



Final Report

**Assessment of Household Energy Options
in RLLP Intervention Areas**

World Bank/ Ministry of Agriculture and Natural Resources

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Acronyms

AEDPD - Alternative Energy Development and Promotion Directorate

ARRA - Agency for Refugees and Returnees Affair

CCS – Clean Cookstove

CRGE – Climate Resilient Green Economy

CSA – Central Statistical Agency

DALY – Disability Adjusted Life Year

DBE – Development Bank of Ethiopia

EE – Energy Efficiency

EEA – Ethiopian Energy Authority

EnDev – Energizing Development

ETB – Ethiopian Birr

FAO – Food and Agriculture Organization of the United Nations

FSS – Fuel Saving Stove

GHG – Greenhouse Gas

GTP – Growth and Transformation Plan

HAP – Household Air Pollution

Hh – Household

IAP – Indoor Air Pollution

ICS – Improved Cookstove

INBAR - International Network for Bamboo and Rattan

Kg – Killo Gram

LA – Lighting Africa

LED – Light Emitting Diod

masl – meters above sea level

MEFCC - Ministry of Environment, Forest and Climate Change

MFI – Micro Finance Institution

MoANR – Ministry of Agriculture and Natural Resources

MoWIE – Ministry of Water, Irrigation and Electricity

NBE-National Bank of Ethiopia

NBP – National Biogas Program

NDC – Nationally Determined Contribution

NGO – Non-Governmental Organization

NICSP – National Improved Cookstoves Program

PAYGO – Pay As You GO

RBF – Result Based Financing

RE – Renewable Energy

REDD+ - Reducing Emission from forest Degradation and Deforestation

REES - Rural Electrification Executive Secretariat

REF – Rural Electrification Fund

RLLP – Resilient Livelihood and Landscape Program

SACCO – Saving and Credit Cooperative

SHG – Self Help Group

SLMP – Sustainable Land Management Program

T – Tone

TJ – Tera Jole (10^{12} Jole)

UNHCR - The United Nations High Commissioner for Refugees

USD – US Dollar

WB – The World Bank

WHO – World Health Organization

WUA – Watershed Users Association

1 Executive Summary

The Ethiopian economy and livelihoods depend to a large degree on agriculture which is responsible for 40% of national income and for more than three-quarter of employment (NBE 2015). Natural resource degradation has direct impact on the economy and the livelihoods of more than fourteen million Ethiopian households.

Traditional energy sources such as woody biomass and agricultural residue are the main sources of energy where they contribute 92% of total energy consumed in the country; hydropower is the main source of electricity meeting more than 95% of electricity generated and sold in Ethiopia (NBE 2015). In rural areas land resources are even more important sources of energy because virtually all cooking, and in poor households lighting as well, is provided with biomass fuels. Landscape degradation reduces access to biomass fuels and hydro-energy. Degradation of natural resources contributes to the deterioration and to reducing the life of physical infrastructure including hydropower dams.

Forest degradation has reduced access to biomass fuels. This has had adverse impacts in availability of biomass fuels as well as in the effort needed to find, collect and transport it for household use. As women and girls are the ones tasked for collection of cooking fuels, this has increased their burden. According to a CSA survey conducted in 2013, 43% of households in rural areas spend more than 2 hours a day for collecting fuelwood; in areas with degraded natural resources, the time needed is obviously greater than this average (CSA 2014).

Current uses of energy in rural areas expose households to harmful indoor air pollution which is responsible for 72,000 deaths annually in Ethiopia (WHO 2004). Women, who are responsible for cooking for the home are exposed to high levels of pollution which result in respiratory and eye diseases that reduce their lifespan, reduce their capacity to function socially and economically.

The purpose of this study is to identify and select appropriate Renewable Energy (RE) and Energy Efficiency (EE) options in the RLLP context and design strategies for their rapid scale up. The specific objectives of the study include assessment of opportunities and challenges for income generation through RE and EE products and services, and development of strategies for rapid scale up of selected RE and EE options to improve household welfare by addressing environmental degradation and promotion of suitable business models for effective delivery of RE and EE products and services.

Different sector policies such as energy, natural resource, and environment are all supportive of the objectives that the RLLP energy component envisages to achieve. Access to affordable, safe, efficient, clean and reliable energy services are stated in the energy policy as necessary conditions to support accelerated and sustainable social and economic development and transformation of the country. The goal of the Environment Policy is to enhance the health and quality of life of citizens and to promote sustainable social and economic development through the sound management and use of natural, human made and cultural resources and the environment. The forest development, conservation and utilization proclamation is instituted because of the alarming rate of deforestation and forest degradation in the country and the consequent impacts on soil, water, biodiversity, and agricultural productivity. The proclamation aims to address these impacts while at the same time meeting the need for forest products by society. Several government and non-government institutions and the private sector are working together in order to achieve the objectives stated in these policies.

Energy needs in rural areas are to meet their basic needs which are mainly focused on cooking, lighting, and powering communication and entertainment devices. Rural industries and services as supplementary income generation activities are not very well developed. Hence, there is limited need for energy for industries. Potable water supply is handled at communal level and is usually manually powered. Energy

sources and technologies that are currently used to meet the basic demands of the rural households are generally very rudimentary in nature, inefficient, and costly.

Assessment of energy needs of communities in the RLLP intervention watersheds was made through reviewing secondary resources and actually visiting sample watersheds. During this assessment period four major watershed areas were visited in Amhara and Benishangul Gumuz regional states. Twelve focus groups discussions, and over twenty interviews and observations were made with major stakeholders from government and non-government organizations operating in different sectors, women groups, fuel efficient cookstove producers, alternative fuel producers, potential biomass resources for energy use, technology developers and promoters.

In both regions visited, most households use traditional open fire for cooking and baking, and dry cell powered hand torches for lighting. Few households adopted fuel efficient cookstoves, *Mirt* and *Gonzie* Stoves, which are primarily used for baking. No fuel efficient stove that serves cooking (non-baking) purpose was observed during the assessment period. The most common rural business observed in the visited areas is *areki* (home brewed alcoholic beverage) production and sales.

Energy sources for the rural households in the villages visited is primary collected firewood, agri-residue, and dung. Household prefer to use firewood for cooking while agri-residues and dung are mostly used for baking. Agri-residue is a seasonal fuel which households depend for four to five months in a year. Rural households also use charcoal for coffee or tea boiling. It is sometimes purchased but mostly use embers left from firewood burning.

Dry cells are widely used for hand torch light and for powering radio. From the Focus Group Discussions, it was learned that rural households, on average, spend up to USD 0.75 (ETB 20) per month to purchase dry cells. Mobile phones are mostly owned by men in almost all households interviewed. They pay about USD 0.20 (ETB 5) per charge which amounts to a minimum of USD 1.00 (ETB 30) per month. Use of kerosene is non-existent or very limited in all visited intervention areas in both Amhara and Benishangul regions.

There are some initiatives on development of alternative fuels from local biomass resources. These includes harvesting and conversion of bamboo, wild grass and acacia decurrens for charcoal production for household use. Conversion and end use technologies that make use of these resources are already developed and proven for their performances.

RE and EE products have been promoted in RLLP intervention areas by SLM and energy sector program for the purpose of natural resource conservation, and others to address public health issues or create income generating opportunities. However, despite these interventions, the adoption rate of RE/EE products by communities in the intervention areas is limited because of several challenges and barriers.

According to improved cookstove producers in the areas visited and observations made during the field visits the main challenges that deter wide scale adoption of RE/EE technologies in the RLLP intervention areas are lack of commercialization network for delivery of the products, low level of awareness on the benefits of clean and efficient energy technologies, lack of sufficient financing accessible and affordable to remote consumers, and absence of appropriate stoves for cooking (non-baking) purposes. Well established commercialized network for supply of RE/EE product does not only make the products accessible, but also provides aftersales service and ensure transfer of product warrantee to consumers which would increase consumers' confidence and adoption rate.

Recommended action that are expected to address these challenges are 1) Establish and/or strengthen existing RE/EE enterprises to manufacture, promote and sale fuel saving cookstove, 2) Introduce and

promote alternative cooking fuels production and use, 3) Promotion of fuel saving cookstoves and alternative cooking fuels, and 4) Provide access to consumer financing and encourage saving through formal and traditional saving groups for the purchase of RE/EE products. These activities will be implemented in collaboration with the Water and Energy Bureaus and Offices of the Region, local government administrations, and energy enterprises.

With successful implementation of the above mentioned barrier removal actions the private sector will be able to distribute over 550 thousand fuel efficient cookstoves for both baking and cooking purposes in about 140 thousand households over two year in program period. The market uptake will be slower without consumer financing and the expected number of cookstoves that will be distributed will be reduce to about 275 thousand adopted by about 100 thousand households. The time required to distribute these number of cookstoves will also be increased to a minimum of 4 years.

2 Overview of the Resilient Landscape and Livelihood Program

The Ethiopian economy and livelihoods depend to a large degree on agriculture which is responsible for 40% of national income and for over 70% of employment¹. Natural resource degradation has direct impact on the economy and the livelihoods of about fourteen million Ethiopian households. Climate and natural resources also have significant impacts in other sectors of the economy through direct linkages to industry and services based on agricultural inputs as well as indirectly, for example, through availability of energy for productive purposes (because Ethiopia's power system is based on hydropower, climate and natural resource related issues impact the availability and reliability of electricity in the country).

Climate change is amplifying the impacts of local resource degradation: reduced and uneven rainfall has impacts on productivity of agriculture, forestry, hydro-energy; high intensity rainfall manifested in floods impacts agriculture, increases soil erosion and damages infrastructure. Sustainable land management must therefore be implemented within a climate resilient context to secure livelihoods, develop the economy, and ensure reliable energy supply.

The Ministry of Agricultural and Natural Resources (MoANR) has been implementing sustainable land management projects, with support from partners, for the past ten years. The current Resilient Landscapes and Livelihoods Project (RLLP) is a continuation of these earlier projects (called SLMP-1 and SLMP-2) which builds and expands upon them. The SLMP-2 program has built resources on 1.3 million hectares of degraded smallholder and communal land through integrated land management interventions which include²:

- (a) natural resource management through water and soil conservation, agro-forestry and forest management, controlled grazing, small-scale irrigation, and climate smart agriculture;
- (b) ascertaining land rights by issuing certificates for legal landholding;
- (c) livelihood support activities including by supporting adoption of clean and efficient biomass cookstoves that reduce the burden of fuel collection for women and reduce their exposure to indoor air pollution

The RLLP contributes directly to key national strategies including the CRGE strategy and the resilience strategies for agriculture, forest, water and energy; Ethiopia's green development commitments including the Nationally Determined Contribution (NDC) to reduce GHG emissions; and the National Forest Sector Strategy and the REDD+ strategy. The RLLP is also aligned with sector policies including those for environment, forest management, water and energy.

Land resources are the main source of energy supply in Ethiopia: woody biomass and agricultural residue are the main sources of energy where they contribute 92% of total energy consumed in the country; hydropower is the main source of electricity meeting more than 95% of electricity generated and sold in Ethiopia (NBE, 2015). In rural areas land resources are even more important sources of energy because virtually all cooking, and in poor households lighting as well, is provided with biomass fuels. Landscape degradation reduces access to biomass fuels and hydro-energy. Degradation of natural resources contributes to the deterioration and to reducing the life of physical infrastructure including hydropower dams.

Forest degradation has reduced access to biomass fuels. This has had adverse impacts in availability of biomass fuels as well as in the effort needed to find, collect and transport it for household use. As women and girls are the ones tasked for collection of cooking fuels, this has increased their burden. According to a

¹ National Bank of Ethiopia (NBE) (2015). Annual Report 2014/14, Addis Ababa

² World Bank (July 2017). Ethiopia - Mission on Resilient Landscapes and Livelihoods Project (P163383) Preparation July 10th to 21st, 2017, AIDE MEMOIRE

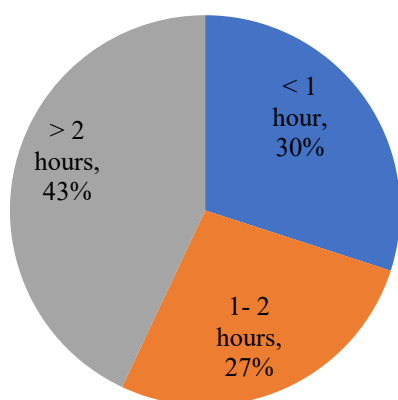
CSA survey in 2013, 43% of households in rural areas spend more than 2 hours a day for collecting fuelwood; in areas with degraded natural resources, the time needed is obviously greater than this average³. Households in degraded landscapes are particularly poor and such households usually spend a larger proportion of their income (monetary and non-monetary) on household energy (for example, household spend longer time daily for collection of fuel – 70% more time than average, probably because they use more biomass energy including for lighting but also they may collect fuel to sell to others).

Non-sustainable use biomass for cooking is one of the main contributors for forest degradation and one of the first actions for reducing greenhouse gases from Ethiopia is the mass dissemination of energy efficient cookstoves.

Current uses of energy in rural areas expose households to harmful indoor air pollution which is responsible for 72,000 deaths in Ethiopia⁴. Women, who are responsible for cooking for the home are exposed to high levels of pollution which result in respiratory and eye diseases that reduce their lifespan, reduce their capacity to function socially and economically.

Figure 2.1 Fuelwood collection times and responsibilities in rural areas, 2013 (CSA, 2014)

a) Fuelwood collection time



b) Fuel collection responsibility

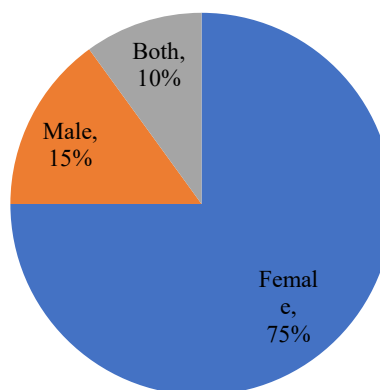


Table 2.1 Respiratory disease burden – Ethiopia and Countries in East Africa, 2009⁵

	Water, Sanitation & Hygiene	Indoor Air Pollution		Outdoor Air Pollution	
	Diarrhea DALYs/1000 capita per year	Deaths/year	DALYs/1000 capita per year	Deaths/year	DALYs/1000 capita per year
Ethiopia	49	72 400	31	2 500	0.5
Kenya	24	14 300	13	600	0.2

³ Central Statistical Agency (CSA) (2014). Ethiopia time use survey 2013, Addis Ababa.

⁴ World Health Organization (WHO) (2004). Estimated deaths & DALYs attributable to selected environmental risk factors, by WHO Member State, 2004

⁵ César, Emelie and Anders Ekblom, 2013. Ethiopia Environmental and Climate Change policy brief

Uganda	35	19 700	23	100	0.1
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DALY= Disability-adjusted life year

The RLLP will scale up activities in the energy sector that have been initiated in the SLMP-2. These include promotion of clean and energy efficient cookstoves and biogas to reduce fuelwood consumption and reduce women's burden for fuel collection; solar technologies to improve home lighting and to provide basic electrical services such as mobile charging. These energy initiatives are so designed to also support income generating activities – therefore, women are organized into self-help groups to produce and distribute improved cookstoves and solar lamps.

3 Objective of the Assessment of Household Energy Options in RLLP Intervention Areas

The overall objective of the assessment is identification and selection of appropriate RE and EE options in the RLLP context and design strategies for their rapid scale up. The three specific objectives are to

- (a) identify and evaluate RE and EE options suitable in the RLLP context,
- (b) assess opportunities and challenges for income generation through RE and EE products and services, and
- (c) develop strategies for rapid scale up of selected RE and EE options to improve household welfare, address environment degradation, promote suitable business models

The scope of the assessment includes:

1. Review of the status of RE and EE technologies in RLLP intervention areas and assess the effectiveness and relevance in terms of adoption of the various business models.
2. Review the existing institutional, policy and regulatory framework to recommend institutional reforms to increase coordination, accountability, and delivery effectiveness.
3. Review of women associations that could engage in last mile retail for existing private sector enterprises in the RE and EE sector, their financial and technical needs.
4. Review roles, responsibilities and capacity needs of stakeholders for effective coordination and recommend approaches and innovative partnerships.
5. Recommend RE and EE delivery mechanisms to (a) increase affordability, (b) incentivize sales in poor rural villages, and (c) ensure sustainability of supply.
6. Recommend best-fit options for RE and EE technologies to increase access.

4 Approaches and Methods to the study

Approach:

According to the Terms of Reference of this assignment, the approach to the study requires:

1. Review of documents on the various benefits of renewable energy and energy efficiency technologies
2. Review of background materials and findings about works undertaken in previous SLM programs,
3. Conduct interviews with SLM project implementers, regional representatives and relevant stakeholders
4. Conduct field visits to obtain firsthand information through interviews and focus group discussions with:

- a. project implementers - Interviews
- b. Watershed Users Association (WUA) - Interviews
- c. self-help/ community group who are engaged in cookstove production and dissemination- FGD
- d. ICS and off-grid solar product user and non-user households - FGD

Methods

Selection of Regions and watersheds for the field assessment:

Because of time constraint the assessment of this project could not cover all RLLP regions. Purposive sampling method, based on characteristics of the population of the Regions and the objectives of the study, was used to select the regions to conduct qualitative assessment. Amhara and Benishangul Gumuz regions were selected for the field assessment. The rationale for selecting these two regions are:

- Energy sector intervention in Amhara, Tigray, Oromia and SNNP have more similarities as most RE/EE interventions usually target these four regions with similar approaches. Hence, visiting Amhara region could also indicate situations in the other three regions.
- The reason for selecting Benishangul Gumuz was because of the additional energy related activities that were initiated under SLMP and others regarding on new fuels such as bamboo and elephant grass for production of charcoal. Additionally, Benshangul Gumuz region also has some similarity to the other developing regions such as Gambella, Afar and Somali Regions.
- The type of food cooked by the majority of the households in each of these regions has more similarity to that of the other regions that they represent.
- Specific watersheds were selected in agreement with the regional bureaus out of those where cookstove interventions have been practiced

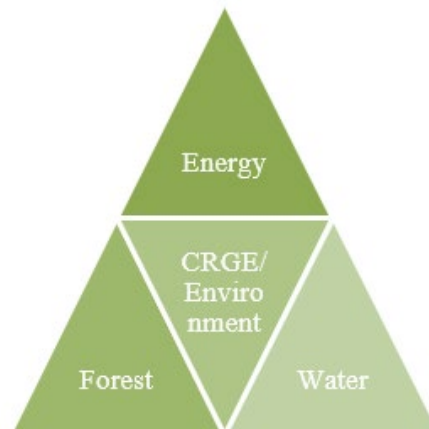
It should, however, be noted that the areas selected and the interviews conducted in this assessment are not representative of all the RLLP intervention areas but are indicative of the socioeconomic conditions, RE/EE technologies that are being used by the households, the cooking practices implemented by the households and the distribution models practiced for the RE/EE technologies.

A total number of eight micro watersheds in the two regions were visited. In Benishangul Gumuz, four micro-watersheds namely, Abay Meda and Shosha, in Sonka major watershed (in Bambassi Woreda), and Lower Akendo and Amba micro-watersheds in Agulash Tiliku Sherkole major watershed (in Homosha Woreda) were visited. In Amhara Region four micro-watersheds were visited. These are Limat and Shengo micro-watersheds in Yezat major watershed (in Yilmana Densa Woreda), and Chentale and Chiketi micro watersheds in Yesira major watershed (in Guagussa Woreda). Twelve Focus Group Discussion were conducted with households and cookstove producers groups in the areas visited. Additionally, over twenty experts were interviewed from different regional and federal level institutions from Amhara, Benishangul, Oromia, and Gambella regions. Summaries of interviews and focus group discussions are in Annex 5.

The assessment helped to gather information on current practices and models for delivery of household energy technologies in the SLMP/ RLLP intervention areas. During the field visit, organizations and businesses that operate in the production and distribution of energy technologies were interviewed to assess existing delivery models for household energy technologies and the possibility of creating synergy with the implementation of the energy subcomponent in RLLP.

5 Relevant Sector Policies and Strategies

An outline of national policies that have direct bearing on resilient landscapes and livelihoods and more specifically policies that impact on energy services is provided in the succeeding sections. Four key policies are outlined: energy, environment, forest and water.



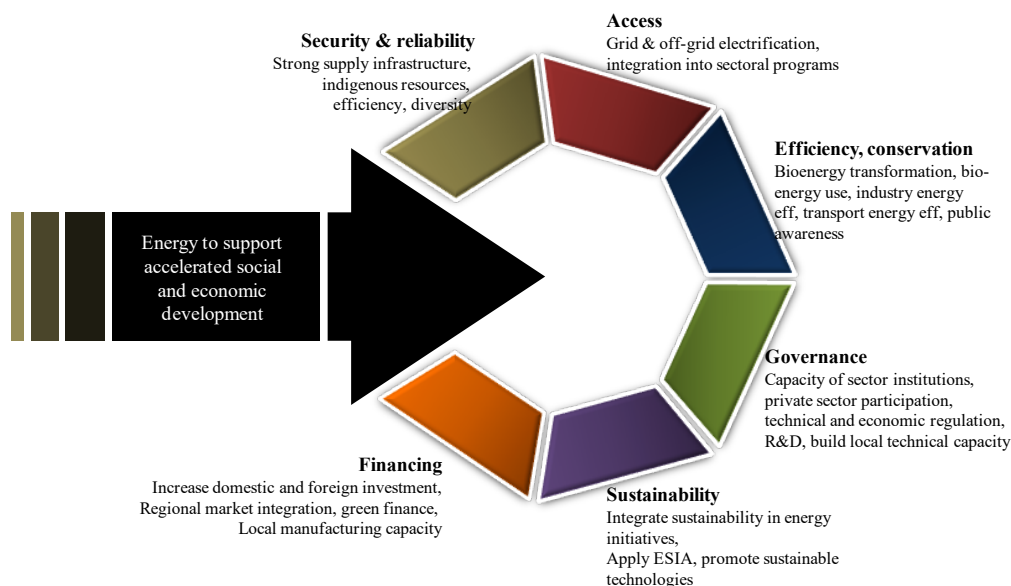
Energy policy (Draft, 2013)

A new energy policy was issued in 2013 to better align the energy sector agenda to the current domestic development strategies as well as the international context related to the competitiveness of renewables, and concern for climate change. The new energy policy addresses many of the oversights regarding energy supply and demand including the viability of wind and solar energy for on-grid and off-grid electrification, the demand for electricity in transport and agriculture, building domestic technical capacity for manufacturing. The new policy also addresses the regional and international context in such areas as regional energy integration, and international cooperation in climate change.

The main issues in the energy sector are identified as (a) severe limitations of energy access, (b) non-sustainable resource extraction, particularly biomass resources, (c) inefficient production, transformation, transport and use of energy resources, (d) low institutional capability including in management, regulations, investment and technical know-how, (e) financing including limited internal resources to finance energy programs, limited engagement of the private sector, and high dependence of energy imports, and (f) vulnerability of the energy systems to climate change particularly for hydropower and bioenergy (the main sources of energy in Ethiopia).

The overall energy policy goal is stated as ensuring the availability, accessibility, affordability, safety and reliability of energy services to support accelerated and sustainable social and economic development and transformation of the country. This overall goal is implemented under six objectives: security and reliability, access, efficiency and conservation, governance, sustainability, and financing. The main policy instruments identified for each of these objectives are shown in the following figure.

Figure 4.1 Objectives of the national energy policy of Ethiopia (2013, draft)



The policy recognized the main issues in the sector including non-sustainable extraction of biomass resources and consequent land degradation, the heavy burden on women and girls related to fuel collection, and exposure of women to indoor air pollutants. It proposed strategies to arrest biomass related environment and social impacts (improved land use, forestry, and agricultural management) including IAP. Key interventions proposed are sustainable forest management and diversifying bioenergy options for cooking and improving production and end use efficiency.

- (a) Sustainable forest management
 - Integrated management of forest resources
 - Private and community plantations, bioenergy production in homesteads, improved management of public plantations (planting in degraded areas, integration of agriculture with forestry)
- (b) Diversify bioenergy production and enhance its production and end-use efficiency
 - Promote efficient end-use devices mainly for cooking in households
 - Diversify household energy options (biogas, biofuels, ethanol, electricity, solar, agro-industrial waste)

Environment policy, 1997

The goal of the Environment Policy was stated as: *to enhance the health and quality of life of Ethiopians and to promote sustainable social and economic development through the sound management and use of natural, human made and cultural resources and the environment.* The specific policy objectives include

- a) Preserve essential ecological processes, biological diversity
- b) Ensure renewable resources are used sustainably
- c) Identify and develop natural resources that are underutilized through new technologies
- d) Prevent pollution of land, air and water
- e) Improve environment of human settlements

f) Ensure participation in environmental management

Policies related to sustainable land management include (a) integrated development of forest resources with land, water, energy, agriculture, ecosystem and genetic resources, (b) support natural regeneration and afforestation of degraded areas through controlled harvest of resources, and (c) management of upstream forests for regulation of water quality and quantity. The policy also pointed to the need for an inter-sectoral process of planning and implementation which brings energy into integrated resource development programs. Specific biomass energy related actions proposed include:

- Maximize the standing biomass in the country through a combination of reforestation, agro-forestry, the rehabilitation of degraded areas, a general revegetation of the land and the control of free range grazing in the highlands
- To focus extension programmes on farm and homestead tree planting to ensure that each homestead grows enough trees to satisfy its wood requirements
- To locate, develop, adopt or adapt energy sources and technologies to replace biomass fuels; substitute construction and fuel wood, promote RE

Forest development, conservation and utilization proclamation, 2007

The forest development, conservation and utilization proclamation is instituted because of the alarming rate of deforestation and forest degradation in the country and the consequent impacts on soil, water, biodiversity, and agricultural productivity. The proclamation aims to address these impacts while at the same time meeting the need for forest products by society. Sustainability of forests will be ensured through

- ensuring the participation of, and benefit sharing by the concerned communities
- harmonizing forest policies and programs with those of other economic sectors, particularly with agriculture and rural development
- encouraging the development of forests and the conservation of remaining limited forest resources
- ensuring rights to forest products for private and communal forest developers
- development and dissemination of forest technology packages that enable to properly use indigenous or foreign knowledge, practices and technologies on the development, conservation and utilization of forests

Water Sector Policy, 2001

The goal of Water Resources Policy is to enhance and promote the efficient, equitable and optimum utilization of the available Water Resources for socioeconomic development on sustainable basis. The objectives are to

- a) develop water resources for economic and social benefits of the people, on equitable and sustainable basis; conserve, protect and enhance water resources and the overall aquatic environment on sustainable basis.
- b) allocate and apportion water, based on comprehensive and integrated plans and optimum allocation principles that incorporate efficiency of use, equity of access, and sustainability of the resource.
- c) combat and regulate floods through sustainable mitigation, prevention, rehabilitation and other practical measures.
- d) manage and combat drought as well as other associated slow on-set disasters through efficient allocation, redistribution, transfer, storage and efficient use of water resources.

Watershed management is an important element of the water policy. The key watershed related policies are

- a) promote practices of efficient and appropriate watershed management to maximize water yields and quality.
- b) ensure that watershed management practices constitute an integral part of the overall water resources management
- c) establish procedures and mechanisms for all actions that are detrimental to water resources including waste discharges, source development, catchments management etc

Health Sector Policy, 1993

The health policy stipulates that the health services should include preventive, promotive, and curative components. The Ethiopian Health Policy prioritizes information, education and communication about health to enhance health awareness and propagate the important concepts and practices of self-responsibility in health. Promotion of occupational health and safety, and development of environmental health are the areas that the health policy gives emphasis to. Moreover, family health, particularly the health care for women and children is given special attention in the Ethiopian Health Policy⁶.

The areas that the Ethiopian Health Policy gives priority and special attention to are directly related to the traditional practices of cooking in Ethiopia where almost all rural and low income urban households entirely depend on use of solid biomass fuels and traditional cooking devises. Use solid biomass fuels for cooking using traditional devises causes not only negative environmental impacts because of unsustainable extraction of biomass but also serious health consequences due to high level of Household Air Pollution (HAP). The harmful emissions from inefficient combustion of biomass during cooking has become a major public health issue. In Ethiopia, HAP from solid fuels burning for cooking is responsible for over 46,000 premature deaths in 2012⁷.

Relevant actions

Rural energy actions in Ethiopia focus mainly on providing energy services for rural households, through off-grid electrification using solar technologies and household cooking technologies including efficient biomass stoves and domestic biogas plants. Other rural energy interventions address energy needs at community level such as in rural health facilities, schools and water supply schemes. These initiatives may be grouped into two areas: (a) off-grid electrification of households and social institutions mainly through solar energy, (b) efficient and clean cooking stoves promotion.

Both government and non-government institutions are promoting these energy initiatives, the main ones are outlined as follows:

⁶ Ethiopian Federal Ministry of Health, Health Policy, 1993.

⁷ World Health Organization (2014), The Global Health Observatory, 2012

<http://apps.who.int/gho/data/view.main.BODHOUSEHOLDIAIRDTHSv> (Accessed date: 14/12/2018)

(a) Efficient and clean cooking stove promotion

National Improved Cookstoves Program (NICSP) is a national program coordinated by the NICS program unit under the MEFCC. Both government (federal and regional) and non-government organizations work in partnership promoting clean and energy efficient biomass cookstoves.

National Biogas Program of Ethiopia (NBPE) promotes the domestic biogas technology in rural areas. The program is coordinated by the National Biogas Coordination office and in the regions by Regional Biogas Coordination offices. SNV provides technical support to the program.

Gaia Association, a local NGO, promotes ethanol and other cooking technologies such as fuel briquettes from biomass waste for cooking.

(b) Off-grid rural electrification

The Rural Electrification Executive Secretariat (REES) under MOWIE is the federal agency responsible for off-grid rural electrification. It is promoting solar electricity for both households and for social institutions. It has distributed about 40,000 solar home systems and helped install solar systems in hundreds of social institutions including schools and health posts.

(c) DBE – Market Development for Renewable Energy & Energy Efficient Product Credit Line

There is Market Development for Renewable Energy & Energy Efficient Product credit line under DBE financed by WB. The credit line has supply side as well as consumer side financing. Private sector enterprises can get access to finance to import different type of RE technologies. As of December 2017, more than 846,000 lighting Africa approved products were imported through the credit line. Since 2018, around 404,649 solar lanterns and around 29,496 solar home systems application have been under process by DBE. From consumer loan side, 14 MFIs were identified and more than Birr 383 million was approved for 12 MFIs. The MFIs already disbursed more than ETB 180 million to 60,531 rural households. DBE provides loans to MFIs at 6% interest rate while MFIs charge 20% and above interest rates to endusers⁸.

The Lighting Africa (LA) program of the IFC/World Bank supports off-grid electrification through solar technologies. It promotes quality management for solar system components; conducts and disseminates off-grid market research; and provides financing to support solar system import and distribution.

Energizing Development (EnDEV) is a GIZ implemented program that promotes off-grid electrification through solar and micro hydropower systems but also clean and energy efficient cooking for households and commercial institutions. The new EnDEV project will focus on micro-grids powered by solar and micro hydropower plants.

UK compact is a new initiative by the UK government to support off-grid electrification. In Ethiopia this project has started with review of the policy/regulatory issues as well as market intelligence related to off-grid electrification.

⁸ Development Bank of Ethiopia (DBE), **Elias Asnake, Energy Coordination Team Leader**, Special Fund Administration and Rural Program Coordination Directorate (SFARPCD); World Bank, Eyob Aguma Ayana, March 2018

The GTP-2 plan for clean and energy efficient cooking and for off-grid electrification are shown in the following table. The plan envisages distribution of 11.5 million clean and efficient cookstoves by 2020. The off-grid electrification plan is expected to provide access to more than 4 million households by 2020. The RLLP program will contribute directly to the GTP-2 plans for both clean cooking and off-grid electrification.

Table 4.1 GTP-2 plan for the off-grid energy sub-sector (2015-2020)

No	Type, systems	Target 2020 (units)
1	Clean and energy efficient cooking	
1.1	Improved fuel saving cook stoves	11.45 million
1.2	Biodiesel stoves, biodiesel processing technologies	20,000
1.3	Biogas	31,400
1.4	Solar cookers	3,600
2	Off-grid electrification	
2.1	Solar lanterns	3,600,000
2.2	Solar home systems	400,000
2.3	Institutional solar systems	3,600
2.4	Solar mini grids	250
2.5	Micro hydropower systems	105
2.6	Solar water pumps	50

6 Institutions and relevant stakeholders

There are several government, bilateral and non-government organization supporting household energy technologies in rural areas. Household energy technologies such as improved cookstoves, off-grid solar products and biogas technologies are supported by government programs. These programs brought several actors together to provide technical and finance supports to leverage the private sector to drive access to clean energy services.

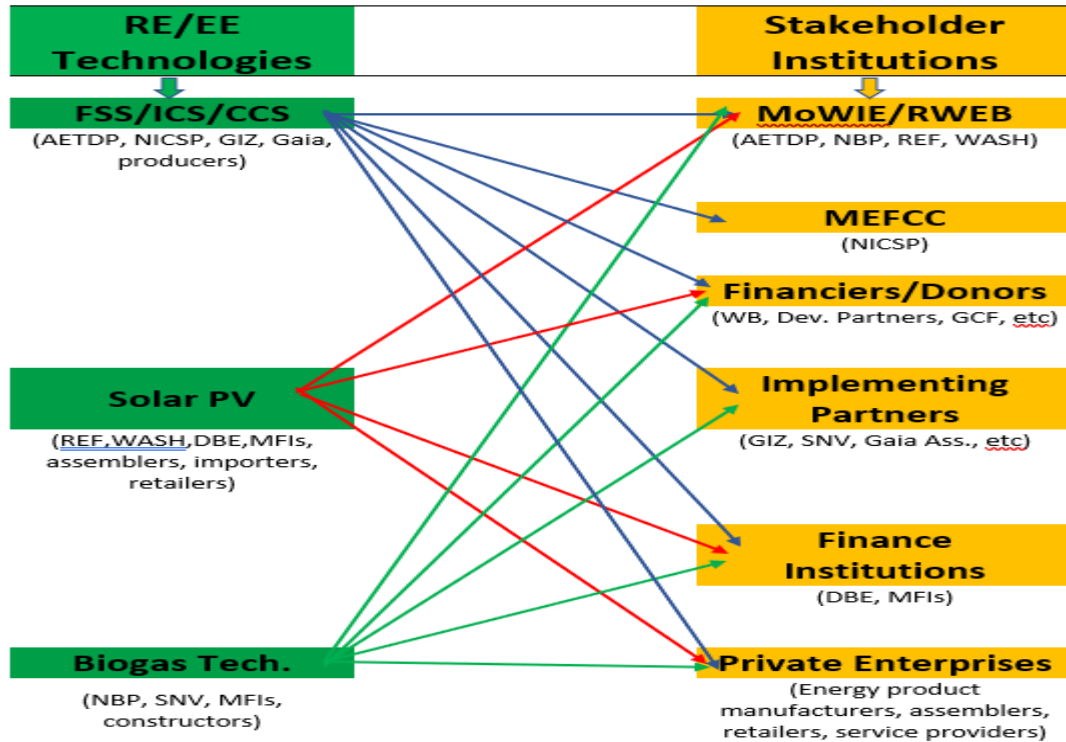
Ministry of Water, Irrigation and Electricity (MoWIE) is the mandated government organization to promote and regulate products and services that operate in improving energy access. MoWIE implements improved cookstove programs, biogas programs and off-grid electricity programs under the Alternative Energy Development and Promotion (AEDP) Directorate. The regulatory body responsible for product and service quality regulation under MoWIE is the Ethiopian Energy Authority (EEA). MoWIE closely works with Regional Water and Energy Bureaus or Agencies for the implementation of improved cookstove programs, off-grid solar product dissemination and National Biogas Program. AEDP under MoWIE works on cookstove design, development and testing.

The National Improved Cookstove Program (NICSP) is recently moved to the Ministry of Environment, Forest and Climate Change (MEFCC). NICSP even though it is not structurally aligned to Regional line organizations (i.e. Regional Bureaus of Water and Energy), that are primarily responsible for implementation of the program, it is working along MoWIE.

Other development partners that work in the household energy sector as their primary intervention area are GIZ Energizing Development (GIZ EnDev), SNV and Gaia Association. Other NGOs also work in the energy sector but more on temporary basis.

At Woreda level, agriculture and health extension services implement energy projects at grass root level with the objectives of natural resource conservation and health impacts that renewable energy technologies, energy efficient and clean energy technologies bring. These programs engaged finance institutions including the World Bank (WB), Development Bank of Ethiopia (DBE) and Micro Finance Institutions to leverage businesses and consumers in order to build a sustainable commercialization of these household energy technologies.

The schematic below indicates how each type of energy technology is linked to different stakeholders – promoters, financiers, businesses and consumers. It is important the RLLP program creates synergy with existing primarily household energy focused programs in order to avoid duplication of efforts and practice effective utilization of resources for successful implementation of the household energy component of the program.



FSS – Fuel Saving Stoves– Fuel consumption reduction is the primary purpose.

ICS – Improved Cookstoves – Improvement can be in any one or more properties of the stoves including fuel consumption reduction, smoke reduction, safety/stability structures or aesthetics.

CCS – Clean Cookstoves – is to refer to cookstoves that have no household air pollution.

Since RLLP implementation is primarily at grassroot level, it is also important to engage Watershed Users Associations (in the regions where they are operational) and link the program with Micro and Small Enterprise Development Activities at Woreda and Kebele levels who are primarily responsible for establishment of such groups, build their capacities and follow up their performances.

7 Rural household energy needs and energy technologies

Energy needs in rural areas are to meet their basic needs which are mainly focused on cooking, lighting, and powering communication and entertainment devices. Rural industries and services as supplementary income generation activities are not very well developed. Hence, there is limited need for energy for industries. Potable water supply is handled at communal level and is usually manually powered. Energy sources and technologies that are currently used to meet the basic demands of the rural households are generally very rudimentary in nature, inefficient, and costly.

7.1 Rural household energy needs

Field observations were made in two regions, Amhara and Benishangul, in four Woredas covering eight micro-watersheds. These micro-watersheds were identified for field visit by regional Agriculture and Natural Resource Bureaus⁹. Interviews and Focus Group Discussions were conducted with community groups, women groups, Watershed Users Associations, fuel saving cookstove producers.

Energy needs of households in the eight micro-watersheds assessed in Amhara and Benishangul regions have more similarity than diversity. In all areas visited, households food preparation requires cooking and baking. Much of the energy demand is for cooking and baking. The type of foods cooked are similar except that those households in Homosha Woreda in Benishangul Region have porridge in their diet. In all the places visited, households mostly use traditional cookstoves to cook and bake. Dry cell powered hand torches and pico LED lights are the most common sources of lighting in the areas visited.

The most widely practiced home-based rural industry observed during the field visit was *areke* production (distilled spirits or liquor) in Guagussa Woreda. Kosober, Addis Gidam and a few other towns along the Debre Markos-Bahir Dar highway are well known for supply of *areke*. Areke production and sales provides additional source of income to the households and is brewed by the women. The areke distillation system used by the households is very inefficient and consumes a lot of firewood per liter of alcohol produced. Traditional distillation methods consume about 2.7 kg of wood per liter of Areke produced¹⁰.

Source of potable water supply for the households in all places visited were community-based hand-dug wells or shallow wells. Water is extracted manually using hand pumps. Recent government strategy indicates phasing out of such systems by gradually replacing them with appropriate size solar pumps¹¹.

7.2 Energy sources and technologies that are currently used by the households

a) Energy Sources

i) Cooking Energy

Energy sources for the rural households in the villages visited is primary collected firewood, agri-residue, and dung. Household prefer to use firewood for cooking while agri-residues and dung are mostly used for baking. Agri-residue is a seasonal fuel which households depend for four to five months in a year. Rural households also use charcoal for coffee or tea boiling. It is sometimes purchased but mostly use embers left from firewood burning.

⁹ Four micro-watersheds from each of the two regions (Benishangul Gumuz and Amhara) were visited.

¹⁰ MoWI, AETDP, May 2014. Project Implementation Document for Energy Efficiency Improvement for Areke Distillation System in Bosona Woreda of North Showa Zone of Amhara Region.

¹¹ Interview with WASH Directorate in MoWIE

ii) *Sources of lighting and powering devises*

Dry cells are widely used for hand torch light and for powering radio. From the Focus Group Discussions, it was learned that rural households, on average, spend up to USD 0.75 (ETB 20) per month to purchase dry cells. Mobile phones are mostly owned by men in almost all households interviewed. They pay about USD 0.20 (ETB 5) per charge which amounts to a minimum of USD 1.00 (ETB 30) per month. Use of kerosene is non-existent or very limited in all visited intervention areas in both Amhara and Benishangul regions.

b) *Energy Technologies*

i) *Cooking and baking Technologies*

In all households visited cooking is done with traditional stoves which sometimes are made from clay by local potters or a three-stone Open fire. No fuel saving stove for cooking is available for the rural households to adopt. Fuel saving stoves such as “Tikikil” are not known by the rural households in the visited areas. Discussion with Regional and Woreda level energy and agriculture bureaus and offices revealed that the fact that the stove is made from metal cladded clay liner makes it too expensive for the rural households to afford. Current price of “Tikikil” stove from producers in Addis Ababa is over USD 10 (ETB 280). On the other hand, prices for the clay stoves that are produced by local potters rang from USD 0.40 to 0.75 (ETB 10 to ETB 20) depending on the size and type. With some training and tools provided to the potters, it seems possible to make local potters supply all clay cooking stoves for a price not exceeding USD 2.00 (ETB 55).

For baking, many households in all visited areas use traditional stove, open fire. In Homosha Woreda in Benishangul, Gonzie is the only fuel saving stove that is known and distributed to the households. In Agulash-Tiliku-Sherkole watershed intervention area (Homosha Woreda), about 30% of the households use Gonzie stove for baking. They are all provided for free by the SLM program as a reward for their participation in conservation activities. Other households that do not have fuel saving stoves are still waiting for the program to deliver the stoves for free to them. In all other visited SLMP intervention areas, Mirt is rather known and preferred than Gonzie. In all SLMP intervention areas, cookstoves are all delivered to the households for free. Due to limited budget of the program, it was possible to distribute fuel saving cookstoves only to limited number of households.

Traditional clay stove and Three Stone used for cooking



Gonzie (left) and Mirt (right) fuel saving stoves



User-built stove promoted by Woreda Office (Bambasi)



In Bambasi Woreda, the Woreda Agriculture Office, in addition to Mirt stove that they promote, they also borrow molds to households who want to build their own baking stoves. This user made baking stove has a chimney to remove the smoke from the cooking place.

ii) Power for lighting, communication devises

All households know about solar lighting products. Some households own solar lanterns which are distributed by SLM Program for free. Households see the benefit of solar lanterns as it is used for both lighting and charging mobile phones. Most of the households interviewed reported that the price of the lantern (about USD 50) is expensive to them and expect the SLM Program to provide them for free. It was also observed in some of the SLMP intervention areas that private suppliers for off-grid solar products were conducting public demonstrations and announcing availability of credit facilities through local micro finance institutions.

7.3 Alternative fuels and technologies for cooking

Observations made during the field assessment in RLLP intervention areas in Amhara and Benishangul Region revealed new fuels with a potential to meet part of the household cooking energy demand. Initial trials and user acceptability assessment are promising provided that sufficient initial stage supports are given to the harvesting and processing of these fuels, and promoting them to users.

a) Cooking fuels and processing tools

Wild grass (savanna grass and others) and bamboo are biomass resources that grow in Benishangul Gumuz Region. In Amhara Region, bamboo and acacia decurrens are widely available.

i) Wild grass to charcoal briquette

In Benishangul Gumuz region, wild grass, including savanna grass and others, grow in abundance. A very small proportion of these grass is used for thatched roof construction. Much of it is burned by wild fire or decay after finishing its life cycle.

Gaia Association closely works with The United Nations High Commissioner for Refugees (UNHCR) and Agency for Refugees and Returnees Affair (ARRA) to address energy issues related to refugees. In Assosa refugee camps, Gaia Association works to address the cooking fuel crisis in the refugee camps by providing alternative clean cooking solutions. One of the options is to process wild grass and convert it to charcoal briquette to be used by the refugee households as supplementary cooking fuel.

Initial trial, which includes harvesting, crushing, charring and briquetting of the wild grass has been successful¹². Carbonized wild grass, pressed in the form of honey-comb briquette, were also tested for

Savana Grass – Homosha Woreda, Assosa Zone



Honey-Comb Charcoal Briquette from agri-waste



¹² Alternatively, the wild grass after harvesting can be briquetted and charred. This requires grass briquetting machine but avoid the need for hammer mill for crashing the grass and also the charcoal briquetting machine. This method produces hard charcoal which can be transported long distance without breakage.

acceptability by beneficiary households. The result indicated that the fuel was well accepted by the households as supplementary cooking fuel. Wild grass and other similar resources, such as elephant grass in Gambella, have a potential to supplement supply of cooking fuels for household use.

Information obtained from Homosha Woreda Agriculture Office (in Assosa Zone) shows that savanna grass covers about 20,000 hectare which accounts for about 8% of the Woreda land cover. The resource is available for harvest for about 4 months in a year from November to end of February.

On site preliminary estimation indicates that the yield can be as high as high 100 tons per hectare per year in areas where there is a good yield and much lower in other areas. Average yield of 50 tons per hectare could be a good estimation of the resource in Benishangul Region. A very conservative estimation could be 25 tons per hectare. Assuming other uses of the grass such as house roofing to be 40% (the demand of which is declining as corrugated tin roof is being widely used to substitute grass) and harvesting efficiency of 50%, there will be over 1,000 tons of grass available for processing every day for four months. Based on information that was obtained from MoWIE, the metal kiln that it promotes has a conversion efficiency of biomass into charcoal as high as 33%. This means, processing wild grass in Homosha Woreda alone can potentially provide over 370 tons of charcoal every day for four months in a year which is sufficient to cover the daily cooking demand of the total population of the Benishangul Gumuz Region if they all were to cook with charcoal. However, after conducting further assessment on the possible impact on the environment, only a feasible portion of the resource can be harnessed and utilized as cooking energy.

This is only a preliminary assessment to determine the technical possibility and financial viability of using wild grass as household cooking fuel. Based on this assessment, it is estimated that charcoal briquette from wild grass in Homosha Woreda can be supplied to consumers at a price of USD 19/kg (ETB 5.03/kg). Current market price of charcoal in Assosa is USD 0.24/kg (ETB 6.50/kg). See Annex 1B for price build up for charcoal briquette from wild grass. Further assessment is needed to determine the environmental implications of a large scale harvesting of the wild grass for production of cooking fuel.

ii) Bamboo charcoal

Bamboo resource in Ethiopia is quite large with an estimated annual yield of 3 million tons from an area coverage of nearly 850 thousand hectares¹³. Benishangul Gumuz and Awi Zone of Amhara Regions are well known for lowland bamboo which is known as *Oxytenanthera abyssinica* (Sympodial bamboo) (FAO, 2005). According to FAO report, unmanaged natural forest bamboo may provide an annual yield of 8 to 10 tons per hectare. On the other hand, an annual biomass increment of 51 and 19 tons per hectare can be obtained from highland and lowland well managed bamboo plantations respectively.

Homosha Woreda is blessed with lowland bamboo which covers an area of nearly 50 thousand hectare accounting for about 20% of the Woreda land area¹⁴. According to Homosha Woreda Natural Resource Office, about 10% of the bamboo covered land might have been encroached by human settlement since this data was last updated.

¹³ Food and Agriculture Organization (FAO), Global Forest Resource Assessment Update 2005, Country Report on Bamboo Resource (Final Report), FAO Forestry Department, International Network for Bamboo and Rattan (INBAR) Addis Ababa, Ethiopia, May 2005

¹⁴ Homosha Woreda Natural Resource Office

A commercial bamboo plantation initiative has already been taken in Dunga Kebele by Homosha Woreda Administration in partnership with Farm Africa. Belemiyu Bamboo Forest Administration Cooperative was established in 2015. The Cooperative, which is composed of 140 members, protected 130 hectares of bamboo forest. The business plan prepared by the Cooperative indicates that the annual revenue that would be obtained from sales of bamboo charcoal was estimated to be over USD 80,000 (ETB 2.2 million). The Cooperative and the Homosha Woreda Administration is seeking technical assistance and startup capital to implement the business.

iii) *Acacia decurrens*

In the highlands of West Gojam where the altitude is around 2,400 masl, tree plantation for construction and cooking fuel purpose has become a main source of livelihood for many farmers. Farmers plant eucalyptus mainly for construction purpose. In the last decade, acacia decurrens plantation has become an alternative source of income. Farmers prefer to grow acacia decurrens to eucalyptus if they want to utilize their land again for crop production. Acacia decurrens provides over 1.3 times more income than the amount obtained from growing teff (assuming a yield of 2.5 tons of teff per hectare).

Acacia decurrens plantation in Guagussa Woreda, Awi Zone



Acacia decurrens in Awi Zone is entirely used for charcoal production. Farmers obtain over 80 tons of charcoal from a hectare of acacia decurrens plantation in a five year harvest cycle. This is worth an annual income of nearly USD 3,700 (ETB 100,000). In addition to this, on the first year of seedling plantation, the land can also be used to grow some crops. The following year farmers usually grow grass side by side the acacia decurrens. It is only in the last three years that farmers are not able to grow any other crop on the land.

Acacia decurrens plantation and charcoal production



Acacia decurrens charred using traditional method



The RLLP program as part of the homestead level tree planning activity could promote diverse species of trees such as acacia decurrens as alternative fuel source.

iv) *Metal kiln, briquetting machine*

Charcoal production in Ethiopia is mainly using traditional earth mound kilns. A typical traditional kiln for charcoal production has an efficiency that ranges from 10% to 15%¹⁵. Best traditional practices up to 20% to 25% are rarely observed by producers with many years of experiences. It is then imperative to introduce a more efficient equipment and methods for charcoal production to those producers that use alternative fuels. This will increase productivity which ultimately addresses demand from wider consumers.

¹⁵ Forum for Social Studies, Reading the Charcoal Industry in Ethiopia: Production, marketing, consumption, and Impact, Policy Brief No. 31, February 2013

Alternative Energy Development and Promotion Directorate of the Ministry of Water, Irrigation and Electricity developed an improved charcoal production kiln which is made up of metal. The equipment is utilized to make charcoal from woody biomass and agri-residues. Practices of use of these improved metal kilns showed an efficiency of 33%, which is more than double of that of the typical traditional method.

The Rural Technology and Mechanization Center in Assosa also produces fuel efficient cookstoves and metal kilns for charcoal production.



b) *Cooking stoves*

Some of the new fuels discussed above can be used with existing cookstoves while others, such as honey-comb charcoal briquette, need an appropriate stove. In addition to this, field observations and Focus Group Discussions with rural household in intervention watershed indicated that there is no fuel efficient stove for cooking purposes to rural households. The type of fuel efficient cookstoves that are distributed in both Amhara and Benishangul regions (Mirt and Gozie stoves) are used only for baking. All other cooking (excluding baking) is done with locally produced traditional clay cookstoves.

i) *Beehive stove*

Beehive stoves are designed to burn charcoal briquettes which are pressed in a form of honey-comb. This stove also burns ordinary charcoal that is commercially available in the market. The stove is also available in the market and is used by many households for burning the common charcoal. At present, honey comb charcoal briquettes are made from charcoal dust that is collected from charcoal production areas and charcoal selling depots.

Beehive stove for burning honey-comb charcoal briquette



ii) *Clay stove for firewood burning*

In Section 6.2, it is shown that cooking stoves made from clay are widely used in Benishangul Gumuz and Amhara Regions. These stoves are produced and marketed by local potters. On the other hand, the fuel saving stove which is known by the name 'Tikikil' was designed by GIZ Endev in partnership with MoWIE. It has been promoted by Regional Energy Bureaus, GIZ Endev and others since 2010. However, the distribution of it has been mostly project based where NGOs and other development partners purchase and freely distribute to consumers. None of this stove was observed in the areas visited during this study.

"Tikikil" Fuel Saving Firewood Stove



With some effort put to train rural potters to adopt the design of the “Tikikil” stove, it can be produced as a whole-clay stove using simple jigs and molds to maintain the dimensions. It could then be possible to provide an affordable fuel saving stove to rural consumers in the RLLP intervention areas. RLLP need to work together with Regional Energy Bureaus and GIZ EnDev to identify sourcing of cooking stoves such as Tikikil, multi-flex stove, EZY stove and others from private producers which operate in the regions.

iii) Domestic biogas plant

The National Biogas Program (NBP) has been implemented since 2009 in eight regions by MoWIE, Regional Energy Bureaus and SNV. The sizes of the digesters range from 4 to 10 cubic meters. Until now, over 18,500 digesters have been constructed in over 300 Woredas. The NBP planned to disseminate 26,500 additional domestic digesters in the second Growth and Transformation Plan. The average cost of a domestic biodigester is about USD 550 (ETB 15,000). The program contribution to the adopters of the technology covers about 50% of the cost. The remaining cost, which includes labor and construction materials, is covered by the households. The Program also arranged credit facilities to the adopters through the MFIs.

According to the program promoters, a biodigester provides light, clean cooking fuel and an organic fertilizer. Of all the services that a biodigester provides, the one which is highly appreciated by the households is the light. However, during the focus group discussion it was mentioned by households who adopted a biogas digester that the daily labor requirement for preparation of dung and feeding the digester as a tiresome activity. Households that participated in the Focus Group Discussion seemed a bit reluctant to adopt biogas technology particularly as solar lighting products are cheaper, provide better light and require no additional labor. In competition with off-grid solar products, domestic biogas would face a challenge to penetrate more households in the future. It is then important for the NBP and other promoters of domestic biogas digesters to provide more focus on and make households aware of the benefits of clean cooking to health and the slurry as an organic fertilizer as selling points. RLLP can do such awareness campaign and consumer education about the multiple benefits of biogas digesters. I should also link any demand for biogas plants that come from the intervention areas to the NBP.

c) Lighting and power

As discussed above, most rural household in the SLMP intervention areas use hand torches powered by dry cells. Kerosene with traditional wick lamps (such as bottle with metal cork and a wick) is seldom used by the households in the areas visited during the assessment. National trend on use of kerosene for lighting also confirms the decline in the percentage of household that use kerosene for lighting. Percentage of rural households that use kerosene for lighting declined from 81.1% in 2005 to 64.4% in 2011 and 30.9% in 2016.¹⁶ In the visited areas, very few households have solar lanterns which are freely provided by SLMP.

Pro-poor business models such as fee-for-service that can provide access to affordable light and power are not widely practiced in Ethiopia. Purchase of off-grid products on loan from MFIs are not affordable to the poor as the interest rate charged is quite high. There is a recent experience by a private sector which pilots a micro grid system powered by renewable sources. The system provides affordable

¹⁶ Welfare Monitoring Survey 2011, Summary Report, Central Statistical Agency, 2012. CSA, NBE, World Bank, 2017. Ethiopia Socio-economy survey (ESS) – 2015/2016

access to electricity to rural households for lighting, powering radio, and charging mobile phones. It is a pro-poor model where households are required to pay a monthly fee for the service which equals to the amount they used to pay for dry cells, kerosene and phone charging. Promoting of such models through community owned or in a partnership model could help increasing electricity access in rural areas. For such models to spread, the regulatory framework must also be reformed to allow operation.

7.4 Evaluation of household energy technologies

Households evaluate energy products against several parameters before they make purchase decisions. Evaluation parameters are usually based on products attributes and households' ability and willingness to pay for the products. Energy products that are promoted through government programs highly influence consumers purchase decisions as they build trust on the quality of the products and the suppliers. Such programs usually come with some incentives and financing to make products more accessible and affordable to users.

Key product features such as performance (convenience to use and speed), aesthetics, and price ranges need to be addressed initially before the products get into market for mass dissemination. Besides these, important product features that households consider to determine their purchase decision include purchase cost of product, durability, fuel consumption reduction, smoke reduction, durability, space requirement, and if they are easily accessible in nearby market places.

The Table below compares most common rural household energy products against these parameters. The comparison is made based on close observation of the products, the supply chain, and feed backs from households and product producers and suppliers obtained during the assessment period. The products are categorized into three groups as baking stoves, non-baking stoves (for boiling and other cooking), and lighting products.

Attributes of the energy products determine the business models that have been used to deliver them to consumer and also affect the way they have been marketed. The comparison matrix and the remarks provided for the products to a certain extent shows how the attributes of the products influence the delivery models and marketing as well.

Household energy products comparison matrix

No.	Hhd. Energy Technologies	Fuel/energy Saving	HAP Reduction	Purchase Cost	Durability	Space Utilization	Accessibility (Ease of delivery)	Remark
I - Baking Stoves (i.e. injera and/or flat bread baking)								
1	Open Fire/ Three-Stone	Low	Low	Low	High	Low	Very High	- Zero cost and provides flexibility in space utilization. It can be used for cooking and baking.
2	Closed Traditional mud stove	Low	Low	Low	Moderate	High	High	- Zero cost but labor. Needs sufficient space in the kitchen to dedicate a permanent place for baking only.
3	User-made mud stove with Chimney	Data not Available	Moderate	Low	Moderate	High	Moderate	- Mold for production must be borrowed from Woreda Agriculture Office. - Needs wider cooking place to install
4	Mirt Fuel Saving Stove	Moderate	Low	Moderate	Moderate	High	Low	- A high mass and fragile cookstove made from cement mix. - High transportation cost. - High breakage rate during transportation. - Has parts which needs on site assembly. - Needs wider cooking place to install. - Not off-the shelf item.
5	Gonzie Fuel Saving Stove	Moderate	Low	Moderate	Moderate	Moderate	Low	- A high mass and fragile stove made from clay. - High transportation cost. - Moderate breakage rate during transportation. - Producers are not interested to produce Gonzie (it takes too much clay and effort for the value) - Marketing has always been through projects support - Not off-the shelf item
II - Other Cooking (wot cooking, boiling, etc)- for non-injera baking activities								
1	Open Fire/ Three-Stone	Low	Low	Low	High	Low	High	- Zero cost and flexible to use for cooking and baking.

No.	Hhd. Energy Technologies	Fuel/energy Saving	HAP Reduction	Purchase Cost	Durability	Space Utilization	Accessibility (Ease of delivery)	Remark
2	Traditional Clay	Low	Low	Low	Low	Low	High	<ul style="list-style-type: none"> - Produced and supplied by local potters. - Portable and off-the shelf item. Easy to market. - Different product variation and cost. - No program support but high penetration rate in rural households
3	Fuel Saving Stoves (Tikikil and others)	Moderate	Low	High	Moderate	Low	High	<ul style="list-style-type: none"> - Stove is whole metal or clay liner cladded with metal – makes product price high. - Portable and off-the shelf item. - Because of price there is low or no rural penetration. - All distribution has been through program support - Never been fully commercialized.
4	Biogas	High	High	Very High	High	Low	Low	<ul style="list-style-type: none"> - The only clean cooking technology/fuel in rural areas - Light is the most revered service from all that it provides. - Low adoption rate despite high program support. - Daily labor requirement is considered as a heavy burden by households.

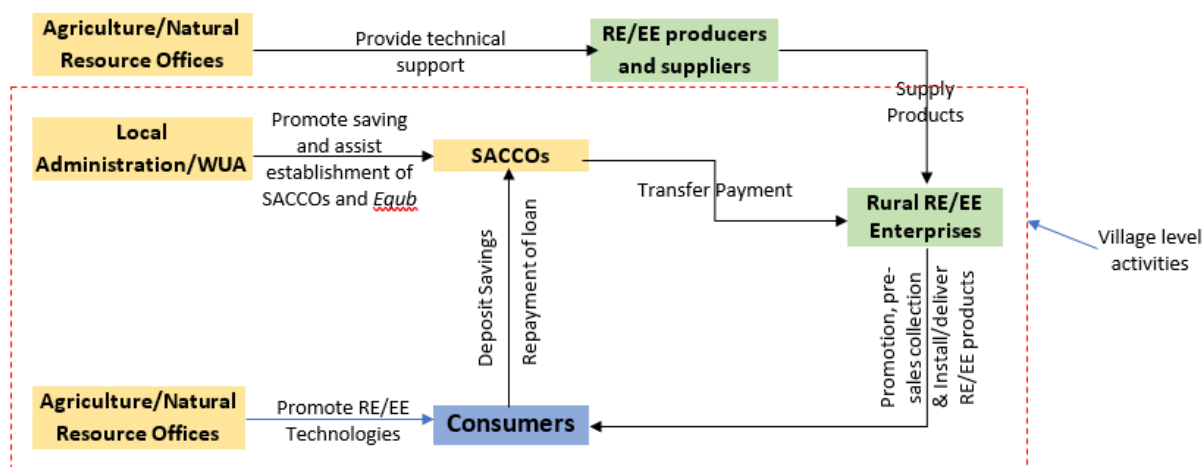
III - Household lighting products

Kerosene wick lamp	Low	Low	Low	Low		High	<ul style="list-style-type: none"> - Households are able to budget and pay for retail purchase of kerosene
Hand torch with dry cell	Low	High	Low	Low		High	<ul style="list-style-type: none"> - Provides better light but dry cell is rather expensive - Products area available in local rural shops - Consumers know they don't last long
Low quality Solar lanterns	High	High	Moderate	Low		Moderate	<ul style="list-style-type: none"> - Because of lack of aftersales service, households consider low price products are less risks

No.	Hhd. Energy Technologies	Fuel/energy Saving	HAP Reduction	Purchase Cost	Durability	Space Utilization	Accessibility (Ease of delivery)	Remark
	Good quality solar lanterns	High	High	High	High		Low	<ul style="list-style-type: none"> - Households see this as high risk as they are not sure for aftersales services - No stablished system for warrantee transfer
	Solar Home Systems	High	High	Very High	High		Low	<ul style="list-style-type: none"> - Households consider this as high-risk investment with no warrantee for products. - No stablished system for warrantee transfer, or no warrantee at all.

From the attributes of the energy products listed above, observations made during the field assessment on consumers' energy needs and products delivery methods, lessons can be drawn as to why the penetration rate for RE/EE products has been low in the rural households and what kind of approaches should be used to improve RE/EE product adoption. Major ones are:

1. No affordable stove for non-baking activities such as boiling, wot cooking is available. Existing fuel saving stoves such as Tikikil and other similar stoves are all produced in major urban areas. These stoves have never been successfully commercialized. Almost all of these stoves were distributed through projects that deliver stoves for free. In very rare cases they were distributed to households with financing made available by cooperatives to their members.
2. All non-baking stoves purchased by rural households are traditional clay stoves which are produced and supplied by rural potters. The workmanship of the products show the skills of the potters which can be utilized for manufacturing of affordable fuel saving stoves after providing some capacity building and promotion/marketing support.
3. All biomass baking stoves are high mass and fragile. Hence, transportation to rural areas on rough roads is not only costly but also damages some stoves. Products must be properly packaged to reduce breakage rate during transportation.
4. Proper and sustainable supply chain does not exist for RE/EE products to reach rural households. Producers do not have sufficient market and could not stay in business. Establishing rural enterprises that collect demand and link to producers helps businesses to sustain. These rural enterprises can do marketing of both cooking and lighting products. Pre-sales collection, installation of stoves and solar products, transferring warrantee from supplier to consumer, provision of minor maintenances, promotion and marketing of RE/EE products can be done by rural enterprises
5. Lack of aftersales service and absence of warrantee transfer system for approved quality RE/EE products makes consumers lose confidence and settle for cheaper poor quality products. This is considered by households as risk mitigation mechanism.
6. Lack of financing to purchase high priced but good quality products has always been a challenge. Encouraging rural financing by initiating traditional saving and credit scheme for RE/EE products (Energy *Ekub*) would help rural households adopt such products.
7. RLLP program including local government institutions such as Kebele Administration, Agriculture and Natural Resource Office, Watershed Users Association (where it exists) together with Rural Energy Enterprises can promote and encourage formation of Energy SACCOs/ *Ekub*. Rural RE/EE enterprises would furnish all market linkage with suppliers to improve product accessibility and ensuring aftersales services. The schematic below indicates the distribution model and the roles and relationships of the different players.



8. Despite strong program support for biogas, the uptake is very limited. Biogas seems to face more challenge from solar. Piggybacking solar with biogas under the same program (NBP) may help marketing of both technologies. This would also leave more resources for clean cooking in the households.
9. No household is observed adopting both baking and cooking stove. Because of this, only part of the households' cooking problem is addressed.
10. Some Woredas promote User-built stoves with chimneys. The approach must be structured so that the design helps reduce fuel consumption, and production must be assisted with jigs and molds to ensure critical dimensions that guarantee fuel reduction.

8 Existing Business and Delivery Models for Household Energy Technologies

Some of the business or delivery models for household energy technologies are formed because of programmatic supports while others follow the traditional supply chain model that are used to channel other household goods. The delivery models discussed below represent existing models as well as new ones that are suggested to build sustainable commercialization of RE and EE products.

A. Cookstoves

i) Purely commercial with neither program support nor access to finance services

In this model producers of the household energy products usually sell their products through wholesalers and retailers to consumer. Some of them sell their products directly to consumers from their manufacturing place. The later is most common with those producers who produce only in smaller quantities. For most of the businesses that operate under this delivery model, RE and EE products are not the only products they supply. (i.e. potters in rural areas who produce and sell clay firewood or charcoal stoves among other products directly to rural or urban consumers).



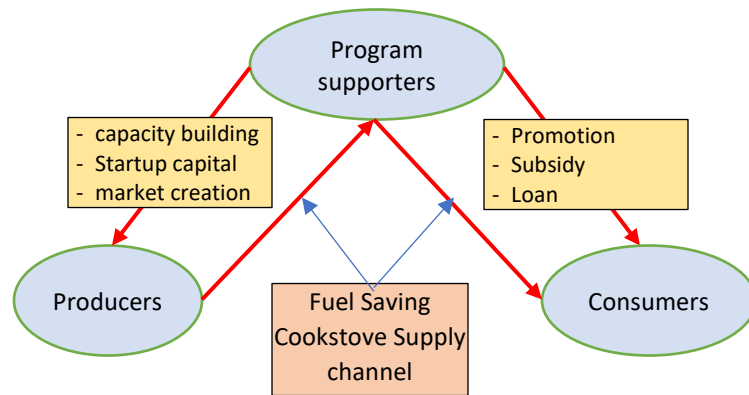
Most business that produce charcoal stoves including improved and traditional ones, and electric stoves fall under this model. They produce in large quantities and deliver their products through wholesalers and retailers. They operate in a purely market based commercial environment with no program level support. This business models are widely operational in both urban and rural settlements.

With small level of RLLP support to potters in a form of technical support and market creation, a sustainable commercialization of fuel saving stoves for cooking (which is not existing currently in rural areas) can be built. The program can also sponsor some number of stoves to kick start the market. These stoves can be delivered to consumers through existing Women Groups or new ones that will be established at Kebele level to fill the supply chain gap.

ii) Program supports – with or without financial services

This is a model used to accelerate wide scale adoption of improved firewood stoves which reduce fuel consumption. Several national level fuel saving cookstove programs have been implemented in Ethiopia since early 1980s. Currently, the National Improved Cookstove Program (NICSP) is being implemented by the Ministry of Environment, Forest and Climate Change (MEFCC) in collaboration with Ministry of Water, Irrigation and Electricity (MoWIE) and Regional energy and agriculture bureaus to promote the adoption and use of fuel saving cookstoves. Almost all of these fuel saving cookstoves are firewood stoves for cooking or baking. Most widely promoted fuel saving cookstoves are *Mirt* firewood injera baking stoves, *Tikikil* firewood stove for cooking, and *Gonzie* stove for both cooking and baking. These stoves are promoted under the NICSP by MEFCC, MoWIE and Regional Energy and Agriculture Bureaus.

Existing distribution model for RE and EE products in SLMP intervention areas

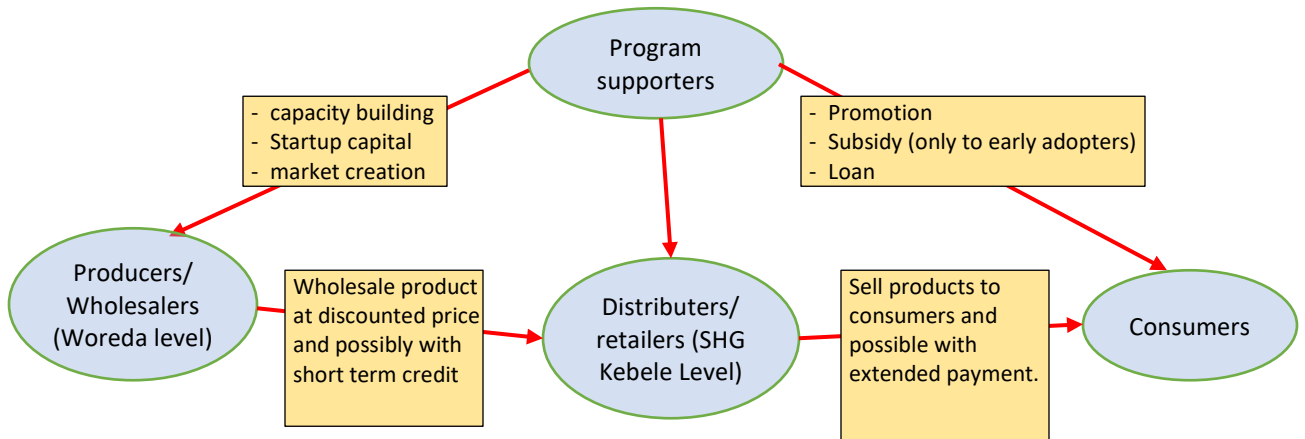


Existing delivery models for distribution of fuel saving cookstove under SLMP intervention areas also fall under this model. The model is established under SLMP 1 and SLMP 2 programs. These model primarily works through Self Help Groups (SHG) which mostly are composed of women. The program provides startup capital in form of production tools and raw materials. SHGs produce and sell improved cookstoves to rural consumers. The subsidy under this model usually comes in a form of free transportation service for bringing raw materials to producers and delivery of products to consumers. In most cases, fuel saving cookstoves are delivered to consumers for free or only with a token amount of payment¹⁷.

Field observations and discussions with communities and promoters in SLMP intervention areas during this study period indicated that free donation of products preempts sustainable commercialization of RE and EE products. Distribution of such products for free or discounted price should be only to limited number of early adopters only for the purpose of introducing and promoting new products. Such financial subsidies should also be available only for specific period of time. Consumers should know that such discounts would be available only for the first few households that would purchase the products. Hence, RLLP program should rather support SHG at Kebele level to fill the gap in the supply chain to the last mile distribution of the products. The program in addition to promotion and market work, can also support distributors in a form of **Result Based Financing** (RBF) which would support transportation and deliver costs of products. To incentivize increased sales of products, it can be structured in a form of a fixed amount of payment to distributors per product sold to end consumers. Wholesalers and distributors (SHG) can provide products to consumers on extended payments with Watershed Users Associations (WUA) and local government enforcing payments by consumers. Rural based Saving and Credit Associations or Groups could be assets that can be utilized for credit sales.

¹⁷ Source: Discussion among Regional representatives of SLMP

Modified distribution model for RE and EE products under RLLP



Revolving funds which could be managed by Agriculture and Natural Resource Office at Woreda level could be used to avoid credit risk by producers or wholesaler.

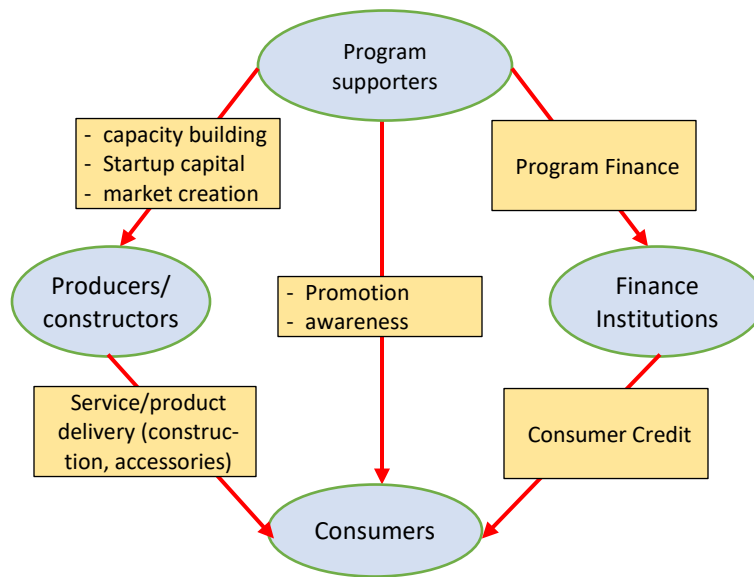
iii) Program support – only technical support to consumers

This model of distribution of cookstoves has already been practiced by Bambasi Woreda Agriculture and Natural Resource Office. The office provides technical training on how to construct a fuel saving cookstove and let households borrow production molds from the Office which they will return after building their own cookstoves. While this method could be very effective to assist household that could not otherwise afford to purchase fuel saving cookstoves, there could be mistakes on the dimension which are critical to ensure fuel consumption reduction. However, care must be taken to ensure proper construction of the cookstoves so that the expected performance would be maintained.

iv) Program support – only with financial supports and subsidy

Household energy products that are delivered under this model only operate with the full program support which include promotion, marketing, technical and financial capacity building to the businesses, and provision of subsidy and access to consumer credit. The National Biogas Program (NBP) supported by MoWIE and SNV, and implemented by Regional Energy Bureaus follows this delivery model.

Distribution model with intensive financing through credit and subsidy



B. Off-grid Solar Products

- i) Purely commercial with no program support nor access to finance services

Off-grid solar products supplied under this delivery model are mostly not certified for their qualities. Most are of inferior qualities. About 80% of the products distributed in the market are supplied through this business model (World Bank/IFC, 2016).

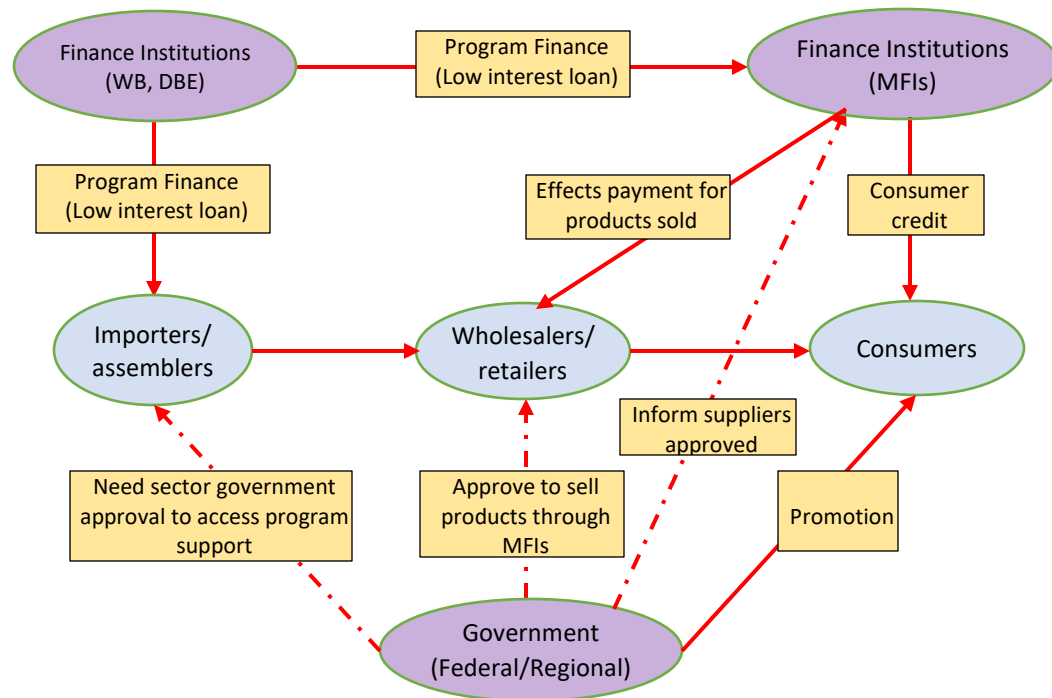


Most of the businesses that operate under this model are not specialized enterprises that sell solar products only. Solar products that they deliver are one set of items among many other consumer goods that they distribute.

- ii) Purely commercial but with program support and access to finance

Off-grid solar products that are channeled through this model are Lighting Global certified products. The program supports such products through promotion, provision of access to finance to importers through the Development Bank of Ethiopia (DBE) and to consumers through Micro Finance Institutions (MFIs). Distributors of these products are permitted to sell their products through MFIs providing consumers credit.

Program supported distribution model for off-grid solar products



iii) Extended payments for off-grid solar products

In East and West African countries several successful innovative business models have been practiced for distribution of off-grid solar products. The main purpose of these models is to reach low income households and provide larger home systems than only solar lanterns. Several variations of extended payment models are provided to consumers. Most common ones are Pay-as-you-go (PAYGO), fee-for-service, product leasing and a combination of one or more them. For these models to operate a telecom platform that allows such practice is needed. Through these models solar companies are able to sell products using various options of extended payment systems which also involve credit facilities.

In Ethiopia, mobile payment system is in its infant stage where only a couple of businesses such as MBirr and Hello Cash are trying. Some solar companies are also trying to use these systems to market their products.

MBirr and Hello Cash are platforms for selling product on credit. These platforms can work in collaboration with Micro Finance Institutions, or by the company that sells the products alone. In the later case, the company that sells the products need to have a good financial capacity to sell products on credit. In Ethiopia, non-finance companies are not allowed to charge interest rate on extended payments for the products they deliver.

To use the MBirr mobile payment platform, the client must first have an MBirr account by registering at an MBirr Agent and start saving in a monthly or weekly basis depending on the agreement. Once the deposit reached a certain amount, the client can acquire the product. Remaining payment would be made on subsequent regular payments on a pre-determined period.

For solar businesses to operate in this platform, the solar products must be designed for a PAYG system and MBirr system must also be mobile phone integrated by a service provider such as ANGARA management model which operates in Kenya. There is no company that provides mobile integration and management services in Ethiopia. Few solar companies in Ethiopia are trying to work with Kenyan based management service providers. Such services would charge an initial payment in the range of USD 10,000 and periodic management fees. Such payment system can also work for fee-for-service model either for individual solar home systems or mini-grids that provide power to consumers. RLLP program may support solar companies that are trying to adopt such systems to help mitigate risks and share the initial financial burden to accelerate the implementation.

C. Mini-grids for rural electricity access

Current government strategy to increase electricity access includes mini-grids powered by renewable energy sources. With this model, a private developer or in partnership with local communities or public sector, would build micro or mini grids to distribute electricity to consumers. Payment terms would be on monthly basis with a fee that depends on the amount of electricity consumed. This is a pro-poor approach as consumers do not need to pay for the product but for the service. Mini-grids would be more sustainable if more power is required from the systems for productive uses as scale economy would improve their financial viability. Such anchored demands for productive uses from rural businesses or industries is not always available. With proper integrated planning, however, it could be possible to connect community water supply systems and social institutions to mini-grids which also provide power to the households and local businesses. Financing in a form of grant and low interest rate loans would make mini-grids more attractive to developers.

There are few initiatives by the private sector and development partners where lessons can be drawn to replicate in RLLP intervention areas.

9 Experiences of SLMP in household energy technology distribution

SLMP1 was implemented from 2007/08 to 2011/12 in 45 watersheds in six regions including Amhara, Tigary, Oromiya, SNNP, Gambella and Benishangul Gumuz. Benefited an estimated number of 98,000 rural households from a combination of environmental and productive interventions¹⁸. SLMP2 scaled up on the SLMP1 45 watersheds and covered a total number of 135 major watersheds in the same six regions. It covered about 2,000 micro watersheds in a total number of 937 rural kebeles¹⁹. This means, each SLMP2 intervention Kebele, on average, had 2 micro-watersheds.

Considering an average population size of 1,000 per Kebele and a rural household size of 4.9 (CSA 2007), the total number of households that benefited under SLMP2 can be estimated a little over 190,000²⁰. Under SLMP1, it was only fuel saving cookstoves that had been promoted in the intervention areas. Under SLMP2, other renewable energy and energy efficiency technologies such as off-grid solar products and biogas were also included. Unlike fuel saving cookstoves, only very few units of these technologies were disseminated to the households in the intervention areas. The solar lanterns were purchased by the Program from private suppliers following the regular government procurement procedure and distributed to selected households as a reward for their contribution in the local land conservation activities. For the domestic biogas technology, the SLM Program worked with the National Biogas Program (NBP) under the Regional Water and Energy Bureaus. The SLM Program obtained the 50% NBP contribution and covered only the remaining 50% of the contribution that the households were supposed to cover. By the time the SLMP2 program phased out in 2017, a total number of about 33,000 fuel saving cookstoves have been disseminated in the 10 years of SLM Program periods²¹. The number of other RE/EE technologies distributed through the program were negligible. The average life time of the stoves promoted is less than 5 years. By the time the two SLM Programs were phased out most of the stoves might have already become non-functional because of age.

9.1 RE/EE delivery model in SLMP

Analyzing the RE/EE delivery models that were used in the SLM Programs would help to understand the reasons for the dissemination of such a small number of products in the whole SLMP period. Under the SLM Program several Self Help Groups (SHG) were established and supported to run different kinds of income generating activities so that they would have improved livelihood. Among the different Income Generating Activities (IGAs), cookstoves production and sales was one. SLMP relied on already established Fuel Saving Stoves (FSS) producers and newly established SHG for the supply of FSS in the intervention areas. The Table below summarizes number of FSS producers, their status and distributions in the six Regions that SLMP operated.

¹⁸ World Bank, Project appraisal document for SLMP 2, October 2013.

¹⁹ World Bank, Aide Memoire, Mission of RLLP (P163383) Preparation, July 10-21, 2017.

²⁰ GIZ SLM Report also confirms that the project benefited around 190,000 households (<https://www.giz.de/en/worldwide/18912.html> , Accessed date 17 January 2018)

²¹ World Bank, Concept Note for The RLLP, Version: May 9, 2017

Number of SHG Established to Produce and Sale Fuel Saving Cookstoves in SLMP intervention areas²²

Regions	No.SHG	Male	Female	Strong/ Active	weak	dissolved	Start-up
Oromia	7	3	200	3	2	-	2
Amhara	1	1	9	0	0	1	0
SNNP	5	0	69	3	0	0	0
Tigray	47	1884	1465	22	22	2	1
Benishangul	1	13	7	0	0	1	0
Gambella	3	-	65	0	3	0	0
Total	64	1901	1815	25	27	4	3

The number of FSS producers in Tigray compared to those in the other regions was quite larger. This could be due to the presence of several cookstove programs that were implemented in the region which all established FSS producers in highly affected watersheds. Another point worth noting is a fair gender distribution in all FSS producers. However, it can also be noticed from the Table above that the number of members in each producer group ranged from 10 to over 50. This did not only make management of members very difficult by such small, new and unexperienced rural enterprises but also made the revenue from the business unattractive to them to stay in business. The assessment showed that it was only less than half of them that were still actively functioning. SLMP sourced FSS for distribution from producers within the intervention areas or from the nearest producers if there was none within the intervention areas.

Under SLMP, FSS or other RE/EE technologies were distributed freely by the program. The Program itself ordered energy products from producers or suppliers, transported and distributed them to consumers from the budget that was set aside in the program for this purpose. A commercialized distribution network for energy products was not established in the SLMP intervention areas. Moreover, free donation of products made consumers dependent that they always wait until the SLM Program distributed the products for free. Such delivery mode limited the number of RE/EE products distributed in the area to the RLLP budget. Businesses halted as there was not sufficient budget from SLMP to purchase and deliver stoves to every household in the intervention areas.

The overall observation is that households in the SLMP intervention areas seem to have developed an expectation for the Program to provide them fuel saving technologies and solar products for free. Free donation of products pre-empted commercialization of the products that ensures sustainable supply of the products. Volume of FSS sales by the enterprises have been too small to generate sufficient revenue to all the members of the enterprises. In most cases, the number of the members in FSS dwindled and only the committed few remain. On the other hand, presence of too many FSS producers in a given area would make all of them out of business. Interviews made with three FSS producers who located in Adet in Yimana Densa Woreda revealed that there has not been sufficient market for FSS to provide sufficient revenue to them. All three of them had high stock of FSS for several months which they could not sell. As a result, one of these enterprises was considering shifting the business from FSS production to something else while the others manage by engaging themselves in other activities. According to all producers visited, FSS has never been their major source of income. They all do it as a side business and some leave the group or close the enterprise as they get better paying one. Some of the stove businesses also ask if they could also sell other renewable energy technologies such as solar lanterns in addition to their cookstove business.

²² Assessment made by SLMP2 evaluation team in 2017

9.2 Lessons learned from SLMP experience

As it is now, because of limited budget, the SLMP could not distribute energy products for free to all households in the intervention areas. Even if it could manage to do it once, replacing worn out ones would be a big challenge. With several years of effort, SLMP managed to distribute only a limited number of FSS. Some households whose freely provided cookstoves are deteriorated, due to aging of the products, still expect the Program for the replacement. Free donation of products should be only as a reward to certain achievements and only be done to demonstrate the products for the purpose of promotion. Discussions with Regional and Woreda level Water and Energy Bureaus and Offices, also show their concern about free distribution of energy products. The Amhara Alternative Energy Directorate Director shared the experience that construction of domestic biogas plants for free to a few households by SLM Program pre-empted the whole potential biogas market in that particular intervention area because of the expectations that they would also get it for free by SLM Program.

Focus group discussions with the households in the SLMP intervention areas in Amhara and Benishangul Gumuz regions showed that there was no fuel saving stove for other cooking such as boiling, cooking wot and other non-baking activities. The cookstoves that have been promoted by SLMP and others serve only baking which is only part of the household cooking needs. Existing fuel saving stoves that are used for other cooking purposes could not penetrate rural areas as their prices are considered too high for either the SLMP program to purchase and distribute for free or for the households to afford. This seems to indicate the need for a different strategy for fuel saving stoves for other cooking purposes. The skills with potters that supply traditional cooking stoves and their existing distribution channels could be potential assets that could be developed for supply of fuel saving stoves for other cooking purposes.

For scaling up of RE and EE technologies in the intervention areas, it is important for SLMP to work together with Energy Sector programs focusing mainly on introduction of technologies and doing more promotion work. Introduction of new fuels and energy technologies would need more technical and financial support until products meet technical requirements, well introduced into the market, and enterprises that supply them are well established. Such activity should be primarily be led by institutions that are mandated for the energy sector development. It would be important for RLLP not to be drawn too much in to energy research and development activities but closely partner to energy sector program for scaling up and extension of such technologies to its intervention watershed areas when they are ready.

Past experiences show that free donation of products to consumers makes them dependent and damages sustainable commercialization of the products. Financial and technical assistances should rather focus on enterprises for the purpose of building the supply chain. It could be in a form of startup capital or market support. Project may subsidize products to consumers at the initial stage of marketing to encourage early adopters. Consumers must be clearly communicated that such prices are not true prices but are only for promotion purpose and that they will be available only temporarily to very few early buyers. The purpose of this should be to trigger sales.

10 Recommendations and action plans

10.1 Recommendations

The RLLP will add 17 new major watersheds on the 135 covered under SLMP2 bringing the total number of watersheds covered under the program to 152. SLMP2 benefited about 190,000 rural households. Assuming same average distribution of Kebeles per watershed in SLMP2, in the 152 watersheds an estimated number of 217,000 households are expected to benefit under RLLP.

For the program to be successful to reach the households under the RLLP intervention areas, the following actions and strategies need to be put in place.

Recommended actions:

1. Establish and/or strengthen existing RE/EE enterprises to manufacture, promote and sale fuel saving cookstove –
 - *Assess how many energy efficient cookstove producers are available*
 - *Strengthen technical and business management capacities of existing fuel efficient cookstoves producers through trainings.*
 - *In areas where there are no producers, identify and form common interest groups that produce fuel efficient cookstoves (Mirt, Gonzie, and other stoves)*
 - *Work with Regional Energy Bureaus to identify private sector producers and distributors for fuel efficient stoves for cooking. Fuel saving stoves for cooking (Non-baking purposes) that are available in the market are Tikikil, multi-flex, and EZY stoves.*
2. Introduce and promote alternative cooking fuels production and use
 - *Promotion of agro-forestry with acacia decurrens*
 - *Wild grass as source of cooking fuel*
 - *Efficient charcoal production kiln promotion (for bamboo, acacia decurrens, wild grass, etc)*
3. Promotion of fuel saving cookstoves and alternative fuels
 - *Billboards*
 - *Posters and leaflet*
 - *Radio promotion*
 - *Public demo (Cookstove producer enterprises will conduct demo at kebele level)*
4. Provide access to consumer financing and encourage saving through formal and traditional saving groups for the purchase of RE/EE products
 - *Promotion and encouraging saving through rural saving groups for energy Saving and Credit Coops (SACCOs)/ Ekub (traditional saving group)*
 - *Revolving Fund for consumers*

The rate of RE/EE dissemination depends on availability of finance to support the project and promote the technologies. With availability of financing to consumers, over 550 thousand fuel efficient cookstoves for both baking and cooking purposes will be distributed in about 140 thousand households over a two year period. However, without a revolving fund, only 275 thousand cookstoves will be distributed in about 100,000 households. The market uptake will be slower without a revolving fund and distribution of these stoves will take over 4 years.

10.2 Action Plan

RLLP adds 17 new watersheds on the existing 135 watersheds. This will bring the total number of watersheds that will be covered under RLLP to 152.

Limited by availability of budget, the energy component of the RLLP will be implemented only in 65% of the watersheds that are included in RLLP. This means, energy intervention will be done in 100 watersheds from the total of 152 watersheds. The budget estimate for implementation of the energy component is USD 2,000,000. Please see distribution of budget by activities in the next section.

Input to Activity/Implementation Plan

1. Establish and/or strengthen existing RE/EE enterprises to manufacture, promote and sell fuel saving cookstove

i. Purpose

- Fill supply chain gap for RE/EE products by connecting suppliers and producers of RE/EE products, and consumers (rural households, businesses, industries, and institutions)
- Promote RE/EE products at Kebele level (micro-watershed level)

ii. Activities of RE/EE Enterprises

- Retail RE/EE products to rural consumers (get margins from RE/EE suppliers and producers, add a certain margin for transportation and delivery, and charge fees for other services such as maintenance and installation of systems they provide)
- Collect pre-sales RE/EE products from consumers
- Conduct promotion (i.e. public demonstration of RE/EE products) in their business area
- Provide minor maintenance services for RE/EE product, and installation of SHS
- Channel/ transfer product warranties from suppliers to consumers (i.e. all Lighting Global approved products have two years product warranty provided by the factory to suppliers to be passed to consumers)

iii. Task - Identify and establish rural enterprises to produce and retail fuel efficient cookstoves (Mirt, Gonzie, and other stoves for cooking)

- Establish new ones or strengthen existing ones where available. A total number of 138 rural Energy enterprises will cover demand for RE/EE products from 690 Kebeles (in 65% of the RLLP watersheds) assuming that one rural enterprise will provide services to 5 Kebeles.
 - Work with Micro Enterprises Development Agency to form groups and establish rural RE/EE enterprises. Let the group choose its members. Limit the number of members that form an enterprise between three to five.
 - Support the enterprise to become legal business entities by registering at the local Trade Office.
 - Businesses must have permanent address in one of the five kebeles it operates.
 - Ensure that there is a good gender composition in the RE/EE enterprises

- Provide startup support to the new RE/EE enterprises:
 - Access to Program support should require certain amount of equity contribution by the members that will form the enterprise.
 - Technical capacity building to RE/EE enterprises:
 - on basic technical knowledge about the products that they deliver, and also on how to conduct minor maintenances
 - Technical capacity building on business management, bookkeeping, marketing and promotion of RE/EE products, and general entrepreneurship skill development
 - Seed fund for business establishment:- purpose of the seed fund is for initial stocking of RE/EE products, setting up demo booth for promotion. For entitlement of the seed money, the members bring guarantor (who is a permanent resident of the Woreda/Kebeles such as family members, etc)

iv. Roles and responsibilities of organizations

Organizations involved:

Regional and Woreda Agriculture and Natural Resources Bureaus and Offices, Ministry of Water, Irrigation and Electricity, Regional and Woreda Energy Bureaus and Offices, Woreda Micro-Enterprise Development Agencies, Local Kebele Administration, Local Trade Offices,

Roles and responsibilities:

- Regional and Woreda Energy Bureaus and Offices – Provide technical capacity building by training rural enterprises on production of Fuel Saving Cookstoves for cooking and baking. Build linkage between cooking stove producers and RE/EE Rural Enterprises
- MoWIE – Develops cookstoves that are appropriate to rural consumers and provide Training of Training on how to produce new stoves to Regional Energy Bureaus. Regional Energy Bureaus in turn train enterprises in their regions to produce fuels saving stoves that are appropriate to the needs of the households in their Regions.
- Regional and Woreda Agriculture and Natural Resources Bureaus and Offices – organize, coordinate and lead all activities, channel necessary resources such as finance to implementing organizations.
- Regional/Woreda Micro Enterprise Development Agency – help establishment of rural enterprises as per the criteria set out by the Energy bureaus. Work with RLLP to channel and administer seed fund as startup capital
- Trade Offices – register rural enterprises and provide operation licenses.

2. Introduce and promote alternative fuels production and use

i. Purpose

- Introduce new alternative fuels for cooking and baking that are affordable to rural households
- Introduce energy efficiency charcoal production method
- Reduce the burden on the natural biomass resource base by reducing amount of biomass extracted for cooking purpose
- Create new IGA schemes to the rural population

ii. Products to be promoted and justification

- Acacia decurrens for agro-forestry to supply cooking fuels need of rural households. Household primarily plant acacia decurrens to meet their own demand for cooking fuel. Any excess produce can be sold to market to generate income to the household. Seedling preparation and supply could also be additional income generating activity. Agro-climate zone where it would be appropriate for acacia decurrens need to be determined before dissemination.
- Wild grass is a seasonal biomass resources that abundantly grows in the western part of Ethiopia particularly in Benishangul Gumuz and Gambella Regions. When it is dry, it can be harvested, pressed and carbonized to convert it to cooking fuel such as charcoal. Further assessment is needed to determine the proportion of wild grass that could be harvested and utilize for cooking without causing environmental damages.
- Bamboo is also an abundant biomass resource in Ethiopia. It is a fast growing biomass plant which, with a carefully managed harvesting technic, can supplement the cooking energy requirement in rural areas where it grows. It can be converted into charcoal.
- Introduce efficient charcoal production kiln. Charcoal production efficiency of traditional method is only 15%. The charcoal kiln that will be promoted under this program is proven to have over 30% conversion efficiency.

iii. Tasks:

- Acacia decurrens – identify agroecology suitable for growing acacia decurrens, select and organize groups (rural enterprises) for seedling preparation and training, establish commercial system for distribution of seedling. Promote acacia decurrens for growing at homesteads or as agro-industry in farm lands. Target to reach 5,000 households/ farms to plant acacia decurrens as supplementary cooking fuel. Train upto 50 seedling growers who would supply to the growers.
- Wild grass – determine the technical, financial and environmental viability of converting wild grass into cooking fuel such as charcoal. Working together with relevant organizations to determine the extent to which wild grass can be harvested without causing any ecosystem damage, introduce resource management system on how to harvest wild grass (i.e. changing harvest places in rotation). Work with upto 6 rural enterprises that have interest to harvest and convert wild grass into household cooking fuel (3 in Benishangul and 3 in Gambella)
- bamboo production – similar to wild grass, harvesting of bamboo for energy production (charcoal making) needs to estimate the resource amount and harvesting technic. Bamboo flourishes more as it is harvested. Build capacities of local producer groups (i.e. rural enterprises) on how to manage the bamboo resource. Work with 2 enterprises who would be interested to harvest and convert bamboo into cooking energy fuel.
- Efficiency charcoal production kiln should be promoted along wild grass and bamboo. Work in close collaboration with MoWIE and regional natural resource conservation bureaus to actualize the promotion of efficient kilns for charcoal production. This can be started in Benishangul Gumuz and Gambella Regions where the resource is found in abundance. For

piloting and demonstration work with 30 charcoal production kilns by promoting them to the other three initiatives – acacia decurrens plantation and charring, wild grass and bamboo production.

iv. Roles and responsibilities of organizations

Organizations involved:

Regional and Woreda Agriculture and Natural Resources Bureaus and Offices, Ministry of Water, Irrigation and Electricity (MoWIE), Regional and Woreda Energy Bureaus and Offices, Woreda Micro-Enterprise Development Agencies, Local Kebele Administration, Local Trade Offices,

Roles and responsibilities:

- Regional Bureaus of Agriculture and Natural Conservation – train seedling raising and handling, train households and farmers on how to plant and nurture acacia decurrens for maximum yield.
- Micro enterprise development agency at Woreda and Kebele level – identify and organize, provide capacity building training to rural enterprises
- MoWIE provide technical support and training on the manufacturing and utilization of efficient kilns for charcoal production
- Local Kebele Administration – provides support and facilitation work on organizing rural energy enterprises
- Local Trade Office – registration of rural enterprises as legal entities

3. Promotion of fuel saving cookstoves and alternative cooking fuels

- i. **Purpose** – to create general awareness about RE/EE products, and influence purchase decision of consumers through use of different purpose designed promotion tools including radio promotion, bill boards, posters & leaflets, and conducting public demos.
- ii. **Tasks:**
 - Content development – Work with partners organization that promote fuel efficient cookstoves and new fuels on development of content for promotion tools (radio, billboard, posters, leaflets, public demos).
 - RLLP may focus more on local level promotion tools such as public demonstration of cookstoves and new fuels for cooking if other partners are to implement other promotion tools.
 - Engage rural enterprises that manufacture and distribute fuel efficient cookstoves and new fuels in rural areas to do public demo.

iii. Roles and responsibilities of organizations

Organizations involved:

Ministry of Environment, Forest and Climate Change (MEFCC), Regional and Woreda Water and Energy Bureaus and Offices, Development Bank of Ethiopia (DBE),

Roles and responsibilities:

MEFCC, DBE and Energy Bureaus and Offices do promotion of cookstoves in partnership with RLLP.

4. Provide access to consumer financing and encourage saving through formal and traditional saving groups for the purchase of RE/EE products

- i. **Purpose** – the cost of finance from micro finance institutions (MFIs) for purchase of energy technologies is quite high for low income rural household. Moreover, MFIs do not lend small amount (under ETB 300) as the cost of lending becomes too high. Most cookstoves are priced under ETB 300 and are not qualified for credit line purchase. Arranging financing mechanism to rural households either by encouraging saving for purchase of energy technologies in formal or traditional saving group, and making a low service charge revolving fund payable in five or six months. Availability of revolving fund encourages saving if saving is put as a criteria to access the revolving fund.
- ii. **Task**
 - Encourage saving groups for purchase of fuel efficient cookstoves through Saving and Credit Cooperatives (SACCOs or formation of traditional saving group – ‘*Ekub*’)
 - Arrange a revolving fund facility for consumers at zero or low service charge for fund management.
 - Link them to rural enterprises that produce or distribute fuel saving cookstoves and other RE/EE products for the supply of energy technologies
 - Investigate institutions such as SACCOs that would be able to manage revolving fund in order to channel funds to consumers.

iii. Roles and responsibilities of organizations

Organizations involved:

Cooperatives organization agencies at Woreda and Kebele level, Kebele level government administration, Fund managing institutions, Rural enterprises,

Roles and responsibilities:

- Rural households are encouraged to join saving cooperatives to save money for purchase of energy products/ fuel saving cookstoves.
- Cooperative organization agencies encourage rural households to save money and also provide access to credit for the purchase of energy technologies
- Rural enterprises supply households with energy products

11 Project Budget

The total project budget for the five years period is USD 2,000,000. Nearly 50% of the total budget is for promotion and consumer education. It is followed by financing for promotion of saving and credit schemes and creating access to a revolving fund which accounts for 20% of the budget. The budget for introduction of alternative fuels, and establishment of rural enterprises account for 18% and 15% of the total budget. These three activities are very critical as they help build the product delivery channel and increase consumers awareness. The budget for wild grass piloting is only 1% as it is mainly piloting by aligning with those institutions that are primarily leading the rollout of the activity.

No.	Description of Activities	Amount	Sub Total
1	Establish Fuel Saving Cookstove producer enterprises		307,489
1.1	Identify and form groups that produce and/or distribute fuel efficient cookstoves (Mirt, Gonzie, Tikikil, Multi-flex and EZY stoves)	161,836	
1.2	Technical and business training	145,653	
2	Alternative Biomass Fuel production		369,610
2.1	Promotion of agro-forestry with acacia decurrense (establishment of nursery sites for seedling, etc)	316,809	
2.2	Wild grass as source of cooking fuel (Build linkage with organizations that promote the fuel)	21,121	
2.3	Efficient charcoal production kiln promotion (for bamboo, acacia decurrense, wild grass, etc)	31,681	
3	Promotion of Fuel Saving Cookstoves and New fuels		922,356
3.1	Billboards	367,921	
3.2	Posters and leaflets	52,801	
3.3	Radio promotion	152,068	
3.4	Public demo (Cookstove producer enterprises will conduct demo at kebele level)	349,566	
4	Financing (Through traditional saving group SACCOs/Ekub, and/or a Revolving Fund) to consumers		400,545
4.1	Promotion and encouraging saving through rural saving groups for energy SACCOs/ Ekub	36,413	
4.2	Revolving Fund to consumers	364,131	
Grand Total			2,000,000

The first year of the program is mostly building linkages and developing partnership to properly align with partner organizations. It is mostly a preparation period to define roles and responsibilities of partners. During the first year, any missing technology such as a fuel saving stove for other cooking (non-baking) activities will be identified ad. Most of the works are in year 2 and 3 where most of the supply and adoption of technologies reach their peak. Budget breakdown by year and activities is indicated in the Table below.

A. Budget breakdown by year

No.	Activities	Yr1	Yr2	Yr3	Yr4	Yr5	Total
1	Establish and/or strengthen existing RE/EE enterprises to manufacture, promote and sale fuel saving cookstove	92,247	122,996	46,123	30,749	15,374	307,489
2	Introduce and promote alternative fuels production and use	36,961	147,844	147,844	18,481	18,481	369,610
3	Promotion of fuel saving cookstoves and alternative cooking fuels	92,236	368,943	368,943	46,118	46,118	922,356
4	Provide access to consumer financing and encourage saving through formal and traditional saving groups for the purchase of RE/EE products	40,054	160,218	160,218	20,027	20,027	400,545
Total		261,498	800,000	723,128	115,374	100,000	2,000,000

Annexes – Market and resource information in visited RLLP intervention areas

Annex 1A – Wild grass (Savanna and other grasses) yield in Homosha Woreda in Assosa Zone

Parameters	Quantity	Units and description
Savana Grass Yield	500,000	ton/year (Conservative estimation based on 25 tons/ha from 20,000 ha in Homosha Woreda alone)
Grass availability for harvest	4	month (from December to December to March)
Other uses of Grass	40%	Other uses include roof cover for traditional houses
Grass Collection efficiency	50%	collection efficiency
Grass available for energy use	100,000	ton/year
Savana Grass processing	25,000	ton/month (amount that must be processed per month for four months)
Available grass for charcoal production	1,136	ton/day (22 working days in a month)
Charring efficiency	33%	Conversion of grass to charred powder
Amount of charcoal production	375	ton/day (if all available grass is converted to charcoal)

Annex 1B - Price build up for production of charcoal briquette from wild grass (savanna grass)

Cost item	Value (ETB/day)	Value (USD/day)	Assumptions
Labor	6,205	228	3 persons @ETB 150/day for harvesting and 2 persons per kiln, 1 person for each of the hammer mill and briquetting machine
<i>Labor harvesting</i>	450	17	
<i>Labor processing</i>	5,755	212	
Depreciation	1,780	65	
<i>Kiln</i>	1,423	52	
<i>Briquette machine</i>	302	11	
<i>Hammer mill</i>	55	2	
Storage	479	18	
Marketing	479	18	
Packaging	319	12	
Miscellaneous costs	399	15	
Total costs	9,662	355	
Margin	25%	0	
Profit	2,415	89	
Product price	12,077	444	Daily production 2.4 tons/day
Retail Price/kg	5.03	0.19	

Annex 2 – Prices of raw materials and RE and EE products

Annex 2.1 – Average cookstove prices in RLLP intervention areas

Type of stove	Price (ETB)
Gonzie Stove Price	150.00
*Clay Fuel Saving Stove (made by potters)	40.00
Clay traditional stove	20.00
Lakech Charcoal stove	150.00
Bee-hive stove	180.00

**This is estimation based on price of similar size products currently supplied by rural potters*

Annex 2.2 – Average price of solar lighting products price (certified Lighting Global approved)

Product type	Price (ETB)	Description
Solar Lanterns	2,300.00	Single light + phone charging
Pico Solar systems	4,500.00	2 to 3 lights + Phone charging
Solar Home System	8,000.00	More than 3 lights + radio cassette player
Larger Solar Home Systems	15,000.00	4 lights + phone charging + radio + TV

Annex 2.3a – Material requirement for production of Mirt injera stove

Material	Unit	Ordinary Mirt	Slim Mirt
Sand	m3	0.05	0.02
Cement	kg	28.60	16.70
Water	Liter	120.00	60.00
Labor	Person-day	0.50	0.25

Annex 2.3b – Price build up for Mirt Injera stove (ETB)

Production cost (ETB)	Mirt	
	Benishangul	Amhara
Material Cost		
Cement	48.43	48.43
Sand	3.64	3.60
Water	9.00	9.00
Lubricating oil	1.00	1.00
Labor	17.50	30.00
Depreciation	5.00	5.00
Production cost	79.57	92.03
Producer's margin, 25%	19.89	23.01
Factory gate price	99.46	115.04
Marketing Costs		
Transport cost	4.26	3.47
Loading/Unloading	2.50	3.00
Warehouse/storage cost	2.50	3.00
Overhead costs	5.00	5.00
Cost of Capital	2.50	2.50
Total Marketing costs	16.76	16.97
Total costs	116.22	132.01
Retailer's Profit Margin, 20%	23.24	26.40
Selling Price	139.47	158.41

Note: Cost structure and material requirement for production of Mirt was obtained from GIZ ECO.

Annex 2.4 – Price build up for ‘Tikikil’ stove

Cost items	Unit	Quantity	Unit price (ETB)	Total (ETB)
Mild sheet metal	m2	0.83	130.00	107.90
Round bar	m	2.10	16.00	33.60
Clay Liner	Number	1	30.00	30.00
Paint	Number	1	12.00	12.00
Labour	Number	1	35.00	35.00
Depreciation		1	2.00	2.00
Production cost		1		220.50
Producer's margin	%	25%		55.13
Manufacturer's price				275.63
Marketing Costs				
Transport cost				4.00
Loading/Unloading				1.00
Warehouse/storage cost				1.00
Overhead costs				5.00
Cost of Capital				2.50
Total Marketing costs				13.50
Total costs				289.13
Retailer's Profit Margin, 20%				57.83
Selling Price				346.95

Annex 2.5 – Raw material prices in RLLP intervention areas

Material	Unit	Benishangul	Amhara
Sand	ETB/m ³	150.00	150.00
Red ash/Sand	ETB/m ³	130.00	687.50
Cement	ETB/100 kg	225.00	290.00
Transport	ETB/(Qntl/km)	0.50	0.39
Labor-unskilled	ETB/day	150.00	240.00
Labor-	ETB/day		
Water	ETB/Liter	0.15	0.15
Gal. sheet metal (5mm)	ETB/m ²		
Mild steel sheet (5mm)	ETB/m ²	130	130
Round bar (6mm)	ETB/m	16	16
Rivets	ETB/pcs		
Clay liner	ETB/pcs	30	30
Paint	ETB/stove	12	12

(Source: Market Survey, Nov/Dec 2017)

Annex 2.6 – Prices of production molds for fuels saving stoves

Type of Molds	ETB	USD
Mirt stove mold	5,000	183.82
Gonzie stove mold	5,000	183.82
Lakech/ Bee-hive stove Charcoal stove	500	18.38

Annex 2.7 – Unit price of equipment and tools needed for wild grass briquette production

Item	Price (USD)
Unit Price of metal Kiln	551
Unit price of briquetting machine	6,000
Unit price of Hammer mill	1,103

Annex 3 – CO₂ Emissions reduction potential

Annex 3.1 Estimation of emissions reduction per stove per household per year for baking (with Mirt stove)

No.	Estimation of CERs/VERs	Symbols	Values	Units
1	Percentage of non-renewable biomass use for Ethiopia	f_{NRB}	88	%
2	Average fuelwood consumption by household for Injera baking in absence of Project	B_y	1.95	tone/hh/year
3	Efficiency of stove being replaced	η_{old}	12	%
4	Efficiency of stove to be deployed	η_{new}	20	%
5	Net Calorific Value of biomass	NCV	0.015	TJ/tonne
6	Emission factor for the substitution of non-renewable biomass	EF	86.1	tCO ₂ /TJ
7	Emission Reductions per stove	E_{ry}	0.89	TCO ₂ /hh/year
8	Number of cookstoves disseminated during project period		273,000	
9	Life time of cookstoves		3	Years
10	Total emissions reduction because of program		726,031	TCO ₂ (In 5 years project period)

Annex 4 – Stakeholders Interview and FDG Guidelines

Annex 4.1 – Stakeholders interview guideline

- a) Region Bureaus of Water and Energy
- b) Woreda Offices of Water and Energy, and Agriculture and Health extension services
- c) Woreda/Kebele administrations – Micro and small enterprise (MSE) development offices
- d) NGOs, Community Based Organizations, others that promote, support or implement household energy projects
- e) Micro Enterprises Development Agencies
- f) Watershed Users Association (WUA)

Introduction

- Introduction to the project. The World Bank in partnership with Ministry of Agriculture and Natural Resource are implementing a Resilient Landscape and Livelihood Program (RLLP) as a continuation of the previous SLMP 1 and 2 Programs in six regions in Ethiopia. Your region is one of the six regions where the RLLP is implemented.
- The objectives of the program are to:
 - Identify, evaluate and select appropriate sustainable energy options for households with focus on the benefits to NR conservation and empowering and strengthening women.
 - Strategically nest existing household energy programs and projects within RLLP as well as identify gaps that could be addressed by the project

Purpose of the interview. I am here to gather information about existing household energy projects and how they are being implemented, and assess possibility for creating synergy with the RLLP program.

No.	Queries	Notes
1	Location and date Date: _____	Region, Zone: Wereda:
2	Officers present in discussion – Name, agency, position, mobile 1 – Name, agency, position, mobile 2	
3	– Relevance of the project (after explanation of its objectives) – Existing activities related to RLLP program (first list activities mentioned by the officers, then ask how activities have gone – viability, acceptance, ownership, mainstreaming) – Type of household energy technology promoted, – Capacity of organization implementing the project (personnel, knowledge, number) – Who is responsible to implement and follow up?	

	<ul style="list-style-type: none"> – Observed challenges for implementation of household energy technologies/projects – Do you see possible solutions to these challenges? If yes, what are they? Do you have the plan to implement them? – Integration of the project into institution's plans (mainstreaming) – Are there other organizations doing household energy projects in the area? – If there are, are their objectives similar to yours? – How possible is it to integrate your household energy project with others implementing the same thing? How can these projects complement each other? – Share Lessons learnt from your project – What are your recommendations – Key points for sustainability 	
4	<p><u>How can energy support rural households, businesses and industries?</u></p> <ul style="list-style-type: none"> – What household energy technologies are useful to the rural households in your area – Awareness of the technologies (illustrate with examples: ICS, SHS, Lanterns, Solar pumps, etc)- are communities aware of such technologies – List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) – Willingness of users to pay – Paying capability of households – Finance availability for users – Finance availability for household energy technology producers and distributors 	
5	<p><u>Is there any program that works in organizing unemployed women/ youth in micro enterprises or SHG?</u></p> <ul style="list-style-type: none"> – Selection criteria – Numbers organized – Supports provided – Possible IGAs – Is Financing available – Possibility to channel household energy technologies through such enterprises 	
6	<ul style="list-style-type: none"> – Community water supply – how is it powered – How far is it from the center where most households are settled 	

7	<ul style="list-style-type: none"> – Water harvesting structures (ponds, cisterns, etc) – Describe how people fetch water – Need for water lifting mechanism 	
8	<ul style="list-style-type: none"> – Any existing irrigation scheme or plan 	
9	Livestock <ul style="list-style-type: none"> – Livestock resource in the woreda – Average holding of livestock per household – Describe livestock management practices in Wereda – Manure collection, use – Manure collection, use responsibilities (women/men) – 	
10	Energy <ul style="list-style-type: none"> – Price of fuels (wood, charcoal, dry cell, candle, etc) 	
11	Health <ul style="list-style-type: none"> – major diseases 	
	<u>Thank Interviewee</u>	

Annex 4.2 - Focus Group Discussion guidelines

- a) Women – Self Help and Community Groups or private businesses engaged in household energy technology dissemination
- b) Individuals working on production or distribution of household energy technologies
- c) RE & EE technology users

Introduction

- Introduction to the project. The World Bank in partnership with Ministry of Agriculture and Natural Resource are implementing a Resilient Landscape and Livelihood Program (RLLP) as a continuation of the previous SLMP 1 and 2 Programs in six regions in Ethiopia. Your region is one of the six regions where the RLLP is implemented.
- The objectives of the program are to:
 - Identify, evaluate and select appropriate sustainable energy options for households with focus on the benefits to NR conservation and empowering and strengthening women.
 - Strategically nest existing household energy programs and projects within RLLP as well as identify gaps that could be addressed by the project

Purpose of the interview. I am here to gather information about existing household energy needs (including home based businesses and industries) and how they have been addressed. Learn about the challenges and barriers for micro businesses that work on production and distribution of household energy technologies in the Woreda/Kebele.

No.	Queries	Notes
1	Location and date Date: _____	Region, Zone: Wereda:
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	
4	– Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation	

	<ul style="list-style-type: none"> – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	
4	<p><u>Main cooking fuels</u></p> <ul style="list-style-type: none"> – List main cooking fuels and how households in the community obtain them – If collection how far do people travel (km), how long it will take them, and who collects the fuel? – If purchased how much does the fuel cost (ETB/kg). Price for each commercial fuel. – What are most widely used cookstoves? – How much fuel is consumed on per week by a household on average? – How much does a household pay to purchase cooking fuel on average? – Awareness of the community about ICS? List the ICSs known and used in the community. – How did they acquire ICS or solar (RE & EE) products? – Were there any organization supporting acquisition of RE & EE products? – List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) – Willingness of users to pay – Paying capability of households – Finance availability for users to purchase ICS? – Finance availability for household energy technology producers and distributors 	

5	<p><u>Lighting</u></p> <ul style="list-style-type: none"> – What do households use for lighting (list sources of lighting)? – How much does a typical household spend for lighting? (List costs per sources of lighting) – Retail prices of source of lighting? (Kerosene, dry cell, candle, etc) – Do most households have mobile phones? If yes, how do they charge them? What is the cost of charging? – Are Solar Home Systems/ Lanterns used by the households? How much do they cost? How do they acquire them? Are there local distributors? – How did they acquire ICS or solar (RE & EE) products? – 	
	<p><u>Thank participants</u></p>	

Annex 5: Summary of Interview and FGDs Conducted with Bureaus and Relevant Institutions

1. Mehamed Haji – SLM Oromia Regional Representative

In Oromia the improved cookstoves program through the Self Help Group (SHG) was tried but could not be sustainable as members of the group could not generate sufficient income to keep them in the Business. The SLM team together with the regional and woreda level energy sector organization trained youth organized in Small and Micro Enterprises (SMEs).

2. Mulatu – Gambella – SLMP Regional Representative

The SLM team works with the women Self Help Groups which were trained and established by the Regional energy bureau and The Adults Training Center which is under the Bureau of Capacity Building. Each producers group is composed of 20 persons. Producers group that was established in Gambella town were allowed to use the Kebele meeting hall as temporary place for the production of cookstove. In other places, plastic sheet covered production sheds were used by the producers groups. Like most of the other regions, Mirt and Gonzie are the two improved cookstoves that have been produced and disseminated in Gambella. Mirt stove is mainly distributed to the highlanders while Gonzie was to the lowlanders.

Production tools and raw materials for production of cookstoves were given as a one time support to help the group start the business. Producers sell Mirt stove for ETB 300 and Gonzie for ETB 200. The bureau of energy provides transport for bringing raw materials to the production place and distribution of the cookstoves to consumers. The average monthly sales of stoves was five.

Producers trained during the first phase are now in business for about 5 years. Those trained in the second phase are in business for 2 years. Out of the eight producers group established during the first and the second phase, only 3 are operational now in Gambella. These producers are legally registered entities. The income from the sales of cookstove is not sufficient to keep them in the business. Other additional activities are needed for the group to generate sufficient revenue stream and make the cookstove business feasible in the region.

3. Enegeg Deresse – SLMP Regional Representative for Amhara Region, Bureau of Agriculture and Natural Resources, SLM Program Officer

Amhara SLM program distributed domestic biogas digesters and improved cookstoves in Yilmana Densa, and Guagussa Woredas. Agriculture and Natural Resource Offices at Woreda level are responsible for distribution of fuel saving stoves to households in the watershed areas. The Natural Resource Office purchases fuel saving stoves from stove producers based in Woreda towns. In Yilman Densa Woreda there are three producers groups. Cookstove production is a side business for them as there is not continuous demand for it.

4. Yohannis – Benishangul Region SLMP Representative

The SLM program of the he Benishangul Gumuz Bureau of Agriculture and Natural Resource works with the Regional Bureau of Water and Energy on the dissemination of improved cookstoves in SLMP watershed areas. In the SLM Program in Benishangul regions, the Bureau of Water and Energy is a member of the task force. The Bureau of Water and Energy in partnership with Woreda Natural Resource Offices established self-help groups for the manufacturing of Mirt improved cookstoves. The energy sector in the region trained the cookstove producers and equipped them with the necessary production

tools. The Energy Bureau also provided raw materials for the production of the first batch of improved cookstoves. Producers were expected to prepare their own production shed in most of the places. The SHG sell Mirt stove at ETB 120. Promotion of Gonzie stove in Benishangul is not successful as households preferred Mirt and also that producers found it easier to produce Mirt than Gonzie. SLMP distributes Mirt stoves to households as a reward for their contribution and support in the watershed rehabilitation effort.

The SHGs were initially established with 12 members. The number usually drops down through time. For example, in one of the groups the number of members dropped down to 8 in three years since its establishment. Only three of them were actively engaged where the other five seldom contribute to the group. The main reason for members leaving the group is because the sells is not consistent and sufficient to generate reliable income for them.

The Rural Technology Development Center in Benishangul produces some energy technologies including cookstoves and efficient charcoal production metal kilns. The Center is more like a research institute where prototypes are produced. Gaia Association in partnership with UNHCR works in development of new fuels from wild grass. The objective is to provide alternative cooking fuel to the refugees in Assosa camps.

5. Sultan Ahmed (Director) and Wondimagegnehu (Expert) – Benishangul Region Rural Technology and Mechanization Center

The Rural Technology and Mechanization Center is located in Assosa town and works on technology adaptation and development for agriculture, water, irrigation and energy sector. Different types of biomass cookstoves including charcoal stoves and confined stoves that burn agri-waste were developed in the center. The center also developed efficient charcoal making kiln from metal for carbonizing bamboo for charcoal making. Technology dissemination is, however, very limited when it comes to energy products. None of the energy technologies were disseminated to users but are there as a showcase. The resources in Rural Technology Mechanization Center in Assosa are not efficiently utilized by the energy sector. Currently, the Center does not contribute much to the energy sector except production of molds that will be used for manufacturing of Mirt stoves.

6. Sultan Busera – Benishangul Gumuz Region, Homosha Woreda, Water

The Water and Energy Office in Homosha Woreda promotes both improved and traditional fuel saving stoves. The Office trained two micro enterprises in the Woreda to manufacture and sell fuel saving stoves. Market linkage has been a challenge. But recently, SLMP in the Woreda buys stoves even though it is not a continuous market. The Water and Energy Office in the Woreda is planning to train and add two additional producer groups. Cookstove is supplementary income to the producers. They are engaged in cookstove production in the dry season where there is no farming activity.

The Water and Energy Office promotes solar lanterns and solar home systems in the Woreda. Households can purchase these technologies through the Micro Finance Institutions with a credit system. Community water supply and water supply for irrigation are other activities that this Office does in the Woreda.

7. Engida Berhanu – Benishangul Gumuz Region, Homosha Woreda Agriculture Office, Natural Resource Conservation Core Process

According to Engida Berhanu, the Women and Youth Office is responsible for establishment of cookstove producers' group. There are two cookstove women Self-Help Groups in Homosha that produce cookstoves.

The Office worked with Farm Africa and the Woreda Administration to establish a cooperative with 100 members to manage and utilize the bamboo resource for charcoal production. Savanah or wild grass is also another local resource which could be converted and utilized as an alternative household cooking fuel.

8. Fikremariam Yeshwaluel – Benishangul Region, Bambasi Woreda, Development Response to Displacement Impact Project (DRDIP), Team Leader

DRDIP is under the Regional Agriculture Office. It was recently established to address the environmental and social impact of refugees presence in the region. Eight kebeles are seriously affected by the refugees settlement in the Region. DRDIP is supported by the World Bank and works on natural resource conservation. DRDIP distributed about 320 Mirt stoves to poor households in the eight affected Kebeles. DRDIP works with the Water and Energy Office of the Woreda to purchase Mirt stoves from local producers to distribute to target beneficiaries. DRDIP also agreed with Region's Bureau of Water and Energy to disseminate solar home systems and domestic biogas digesters. Households prefer Mirt stove than Gonzie.

9. Yacob Abdulahi – Benishangu Gumuz Water, Mines and Energy Bureau, Bureau Head

The Bureau works with several development partners including DRDIP, World Vision Ethiopia, SLMP for dissemination of fuel saving stoves, off-grid solar lighting products, and domestic biogas digesters.

Energy experts from the Bureaus and Woreda Offices provide technical capacity building trainings to new producers. Development partners uses these experts when they want to train Self Help Groups in fuels saving cookstove production.

On the water sector, the Bureau has several projects. Access to water is high in the Region but sustainability is the major issue. About 50% of the Bureau's effort on the waters sector is on rehabilitation existing water supply systems.

There is a direction given by the Federal and Regional Governments to shift towards renewable energy sources to power community water supply systems. The Bureau already completed a study to change the existing diesel powered water supply system by solar.

10. Bihonegn Etefa (Director) – Benishangul Region, Alternative Energy Development and Monitoring Directorate

Main objective of the bureau is to promote and disseminate alternative energy and energy efficiency solutions. Activities in the bureau include: awareness raising for solar lighting products through distribution of leaflets, brochures and monitoring, promote and help create demand for solar home system adoption through credit lines of Micro Finance Institutions, promote fuel saving stoves, train cookstove producers (Mirt and Gonzie stoves), developed high mass cooking stove for porridge

preparation (very limited dissemination), promote Lakech charcoal, rocket stoves and locally produced clay stoves (the market uptake is high), and promotes energy efficient lamps (CFL and LED light bulbs).

In the last two years the bureau supported dissemination of over 2,000 solar home systems, 1,500 solar lanterns. There is a capacity limitation in cookstove design and testing. For example, the stove designed and developed by the bureau for cooking traditional food such as porridge has never been tested for its performance.

The Bureau built a domestic biogas digester for promotion. Now, the region is also included in the domestic biogas program. The plan is to conduct demand assessment for fuel saving cookstoves, selection of appropriate stove types and raw materials such as sand and clay. The strategy by the bureau is to organize producers in micro enterprises with two or three members and equip them with the molds and tools necessary for the production of cookstoves. The enterprises themselves will be responsible to sell the stoves to consumers. Lack of access road, low awareness level of households on the benefits of fuel saving cookstoves, and low level of willingness to pay (as fuel is freely collected in most places) are major challenges. According to the bureau, cookstove producers are found in 65 Kebeles. Their sales is very low which on average is one stove per week.

Other challenges are lack of production shed, limited or no access to finance (low interest rate or revolving fund), production takes longer and a lot of effort, and transportation of raw materials from source to production place and finished products to consumers. Selling outlets are usually located in Woreda towns which are not easily accessible to consumers in the villages. Because of low volume of sales, many of the group members leave the group into other businesses. Women & Youth Bureau, SLMP promote and disseminate cookstoves in the region.

The price of cookstoves is ETB 220 for Mirt, and between ETB 150-ETB180 for Gonzie.

11. Tewodros Berhanu - World Vision Ethiopia (WVE), Manger of the Bambassi Woreda WVE office.

WVE in Bambassi Woreda works on health, child protection, energy, WASH and other community related projects. WVE has very strong integration with local government administrations and government sector organizations. The energy project implemented by WVE is dissemination of fuel saving stoves. WVE established producers group and got them trained by the energy office. Now, there are two producer groups in the Bambassi Woreda who produce Mirt stove.

12. Alemgena Ketsela (Director)- Benishangul Gumuz Region – Water and Sanitation Directorate

Ministry of Water, Irrigation and Electricity gave direction to regional water bureaus include that of Benishangul region to plan all their community water supply systems to be powered by renewable energy sources. The bureau conducted assessment of existing remote water supply systems powered by diesel. They plan hybrid systems to ensure reliability. There is also a plan to replace hand pumps by solar pumps. The bureau works with different development partners that operate in the region.

13. Desalegn Genatneh (Manager), Gaia Association

Gaia Association has been working over the last 15 years in promotion of clean cooking using ethanol fuel. It promotes ethanol fuel and stove to households and refugees. It closely works with UNHCR to address social and environmental issues associated to refugees' demand for cooking fuel energy.

Gaia extended its service in Benishangul Gumuz region to address the energy crisis and its environment consequences because of refugees settled in Benishangul region. As part of its strategy, Gaia is working in providing alternative cooking fuels. It identified wild grass and bamboo as potential energy resource which can be developed to supplement the cooking fuel needs of the refugees and host communities. Gaia Association has already developed charcoal briquette from carbonized wild grass. The fuel got wide acceptance by both refugee and host communities. It is now planning for a scaled up dissemination. Gaia Association is willing to partner with RLLP program of the World Bank or the Regional SLM programs to share its experience and partner in the effort for promotion of clean and sustainable cooking fuels to the households.

14. Yisehak Seboka (Laboratory and Workshop team leader), Alternative Energy Promotion and Development Center, MoWIE

Ministry of Water, Irrigation and Electricity conduct research and development in renewable energy and energy efficiency technologies. It works in adoption, training and dissemination of such technologies. As part of its energy efficiency R&D work, the Ministry developed an efficient charcoal production kiln which is able to carbonize biomass materials in much higher efficiencies than the traditional charcoal production methods. The metal kiln developed by MoWIE is proven to have a conversion efficiency of 33%. This is a remarkable achievement compared to the traditional charcoal production practices with efficiencies of 15%. MoWIE is willing to work with SLM program to train producers of metal kilns.

15. Kassahun (SLM expert) – Amhara Region, Yimana Densa Woreda, Agriculture and Natural Resource Office

The Bureau works closely with the Bureau of Water and Energy in promotion and training of fuel saving cookstoves production and dissemination. Mirt stove is promoted in this Woreda. There are three producer groups located in the Woreda capital, Adet town. The SLM program purchases Mirt stove from these producers and distributes it to users households in the SLMP intervention watershed areas. SLM program suggests that production of the stoves in the villages where consumers are located could resolve many of the problems currently observed in the dissemination of the stove. These problems are transportation of stoves from the production place to the villages, breakage of stoves during transportation, and high cost of transportation if commercial transport is used. Production of stoves at the watersheds may reduce transport cost, breakage, confirm product quality and also creates jobs. However, during the discussion, it was realized that the transportation cost could not be reduced significantly as transportation of raw material would be needed. Secondly and most importantly, setting up production in the watersheds would drain the market for the producers that are based at the Woreda capital that supply all the stoves in the region.

Watershed Users Association (WUA) is started in Amhara region. The association follows up activities and ensure that residents in the watershed abide by the rule in their daily practices.

16. Ayin Engeda (Team Leader) – Amhara Region, Yimana Densa Woreda, Alternative Energy Development and Promotion Desk

Fuel saving producers in the Woreda do not have production place except one of them that is supported by a local NGO. The two most active producers are those who do not have production place. They produce the stoves in small compounds at their homes. The main problem is creating a sustainable market for them. Breakage during transportation is also another problem. The Bureau trained additional four producers groups near consumers in order to reduce breakage during transportation. However, for lack of production tools and molds, these trained people could not get into the production business. Price of mold for Mirt stove production used to cost ETB 450 two years before.

17. Wondimu Berhanu (Director) – Amhara Region, Water and Energy Bureau, Bioenergy technology Development Directorate

The Bureau is aware of the cookstove intervention that the Bureau of Agriculture implements through the SLM Program in the watershed areas it operates. He emphasized that the distribution model the SLMP implements creates market distortion as the program freely distributes the stoves affecting the effort to build a sustainable commercialization network for cookstoves dissemination.

The Bureau provides technical support in a form of training to new business for fuel saving stove production. It also facilitates and supports supply of molds and accessories necessary for production of improved cookstoves. Start up capital is available from Micro Finance Institutions to producers. The Bureau promotes different types of RE/EE technologies: Mirt, Gonzie, Lakech charcoal stove, Fetenech cooking stove, domestic biogas, and solar products.

Raw materials for the production of cookstoves such as Tikikil firewood stove (a variation of rocket stove made locally), Lakech charcoal stove and Fetenech include metal components which are not easily available in rural areas. The bureau also suggested for SLMP to promote domestic biogas digesters for cooking, lighting and use of the slurry for fertilizer. There is awareness problem in eastern Amhara.

Other RE technologies that the Bureau promotes includes solar water pumping system, solar lanterns and solar home systems. The bureau gets support from MoWIE on design and sizing of solar water pumping systems. Credit lines are available for household to adopt solar lighting products from Amhara Credit and Saving Institution. The REDD+ program of the Ministry of Environment, Forest and Climate Change closely works with the Amhara Region Water and Energy Bureau. The Water and Energy Bureau is willing to work with the Regional Bureau of Agriculture and Natural Resource.

18. Tewodros (Manager) – GIZ EnDev Bahir Dar Office

GIZ energy office has been operating in Bahirdar for the last two decades. It was promoting and providing training for the production of Mirt cookstoves and Tikikil stove for wot cooking. GIZ also promoted institutional system to health posts. It installed several institutional systems in health centers in Amhara and other regions.

GIZ EnDev Bahirdar office is working with cookstove producers to form an association that help them advocate for policy supports to the cookstove sector and also maintain quality of product standard and branding of fuel saving cookstoves. GIZ already helped establishment of The Amhara Regional Improved Cookstove Association (ARICA). ARICA is now institutionalized and functional. ARICA also helps on cookstove supply chain development creating and developing a market for fuel efficient and clean cookstoves and fuels.

19. Tizazu (Team Leader) – Amhara Region, Awi Zone, Guagussa Woreda, Agriculture and Natural Resource Conservation Office.

The Agriculture and Natural Resource Conservation Office works on dissemination of fuel saving stoves in the watersheds that it operates and also encourages farmers to plant alternative cooking fuel such as acacia decurrens. The Agriculture Office uses producers trained by the Energy Office for the supply of fuel saving stoves. Cookstoves are freely distributed to households. Mirt stove is the fuel saving stove promoted in the zone. Most of the households in the area use traditional open fire for injera baking, and locally made clay stove for cooking wot and boiling tea or coffee. There are three producers in the Woreda. All of them produce Mirt stove and are located in Tilili, the capital of Awi Zone and also in Guagussa Woreda.

20. Farmer in Awi Zone – Amhara Region, Awi Zone, Guagussa Woreda,

This farmer owns a quarter of a hectare of land which he plants acacia decurrens to supply fuel for cooking. The harvest cycle for acacia decurrens is five years. The first year, he also plants crops side by side the acacia seedlings. The following year, he grows grass and sales for animal feed. From the third year onwards until harvest the land cannot be used for anything else. After the harvest, the biomass is carbonized to make charcoal. From the quarter of a hectare he procures about 1,200 bags of high quality charcoal. Each bag on average weighs about 20kg which he wholesales each bag for ETB 100. According to the farmer, acacia decurrens has a capability to replenish nutrients in the land. Unlike eucalyptus the land can be used for growing crops again.

Annex 6: Focus Group Discussion with Households in SLMP Watershed Intervention Areas

FGD – Benishangul-1 – RE/EE Technology Users

Introduction

- Introduction to the project. The World Bank in partnership with Ministry of Agriculture and Natural Resource are implementing a Resilient Landscape and Livelihood Program (RLLP) as a continuation of the previous SLMP 1 and 2 Programs in six regions in Ethiopia. Your region is one of the six regions where the RLLP is implemented.
- The objectives of the program are to:
 - Identify, evaluate and select appropriate sustainable energy options for households with focus on the benefits to *NR conservation* and *empowering and strengthening women*.
 - Strategically nest existing household energy programs and projects within RLLP as well as identify gaps that could be addressed by the project

Purpose of the interview. I am here to gather information about existing household energy needs (including home based businesses and industries) and how they have been addressed. Learn about the challenges and barriers for micro businesses that work on production and distribution of household energy technologies in the Woreda/Kebele.

No.	Queries	Notes															
1	Location and date Date: <u>21 November 2017</u>	Region, Zone: Benishangul Gumuz, Assosa Zone Wereda: Homosha, Kebele: Gumu Watershed: Agulash Tikiku Sherkole Watershed, Mirco-watershed: Lower Akendo															
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	<table border="1"> <tr> <td>1. Atom Oeiwan (Male)</td> <td>6. Roda</td> <td>11. Hamil</td> </tr> <tr> <td>2. Halifa Abdu (Male)</td> <td>7. Amuna</td> <td>12. Hawa</td> </tr> <tr> <td>3. Siama Remadan (F)</td> <td>8. Gemai</td> <td>13. Siama</td> </tr> <tr> <td>4. Subeda (F)</td> <td>9. Hasise</td> <td></td> </tr> <tr> <td>5. Hadiya (F)</td> <td>10. Assia</td> <td></td> </tr> </table>	1. Atom Oeiwan (Male)	6. Roda	11. Hamil	2. Halifa Abdu (Male)	7. Amuna	12. Hawa	3. Siama Remadan (F)	8. Gemai	13. Siama	4. Subeda (F)	9. Hasise		5. Hadiya (F)	10. Assia	
1. Atom Oeiwan (Male)	6. Roda	11. Hamil															
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4. Subeda (F)	9. Hasise																
5. Hadiya (F)	10. Assia																
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Almost all of the households based their livelihood on farming – crop, fruits and vegetable for production for own consumption and market, some of the households also keep cattle and sheep/goat															
4	– Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw	Households with and without fuel saving cookstoves. Family size of participants = Maximum=17, Minimum=6, Average=8 Water supply – hand dung well with a hand pump, one pump for 42 households															

	<p>materials and associated costs including transportation</p> <ul style="list-style-type: none"> – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	
4	<p><u>Main cooking fuels</u></p> <ul style="list-style-type: none"> – List main cooking fuels and how households in the community obtain them – If collection how far do people travel (km), how long it will take them, and who collects the fuel? – If purchased how much does the fuel cost (ETB/kg). Price for each commercial fuel. – What are most widely used cookstoves? – How much fuel is consumed on per week by a household on average? – How much does a household pay to purchase cooking fuel on average? – Awareness of the community about ICS? List the ICSs known and used in the community. – How did they acquire ICS or solar (RE & EE) products? – Were there any organization supporting acquisition of RE & EE products? – List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) – Willingness of users to pay – Paying capability of households 	<ul style="list-style-type: none"> - Use agri-residues, twigs and picking for injera baking but firewood for cooking - All households collect their firewood. Those households that use fuel saving stoves collect three times a week while those who do not have fuel saving stoves collect every day. - Firewood collection takes 2:30 hours for both trips and collection (Collection time is about 30 minutes) - None of the households sale firewood - It is the women who collect firewood. One women load of firewood weighs between 20 to 30 kg (of the total weight about $\frac{3}{4}$ is twigs and the rest is firewood). This means, injera baking takes about 65% of the cooking fuel. - Mirt and Gonzie stoves are know by the households. Four of the households in the FGD own Gonzie. They purchased the stoves themselves. The others who own a fuel saving stove got them from SLMP for free – perhaps as a reward for their contribution to the watershed works. Those who purchased the stoves paid ETB 50 for the stove. SLMP recently distributed additional 50 Gonzie stove in this micro watershed. - There is not improved cookstove for wot cooking. None of the households is aware of a fuel saving stove for cooking. - The households bake injera on a daily basis. On average they bake about 15 injera and this takes them about 1 hour. - Households cook three times a day. <i>Shiro wot</i> and <i>Kentes</i> (vegetable stew) are typical food they cook on daily basis. - Households estimate the price of Gonzie is about ETB 100. - Most of the participants seem willing to pay up to ETB 30 for a fuel saving cookstoves.

	<ul style="list-style-type: none"> – Finance availability for users to purchase ICS? – Finance availability for household energy technology producers and distributors 	<ul style="list-style-type: none"> - Source of income for the households is sales of fruits such as mango and vegetables. - Formal saving and Credit service is not available or not known by the participants. - Some of the women do save on traditional saving group (Ekub) on a weekly or monthly basis.
5	<u>Lighting</u> <ul style="list-style-type: none"> – What do households use for lighting (list sources of lighting)? – How much does a typical household spend for lighting? (List costs per sources of lighting) – Retail prices of source of lighting? (Kerosene, dry cell, candle, etc) – Do most households have mobile phones? If yes, how do they charge them? What is the cost of charging? – Are Solar Home Systems/ Lanterns used by the households? How much do they cost? How do they acquire them? Are there local distributors? – How did they acquire ICS or solar (RE & EE) products? – 	<ul style="list-style-type: none"> - Most households use dry cell powered hand torches for lighting. Solar lanterns are used by about 6 households out of a total number of 42 households in the village. - The 6 households obtained the solar lanterns for free from SLMP. - The households on average purchase 3 dry cells every two weeks paying about ETB 22.50 (which is ETB 43 per month). - Price of a dry cell powered hand torch is about ETB 40. - The husbands of all the women participated in the discussion own mobile phones. They send them to Assosa town for charging.
	<u>Other</u>	<ul style="list-style-type: none"> - Households commented that they need a technology without a smoke. Gonzie smokes more than the traditional stove when it burns fuels other than firewood.
	<u>Thank participants</u>	

FGD – Benishangul-2: RE/EE Technology Users

No.	Queries	Notes		
1	Location and date Date: <u>21 November 2017</u>	Region, Zone: Benishangul Gumuz, Assosa Zone Wereda: Homosha, Kebele: Tsore Almetema Watershed: Agulash Tikiku Sherkole Watershed, Mirco-watershed: Lower Akendo Afafre (GPS Coordinate system: 10.211146N, 34.691043E)		
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	1. Jajije Jabir 2. Jemeiya 3. Hadimela 4. Aseta Hali 5. Reya Elfati	6. Halima Anoru 7. Neimar Aseit 8. Shekawa 9. Halima	
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	All households depend on farming and cattle rearing.		
4	– Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area	Households with and without fuel saving cookstoves.		

	<ul style="list-style-type: none"> – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	
4	<p><u>Main cooking fuels</u></p> <ul style="list-style-type: none"> – List main cooking fuels and how households in the community obtain them – If collection how far do people travel (km), how long it will take them, and who collects the fuel? – If purchased how much does the fuel cost (ETB/kg). Price for each commercial fuel. – What are most widely used cookstoves? – How much fuel is consumed on per week by a household on average? – How much does a household pay to purchase cooking fuel on average? – Awareness of the community about ICS? List the ICSs known and used in the community. – How did they acquire ICS or solar (RE & EE) products? – Were there any organization supporting acquisition of RE & EE products? – List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) – Willingness of users to pay – Paying capability of households – Finance availability for users to purchase ICS? – Finance availability for household energy technology producers and distributors 	<ul style="list-style-type: none"> - Injera, porridge and wot, tea/coffee, bread, boiled sweet potato, boiled cereals are the common food cooked by the households. - Cooking fuel: bamboo and maize stock is used for injera baking, while firewood is for cooking wot. - The most common injera baking stone is openfire (3-stone), some households own Gonzie stove. - All households use 3-stone fire for cooking wot. - There are about 252 households in the kebele and about 80 of them have Gonzie stove which were distributed by the SLMP as a reward for their contribution in the SLMP activities in the kebele. - Households commented that Gonzie protects them from open flame and also saves fuel, but smoke is a problem. It smokes more than open fire stove. - One women load of cooking fuel lasts for a week (about 12 kg). Additionally, maize stalk and bamboo (about 12 kg) is consumed by the households per week. - The households use about ¾ of the fuel for non-injera cooking. - The estimate the price of Gonzie around ETB 100. - The participants are willing to pay up to ETB 50 for a fuels saving cooking stove for wot cooking. - Cooking fuel collection takes about 2 hours including collection and travel time. - They do not purchase or sell cooking fuel. - The is not formal Saving and Credit Association/ Cooperative - The households have been using Gonzie for the last 5 to 10 months.
5	<p><u>Lighting</u></p> <ul style="list-style-type: none"> – What do households use for lighting (list sources of lighting)? – How much does a typical household spend for lighting? (List costs per sources of lighting) – Retail prices of source of lighting? (Kerosene, dry cell, candle, etc) – Do most households have mobile phones? If yes, how do they charge them? What is the cost of charging? – Are Solar Home Systems/ Lanterns used by the households? How much do they cost? How do they acquire them? Are there local distributors? 	<ul style="list-style-type: none"> - The main source of lighting is dry cell with hand torches. None of the households participated in the discussion use kerosene. - Price of a hand torch varies between ETB 25 to 50 depending on the size and quality. - Dry cell price – 1 dry cell cost ETB9.00 - On average a household spends for dry cell between ETB 18-30 per month. - Husbands of the participants own mobile phones. Fee for one time electricity charging is ETB 5.00. - Some of the participants have seen solar lanterns - The main source of income for the participant households is crop production. They said that they cannot afford to pay ETB 1,000 for a solar lantern. But are willing to pay the ETB 1000 on credit with extended payment to be paid in a year without interest.

	<ul style="list-style-type: none"> – How did they acquire ICS or solar (RE & EE) products? – 	
	<u>Other</u>	- They said that they need solar lights and fuel saving stove for wot cooking and boiling, the light will help children to study at night and the women to prepare food for the family.
	<u>Thank participants</u>	

FGD – Benishangul-3: RE/EE Producers Group and User Households

No.	Queries	Notes		
1	Location and date Date: <u>23 November 2017</u>	Region, Zone: Benishangul Gumuz, Assosa Zone Wereda: Bambassi, Kebele: 44 Watershed: Sonka, Mirco-watershed: Shosha (GPS Coordinate system: 9.797500N, 34.723331E)		
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	1. Aisha Aminu 2. Zeineba Enderis 3. Abebu Zeid 4. Kedija Amin 5. Emebet Eshete	6. Tiringo Mehammed 7. Rahimet Ahmed 8. Tiru Shiferaw	
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Farming is the main source of their livelihood.		
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area 	<ul style="list-style-type: none"> - The Women producer group was established more than 10 years ago (around 2006) by the Bureau of Water and Energy of the Region. Now, the producers group is supported by the Women and Youth Office of Bambassi Woreda. - The members were 15 when they start the business, now it is reduced to 8 as seven of them left the group. - Bureau of Water and Energy provided the training and the necessary tools for the production. - The producers group built the production shed later on its own. - Cookstoves produced by this group includes Gonzie and another type of stove for cooking. The stove that is used for cooking wot does not have much demand and they stopped production of it. - The price for Gonzie Stove is ETB 220. - The number of Gonzie stoves produced and sold in 2015 was about 200. - Transport cost for bringing raw material such as clay and sand is expensive. Since there is no access road, they transport the raw materials on donkey back. - The cost of firewood for firing 200 Gonzie stoves between ETB 1,000 to ETB 1,500. - During firing the stoves, there is additional cost for grass which provides a tight cover in the traditional kiln. - The SHG has the capacity to produce 30 Gonzie stove per week. Material collection and preparation takes about 6 days. Water for mixing the clay is brought by donkeys. For transporting water with a 20 liter jerry-can by a donkey costs about ETB 2.00. - Lack of market for the stove is their main problem. It is only the projects that buy from them once in a while. Almost all of the Keble households have Gonzie stove. They got them for free from the SLMP. All households 		

	<ul style="list-style-type: none"> - Does the business generate sufficient income for all? If not, Why? - Do you want to add other items in your business? Why? If yes, what kind of items? - Where do you think you would get financing for expansion of your business? 	<p>know the benefit of the stove. They sometimes come to buy part of the stove for replacement of broken parts. Producers believe that Gonzie lasts for about 10 years.</p> <ul style="list-style-type: none"> - Producers complain that there is no demand for the stoves on a daily basis to generate revenue that enable them meet their daily needs. All of the stove producers also do potter in their own homes. Some of the products they produce include Mitad (clay plate for injera baking), clay cooking pots, and coffee pots. The price for Mitad is ETB 50 per piece. - Pottery is the main employment for the women in the Kebele.
4	<p><u>Main cooking fuels</u></p> <ul style="list-style-type: none"> - List main cooking fuels and how households in the community obtain them - If collection how far do people travel (km), how long it will take them, and who collects the fuel? - If purchased how much does the fuel cost (ETB/kg). Price for each commercial fuel. - What are most widely used cookstoves? - How much fuel is consumed on per week by a household on average? - How much does a household pay to purchase cooking fuel on average? - Awareness of the community about ICS? List the ICSs known and used in the community. - How did they acquire ICS or solar (RE & EE) products? - Were there any organization supporting acquisition of RE & EE products? - List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) - Willingness of users to pay - Paying capability of households - Finance availability for users to purchase ICS? - Finance availability for household energy technology producers and distributors 	<ul style="list-style-type: none"> - The major fuel used for cooking are: maize or sorghum stalk, bamboo and firewood. - Gonzie uses about 1/3 of the fuel that Open fire consume for the same task. - Oppesye stove (enclosed portable stove for cooking) and 3-stone fire are widely used by the households for wot cooking and boiling. - Gonzie for wot cooking is not convenient. - Gonzie is portable compared to Mirt stove. There is no demand for Mirt stove in their area. - The households in the area bake injera almost on a daily basis. Very few households bake every other day. This is because of the weather which spoils the food if stayed overnight. - Price of firewood – A donkey-cart firewood on average costs ETB 200. It is used only for injera baking. One donkey load lasts for a month. The average weight is estimated about 500 kg. - Households also collect additional fuel for cooking wot and other things. - Households are willing and able to pay up to ETB 120 for a fuel efficient wot cooking stove (for wot, absit, porridge).
5	<p><u>Lighting</u></p> <ul style="list-style-type: none"> - What do households use for lighting (list sources of lighting)? 	<ul style="list-style-type: none"> - There is grid electricity coverage in the Kebele since the last 10 years. Almost all households are connected. Power meter from EEU costed them ETB 1,300 and internal wiring took another ETB1,500. - Almost none of the households use electricity for either cooking or baking. One of the reasons provided by them is that the initial cost of an electric mited (electric stove for injera baking) is very high (More than ETB 200).

	<ul style="list-style-type: none"> – How much does a typical household spend for lighting? (List costs per sources of lighting) – Retail prices of source of lighting? (Kerosene, dry cell, candle, etc) – Do most households have mobile phones? If yes, how do they charge them? What is the cost of charging? – Are Solar Home Systems/ Lanterns used by the households? How much do they cost? How do they acquire them? Are there local distributors? – How did they acquire ICS or solar (RE & EE) products? – 	<p>Some household in town use electricity. Power interruption is not a reason for them not to use electricity for cooking. A 20 to 30 minutes power interruption in a day is common though.</p> <ul style="list-style-type: none"> - - there is no supplier for electric cookstove. Recently, some youth started to produce electric injera stove.
	<u>Other</u>	<ul style="list-style-type: none"> - Informal traditional group for saving and credit is commonly practiced in this area. - The kebele is connected to the national electricity grid
	<u>Thank participants</u>	

FGD – Benishangul-4: RE/EE Producers Group and User Households

No.	Queries	Notes		
1	Location and date Date: <u>23 November 2017</u>	Region, Zone: Benishangul Gumuz, Assosa Zone Wereda: Bambassi, Kebele: 49 Watershed: Sonka, Mirco-watershed: Abay Meda (GPS Coordinate system: 9.837900N, 34.693638E)		
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	1. Zeineba Seid 2. Alima Seid 3. Aminat Hussien 4. Ayisha Ibrahim 5. Workie Abebe	6. Zebiba Ibrahim 7.	
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Total number of households in the Kebele is 330. They all are connected to the national electricity grid since 2009/10.		
4	– Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area	– They used to produce improved cookstoves as a group. They are now re-trained by the Woreda Energy Office. They are waiting for the Bureau or a local development partner organization to provide them with the tools and molds necessary for the production of improved cookstoves particularly Gonzie stove. – These producers are of the opinion that Mirt stove production would be faster as it does not need drying and firing as opposed to Gonzie stove production. – The market for improved stoves is project driven. Retails to households is very few. – The major source of livelihood for them is agriculture.		

	<ul style="list-style-type: none"> - Does the business generate sufficient income for all? If not, Why? - Do you want to add other items in your business? Why? If yes, what kind of items? - Where do you think you would get financing for expansion of your business? 	
4	<p><u>Main cooking fuels</u></p> <ul style="list-style-type: none"> - List main cooking fuels and how households in the community obtain them - If collection how far do people travel (km), how long it will take them, and who collects the fuel? - If purchased how much does the fuel cost (ETB/kg). Price for each commercial fuel. - What are most widely used cookstoves? - How much fuel is consumed on per week by a household on average? - How much does a household pay to purchase cooking fuel on average? - Awareness of the community about ICS? List the ICSs known and used in the community. - How did they acquire ICS or solar (RE & EE) products? - Were there any organization supporting acquisition of RE & EE products? - List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) - Willingness of users to pay - Paying capability of households - Finance availability for users to purchase ICS? - Finance availability for household energy technology producers and distributors 	<ul style="list-style-type: none"> - Fuels used for injera baking are firewood, maize and sorghum stalk. - The households mostly collect and sometimes purchase firewood. - For cooking wot or boiling coffee they also use firewood. - In Bambassi, a donkey-cart firewood costs ETB 200 which weighs about 200 kg. - Households also collect firewood 2 or 3 times a week. Women and children are responsible to collection firewood. Each time they collect they bring about 30kg of firewood. - On average, the households feel that they consume about 120 kg of cooking fuel per week. - Maize and sorghum stalk is additional to firewood. - Injera baking takes 65% of the fuel collected. - Opesi stove is sold in the market with an average price of ETB 30. - The households are willing to pay up to ETB 50 for a fuel saving stove that will be used for cooking wot and boiling coffee, etc. - Gonzie stove reduces fuel consumption but produces more fuel. - Producers themselves change the design of Gonzie stove by blocking the opening at the back which serves as smoke outlet. - The participants commented that most users prefer to have Mirt stove than Gonzie stove. They have seen previously Mirt stoves distributed by World Vision Ethiopia. - All of the households participated in this FGD are connected to the grid but none of them use electricity for either cooking or baking. The all agreed that the initial price of electric injera baking stove (ETB 2,400) and ETB 500 for wot cooking stove is expensive to them to adopt. - They are all willing to pay up to ETB 70 per month for electricity per month using it for cooking and baking. -
5	<p><u>Lighting</u></p> <ul style="list-style-type: none"> - What do households use for lighting (list sources of lighting)? - How much does a typical household spend for lighting? (List costs per sources of lighting) - Retail prices of source of lighting? (Kerosene, dry cell, candle, etc) - Do most households have mobile phones? If yes, how do they charge them? What is the cost of charging? - Are Solar Home Systems/ Lanterns used by the households? How much do they cost? How do they acquire them? Are there local distributors? 	<ul style="list-style-type: none"> - Lighting is from the grid electricity. During power interruption they use dry cell powered torches mostly. -

	<p>– How did they acquire ICS or solar (RE & EE) products?</p> <p>–</p>	
	<p><u>Other</u></p>	<ul style="list-style-type: none"> - Recommend proper soil/clay study should be conducted to identify clay. Now there is no sufficient supply nearby. - The group used to produce clay pots, clay stoves (Oppesi, etc). The market for the products declined and they stopped production. - They believe that Mirt stove would have a better demand. They also suggested that it can be produced from clay. They would be willing to pay upto ETB 100 for Mirt stove. - Smoke removal from the kitchen is mentioned as an important parameter for the households
	<p><u>Thank participants</u></p>	

FGD – Benishangul-5: RE/EE Producers Group -

No.	Queries	Notes		
1	Location and date Date: <u>23 November 2017</u>	Region, Zone: Benishangul Gumuz, Assosa Zone Wereda: Homosha, Kebele: Turmet Watershed: Sherkole Mirco-watershed:		
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	Berhan ICS Producers Micro Enterpris 1. Hajjeje Mehamed		
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Berhan ICS Producers Micro Enterpris		
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	<ul style="list-style-type: none"> - The group was established in around 2012 with 7 members. All are women. - They produce Gonzie stove and clay pots. The clay stove does not have much demand. - World Vision Ethiopia helped the group to establish. It provided them tools, molds and built the production shed for them. They were also provided with raw materials to start the business. - The group produced about 350 Gonzie stove the previous year and earned about ETB 25,000. - The members of the group also produce stove to sell on individual basis. One of them produces up to 60 per month alone to sell it for herself. The are allowed to use the tools and the shed but should bring their own raw materials. - Raw materials needed for production of cookstoves are: <ul style="list-style-type: none"> o Sand (2.5 cubic meter costs ETB 300). o Black soil, firewood, and water (only their labor to bring from the sources in the area) - 2.5 cubic meter of sand is used to produced about 40 stoves - One person on average can produce 1.5 stoves per day including clay preparation . - One donkey load of firewood costs ETB 140 and is used to fire up to 22 stoves. - Firewood – women load weights about 12kg and costs ETB 20. - The price of the Gonzie stove they produce is ETB 100 		

FGD – Amhara-6: RE/EE Producers Group -

No.	Queries	Notes
1	Location and date Date: <u>07 December 2017</u>	Region-Amhara, Zone: West Gojam Wereda: Yimana Densa, Town: Adet Watershed: Yezat Mirco-watershed: Limat and Shengo
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	Tenahiwot improved cookstove producers
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Tenahiwot ICS Producers Group
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	<ul style="list-style-type: none"> - The producers group was established in March 2017. It has a well fenced facility with production shed of about 150 square meter which is covered with corrected roof. The facility has store and offices. - The members are 30 in number but only 5 of them are involved in the cookstove production. These five members work with a monthly salary of ETB 500 and also share in percentage terms from the stove they produce and sell. - Since their establishment, they sold only 20 Mirt stoves. However, they have 270 Mirt stoves in stalk which they cannot sell for lack of market. The facility has a capacity to produce 40 stoves in a day. - They sell Mirt stove for ETB 150

FGD – Amhara-7: RE/EE Producers Group -

No.	Queries	Notes
1	Location and date Date: <u>07 December 2017</u>	Region-Amhara Region, Zone: West Gojam Wereda: Yilmana Densa, Kebele: Adet Watershed: Yezat Mirco-watershed: Limat and Shengo
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	1. Abiyot 2. Muluwork
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Abiyot and Muluwork Partnership
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	<ul style="list-style-type: none"> - The producers were established in 2013 with 3 members. - They don't have a production place but use the small open space provided to the relative of one of them at their home. - The local administration provided them a production shed but the place does not water. The nearest water source is far away from the production place. - This is the most vibrant group that sell improved cookstoves. In 2016 they sold 1,000 Mirt stove. - They have the capacity to produce 30 Mirt stove a day if there is a market to absorb it. - There is a limited space for continuous production as the cement blocks need to be cured for 15 days before delivered to consumers. - They buy sand with a 16 cubic meter track with ETB 8,500 with the transportation cost - Cement costs ETB 300 per 100kg - They do not produce stove for cooking wot or boiling purposes. - During transportation of finished cookstoves to users, the breakage rate is about 7%. - The price of Mirt stove is fixed by the Energy Office of the Woreda and is ETB 150.

FGD – Amhara-8: RE/EE Producers Group -

No.	Queries	Notes		
1	Location and date Date: <u>07 December 2017</u>	Region-Amhara Region, Zone: West Gojam Wereda: Yilmana Densa, Kebele: Adet Watershed: Yezat Mirco-watershed: Limat and Shengo		
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	1. Tenagne Digafe		
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Tenagne Digafe Mirt Stove Producer		
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	<ul style="list-style-type: none"> - She is the first Mirt stove producer trained by GIZ before 2008. - She is in the business for over 10 years. - Her main market are the households in Adet town and also projects that purchase and distribute fuel saving stoves to rural consumers including the SLM program. - There are about 60 Mirt stoves that are in stalk. - Sales is not regular. Individuals come one or twice a week and sometimes there will be no sales for two or three weeks. - She sales the stoves for ETB 200 for individual consumers but if it is a project the price is ETB 150 as determined by the energy office. 		

FGD – Amhara-9: RE/EE Producers Group -

No.	Queries	Notes
1	Location and date Date: <u>06 December 2017</u>	Region-Amhara Region, Zone: Awi Zone Wereda: Guagussa, Twon: Tilili Watershed: Yesir Mirco-watershed: Chenetali and Chiketi
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	Tilaye Zeleke fuel saving stove producer
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Tesfay Zeleke fuel saving stove producer. Produces and sells cookstoves
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	<ul style="list-style-type: none"> - The business was established in 2007/08. - He was trained on Mirt stove production by The Woreda Energy Office experts. - He sells about 50 stoves per month to individual households from Tilili and near by towns. This greatly varies from month to month. - He also sold 530 Mirt stoves to the Water and Energy Office of the Woreda last year. - The SLM program purchased about 130 Mirt stoves annually for three years from 2013 to 2015. - The price for Mirt stove is ETB 150. - The major challenge is creating market for cookstoves. Projects such as SLM and others don't come on regular basis. - The business generates sufficient income as he also sells his products to individual households even though sales is inconsistent. - He would love to add other items in his business such as solar lanterns or other types of cookstoves.

FGD – Amhara-10: RE/EE Producers Group -

No.	Queries	Notes
1	Location and date Date: <u>06 December 2017</u>	Region-Amhara Region, Zone: Awi Zone Wereda: Guagussa, Twon: Tilili Watershed: Yesir Mirco-watershed: Chenetali and Chiketi
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	Begotesfa Charity Mahiber fuel saving stove producers group
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Begotesfay Charity Mahiber has 450 members
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. – No. of persons/groups selling ICS in our area – Does the business generate sufficient income for all? If not, Why? – Do you want to add other items in your business? Why? If yes, what kind of items? – Where do you think you would get financing for expansion of your business? 	<ul style="list-style-type: none"> - They started production of fuel saving stoves in 2014/15. - Five of their members are working on cookstove production. - They get ETB 30 per Mirt stove they produce and sell. - The production shed is about 60 square meter. The production capacity is about 50 stoves per day. - They have 7 molds for production of only 7 stoves at the same time. - Production space will also one of the limiting factor if they want to scale up production. - For now, it is enough to supply the demand. There were over 20 Mirts stoves in stock waiting for persons to buy them. - Market is the biggest challenge - Cookstove sales does not cover for their expenses. They need to do some other work as well. - Mirt stove price is ETB 150 in Tilili. - Cement (100kg) costs ETB 260 - Sand – ETB 130 per 100 kg from a retail market. - Sand – 16cubic meter track costs ETB 11,000 - One quintal of cement – produces 8 complete Mirt stoves - 1 quintal sand – produces 8 Mirt stoves - Labour – ETB 30 per stove - Water is also a cost. - Curing time for the stoves is at least 10 days. - They would like to have other items to sell as the revenue from sales of cookstoves is not sufficient to meet their needs. -

FGD – Amhara-11: RE/EE Technology Users

No.	Queries	Notes		
1	Location and date Date: <u>07 December 2017</u>	Region-Amhara, Zone: Awi Zone Wereda: Guagussa , Kebele: Watershed: Yesira Mirco-watershed: Chenteli (GPS Coordinate system: 10.775833N, 37.055608E)		
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	1. Addisei Awoke (F) 2. Agere Asmare (F) 3. Yimegnu Bante (F) 4. Workei Anagaw (F) 5. Tiguated Sewnet (F)		
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Farming/ crop production is the main source of livelihood for the participants. Most households also practice agro-forestry. Sales of firewood from the plantation provides additional income to the households.		
4	– Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain.			

	<ul style="list-style-type: none"> - No. of persons/groups selling ICS in our area - Does the business generate sufficient income for all? If not, Why? - Do you want to add other items in your business? Why? If yes, what kind of items? - Where do you think you would get financing for expansion of your business? 	
4	<u>Main cooking fuels</u> <ul style="list-style-type: none"> - List main cooking fuels and how households in the community obtain them - If collection how far do people travel (km), how long it will take them, and who collects the fuel? - If purchased how much does the fuel cost (ETB/kg). Price for each commercial fuel. - What are most widely used cookstoves? - How much fuel is consumed on per week by a household on average? - How much does a household pay to purchase cooking fuel on average? - Awareness of the community about ICS? List the ICSs known and used in the community. - How did they acquire ICS or solar (RE & EE) products? - Were there any organization supporting acquisition of RE & EE products? - List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) - Willingness of users to pay - Paying capability of households - Finance availability for users to purchase ICS? - Finance availability for household energy technology producers and distributors 	<ul style="list-style-type: none"> - Mani cooking fuel for injera baking:- firewood from eucalyptus, corncob, maize and sorghum stalks, - Main fuel for cooking wot and boiling tea/coffee:- firewood, charcoal. Households mostly made their own charcoal from eucalyptus and acacia decurrense and also purchase. - The collect firewood from their own plantations. - Agro-forestry is widely used in this watershed. - Sales of firewood from the plantation also generates income to the households. - Those households who have larger farm land, dedicate about a quarter of their land to grow acacia decurrense. - Those households who do not have Mirt stove use three-stone fire for injera baking. - For wot cooking most households use traditional clay stoves which costs about ETB 15 to ETB 20. They also use Lakech charcoal stove (price is ETB 80) which they purchase from shops in town. There are also traditional charcoal stoves (cost ETB 7) which are locally made from clay that are widely used by the households. - Mirt stove was distributed by SLMP to most households in 2010/11 for free. - Charcoal price for a 20 to 25 kg sack is: ETB 50 for eucalyptus and ETB 80 for acacia decurrense.
5	<u>Lighting</u> <ul style="list-style-type: none"> - What do households use for lighting (list sources of lighting)? - How much does a typical household spend for lighting? (List costs per sources of lighting) - Retail prices of source of lighting? (Kerosene, dry cell, candle, etc) - Do most households have mobile phones? If yes, how do they charge them? What is the cost of charging? - Are Solar Home Systems/ Lanterns used by the households? How much do they 	<ul style="list-style-type: none"> - Some households purchased solar lanterns through Amhara Credit and Saving Institution. Price of solar lanterns ranges from ETB 1,200 to ETB 3,500. - Most households use dry cell powered hand torches and very rarely kerosene. - Dry cell costs ETB 18 for two. Hand torch price varies depending on size and quality. Price ranges between ETB 25 to ETB 60. - There is at least one mobile phone in the households that participated in the group discussion. They get their phones charge for ETB 2 in town.

	<p>cost? How do they acquire them? Are there local distributors?</p> <p>– How did they acquire ICS or solar (RE & EE) products?</p> <p>–</p>	
	<u>Other</u>	-
	<u>Thank participants</u>	

FGD – Amhara-12: RE/EE Technology Users and Watershed Users Association Committees

No.	Queries	Notes		
1	Location and date Date: <u>07 December 2017</u>	Region-Amhara, Zone: West Gojam Wereda: Yilmana Densa, Kebele: Watershed: Yezat Mirco-watershed: Limat and Tesfay (GPS Coordinate system: 11.175285N, 37.547650E)		
2	Persons attending the FGD session (Numbers in an FGD discussion should be about 10) – Name, age, activity	1. Adina Sintayehu 2. Laguaye Hunegnaw 3. Kes Yiheyis Maru 4. Maru Wosto 5. Getachew Eskezia (Chairman of WUA)	6. Muche Tegegn 7. Fikadu Yalew 8. Yalemtehai Mesfin 9. Melkam Tesfa 10. Endayu Addisu	
3	Introduction to each other and about the purpose of the FGD – who they are and what they do for living	Households and watershed users association members Farming/ crop production is the main source of livelihood for the participants.		
4	<ul style="list-style-type: none"> – Years in the business – Number of members – Products or services they provide (Items they produce or sale) – Quantity they sell in a week (from each product item) – For ICS producers – cost of production (raw material, labor, water, etc). List raw materials and associated costs including transportation – For ICS producers – Production process, time required per unit, number of persons involved in production, hours worked) – Cost of production per ICS – Selling price of ICS (product price and transportation separately) – Awareness of community on benefits of ICS – Ability and willingness to pay of communities for ICS – Access to finance to small businesses. – Major market challenges – Major non-market challenges – Working in a group a challenge? If yes, explain. 			

	<ul style="list-style-type: none"> - No. of persons/groups selling ICS in our area - Does the business generate sufficient income for all? If not, Why? - Do you want to add other items in your business? Why? If yes, what kind of items? - Where do you think you would get financing for expansion of your business? 	
4	<p><u>Main cooking fuels</u></p> <ul style="list-style-type: none"> - List main cooking fuels and how households in the community obtain them - If collection how far do people travel (km), how long it will take them, and who collects the fuel? - If purchased how much does the fuel cost (ETB/kg). Price for each commercial fuel. - What are most widely used cookstoves? - How much fuel is consumed on per week by a household on average? - How much does a household pay to purchase cooking fuel on average? - Awareness of the community about ICS? List the ICSs known and used in the community. - How did they acquire ICS or solar (RE & EE) products? - Were there any organization supporting acquisition of RE & EE products? - List of household businesses and industries in the area (eateries, weaving, brewing drinks, etc) - Willingness of users to pay - Paying capability of households - Finance availability for users to purchase ICS? - Finance availability for household energy technology producers and distributors 	<ul style="list-style-type: none"> - The Watershed Users Association was established in 2010/11. - The objectives are conservation, recovery of resource for cattle feeding, water supply, fuel saving stove promotion - Out of 90 households in the kebele 25 of the were given fuel saving stoves by the SLM Program for free. Selection of households is based on their contribution to the effort in the watershed management work. - Because of budget limitation in SLMP, fuel saving stoves could not be distributed to all households. - Mirt is the fuel saving stove promoted in the area. - There is no fuel saving stove for cooking wot and boiling tea/coffee. - Almost all households us traditional clay firewood stoves for wot cooking. It costs from ET 15 to 20. - Traditional clay charcoal stoves costs less than ETB 10. - Mirt stove protects from fire and smoke, and also saves fuel. - Quality of Mirt stoves is poor. It breaks during transportation and deteriorates quickly. - Most urban households (households near the Kebele office) do not have separate kitchen. But rural households cook in a separate kitchen. Urban households mostly use charcoal for cooking wot and boiling coffee while rural households use half charcoal and half firewood. - Biogas is adopted by only two households. It requires a minimum number of 4 cattle to generate sufficient feedstock. The cash contribution for the biogas is about ETB 7,000 which is mainly for cement and some accessories. The new biogas digester design reduces the cost that farmers need to contribute by about half. - For farmers the importance of biogass benefits in priority order is: light, gas for cooking (mainly for coffee boiling), and the slurry for composting. - Solar lanterns were also distributed to about 50% of the households by SLMP for free. Most households hold solar lanterns. Some households purchased solar lanterns with the mirco finance credit line. The interest rate for loan is 25%. The payment period depends on the warrantee year the supplier gives for the product. - WUA also works with health extension agents to provide primary health training. - There is no household that bakes injera with open fire. The extension agents informed households to open a hole through the wall and let smoke go through it. There were few house burning issues due to fire burning the walls of the houses. - The main cooking fuel in the rural households is firewood. In urban areas near the kebele administration, households mainly depend on charcoal for cooking. - -

5	<u>Lighting</u> <ul style="list-style-type: none"> – What do households use for lighting (list sources of lighting)? – How much does a typical household spend for lighting? (List costs per sources of lighting) – Retail prices of source of lighting? (Kerosene, dry cell, candle, etc) – Do most households have mobile phones? If yes, how do they charge them? What is the cost of charging? – Are Solar Home Systems/ Lanterns used by the households? How much do they cost? How do they acquire them? Are there local distributors? – How did they acquire ICS or solar (RE & EE) products? – 	<ul style="list-style-type: none"> - Dry cell powered hand torches and LED lights are mainly used by the households. Kerosene is very rarely used by some households. - Solar lantern ownership is increasing in the households. -
	<u>Other</u>	-
	<u>Thank participants</u>	