another 0.4 M ha is eligible for commercial plantations. Rwanda identifies 1.1 M ha to be restored through agroforestry, while another 0.25 M ha consists of existing eucalyptus plantations with the potential to be improved.

The ROAM assessment conducted in **Rwanda** generated six restoration interventions consisting of 1) new agroforestry on steeply sloping land, 2) new agroforestry on flat and gently sloping land, 3) improved management of existing eucalyptus woodlots, 4) improved management of existing pine timber plantations, 5) protection and restoration of existing protected forest and 6) establishment or improvement of protected forests on sensitive sites. The assessment indicated the first three restoration options are relevant to feedstock production for bioenergy, summing up to 1.37 Mha out of a total restoration opportunity of 1.52 M ha.

The ROAM assessment was also carried out in **Kenya** which generated seven restoration interventions consisting of 1) reforestation and afforestation of natural forests, 2) rehabilitation of degraded natural forest, 3) agroforestry on cropland, 4) commercial plantations on marginal cropland and un-stocked plantation forests, 5) buffer zones along water bodies and wetlands, 6) buffer zones along roads and 7) restoration of degraded rangelands. The assessment found

the third and fourth options to be appropriate for producing feedstock for bioenergy, amounting to 2.2 M ha out of a total restoration opportunity of 5.1 M ha.

Co-benefits:

Using land with zero or little previous productivity can contribute to social and economic development in rural regions. In Africa, additional bioenergy production could generate further benefits by lightening the burden of energy insecurity so typical of the region while generating employment and income, thereby reducing poverty.

iv.Prospects

Reasons or main drivers:

Using degraded land to produce bioenergy may avoid problems related to land use change because this type of land is usually unsuited to and economically unattractive for food crops.

Key enabling factors:

SRWC is especially well suited to landscape restoration because it can grow on non-prime agricultural land and could provide different ecosystem services. SRWC could increase soil carbon sequestration, reduce soil degradation processes such as water and wind erosion and improve wildlife habitat.

Main challenges encountered:

Difficult growing conditions mean that establishing perennial energy crops on such land will require sustained effort over many years. Even then, the expected yields in these areas will be lower than on high-quality land. Furthermore, these degraded sites are often an essential resource for poor rural communities. Though degraded, land may still produce useful amounts of food and animal feed that could be displaced by wood crops, which are often considered an alternative. Restoration with wood crops should be planned in such a way that supplements rather than displaces more important uses with higher markets or other value.

In addition, prioritising the restoration of land with relatively low yield potential could divert attention from other action that could more effectively improve the overall efficiency of land use. Examples included increasing the yields on existing cropland and reducing the demand for land-intensive products.

Potential for scaling-up and replicability:

Studies investigating the potential for bioenergy in more detail at a national level should be conducted when ROAM assessments become available. However, more accurate and detailed input data on land degradation and availability are required as well in order to conduct meaningful country-level studies. This will involve primary field research. Economic and social factors should be included as well as environmental sustainability. Involving local stakeholders in the process is important because land restoration should respect their rights and provide them with benefits. Incorporating bioenergy potential assessments into future ROAM studies is a possibility worth considering, since the ROAM studies engage with local stakeholders.

v.References and additional information

Contact name, Affiliation/Organisation:

Toshimasa Masuyama, International Renewable Energy Agency (IRENA)

Further relevant details:

IRENA is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy.

Publication:

IRENA, 2017. *Bioenergy from Degraded Land in Africa: Sustainable and technical potential under Bonn Challenge pledges*. IRENA, Abu Dhabi. ISBN 978-92-9260-050-1 Available at : https://www.irena.org/publications/2017/Dec/Bioenergy-from-degraded-land-in-Africa

b. Forest and farms producers organizations for sustainable charcoal production in Zambia.

i.Overview

Geographical location: Choma district, Zambia

Type of example: Project

Status: Ongoing

ii.Executive summary

Zambia is a land locked country surrounded by the Democratic Republic of the Congo in the northern part, Malawi on the eastern, on the southeast by Mozambique; on the south by Zimbabwe, Botswana, and the Caprivi Strip of Namibia; and on the west by Angola. It is about is 752 614 km^2 in size and the capital city is Lusaka.

Zambia has approximately 60 percent of its land area forested. However, the rate of deforestation is one of the highest in Africa between 250 000 to 300 000 hectares of land per year. Charcoal production is one of the many drivers of deforestation. However, access to electricity in rural and urban areas is estimated at 3.2 and 49.3 percent, respectively, and Zambia relies on wood fuel (including charcoal) as the main source of energy for over 75 percent of energy needs (NJP, 2010). An estimated 700 000 tonnes of charcoal is consumed annually and 85 percent urban households are reported to use it (AFREC, 2011).

The Forest and Farm Facility (FFF) is working in Choma district of southern province about 300 kilometres away from the capital city Lusaka. The project is among other objectives supporting sustainable charcoal production and other wood fuel value chains. FFF believes in organised producers as major drivers of change. The project in Choma has mobilised 600 producers into 40 groups working to improve the charcoal value chain. Furthermore, FFF has facilitated the formation of an association with the 600 producers to enable the producers/traders in the charcoal value chain to come up with a discussion platform and opportunities for meaningful dialogue and come up with the way forward on contentious issues like, policy, pricing, harvesting and manufacturing methods. As part of this project, improved charcoal production technologies are also promoted, such as the drum kiln shown in **Errore. L'origine riferimento non è stata trovata.** (b).

Figure 5: Traditional (a) and improved (b) kilns for charcoal production in Zambia.

iii. Sustainable wood energy and forest landscape restoration relationships

Positive impacts for sustainable wood energy:

The organisation of charcoal producers/traders into an association is expected to benefit the wood energy value chain through the adoption of sustainable means of harvest and production and a reduction in the illegal trade in charcoal.

The associations also enhance the relationship between the producers/traders and government (FD) through dialogue, which will lead to increased regulation efficiency by FD through the association.

Positive impacts for forest landscape restoration:

The traditional methods of charcoal production currently have a recovery rate of around 10 percent. Improved methods being promoted currently using a drum kiln, which has over 40 percent recovery rate.

Currently a participatory Grantee system is being promoted to allow traceability of sustainably produced charcoal.

Given these improvements in the sustainable harvest and production of wood fuel and the reduction in illegal trade in charcoal, the outputs of the project are also expected to reduce deforestation rate in Choma and surrounding areas.

Co-benefits:

FFF is empowering charcoal producers with improved technologies of production and harvesting, which will improve efficiency in the charcoal value chain. This will have benefits by reducing net GHG emissions, as well as reducing illnesses caused by the production and utilisation of charcoal due to carbon monoxide through improved technologies.

Improved charcoal production would require the following additional cost to the producers: cost of improved kilns, packaging and labelling with a green certified logo (approximately USD 10 per bag). However, improved revenues would be realised from premium prices of certified sustainable charcoal and through improved efficiency of production from below 10 percent to about 30 percent conversion ratio of biomass into charcoal. This will increase revenues for producers by approximately 30 percent.

Additionally, FFF has tried to build capacity among the charcoal producers and communities to attain improved business practices and participation in policy engagement. Participation by women encouraged and facilitated in all capacity development activities, including business

training for producer organizations using the FFF Market Analysis and Development approach with at least 50 percent female participation

iv. Prospects

Reasons or main drivers and key enabling factors:

The traditional methods for charcoal production currently have a recovery rate of at most 10 percent of the biomass, with over 90 percent of the primary resources being lost or wasted. Therefore, there is a great opportunity to improve the methods for charcoal production, with the consequential environmental, social and economic benefits.

Main challenges encountered:

The main challenges encountered are the following:

- Need for a charcoal regulation to promote sustainable charcoal production.
- Inadequate awareness among charcoal producers and other stakeholders on current forest regulations and sustainable charcoal practices.
- Inadequate finance and technical support to the public forest administration for effective implementation of the 2015 national policy that encourages sustainable forestry resource management.

v. References and additional information

Affiliation/Organisation:

FFF provides direct financial support and technical assistance to strengthen Forest and Farm Producer Organizations (FFPOs) representing smallholders, rural women's groups, local communities and indigenous peoples' institutions. A partnership between FAO, IIED, IUCN and Agricord, FFF is funded by the EU through the FAO-EU FLEGT programme, Finland, Germany, IKEA, Sweden, the Netherlands, and the United States of America.

Additional resources:

- National Assembly of Zambia, 2015. The Forests Act. [Act Number 4 of 2015. Date of Assent: 14 August 2015]. Available at: http://www.parliament.gov.zm/node/4535
- FAO, 2017. Greening Zambia's charcoal business for improved livelihoods and forest management through strong producer groups. Rome. Available at: http://www.fao.org/3/a-i7238e.pdf

c. Deployment of biochar systems for efficient production of cooking energy and biochar

i.Overview

Geographic location: Central Region of Ghana – Cape Coast.

Type of example: Specific project/practice/activity.

Status: on going

ii.Executive summary

The biochar systems have been developed and tested under the course of two ACP S&T financed projects, namely *Bebi – Benefits from Biochar* and *Biochar Plus*. Several other activities have been conducted from 2009 up to date and now ASA Initiative is implementing biochar systems in Ghana.

This project looks to deploy biochar systems in Ghana. These include the production of pellet from forestry/agricultural residues, improved stoves/kilns for efficient production of cooking energy and production and use of biochar, a by-product that can improve soil fertility, crop yield and restore toxic and degraded forestry and/or agricultural soil.

The project develops and promotes slow pyrolysis, low-temperature cooking stoves that use woody and agricultural solid residues (e.g. palm oil kernel shells) or pellets, locally produced from forestry/agricultural residues, thus avoiding the use of wood fuel and saving forests. The process also produces biochar, a carbon-rich by-product; the value chain is therefore called the *biochar system*. The system represents a technical solution to address drivers of deforestation hence contributing to FLR whilst increasing bioenergy access.

Biochar systems are scalable and flexible, because they can use various types of solid biomass as feedstock. The technologies are characterized by a high efficiency; a small scale burner (diameter of 6 inches) can allow for 2 hours of cooking with 1.5 kg of pellets or kernel shells. Stoves produce 70 percent gas and 30 percent biochar.

The biochar itself has multiple benefits, namely:

- it can be buried into the soil as an amendment and fertilizer to improve soil fertility, crop yield and forest growth. Furthermore, due to its high carbon content, it serves as a means for carbon capture and storage (CCS);
- it increases the soil capacity to hold nutrients and water over a long period of time and makes them available to the plants thus allowing for increased yield;
- it is a porous material. Its holes enable air circulation in the soil to improve soil fertility;
- it provides a platform for micro-organisms to grow in the soil; and

- it can be buried in toxic and degraded forest soil as a successful means to support seed germination, and plant and forest growth, thus bringing pollutted back to life (see Figure 6).

Figure 6: Field trials conducted in unproductive degraded land originated by small scale mining (a); biochar treatment of degraded and toxic soil (b); maize yield after biochar treatment (c). ©Veronica Agodoa Kitti, 2020.

iii.Sustainable wood energy and forest landscape restoration relationships

Positive impacts for sustainable wood energy:

The biochar system includes technology for converting forestry and agro-waste into pellets as an alternative to wood fuel as a source of energy for cooking. This reduces pressure on forest resources through the use of waste streams, whilst also improving the efficiency of use of biomass. The system also includes the use of a micro-gasifier for burning the feedstock in an efficient way. The syngas produced during the gasification is 100 percent burnt and used as cooking energy, whilst the biochar is buried into the soil to enhance soil quality and fertility and as a means for CCS.

Positive impacts for forest landscape restoration:

The biochar system represents a valuable alternative to the use of wood fuel (charcoal and firewood), thus allowing for a reduced pressure on forest resources. Micro-gasification increases the efficiency of feedstock use compared to traditional stoves or kilns, thus, even if alternative feedstock is not available, the amount of wood needed for cooking is still reduced (wood must first be chipped). Biochar can be used as component of soilless substrates, thus serving in nurseries to grow forest seedlings: tests show that it leads to faster seed germination and forest seedlings' growth. Furthermore, when buried in the soil, biochar has been proven to be an efficient means for restoring soil polluted by heavy-metals; increase soil water holding capacity; and increase the availability of plant mineral nutrients (e.g. Ca, P, K).

Co-benefits:

The biochar system represents an efficient strategy towards the achievement of the objectives defined under the Paris Agreement. It has dual climate benefits: 1-reducing carbon emission and 2- creating carbon sinks.

Biochar is a highly stable C-rich product, thus it is an efficient means for CCS for a long period of time and can contribute to climate change mitigation. Biochar systems also allow for significant GHG emission reduction compared to the traditional stoves or ways of making fire (e.g. three stone fire).

iv.Prospects

Reasons or main drivers:

Self-motivation coupled with effectiveness of biochar technology and good field results from biochar field trials.

Key enabling factors:

Local availability of residues and/or waste biomass and/or ability to produce waste biomass and biochar system technology.

Main challenges encountered:

- Slow fund raising process for activity implementation;
- Inconsistency of rainfall

Potential for scaling-up and replicability:

The practice has potential for replication and scale-up. There is the potential for many businesses for the production of pellets, stoves, and the sale of biochar in agriculture value chains for livelihood improvements.

The biochar technology is simple to replicate under the following conditions:

- Availability of waste biomass;
- Existence of artisanal skills; and
- Willingness and commitment of the local people

However, financial resources are needed to establish the value chain and allow for market uptake of the technology.

v.References and additional information

Contact name: Veronica Agodoa Kitti;

Affiliation/Organisation: ASA Initiative, Ghana

Further relevant details:

ASA Initiative is a non -governmental organization (NGO) that is implementing biochar systems in Ghana since 2009. It is a private Institution with a scale of medium size in nature that depends on grant for her project implementation.

Link:

Biochar Plus Project website: https://sites.google.com/site/biocharplusproject/home

Publications:

- FAO, 2018. *Lessons learned on the Sustainability and Replicability of Integrated Food-Energy Systems in Ghana and Mozambique*. FAO, Rome. ISBN 978-92-5-130350-4. Available at: http://www.fao.org/3/i8627en/I8627EN.pdf
- Dubois O., Pirelli T., Peressotti A., 2019. Biomass anaerobic digestion and gasification in non-OECD countries—an overview, *In* Substitute Natural Gas from Waste: Technical Assessment and Industrial Applications of Biochemical and Thermochemical Processes, Chapter 13. Available at: https://www.sciencedirect.com/science/article/pii/B9780128155547000131

d. Initiative for the production and distribution of sustainable charcoal and feedstock in Togo

i.Overview

Geographic location: Plateaux region; Atakpamé capital - Population 1 425 199 (est. 2006) - Density 84 people per km^2 - Area 16 975 km^2

Type of example: Project

Status: 2016 – 2017 (pre-study)

ii.Executive summary

Charcoal is the basic energy resource for the majority of Africans. In Togo, the share of energy biomass (firewood, charcoal, plant waste) amounts to 75 percent of national total final consumption, with wood supply coming mainly from unmanaged forests and from rural traditional production. The resulting deforestation is massive, bringing with it climate change and an inexorable rise in the cost of charcoal. ***To fight the problem of traditional charcoal production is to fight the problem of deforestation at its origin***.

The project is located in Togo, in the plateaux region, more precisely in the prefecture of KLOTO Kpalimé, in the village of Gadjagan (15 km South West of Kpalimé). The region is characterized by its mild climate and lush vegetation. Kpalimé is one of the most important cities in the region and is located in the South West, approximately 120 km from Lomé, and is at the centre of the coffee and cocoa region. The area surrounding the city is lush and fertile, surrounded by thick wooded hills, deep valleys and small peasant villages. The landscape remains green even during the dry season. Despite intense agricultural development, the Kpalimé region still retains some of the most beautiful forests in Togo, where mahogany, Wawa and Iroquos abound.

The *Bio Charcoal* project started in January 2017 with in mind the idea to make a new sustainable and economical charcoal to limit the ecological disaster caused by the consumption of charcoal and the uncontrolled cutting of wood resources. '**Bio charcoal'** (sometimes called 'green charcoal') **refers to the charcoal produced from renewable raw materials**. For this project, these raw materials are **waste from the agricultural and forestry sectors, as well as bush straw** that is usually burnt. Compared to traditional charcoal, bio charcoal is:

- an ecological alternative: it preserves the forest;
- a sustainable alternative: the revalorization of a generally wasted raw material;
- a competitive alternative: on an industrial scale, Bio Charcoal can be more competitive than traditional charcoal, and have a positive impact on the purchasing power of the citizens and on the environment.

The project is the result of a preliminary study carried out by the Togolese association '*Mouvement Togolais pour le Salut des Peuples'* (Togolese Movement for the Salvation of Peoples – MTSP), with technical and financial assistance of the French association '*Graine de Développement*' (GDD).

It began with an analysis of the charcoal and wood-energy sector in Togo. This lead to the discovery of a solution to the problems of deforestation through a first experimental phase in which a "prototype" of charcoal made from agricultural biomass – bio charcoal – was obtained. This laid the foundations for a semi-industrial production which started in late 2017. Construction started in 2018 and ended in 2019 (see Figure 7).

Figure 7: Chronogram of the project conducted in Togo. ©Dzotsi, 2020.

Today, the association is embarking on the search for funds for the construction of the first industrial production unit in the country which should ultimately allow the production of more than 1 tonne per day of bio charcoal. The final objective being in a few years to set up profitable industrial production.

iii. Sustainable wood energy and forest landscape restoration relationships

The degradation of forest resources is a major environmental problem that Togo must face. The causes are slash and burn agriculture and unsustainable logging of wood energy. According to FAO, Togo loses 4.5 percent of its forests each year, one of the highest rates of deforestation in the world. The wood energy sector alone accounts for a third of these losses.

Only three sources of energy are used as main energy sources by Togolese households: charcoal has been used as main energy source by 56 percent of households, firewood by 35 percent of households and butane gas by 8 percent of households. Other sources of cooking energy such as petroleum, electricity and agricultural residues are rarely used as cooking energy by households.

Bio Charcoal was chosen for this project to solve this problem and produce positive effects on the sustainability of the wood energy value chain and the restoration of forest landscapes.

Solutions exist to produce charcoal not from trees but from unused agricultural biomass (e.g. bush reed, peanut bark, bamboo, corn stalk - see Figure 8). Furthermore, any woody material can easily be used to make Bio Charcoal.

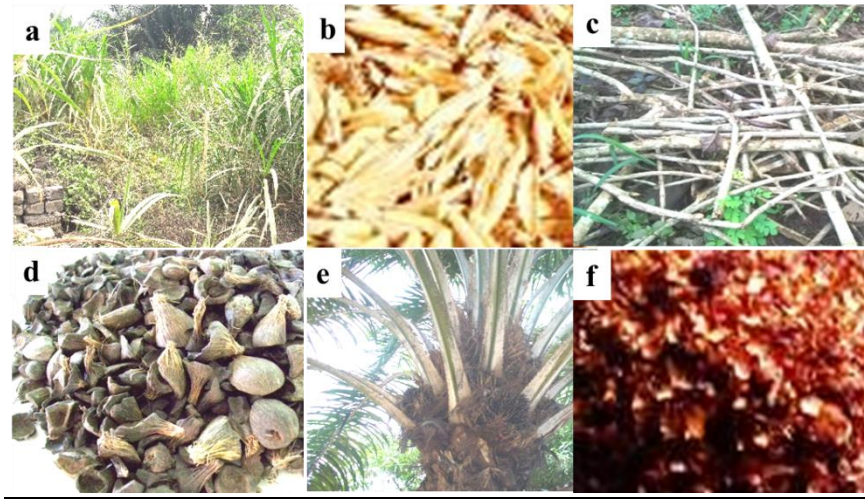

Figure 8: forest and agricultural waste and residues suitable for the production of Bio Charcoal. a: reed; b: rice husk; c: teak branch; d: palm oil kernel shells; e: palm fronds; f: coffee rind.
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Positive impacts for sustainable wood energy and forest landscape restoration

Given the quantity, availability and diversity of the existing biomass, charcoal produced on an industrial scale would be very competitive (given its calorific value) and very accessible to the population. This would persuade the population to switch to this new type of charcoal which would allow the natural flora to grow according to its normal cycle, thus allowing the restoration of the forest landscape and having a positive effect on the wood energy value chain.

Co-benefits:

Through the transition to Bio Charcoal, change in behaviour at the level of the base population could be achieved, which would produce environmental benefits (timely cutting of trees, regrowth of forests, clean environment, stable rainfall, etc.). Many socioeconomic advantages would emerge from these positive effects on the environment, namely: increase in the volumes of agricultural production, new trade due to the sale of Bio Charcoal, trade in biomass which before was burnt, and many others.

iv.Prospects

Reasons or main drivers and key enabling factors:

The reason for the implementation of this project focuses mainly on the following issues:

- Recycling of unused agricultural biomass;
- Fight against deforestation and environmental deterioration;
- Political will of those responsible for the environment; and
- Energy to put an end to the anarchic exploitation of wood fuels.

Main challenges encountered:

Technology is not a problem in such a project, it has existed for several years and continues to evolve in the right direction. The issue is about having enough funds to buy them. However, the main problems arise on several other levels, namely at the human level due to tenacious habits but also from the point of view of production with high production costs and a non-existent market for agricultural residues:

- At a first glance, it is difficult to make the Bio Charcoal sector profitable as transport and electricity costs are high in a country like Togo. (Solutions are possible thanks to the installation of solar panels or by reducing the volume of raw material transported by grinding it directly in the fields rather than in the factory.)
- Rarity of the rains leading to mediocre productions.
- The bio charcoal sector being non-existent, it is difficult to succeed in fixing a price on the raw material, namely a biomass thrown away for decades and which nobody suspects it of any market value.
- One of the project's problems, and probably no less important, consists in raising awareness among farmers, organizing collection points, setting a price for the raw material to bring them additional income. It is an ant's work given the high number of small producers and to achieve this work a possible axis is to address directly to the

farmers' groups which are already present in the villages, they are privileged intermediaries to achieve this.

- For decades, Togolese have known how to recognize quality charcoal at first glance. In addition, old habits die hard in this country of traditions. Therefore, acceptance of this new product, even if it is environmentally friendly, is difficult. One possible solution is the price, if a product of similar quality is offered at a lower price then everything suggests that it will be strongly accepted despite stubborn habits. However, in order for the product to be cheaper than traditional coal, it requires a subsidy until it becomes profitable.
- Now the biggest and most serious problem is the financing and the tax exemption of the company. (The factory is profitable only on an industrial level, but at this level the large machines are expensive when not bought on the chinese market.)

Potential for scaling-up and replicability:

Unlike many bio charcoal projects around the world, this approach is designed to be a scalable model which could be replicated in several places across the country and even in neighbouring countries.

The semi-industrial pilot project is a "test" factory, which must be thought of from the start as a profitable enterprise which will function without subsidies in the long run. Produced industrially, bio charcoal can be very profitable, but must have industry funding in its infancy.

The only condition for the dissemination and replication of this model is availability of funds. The project was a pilot project which studied all the possibilities of production in all regions of Togo, the biomass available in all regions and the positive impact that this could have on the environment, especially in areas near the Sahel where deforestation is very pronounced.

v.References and additional information

Contact name: Dzotsi Koffi Elom Towodjo

Affiliation/Organisation: Mouvement Togolais pour le Salut des Peuples (MTSP) - Non-profit organization - Kpalimé – Togo.

e. Support for the promotion of the *Casamance improved kiln* in Togo

i. Overview

Geographic location: *5 economic regions of Togo (West Africa)*

Type of example: *project*

Status: on going (*2019-2021 - 36 months)*

ii. Executive summary

The use of traditional kilns in Togo is highly inefficient, with the consequential negative impacts on forest resources, GHG emissions and livelihoods of rural populations. The casamance improved kiln is an type of modified earth kiln with greater efficiency than its traditional counterparts thanks to a central chimney.

This project, a part of the ProDRA program in Togo, aim to diffuse the Casamance improved kiln technology to overcome these problems. It is currently training 1 500 charcoal producers on the using of the Casamance improved kiln and is raising their awareness of reforestation with a wood-energy vocation with pilot reforestation. The mains objectives are to:

- Reduce deforestation and increase carbon sinks;
- Increase revenue for charcoal makers; and
- Reduce GHG emissions in the forestry sector.

iii. Sustainable wood energy and forest landscape restoration relationships

Positive impacts for sustainable wood energy:

The Casamance improved kiln increases the efficiency of carbonization up to more than 26 percent while the traditional kiln has a yield of only 10 percent; which means that the demand for wood energy can be satisfied with fewer resources. The project on the Casamance improved kiln makes it possible to sensitize charcoal producers on energy efficiency and to strengthen their capacity to use this technology.

Positive impacts for forest landscape restoration:

If the Casamance improved kiln became widespread in Togo, this would make it possible to save 2.2 million tonnes of wood per year, which would constitute increased carbon sinks and retain the other benefits of the forest (Fontodji, 2015).

Co-benefits:

The widespread of the Casamance improved kiln in Togo would make it possible to avoid 800 000 tonnes of CO_2 per year (Fontodji, 2015). This is a real mitigation tool that is directly linked to the NDC and REDD+ in Togo.

From an economic point of view, the Casamance improved kiln generates added value for the charcoal producers. With the traditional charcoal kiln, the charcoal producing activity is a huge loss but the charcoal makers do not realize it because they often do not have an operating account and do not take into account the cost of wood and labour. An example comes from the community forest of Alibi 1 (put under management in 2018 with the support of GIZ) in the Central region of Togo; if the Casamance kiln is used for the exploitation of wood energy in the first annual cutting of the forest, the net operating profit is 1 770 850 CFA francs versus – 592 250 CFA francs for the traditional charcoal kiln (Table 3). Given the huge improvement in profits from net negative to net positive balance, the Casamance improved kiln could be a leverage for rural development.

Table 3 comparison of the net benefits from the exploitation of wood energy using traditional and Casamance kilns in the community forest of Alibi 1

	Traditional	***Casamance improved kiln***
Total revenues (F CFA)	*2 175 000*	*4 945 000*
Total costs (F CFA)	*2 767 250*	*3 174 150*
***Net profits** (F CFA)*	***- 592 250***	***1 770 850***

iv.Prospects

Reasons or main drivers and key enabling factors:

Wood energy represented 75 percent of the national energy balance in 2018 and constitutes the main source of domestic energy for more than 90 percent of Togolese households. The techniques of carbonization of wood energy are very inefficient with yields on the order of 10 percent. The current demand for woody biomass for energy in the country is 2.5 times higher than the actual sustainable offer and this is a source of huge losses of forest resources (MERF Togo, 2017).

In recent years, the Togolese government has become aware of the importance of wood energy and its impact on forest resources and the climate. This led to the design and implementation of the ProDRA program with the support of GIZ. Component 3 of ProDRA concerned the modernization of the wood-energy sector. Between 2013 and 2016, the implementation of

ProDRA component 3 made it possible to carry out pilot reforestation with a wood-energy vocation, and to demonstrate the effectiveness of the Casamance improved kiln to fight against deforestation. Since the results of ProDRA component 3 have been very satisfactory, the AMCC+/PALCC project funded by the European Union has integrated the scaling up of ProDRA component 3 achievements. This is why, at present, a component of the AMCC+ project is devoted to the promotion of the Casamance improved kiln in the 5 regions of Togo. This project is currently training 1 500 charcoal producers on the using of the Casamance improved kiln and is raising their awareness of reforestation with a wood-energy vocation with pilot reforestation.

Main challenges encountered:

The main difficulty is the insufficient funding to extend the use of the Casamance improved kiln to the majority of charcoal producers and facilitate their access to the equipment of the Casamance improved kiln.

Another difficulty is that the charcoal producers show the will to carry out reforestation with a wood-energy vocation, but they do not have capacity to carry out the reforestation techniques.

Potential for scaling-up and replicability:

The Casamance improved kiln is economically very viable. As seen above in Table 3, the improved technology makes the charcoal production activity profitable.

The Casamance improved kiln is very easily managed by the charcoal producers and easy to replicate. Charcoal producers trained on this technology by different projects in Togo easily replicate it after the training. The Togolese government's perspective is to scale-up this technology throughout the country as part of the AMCC+ project.

v.References and additional information

Contact name: Dr. Jérémie Kokou FONTODJI

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Publications:

- Fontodji K.J., Tagba M.S., Akponikpe P.B.I., Adjonou K., Akossou A.Y.J., Akouehou G., Kokutse A.D., Nuto Y. et Kokou K., 2013. Diagnostic analysis of the techniques of carbonization in Togo (West Africa). *Scientific Journal of Environmental Sciences* 2(6): 106-117.

- Fontodji K.J., 2015. Déterminants de la production - consommation du charbon de bois au Togo et vulnérabilité aux changements climatiques. Thèse de Doctorat, UL, Togo, 121 p.

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