FINAL REPORT: HOUSEHOLD ENERGY BASELINE SURVEY IN SNNPR

GIZ: ECO – BIO-ENERGY DEPARTMENT

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ABBREVIATIONS AND ACRONYMS

AMES - C	Access to Modern Energy Services, Predecessor of ECO
BCEF	Biomass Conversion and Efficiency Factor
BLT	Branches, Leaves and Twigs
BoFED	Bureau of Finance and Economic Development, SNNPR State
CDM	Clean Development Mechanism
CPA	CDM Programme Activity
CER	Certified Emissions Reduction
cm	Centimeters
Co^2	Carbon-di-oxide
CSA	Central Statistics Agency
CSO	Civil Society organization
ECO	Energy Coordination Office (of GIZ)
Etb	Ethiopian Birr (local currency)
FAO	Food and Agricultural Organization (of the UN)
FEWS	Famine Early Warning System
GIZ	German International Cooperation
GoE	Government of Ethiopia
Ha	Hectare
HEPNR	Household Energy and Protection of Natural Resources
HHs	Households
Hr	Hour
IAP	In-door Air Pollution
IPCC	International Panel on Climate Change
Kgwe	Kilogram of wood equivalent
Masl	meters above sea level
MJ	Mega Joule
NGO	Non Governmental Organization
NRB	Non Renewable Biomass
OWL	Other Wood Land
PFM	Participatory Forest Management
PoA	Programme of Activity
SNNPR	Southern Nations, Nationalities and Peoples' Region
SUN	Sustainable Utilization of Natural Resources
Tcal	Terra Calorie
tCO_2	Tons of Carbon Di Oxide
TJ	Terra Joule
UNFCCC	United Nations Framework Convention on Climate Change
VER	Voluntary Emissions Reduction
WBISPP	Woody Biomass Inventory and Strategic Planning Project

EXECUTIVE SUMMARY

0.1 Background to the Contract

Energy Coordination Office (ECO) of the German International Development Cooperation (GIZ) commissioned Megen Power (MGP) Consultants to undertake a ***"Cooking Energy Baseline Survey in Sothern Nations, Nationalities and Peoples' Regional State (SNNPRS)***. The Terms of Reference for this Contract is provided in Annex 5. This Final Report is prepared by MGP as part of completion of the assignment; and submitted to ECO – Bio-energy Department.

0.2 Background to SNNPR

The SNNPR is the most diverse Regional State in Ethiopia in many ways. Its numerous diversities manifest themselves in several ways ethnicity, language, history, agro-ecology, cultural values, socio-political systems, and livelihood activities. Currently, there are about 56 different ethnic groups with their own distinct ethnic and cultural identities living in the region harmoniously. Multitudes of diversities that characterize the region are widely believed to influence the way people produce, acquire and utilize energy for domestic use. With a current population of about 17 million inhabitants, the SNNPR is the third largest regional state next to Oromia and Amhara regions. Rate of urbanization in the region is far lower (10.3 percent) compared to the national average of about 16 percent.

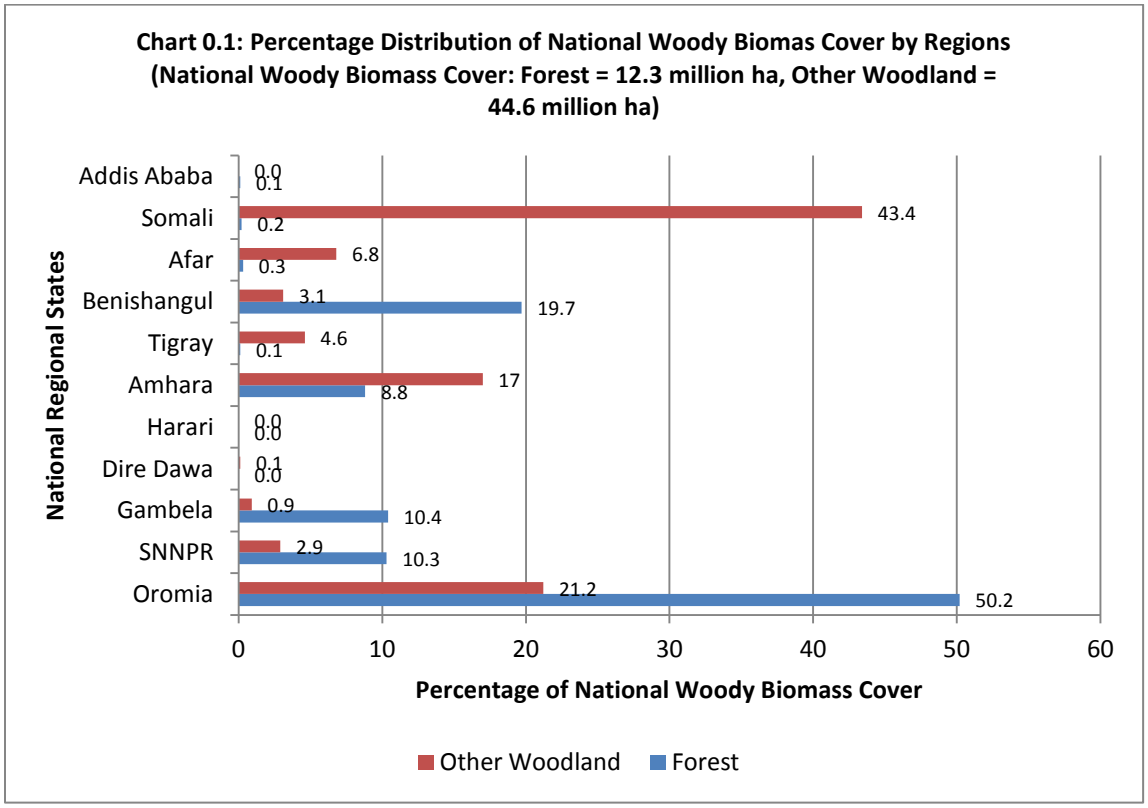
0.3 The Study Objective and Methodology

After having pulled out its activities from SNNPR in 2005, GIZ – Bio-energy Department re-launched its improved stoves project in mid 2009; and it was in the context of such a renewed effort that a region-wide comprehensive household energy baseline survey was needed in SNNPR. Thus, the overriding objective of the current study is to provide ECO – Bio-energy Department with baseline information on household energy supply and demand including cooking fuels consumption, biomass production and supply, private sector participation in energy services and cooking technologies in SNNPR. This household energy baseline survey was conducted in a sample of 795 households (683 urban and 112 rural) in SNNPR. The sample was sub divided further in to three groups primarily based the level of woody biomass endowment. Three zones namely Kaffa (representing "High"), Sidama (representing "Moderate") and Hadiya (representing "Low") woody biomass endowment were pre-selected for the survey. While the urban household baseline surveys were conducted in Bonga, Yirgalem

and Hosaena towns, the rural surveys were conducted in satellite rural villages located about 10 to 15 kms outside each town.

0.4 Main Findings

With an estimated forest area of about 1.3 million hectares (10.3 percent of national woody biomass cover) SNNPR is fourth region with highest forest cover in the country next to Oromia, Benishangul-Gumuz and Gambella National Regional States (see Chart 0.1). Despite its relatively better endowment of forest resources including the nation's renowned high tropical forests of south-west, SNNPR is also known for its highest rate of deforestation mainly due to its extraordinarily high population densities that exert enormous pressure on the bio-physical environment in general and woody biomass resources in particular. The Region is losing an estimated 21,866 ha (1.6 percent per annum) of its forest annually.



Source: Study Team's own assessment based on current FAO estimates

Unsurprisingly, firewood (including branches, twigs) and charcoal are the two most important traditional fuels commonly used by urban households in SNNPR. Although kerosene comes in the third place, it use is not wide as the other cooking fuels, which may be due to increasingly soaring petroleum prices in the global market, which in turn is widely believed to have forced the Government of Ethiopia (GoE) to remove or at least reduce subsidy on kerosene that had

existed for over two decades. In response to the steadily rising retail price of kerosene, it is evident that increasing number of urban households are shifting to other options mainly charcoal but also electricity in recent years. Traditional fuels are increasingly commercialized in urban areas in SNNPR, but about one-third of urban households in areas with better woody biomass endowment still freely collect their supplies. Despite localized variations, all freely collecting households perceived increased effort and time for collecting firewood recently. Women, poorer men and members of socially marginalized groups such as the Manja, forest people in the case of Kaffa, are the main producers and suppliers of traditional fuels in the region.

Three-stone fire is the most widely used stove among households in SNNPR. While the basic design and performance remains the same, three-stone fire in SNNPR comes with a whole lot of different names, shapes, patterns and features. Closely following the pattern of fuel use, charcoal stoves come in the second place in urban households' cooking energy/stove use ladder. Urban households in SNNPR utilize mainly aluminum pots, but also clay pots to a lesser extent, for cooking food. The diameter of at least 70 percent aluminum cooking pots commonly used by urban households in SNNPR fall within in the range of 15 cm and 30 cm.

Urban households in SNNPR bake and consume both Injera and a variety of non-Injera breads (Kocho, Bursame, Torosho, Qitta, etc) as part of their regular diet. Contrary to the widely held belief that less important part of the local diet, the majority of urban households in SNNPR bake and consume Injera more regularly. What is uniquely different is that the frequency as well as quantity of Injera baked per baking session is significantly among households in SNNPR than those of other urban areas such as Addis Ababa.

0.5 Household Energy Supply and Consumption

Owing to relatively better woody biomass endowment, traditional fuels are originated and supplied from relatively shorter distances in SNNPR. With the exception of woody biomass scarce areas such as northern and central Zones where traditional fuels particularly charcoal is supplied from far afield locations, firewood is often supplied from within "arms-stretch" in biomass rich Kaffa Zone. As an economic activity, biomass trade provides sustainable livelihood to significant numbers of people mainly women and poor men in SNNPR. Unlike many other urban areas in the country, the number of women engaged in the supply of traditional fuels is relatively smaller mainly due to the heavy involvement of men and boys from the occupational caste group of Manja in the trade particularly in woody biomass rich areas of SNNPR.

Urban households in SNNPR consumed 6.92 Kilograms of wood equivalent (Kgwe) per day per household for baking (Injera and non Injera bread) and other cooking purposes. This is

equivalent to 1.65 Kgwe per day per capita. Based on actual fuel consumption measurements conducted in survey households, cooking energy consumption for urban households in SNNPR is estimated to amount 1.01 million tons of wood equivalent per annum.

Injera and non Injera bread baking together assumed nearly half (47 percent) of the household cooking fuels consumption share and the remainder (53 percent) was consumed for other types of cooking. Non Injera bread baking, claiming 24 percent of the total household energy budget, is a uniquely important end-use in SNNPR that needs to be addressed by improved stove projects working to improve the social, economic and environmental situation in the Region.

0.6 Non Renewable Biomass Use for Cooking

Annual deforestation rate in SNNPR is estimated to be 1.6 percent, representing one of the highest deforestation rates in the country. Based on Gain-Loss methodology developed by IPCC, non-renewable fraction of biomass use (NRBf) for cooking in SNNPR is estimated to be 68.1 percent – much lower than the national average of 84.3 percent. The implication is that there is there is a considerable opportunity for developing a carbon finance project in the Region. For example, if we assume a 50 percent penetration rate (or about 204,000 households) for non-Injera improved stoves such as the Tikikil stove over a period of ten years in SNNPR, a total of over 96,000 CERs could be generated annually in SNNPR alone. The potential gain in terms of reduction of deforestation and forest degradation is in fact much greater. With a conservative assumption of 40 percent reduction in fuel consumption and 50 percent penetration rate of improved stove for cooking (excluding Injera baking) in the region, a total of about 165,774 ton of woody biomass or 1,120 hectares of forest land could be saved annually from further deforestation in SNNPR.

0.7 Market Potential and Opportunities

Despite considerable experience gained and market infrastructure put in place, with only about half a million Mirt stoves sold to date, the rate of nation-wide market penetration is very modest. Among reasons often cited as barriers to large scale market uptake of the Mirt stoves are lack of portability, increasingly soaring raw material prices (cement in particular), low disposable income of the majority of rural households, and very low levels of commercialization of traditional fuels in rural areas particularly in the SNNPR. Given the considerable emission reduction potential of improved stoves, giving current and all future improved stoves promotion efforts a carbon-finance spin is essential since revenues from emission reductions could play a catalytic role in up-scaling stove production and dissemination efforts and make it possible for projects to reach wider, but more difficult rural market on a larger scale than public funding alone could do.

I. Background and Methodology

1.1 Background: An Overview of Southern Nations, Nationalities and Peoples' Region

Located in southern and southwestern Ethiopia and covering an estimated total area of 114, 781 km^2, the Southern Nations, Nationalities and Peoples Regional State (SNNPRS) is one of the nine federated states of Ethiopia. According to Central Statistics Agency (CSA), with over 15 million inhabitants in 2007, the SNNPR is the third largest regional state next to Oromia and Amhara regions. Rate of urbanization in the region is far lower (10.3 percent) compared to the national average of about 16 percent. Administratively, the region is sub divided in to eight Special Woredas and 13 Zones – these Zones are subdivided further in to 126 Woredas. There are a total of 3,714 rural and 238 urban Kebeles (lowest administrative units) in the region.

The SNNPR is the most diverse Regional State in Ethiopia. Its numerous diversities manifest themselves in several ways ethnicity, language, history, agro-ecology, cultural values, socio-political systems, and livelihood activities. Currently, there are about 56 different ethnic groups with their own distinct ethnic and cultural identities living in the region harmoniously. If we disregard the more urbanized Administrations of Addis Ababa and Dire Dawa Cities and Harari region, with a population density of over 130 persons per square kilometer, SNNPR is the most densely populated region in Ethiopia next to none. In some of the Administrative Zones and Woredas such as Wolaita, Kambata, Hadiya and Guraghe, population densities are close to one-thousand persons per square kilometer. Thus, with only about 10 percent of Ethiopia's total land area, the SNNPR is a home for over 20 percent of the nation's population. The region's population is growing at a faster rate of about three percent. On the other hand, it should also be noted that the frontier areas of SNNPR where pastoralism and agro-pastoralism are the two dominant livelihood strategies, there are wide expanses of land with scattered human settlements.

The SNNP is a Region of incredible ecological and cultural diversity: ranging from arid to semi desert in the Omo river lowlands inhabited by transhumant pastoralists, to montane forests with high rainfall inhabited by bush fallowing agriculturists (WBISPP, 2001). Agro-ecologically, the SNNP Region can be broadly divided into a number of highland and lowland zones. Using an altitude of 1,500 masl as a cut-off point, the Woody Biomass project divided the SNNPR into "Highland" and "Lowland" areas as follows:

a) *The Rift Valley which separates the Sidamo-Amaro Highlands in the east,*
b) *The Highlands just to the west of the Rift Valley running southwestwards from Gurage to North Omo Zones,*
c) *The Highlands of Kaffa-Sheka running southwards in to Bench-Maji Zone,*
d) *The Omo and Sagen Valley Lowlands in South Omo Zone.*

Needless to mention that social, cultural, economic, ecological diversities that characterize the SNNPR often influence how stoves and fuels are acquired and used by people in the region. As we will explain in more detail later in this Chapter (see Methodology section), variations in woody biomass endowment, which, in turn are determined by agro-ecology, is used as key criteria used for sampling in this study.

1.1.1 The Household Energy Landscape

Like all other regions of Ethiopia, the household energy scene of the SNNPR is dominated by the use of traditional fuels including firewood, branches-leaves-twigs (BLT), charcoal, cow dung, and agricultural residue and the household sector is the major consumer of energy. While almost all urban households obtain their cooking energy supplies commercially, the majority of rural households 'freely' collect their fuel wood supplies. However, with increasing scarcity of supplies and diminishing woody biomass resources, recently increasing numbers of peri-urban and rural households were observed purchasing traditional fuel supplies. In addition to urban and rural households, thousands of institutions, (hospitals, boarding schools, universities, correctional facilities, etc), commercial food-catering establishments, and cottage industries also rely on traditional fuels for their cooking or other energy needs.

A WBISPP survey conducted in mid 1990s estimated that, in weight terms, with exception of electricity, between 97 percent and one-hundred percent of all energy consumption from all sources (traditional as well as modern) took place in the household (urban and rural) sector. Implication of such disproportionate energy consumption in the household sector is that in the SNNPR the bulk of energy consumption is meant to meet basic physiological needs (cooking, lighting and perhaps heating too) rather than productive use. In year 2000, it was estimated that the commercial services sector (businesses, bars, restaurants, hotels) consumed nearly three percent of kerosene and 72 percent of electricity.

The WBISPP studies indicated that patterns of fuel wood consumption also vary widely across the region. For example, while the overall average annual fuel wood consumption for SNNPR as a whole was estimated to be about 1,200 kg per capita per year in 2005, the rate varies widely from the lowest 500 kgs in the pastoral and agro-pastoral areas to the highest 2,200 kgs in the high forest areas of Kaficho-Shakicho and Benchi-Maji Zones. The other interesting feature of energy consumption in the SNNPR is its heavy dependence on traditional fuels. For example, out of a total of 47,681 Terra Calories (Tcal) of energy consumed in the region in year 2002, 99.6 percent was obtained from traditional sources. This may not be unique to the SNNPR, but it is quiet higher than the national average of about 94 percent. As far as Zonal differences in the extent of traditional fuels use is concerned, the proportions vary from the lowest 97.0 percent in Darashe Special Woreda to 99.9 percent in Yem Special Woreda.

1.1.2 Previous Household Energy Interventions

Interventions aimed at improving household energy efficiencies (improved stoves) are not entirely new to the SNNPR. In fact, a number of improved stoves promotion and dissemination projects were undertaken by the Federal and Regional governments in collaboration with international development agencies (GIZ-HEPNR included) and NGOs since early 1990s. While the other improved stoves were sporadic, under-funded and short-lived in nature, GIZ-supported Household Energy and Protection of Natural Resources (HEPNR), which had adopted a more systematic approach and wider out-reach was implemented in the SNNP Region between 1998 and 2005.

The GIZ – HEPNR project had trained and set up 36 Mirt stoves production units in 17 towns distributed in 16 Woredas and seven Zones of the Region. Disregarding several smaller towns in each Administrative Zone, Zonal Capitals that were covered by previous improved stoves efforts (GIZ-supported or otherwise) include Hawassa, Dilla, Soddo, Durame, Hosaina, Wolkite, Arba Minch, Mizan and Alaba Kulito. To date an estimated 40, 000 to 50, 000 Mirt improved stoves were in use throughout SNNPR, thanks to previous household energy efficiency improvement initiatives. Therefore, given the core objective of the current study (establishing baseline indicators against which performance of the project could be measured in the future, e.g., setting up an underlying project for CDM or other forms of Carbon finance), urban areas where improved stoves were sold (at least in significant quantities) were excluded from the sample.

1.2 The Study Objectives and Methodology

1.2.1 Objectives of the Study

After GIZ had pulled out its improved stoves promotion activities from SNNPR in 2005, the number of active Mirt stove producers has gone down nearly to half of what it used to be. Later on, following the amalgamation of the GIZ - SUN program into a larger GIZ Energy Coordination Office (GIZ – ECO), the project re-incorporated its improved stoves portfolio in the SNNPR back into a larger program under the auspices of Access to Modern Energy Services – Cooking (AMES – C, now known as Bio-energy Department). Currently, Bio-energy Department of ECO intends to re-launch its improved stoves activities in SNNPR with a new vigor committed resources. It was in the context of such a renewed effort that a region-wide comprehensive household energy baseline survey was needed in SNNPR. Thus, the overriding objective of the current study is to provide ECO – Bio-energy Department with baseline information on household energy supply and demand including cooking fuels consumption, biomass production and supply, private sector participation in energy services and cooking technologies in SNNPR (for details on objectives and scope of work see ToR in Annexes).

1.2.2 The Study Methodology

Thus, the ToR for the proposed study requires a number of surveys and other information collection activities to be completed in order to meet objectives of the study. Broadly speaking, data and information collection methods that will be employed in this study can be grouped in to three broad categories. These are: A) Literature Review, B) Qualitative Assessments which include interviews and discussions with key stakeholders (government offices, potential and actual stove producers, NGOs / CBOs active in the area and relevant others), and C) Quantitative Sample Surveys including household energy baseline surveys, longitudinal fuel consumption monitoring surveys, biomass fuels inflow surveys, and biomass fuels market price surveys.

1.2.2.1 Literature Review:

Preliminary assessment made by the study team indicates that a number of study reports, resource maps and similar documents dealing with woody biomass resource distribution and household energy acquisition and utilization patterns in the SNNPR are readily available. In

addition to providing useful information to the current study, some of these secondary sources will serve as a direct raw material in our assessment of fraction of fuel wood use that originates from non-renewable biomass base. As part of document reviews, Inter-governmental Panel on Climate Change Convention (IPCCC) and Food and Agricultural Organization (FAO) web sites were consulted for information on methodology for assessing the non renewable fraction of biomass use for cooking.

1.2.2.2 Quantitative Sample Surveys

Household Energy Baseline Survey

This is a one-shot survey intended to collect baseline information regarding domestic fuels and cooking stoves acquisition, ownership, management, utilization and gender roles related to household energy issues. As per the original intentions, the central focus of the current baseline survey is urban households; and it remained so. However, a decision was made later in the project to include a small sample of rural households in the wider baseline surveys. While the focus of this study remains focused on urban households, some rural households were included in the baseline survey. The main purpose of including rural households in this survey was to gather data and information that would enable the study team paint a broad-based picture of the Region's domestic energy scene. This will, in turn, inform the project in its effort to design strategies to reach out the wider rural consumers in the future.

Longitudinal Monitoring of Fuel Consumption in Urban Households

Longitudinal fuel consumption survey was intended primarily to monitor households' cooking fuels consumption on a daily basis. In addition, data related to fuel acquisition and cooking practices were collected from a sample of urban households in all three urban settlements. In order to generate quantitative data and information required for the baseline, cooking fuels consumption was monitored in a sample of 120 households in three selected towns. Weight measurements were taken in sample households for ten consecutive days. Weighing scales with 100 grams accuracy were used in measuring the fuel consumption. In order to enhance the quality of data collected female enumerators were recruited and received two-days training on weight measurement and interviewing techniques. Sample households for the actual measurement of cooking fuels consumption were selected from the larger sample used for the wider baseline survey.

Based on relative endowment of woody biomass (forest and other woody biomass combined) and socio-ecological differences embedded into the former, Zones and Special woredas of the Region were first stratified in to three groups each representing administrative areas with

"High", "Moderate", and "Low" woody biomass endowment. Based on this criterion, Kaffa, Sidama and Hadiya Zones – each representing respectively "High", "Moderate" and "Low" woody biomass endowment - were selected for the study. As far as selection of the study towns is concerned, the two most important criteria are previous improved stoves history and population size of urban settlements. From the three zones selected above the towns of Bonga, Yirgalem and Hosaena are identified as survey towns. The remaining administrative level is the Kebele Administrations. In consultation with local Administrations, urban Kebeles were stratified in to three wealth groups from which representative samples were drawn in each survey site. Details of sampling plan and sample sizes used in this study are presented in Table 1.1 below.

Table 1.1 Distribution of the Sample by Woody Biomass Endowment Areas

Woody Biomass Endowment	Urban Population (CSA, 2007)	Percent of Urban Population	Representative Zone Selected	Town Selected	Sample Size (Urban)	Additional Sample (Rural)	Total Sample Size	Percent
High	381,621	24	Kaffa	Bonga	173	32	205	26
Moderate	555,742	37	Sidama	Yirgalem	255	40	295	37
Low	604,403	39	Hadiya	Hosaena	255	40	295	37
Total	**1,541,766**	**100**	**na**	**na**	**683**	**112**	**795**	**100**

As could be seen from Table 1.1 above, this baseline survey was conducted in a total of 683 urban households and daily biomass fuels consumption monitored in a sub set of 120 households (selected from the much larger sample above) in three towns namely Yirgalem, Hosaena and Bonga each representing their own groups of Zones and Special Woredas as specified in Table 1.1 above. Based on the size of urban populations each selected town represents, the total sample is distributed proportionally between Yirgalem (255 HHs), Hosaena (255 HHs) and Bonga (173 HHs). In addition to the 683 urban households, a total of 112 rural households were included from respective satellite rural in survey site. Obviously, rural samples are too small to represent the whole of SNNPR; and this was not the intention in the first place. Rather, the intentions was to capitalize on the opportunity that the urban household study offered and collect some basic information that could provide some insights about the rural household energy profile in SNNPR.

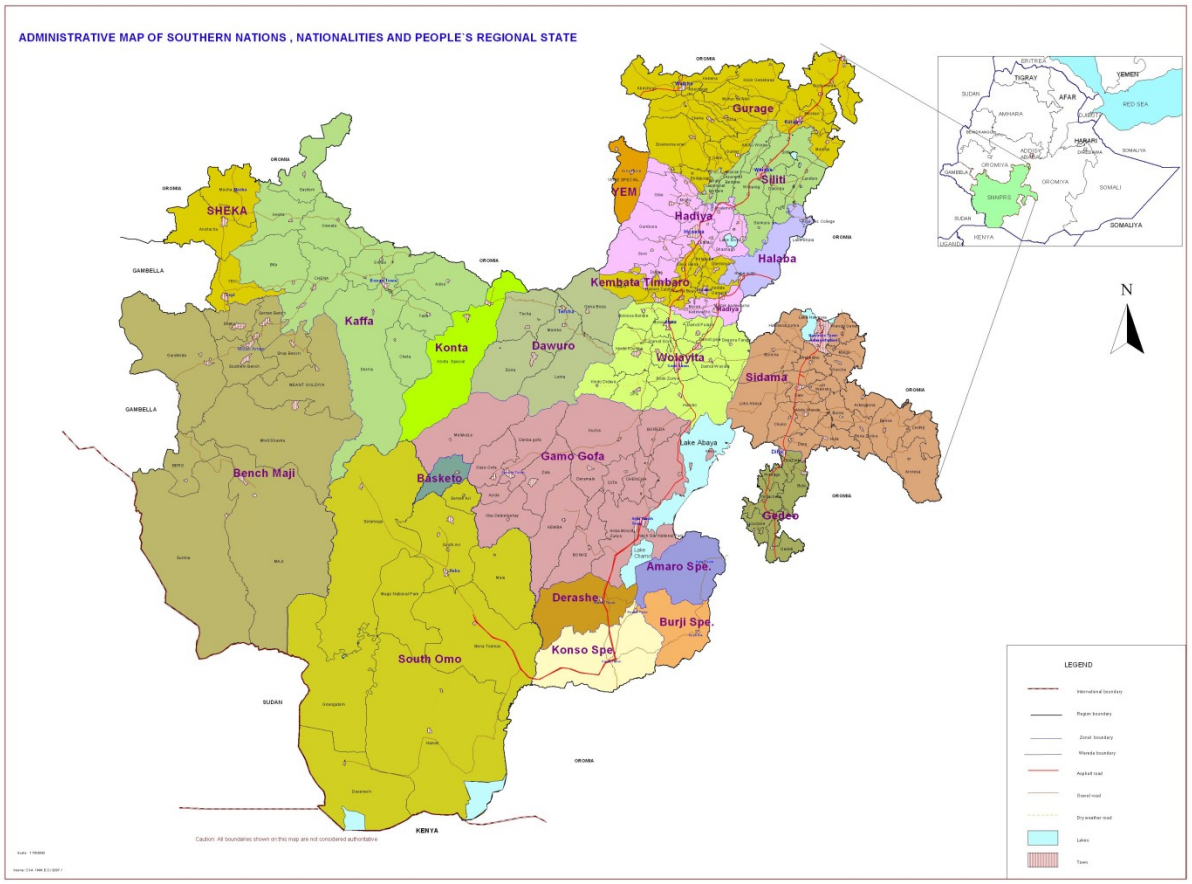
Biomass Fuels Inflow and Market Surveys

Supply side information such as volume of supply, supply routes and sources (catchment area), types of fuels, mode of transport and supplier characteristics are all crucial for informed project planning and execution. In line with this, traditional fuels inflow surveys were conducted for

three to four days (one market day and the rest non market days) in all major inflow routes in all the three study towns. In order to generate gender-disaggregated data, which will provide quantitative information on the role of women as biomass fuels suppliers, inflows were recorded for all biomass fuels carriers/transporters (women, men, girls, boys, donkeys, etc) separately. In addition, in order to assess the role of biomass fuels to people's sustainable livelihoods and to obtain a picture of the biomass fuels market in the region, biomass fuel retail price surveys were also conducted in all the three study towns (for details on questionnaires and data collection formats see Annexes).

In addition to document reviews and quantitative sample surveys described above, qualitative assessments were conducted with key stakeholders and market players in household energy related sectors in the region. Interviews and discussions were held with Regional and Woreda Bureaus/Offices of Energy, Agriculture and Health, NGOs and CSOs actively engaged in natural resource conservation and/ or improved stoves promotion, food-catering institutions and businesses, and existing and potential improved stove producers / businesses.

Map 1: Administrative Map of SNNPR State (Source: BoFED, SNNPR)



II. Main Findings of the Urban Household Energy Baseline Surveys

A household energy baseline survey was conducted in a sample of 683 urban households in three randomly selected towns in SNNPR namely Bonga, Yirgalem and Hosaena representing areas with high, moderate and low woody biomass cover in the. Main findings of the baseline surveys are presented in the proceeding sections.

2.1 Demographic and Socio-economic Profile of the Study Households

Out of a total of 683 urban households surveyed, while households in areas with "High" woody biomass endowment constituted about one-quarter, the remaining three-quarters is equally divided between areas with "Moderate" and "Low" woody biomass endowment in SNNPR. With regard to headship pattern of the survey households, with male-headed and female-headed households constituting about 75 percent and 25 percent respectively (see Table 2.1).

Table 2.1: Distribution of Survey Households by Sex of Head of Household and Woody Biomass Endowment Category

Woody Biomass Endowment	Male	Female	Both Sexes	Percent
High	132	41	173	25.3
Moderate	195	60	255	37.3
Low	183	72	255	37.3
All	**510**	**173**	**683**	**100.0**
Percent	**74.7**	**25.3**	**100.0**	

Results of the baseline survey revealed that a total of 3,748 members were residing permanently in 683 urban households surveyed. While the average family size varied significantly between "High" woody biomass potential (4.9 persons per household) and "Low" woody biomass potential (5.9 persons per household) areas of SNNPR, the overall average for the Region is 5.5 persons per family, which is significantly higher than the Regional Average of 4.2 for urban households (CSA, 2007). As far as distribution of broad age groups is concerned, with an estimated 31 percent of the population falling under the age of 15 years, the age structure demonstrates that the population is basically youthful. For population older than 15 years, the proportion of males is significantly lower (32 percent) compared to that of females (38 percent). Details of age and sex distribution of the population in survey households are summarized in Table 2.2 below.

Table 2.2: Distribution of Population in Survey Households by Age Groups and Sex of Household Members

Woody Biomass Endowment	Children Below 15 Years	Male Above 15 Years	Female Above15 Years	All	Average Household Size
High	265	258	324	847	4.9
Moderate	487	396	514	1397	5.5
Low	394	532	578	1504	5.9
All	**1,146**	**1,186**	**1,416**	**3,748**	**5.5**
Percent	**30.6**	**31.6**	**37.8**	**100.0**	

With regard to educational status of heads of households who participated in the survey, some important variations were observed between areas labeled as "High", Moderate", and "Low" woody biomass cover. One of such variations is the tendency of household heads with no formal education (illiterate) to concentrate in areas with "high" biomass cover indicating low level of access to education in outlying frontier areas of the south and south-west. Conversely, household heads with higher levels of educational attainment predominate areas with "Moderate" and "Low" woody biomass endowment (see Table 2.3).

Table 2.3: Percentage Distribution Heads of Survey Households by Level of Education and Woody Biomass Endowment

Level of Education	Woody Biomass Endowment Level			All
	High	Moderate	Low	
Illiterate (No formal education)	20.8	4.3	14.9	12.5
Read & Write (Informal education)	5.2	8.2	7.1	7.0
Primary (Grade 1 to 6)	18.5	10.6	15.7	14.5
Junior Secondary (Grade 7 to 8)	12.1	14.1	15.3	14.1
Senior Secondary (Grade 1 to 12)	17.9	23.5	19.2	20.4
Certificate/Diploma	19.7	26.7	16.1	20.8
First Degree	3.5	12.2	10.2	9.2
Second Degree and Above	2.3	0.4	1.6	1.3

The other important socio-economic variable which this survey captured information on is household income and livelihood in urban areas of SNNPR. Some of the most important income and livelihoods for the households included salary (44 percent), running small and medium businesses (15 percent), casual labor (13 percent), and renting out property – residential housing units in particular (11 percent). Petty trading, remittance from relatives and friends elsewhere and pension each providing income to about 10 percent of the households, are also significant source of sustainable livelihood in urban areas of SNNPR. It is also important to note that the role of remittance and pension are more pronounced in Hosaena – a town representing "Low" woody biomass endowment areas – mainly because of exodus-like youth migration that are

sending considerable amount of remittances to support their parents and families back home. Moreover, the fact that about 12 percent of the households were deriving their livelihoods from farming in Bonga – a town representing "High" woody biomass endowment areas – signifies the fact that towns in such areas are less urbanized relative to those labeled as "Moderate" and "Low" (see Table 2.4 for details).

Table 2.4: Percentage Distribution of Annual Income of Heads of Survey Households by Sources of Income and Woody Biomass Endowment

Source of Income	High	Moderate	Low	All
Salary	46.2	50.2	36.1	43.9
Medium Business (Shops, restaurants, etc)	6.4	11.8	24.7	15.2
Daily labor	13.9	14.5	10.6	12.9
Rent (house, land etc)	14.5	9.0	11.4	11.3
Petty trade	17.3	10.2	5.9	10.4
Remittance	12.1	5.5	12.9	10.0
Pension	9.8	7.1	13.7	10.2
Unemployed	0.6	0.8	-	0.4
Farming	11.6	6.7	5.1	7.3
Other	2.3	-	1.2	1.0

Further analysis of results of the baseline surveys revealed that with over half of the households falling within an annual income bracket of Etb 1,000 to Etb 10,000, income levels of the survey households are generally low. Only about five percent of the survey households reported an annual cash income in excess of Etb 35,000. Overall, average of annual income of the households is estimated to be about Etb 12,114 per household. Household income was a little higher in urban areas with "Low" biomass endowment and a little lower in areas with "Moderate" woody biomass cover. Interestingly, though not surprisingly, results of the survey indicated that male-headed households earn nearly twice as much as female-headed households (see Table 2.5) – ascertaining largely expected gender bias in income distribution against households headed by women. Addressing such gendered dimensions of household income in improved stoves promotion initiatives bring women - who are at the core center of household energy supply as well utilization – one step closer to sharing the benefits of their sustainable development effort.

Table 2.5: Percentage Distribution of Annual Income of Heads of Survey Households by Income Groups of Income and Woody Biomass Endowment

Income Group	High	Moderate	Low	All	Cumulative
Less than 1,000	5.8	5.1	3.9	4.8	4.8
1,000 to 5,000	25.4	31.0	32.5	30.2	35.0
5,001 to 10,000	27.7	18.4	18.4	20.8	55.8
10,001 to 15,000	16.2	17.6	14.9	16.3	72.1
15,001 to 20,000	5.2	9.4	8.2	7.9	80.0
20,001 to 25,000	8.7	11.8	11.0	10.7	90.7
25,001 to 30,000	2.3	4.3	3.9	3.7	94.4
30,001 to 35,000	1.2	-	0.4	0.4	94.8
35,001 to 40,000	2.9	1.6	2.0	2.0	96.8
Above 40,000	4.6	0.8	4.7	3.2	100.0
Average Income(All HHs)	***12,099***	***11,138***	***13,021***	***12,114***	
Average Income (Male-headed)				***13,499***	
Average Income (Female-headed)				***7,914***	

2.2 Biomass Fuels Utilization and Acquisition Patterns

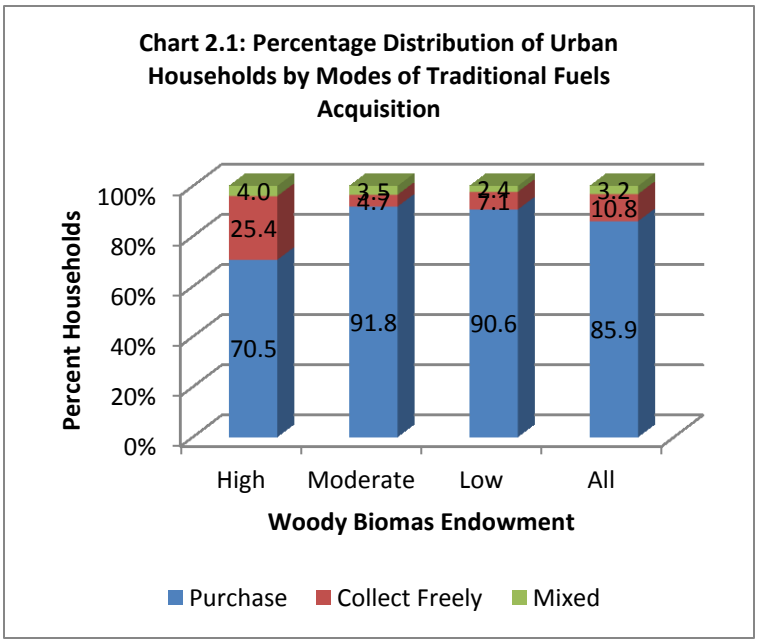
2.2.1 Utilization and Acquisition

Firewood (97 percent), closely followed by charcoal (88 percent) are the two most frequently used cooking fuels in the study households. Kerosene and branches/leaves/twigs (BLT) reported to have been used frequently in 15 percent and 12 percent of the survey households are also important cooking fuels in SNNPR. While no significant variations were observed in the use of firewood and charcoal between areas with different woody biomass endowment, use of kerosene stoves was notably higher in Yirgalem town that represented urban areas with "Moderate" woody biomass endowment (see Table 2.6). Perhaps due to removal of subsidy on kerosene and resulting escalation of prices of traditional fuels in recent years, it appears that electricity, whose application was confined to lighting and running consumer electronics hitherto, is emerging as an important cooking fuel.

Table 2.6: Percentage Distribution of Survey Households by Types of Fuels commonly used for Cooking

Type of Fuel	High	Moderate	Low	All
Firewood	96.0	96.5	97.6	96.8
Charcoal	83.2	88.2	90.2	87.7
Kerosene	1.2	27.8	10.2	14.5
BLT	24.9	4.7	10.2	11.9
Electricity	6.4	8.2	5.9	6.9
Agri-residue	4.6	0.8	1.6	2.0
Dung	0.6	1.2	3.9	2.0
LPG	0.0	0.4	0.4	0.3
Other	0.6	2.7	0.0	1.2

Naturally, urban consumers including urban households purchase their traditional fuel supplies from the market. However, depending upon accessibility (both physically and financially) and the degree of commercialization of traditional fuels, some households may continue collecting traditional fuels freely. Results of the baseline survey confirm this line of argument. For example, while the degree of commercialization of traditional fuels has reached about 86 percent for urban areas of SNNPR as a whole, it is much lower (70 percent) in Bonga town, representing the woody biomass rich areas of the south-west. Therefore, it is no surprise to see that in woody biomass endowed south-western areas of SNNPR over a quarter of the households are still freely collecting traditional fuels instead of purchasing them. On the other hand, in areas of relative scarcity of woody biomass, about 90 percent of urban households reported that they purchase their traditional fuel supplies (Chart 2.1). In other words, only about 10 percent of the urban households obtain their cooking fuel supplies through freely collecting traditional fuels.



Results of the survey also revealed that there is a negative correlation between traditional fuels availability and the amount of time required to freely collect the fuels. For example, while only less than 18 percent of the freely collecting households in areas of relative abundance of

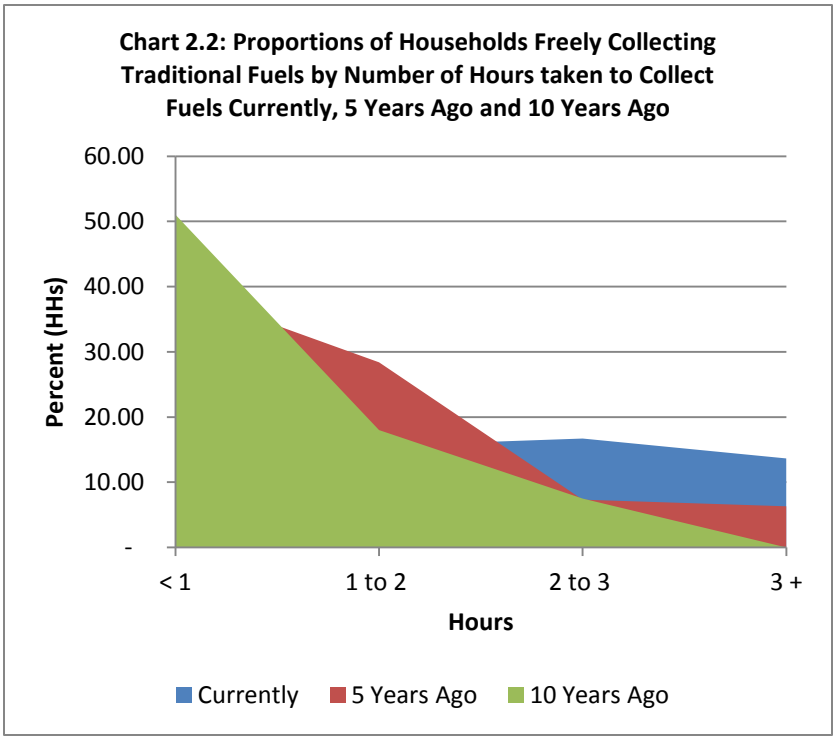
traditional fuels reported that it takes two and more hours to collect their supplies, the proportions reach 52 percent and 44 percent in areas where woody biomass resources are scarcer (see Table 2.7). Regardless of differences in levels of woody biomass endowment, nearly two-thirds of households that freely collect traditional fuels reported that time and effort required to collect fuels has increased at present. Increasing land clearing for agriculture and growing demand for cooking fuels (both are needed to feed a growing population) were cited by the households as the two most important reasons for scarcity of traditional fuels.

Table 2.7: Percentage Distribution of Households Freely Collecting Traditional Fuels by Amount of Time Taken to Collect Fuels Currently (Round Trip)

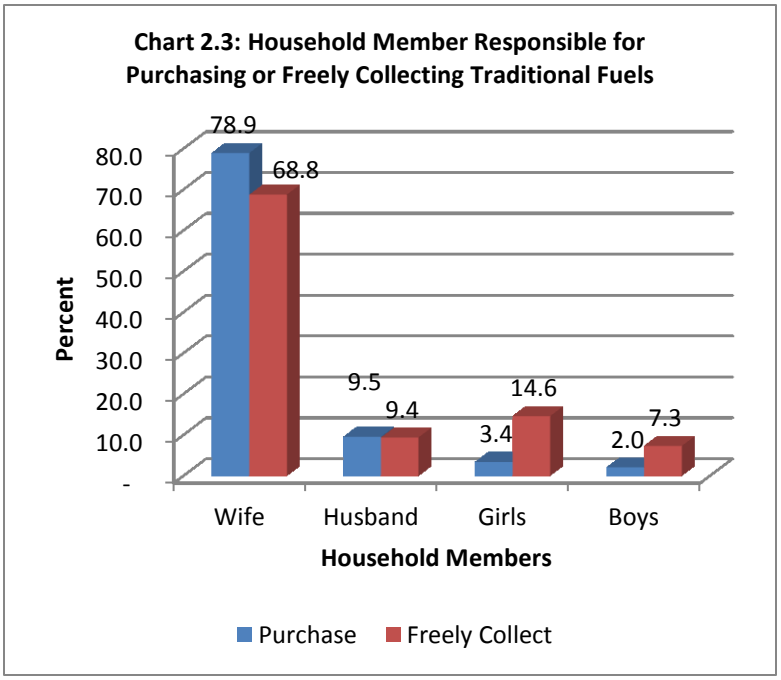
Time taken to collect	High	Moderate	Low	All
Less than 30 min	14.0	-	5.6	9.3
30 min to 1 hr	24.6	4.8	22.2	19.9
1:00 to 1:30	1.8	-	-	1.0
1:30 to 2:00	21.1	-	11.1	14.6
2:00 to 2:30	1.8	-	11.1	3.2
2:30 to 3:00	7.0	33.3	11.1	13.5
More than 3:00	8.8	19.0	22.2	13.6

Clearly, depending on the nature and magnitude of impact felt by consumers, different households respond differently to scarcity of cooking fuels. For example, households that freely collect traditional fuels reported that time and effort required to collect the same amount of fuel has risen considerably during the past one decade. As it can be seen from Chart 2.2, the majority of households used to collect traditional fuels within one hour or so five years ago. That effort and time appear to have doubled or even tripled at present signifying increasing difficulty of obtaining supplies due to growing scarcity.

Chart 2.2: Proportions of Households Freely Collecting Traditional Fuels by Number of Hours taken to Collect Fuels Currently, 5 Years Ago and 10 Years Ago



Unsurprisingly, results of the survey revealed that the supply of traditional fuels in SNNPR is highly gendered like it is elsewhere in Ethiopia. Irrespective of woody biomass endowment and whether fuels are purchased or freely collected, results of the survey revealed that traditional fuels supply scene is dominated by women followed distantly by girls (Chart 2.3). Men and boys supplied traditional fuels less than 10 percent of the households – which can be considered an improvement, but also indicating a snail-pace-type change over the deep rooted gender bias against women in SNNPR like the wider Ethiopian society at large.



2.2.2. Temporal Variation, Supply Scarcity and Coping Mechanisms

Like many other natural resources, the spatial and temporal distribution of woody biomass resources is uneven over space and time. While the spatial variations are more immediately apparent, the temporal ones may not be so necessarily. In Ethiopian context in general and that of SNNPR in particular, where traditional fuels are the most important sources of household cooking energy, adequate knowledge and understanding of the nature and dynamics of temporal variations in the availability and supply of woody biomass fuels is vital to the planning and execution of initiatives related to household energy. In line with this, attempts were made in this survey to capture some information on seasonal and temporal variations or changes in availability or scarcity, types of cooking fuels used at different seasons or periods, time and effort required to collect traditional fuels (only for those that freely collect), and household responses to supply scarcity.

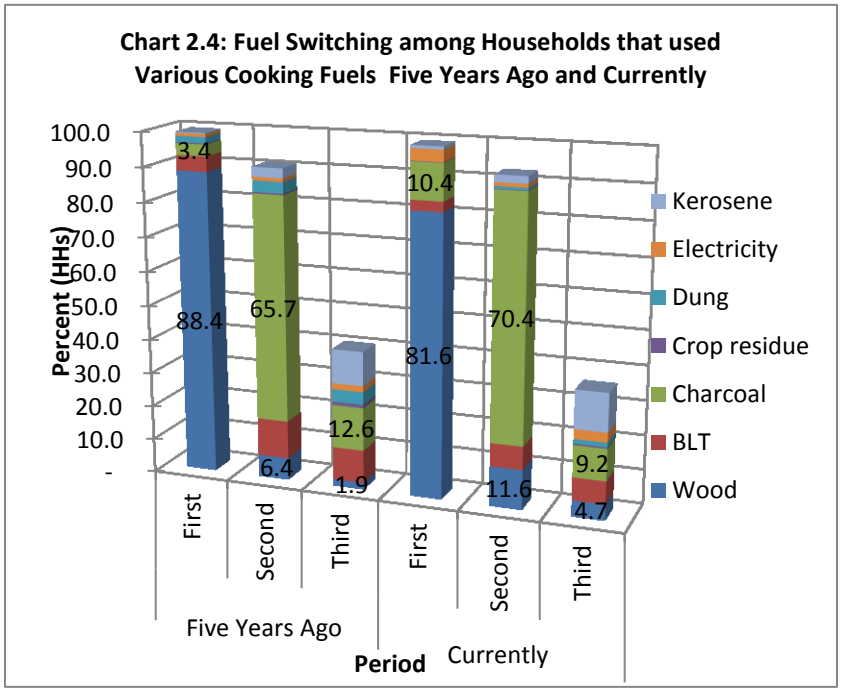
Analysis of the survey results indicate that wood is the most important cooking fuel commonly used by the households both in dry and wet seasons. Despite such importance, however, the proportion of households that use wood as a primary cooking fuel significantly drops in wet season (77 percent) compared to those using it in dry season (86 percent). Similarly, despite the second place it maintains both in dry and wet seasons, the proportion of households that use

charcoal drops from 70 percent in dry season to about 64 percent in wet season. This finding is, however, against conventional wisdom that suggests the number of households that use charcoal increases in wet season - response to temperature drop associated to wet season. Kerosene and BLT, respectively coming in third and fourth place, are also important household fuels in the household cooking energy ladder (see Table 2.8).

Table 2.8: Percentage Distribution of Survey Households by Types of Commonly used Cooking Fuels (in order of importance) in Dry and Wet Seasons

	Dry Season			Wet Season		
Type of Fuel	**First**	**Second**	**Third**	**First**	**Second**	**Third**
Wood	85.8	8.9	2.9	77.0	16.3	4.8
Charcoal	2.9	69.7	14.9	17.3	63.5	10.7
BLT	7.5	8.3	6.4	1.8	5.7	5.0
Kerosene	-	2.3	9.8	0.7	5.3	7.9
Sawdust	0.9	2.5	5.0	0.1	1.2	3.2
Electricity	2.2	1.8	2.3	2.9	2.0	2.0
Dung	0.4	1.9	2.3	-	0.6	1.5
Crop-residue	0.3	-	0.9	-	0.1	0.4

Furthermore, results of the survey indicate how households were adjusting themselves with the ever-changing cooking fuels availability and or accessibility over time. As could be seen from Chart 2.4, while the proportion of households using firewood dropped from 88 percent five years ago to about 82 percent currently, the proportion of households using charcoal as a first and second choice fuel has risen tremendously respectively from three percent and 67 percent five years ago to a respective new heights of 10 percent and 70 percent currently. Such inter-fuel substitution suggests that in the absence of any other attractive option (e.g. subsidized kerosene as it used to be until 2010), it appears that urban



households in SNNPR are showing a tendency to switch from firewood to charcoal – mainly due to convenience of the latter and not price advantages.

In addition to opportunistic behavior (owning a range of stoves to facilitate fuel switching depending on financial as well as physical accessibility), urban households in SNNPR adopted various measures to cope with rising fuel scarcity over the years. Some of the prominent measures that the households reported to have adopted in the past include using fuels more economically, purchase fuels in large quantities (to take advantage scale of economy) and switch from buying fuels to collecting them freely in areas of relative abundance in particular. Reportedly, in most severe cases, households had opted to using low-grade fuels such as cow dung and even to reducing the number of meals cooked (see Table 2.9 for details).

Table 2.9: Percentage Distribution Mechanisms Adopted by Survey Households in Response to Fuel Scarcity

Coping Mechanisms	High	Moderate	Low	All
Use Fuel Sparingly	65.3	78.8	76.9	74.7
Purchase Fuels in Large Quantities	9.8	12.9	4.3	8.9
Freely Collect Fuels Instead of Buying	20.2	4.7	4.7	8.6
Cooking Less Meals	1.2	-	9.4	3.8
Use Less Preferred Fuels	-	2.0	-	0.7
Use Fuel Efficient Stoves	3.5	1.6	4.3	3.1

2.3 Stove Ownership and Utilization: Cooking Places, Stoves and Pots

2.3.1 Cooking Places

The majority of urban households in SNNPR use privately owned kitchens for Injera and other bread baking and cooking purposes. According to results of the survey, while 89 percent bake in private kitchens, the proportion of households that cook in private kitchens is significantly lower (63%). Results of the survey further revealed while the proportions of households that use private kitchen for cooking greatly vary between the three categories of woody biomass endowment (High 65%), (Moderate 89%) and (Low 34%), the variation for Injera and other bread baking was insignificant. It is also interesting to note that the reason behind greater proportions of households baking Injera in private kitchens could be that Injera baking unlike other non-Injera cooking takes up space, generates massive heat and smoke-screen and produces dangerous flames too – making it too risky to perform in living quarters.

Despite such risks however, living rooms are used for Injera and other bread baking (in five percent of the households) and non-Injera cooking (in 31 percent of the households) in urban areas of SNNPR (Table 2.10). Obviously, women, who are responsible (by tradition of gendered division of labor) for cooking meals for the family and children who often stay with their mothers around cooking places, suffer disproportionate health risks associated with such cooking practices. Worse is the fact that both baking and cooking are performed over a three stone fire (which produces large quantities of smoke and toxic compounds due to poor combustion) usually in poorly lit and ventilated kitchens – a recipe for disaster. Therefore, addressing the issues of separate kitchens with adequate lighting and ventilation along with ongoing and future efforts of disseminating improved stoves in SNNPR has a great potential for reducing health risks related to in-door air pollution while increasing acceptability of the technology at the same time.

Table 2.10: Percentage Distribution of Survey Households by Places of Baking/Cooking

Place of Baking /Cooking	Baking (Injera / Other Bread)				Cooking			
	High	Moderate	Low	All	High	Moderate	Low	All
Private kitchen	86.1	90.6	89.4	89.0	64.7	87.8	36.9	63.0
Shared Kitchen	4.0	6.3	5.1	5.3	2.3	5.5	5.1	4.5
Living Room	8.1	2.0	5.1	4.7	31.2	5.5	56.9	31.2
Outdoors (open space)	0.6	0.8	-	0.4	1.2	0.8	0.8	0.9
Other	1.2	0.4	-	0.4	0.6	0.4	-	0.3

2.3.2 Cooking Pots and Plates

Urban households in SNNPR utilize two types of cooking pots and plates namely aluminum and clay. While Injera is exclusively baked on a ceramic plate, both ceramic and metal plates are used for baking various types of breads (Kocho, Kita, … etc) other than Injera and grain roasting. The diameter of most commonly used plates range between 54 cm and 60cm (measured from end to end).

According to findings of the baseline survey, a total of 2,267 aluminum pots were in use in a total of 683 urban households surveyed. Although ownership in the number of pots does not vary significantly between the three categories of woody biomass endowment, households living in areas with relatively better biomass endowment tend to own more pots than their counterparts – but the reason behind this remains unclear for the time being. On the average, however, an urban household in SNNPR owns and uses 3.3 aluminum cooking pots.

The other interesting aspect – also crucially important from view point of improved stoves design and development - of aluminum pots used by the households is the diversity of sizes. Urban households in the study areas were observed utilizing a wide range of sizes aluminum cooking pots. Based on actual measurements taken during the field work, the proportion of households using smaller size pots (diameter of less than 15 cm) is disproportionately high in areas with "High" biomass endowment than the other two categories. But, the reverse is not necessarily true. More importantly, the diameter of at least 70 percent aluminum pots commonly used by urban households in SNNPR fall within in the range of 15 cm and 30 cm (see Table 3.11). Thus, this is the most important range of cooking pots size in SNNPR that all key players in the improved stoves industry should not and cannot miss out in their efforts.

Regarding ownership of clay pots, with only about 326 clay pots owned in a total of 683 households, the ownership rate is far lower compared to aluminum pots. But, what is more interesting is the fact that ownership rate of clay pots is extremely and disproportionately high in areas with relatively better woody biomass endowment. For instance, an estimated three-quarter of all clay pots were owned by biomass-rich western parts (including Kaffa and Sheka Zones) of SNNPR. Experience suggest that heat transfer rate of clay pots is generally lower than that of aluminum pots. Thus, the tendency among households in relatively biomass-rich parts of SNNPR to dominantly own and continue using clay pots is self-explaining. That is, while households in biomass-scarce areas have completed their transition from clay pots to aluminum ones – thanks to rising prices due to increasing scarcity of supplies – financial and other incentives aluminum pots offer to their consumers are not large enough to attract households in biomass-rich areas to invest on the pots – thanks to inexpensive traditional fuel supplies for the moment.

Table 3.11: Percentage Distribution of Aluminum Cooking Pots by Diameter (cm) of Pots

Diameter (cm)	High	Moderate	Low	All
Number	***619***	***857***	***791***	***2,267***
Percent	***27.3***	***37.8***	***34.9***	***100.0***
Per Capita Per HH	***3.6***	***3.4***	***3.1***	***3.3***
Less than 10	7.1	0.6	0.4	2.4
10 to 15	14.7	10.1	4.7	9.6
15 to 17	5.8	9.0	4.4	6.6
17 to 20	23.6	20.4	11.2	18.3
20 to 23	12.6	18.5	21.1	17.7
23 to 25	8.0	10.3	8.7	9.1
25 to 27	5.8	6.6	10.8	7.8
27 to 30	12.8	9.9	10.2	10.8
30 to 33	5.7	6.5	17.4	9.9
33 to 35	1.8	3.9	3.4	3.1
Above 35	2.0	4.0	7.7	4.6

2.3.3 Injera and Non-Injera Bread Baking

With a total of about 56 different ethnic groups residing in the region harmoniously – each group with its own distinct ethnic and socio-cultural identities and shared values - ethnographically, the SNNPR is the most diverse Regional State in Ethiopia. Its numerous diversities often transcend beyond mere ethnographic and agro-ecological differences and include diversities in livelihood systems. It is widely expected that such socio-cultural differences could be reflected in types of meals commonly cooked and the way people obtain and use energy to cook food with. Findings of our inquiry in to Injera and non-Injera bread baking in urban households are discussed below.

Urban households in SNNPR bake and consume both Injera and a variety of non-Injera breads (Kocho, Bursame, Torosho, Qitta, etc) as part of their regular diet (see Photo 2.1). According to results of the survey, two-third (67 percent) of the survey households bake Injera twice per week. Results of the survey further revealed that households in low biomass endowment areas tend to bake Injera more frequently compared to their counterparts in areas with relatively better woody biomass endowment. It appears that frequency of Injera baking has more to do with the degree of urbanization and consumption of other non-Injera bread than scarcity or availability of woody biomass fuels. For instance, reportedly, urban households in wood scarce areas (represented by Hosaena town) bake Injera 2.3 times per week. On the whole, urban households in SNNPR bake Injera 2.2 times per week.

Photo 2.1: Qitta & Qocho baking, both staple bread in SNNPR, on three-stone fire

It is also important to note that despite the widely held belief that sizeable proportion of households in SNNPR may not bake Injera at all (mainly due to wide cultural diversities and associated dietary differences in the region), it was found out that the overwhelming majority of urban households (97 percent) in SNNPR bake and eat Injera regularly. Actually, results of the survey showed that urban households bake about 22 Injeras per baking sessions, which is exactly similar with those of Addis Ababa households (Addis Ababa Household Energy Baseline Survey, 2008). Owing to consumption of local breads and other diets, frequency and number of Injeras baked per session are lower in areas with relatively better wood resource

endowment. It should also be noted that areas with better woody biomass endowment are relatively less commercialized if not urbanized. While households in biomass rich areas tend to bake Injera a little less frequently than their counterparts, the variation in frequency of baking between the three areas of woody biomass endowment levels remains insignificant.

Table 2.12: Percentage Distribution of Households by Frequency of Injera Baking per Week

Injera Baking Sessions per Week	High	Moderate	Low	All
Once	5.2	15.3	8.6	10.2
Twice	75.1	69.0	58.4	66.6
Three Times	15.6	9.0	27.8	17.7
Four Times and More	1.2	1.6	3.9	2.3
Do Not Bake Injera at All	2.9	5.1	1.2	3.1
No. of Injera baking sessions per week	**2.2**	**2.0**	**2.3**	**2.2**
No. of Injeras baked per session	**18.8**	**20.9**	**24.2**	**21.5**

As briefly mentioned in previous sections of this report, non-Injera bread such as Kocho and Kita are widely baked in SNNPR. About 88 percent of households in SNNPR bake and eat non-Injera breads. While Kocho is commonly consumed in the highlands on either sides of the Rift Valley, Kitta mainly made from maize flour is consumed in the lowlands. Results of the survey show that well over two third (68 percent) of the households bake non-Injera bread at least once a week. While the overall average for SNNPR is about twice per week, households in woody biomass rich areas tend to bake non Injera bread not only less frequently, but also fewer number of breads per baking session – perhaps due to their dependence on tubers and a variety of other root crops. Overall, urban households in SNNPR bake about six non Injera breads per baking session, but this figure could go as low as two breads per session in areas designated as having better wood resource endowment (see Table 2.13 for details)..

Table 2.13: Percentage Distribution of Households by Number of Non-Injera Bread Baking Sessions per Week

No. of Sessions per Week	High	Moderate	Low	All
N	***173***	***255***	***225***	***683***
Once	46.8	26.7	29.0	32.7
Twice	23.7	43.5	36.5	35.9
Three Times	10.4	12.2	13.7	12.3
Four Times	3.5	11.8	5.5	7.3
Do Not Bake Other Bread	15.6	5.9	15.3	11.9
No. of Non-Injera bread baking sessions per week	**1.7**	**2.3**	**2.0**	**2.1**
No. of Non-Injera breads baked per sessions	**1.9**	**7.1**	**5.1**	**5.6**

Kocho, which takes various names locally (Wussa in Guraghe, Wassa in Kambatta and Hadiya, Worke in Sidama, …. etc., is a unique staple SNNPR. Kocho is made from Enset a drought-resistant famine crop grown largely in the highlands of SNNPR. Enset is a uniquely versatile crop with almost every part of it put to use as food or other purposes including animal fodder and rope making (see Box 2.1 for details about Enset). Baking Kocho is a relatively laborious process which starts with removal and repeated cutting of the raw Kocho until all the fiber is cut into tiny pieces and made suitable for human consumption. Once the cutting is over, Kocho is baked over a plate (preferably ceramic but also iron) for 10 to 15 minutes.

Box 2.1: Enset, a unique staple to the SNNPR

The most characteristic product of SNNPR is enset, a food unique to Ethiopia, and in modern times at least, largely confined to southern Ethiopia as a staple. Enset (*Ensete ventricosum*) is sometimes called 'False Banana' because its leaves are so similar to those of the banana plants to which it is related; but it is the starchy base of the plant – the corm and the leaf-sheaths – which provides the foodstuff. This is eaten in various forms: boiled corm (*amicho*), or a fermented product in the form of a bread (*kocho*), or the best-quality product from mature plants (*bulla*) in the form of pancakes, porridge or dumplings. Enset may be planted in clusters around the compound, or in dense fields. As a perennial, maturing at around four years and grown up to seven years, enset acts as a food store which can be used at any time of year; it is a relatively drought-resistant plant, and the leaves provide fodder for livestock as well as twine for rope-making. (*USAID, FEWS Net: 2006).*

2.3.4 Consumers' Ability and Willingness to Pay for Improved Stoves

Information on consumers' ability and willingness to pay for energy-efficient biomass stoves were sought as part of the baseline survey. According to results of the survey, overwhelming majority of the survey households (91 percent) were keen to purchase the stove and offered what they think should the price of the stove. Unsurprisingly, compared to households living in woody biomass rich areas, more households living in biomass scarce areas showed willingness to purchase energy-efficient cooking technologies. It is also important to note that while 38 percent of the households suggested a price of under Etb 50, another quarter of the households suggested a price of up to Etb 75 for improved wood-burning stoves (see Table 2.14). From a view point of commercial approach adopted by GIZ-supported improved stoves promotion, prices suggested by consumers may sound to be on the lower side particularly for improved stoves available in the market at the moment. But, what should be borne in mind is that any future improved stoves pricing strategy should take into account consumers' ability and willingness to pay among other things.

Table 2.14: Percentage of households by amount of money they are willing to pay for improved stove

Price range	High	Moderate	Low	% of Willing	% of Total
Less than ETB 50	25.4	33.7	50.6	**41.6**	**37.9**
ETB 51 to ETB 75	18.5	28.6	24.3	**26.8**	**24.5**
ETB 76 to ETB 100	24.3	20.0	13.3	**20.4**	**18.6**
ETB 101 to ETB 150	11.0	4.7	3.9	**6.6**	**6.0**
Above ETB 150	9.2	3.5	1.2	**4.5**	**4.1**
Percent of Willing	**88.4**	**90.6**	**93.3**	**91.1**	**100.0**
Percent of Total	**100.0**	**100.0**	**100.0**	**100.0**	**91.1**

As far as promoting energy efficiency cooking and baking is concerned, it is also important to note that, in SNNPR, like many urban areas in Ethiopia, the household is not only a residential unit, but it is also a place where business (including catering food and drinks) is conducted. For example, in spite of the fact households in business districts were intentionally underrepresented in the sample, findings of the survey indicated that about 14 percent of the households were catering food commercially. Owing to economies of scale it involves, the potential for energy savings (using improved stoves and cooking techniques) is enormous in commercial food catering sector. Besides, due to quick returns on investment they would enjoy, commercial food catering institutions represent a huge cash market for improved stoves entrepreneurs.

III. The Rural Household Energy Scene in SNNPR: A Cursory Review of the Survey Results

As it was explained in the methodology section of this report, this household cooking fuels baseline survey was conducted basically in urban households. However, it was decided later in the project to gather basic information on energy utilization patterns of rural households. At this point, it was decided to include 40 to 50 rural households in the wider survey from the three study sites. Obviously, the sample is too small (112 households) to allow conclusive statements and it may not be representative. But, it is good enough to provide a bird's eye view of how rural households in the region are obtaining and utilizing traditional cooking fuels. For the rural household survey a total of 112 households (High 32, Moderate 40 and Low 40 households) were included and results of the surveys are briefly discussed in this section.

3.1 Socio-economic Characteristics of the Households

Some of the most important socio-economic characteristics of the rural survey households are summarized in Table 3.1. The three locations where the rural household surveys were conducted are Secha-Roma near Hosaena town, Wonsho near Yirgalem town and Gimbo near Bonga town. Out of the total 112 rural households surveyed about 82 percent were headed by males and the remaining 18 percent by female heads of households. Average family size of the households is 6.2 persons per household, but the figure varies between the lowest 4.8 in high biomass endowed areas and the highest 7.2 persons in woody biomass poor areas. With over half the household heads without any kind of formal education, literacy rates among rural populations is obviously far lower than those of urban households. Similarly, total annual cash incomes are much lower among rural households in the study areas. Results of the survey indicated that rural households in SNNPR earn average annual cash income of Etb 3,637. Annual cash income was lowest among households in woody biomass rich areas (Etb 2,828 per annum) and highest among households in areas with "Moderate" woody biomass cover.

Table 3.1: Percentage Distribution of Rural Households by Socio-economic Characteristics of Heads of Households

Characteristics of Household Heads		Woody Biomass Endowment			
		High	Moderate	Low	All
N		***32***	***40***	***40***	***112***
Sex of HHH	Female	25.0	15.0	15.0	17.9
	Male	75.0	85.0	85.0	82.1
	Both Sexes	***100.0***	***100.0***	***100.0***	***100.0***
Family Size	< 3	6.3	-	-	1.79
	3 to 5	62.5	50.0	32.5	47.32
	6 to 8	31.3	27.5	47.5	35.71
	9 to 11	-	17.5	12.5	10.71
	12 & More	-	5.0	7.5	4.46
	Total	***100.0***	***100.0***	***100.0***	***100.00***
Level of Education	Illiterate	65.6	25.0	42.5	42.9
	Read & Write	3.1	12.5	10.0	8.9
	Primary	28.1	27.5	20.0	25.0
	Junior Secondary	3.1	17.5	17.5	13.4
	Senior Secondary	0.0	10.0	7.5	6.3
	Certificate/Diploma	0.0	7.5	2.5	3.6
	Total	***100.0***	***100.0***	***100.0***	***100.0***
Annual Cash Income	< 1000	12.5	5.0	17.5	11.6
	1000 - 2999	34.4	45.0	27.5	35.7
	3,000 - 4,999	40.6	20.0	22.5	26.8
	5,000 - 6,999	9.4	12.5	20.0	14.3
	7,000 - 8,999	3.1	5.0	10.0	6.3
	9,000 - 10,999	-	5.0	-	1.8
	12,000& More	-	7.5	2.5	3.6
	Total	***100.0***	***100.0***	***100.0***	***100.0***
	Average Annual Cash Income	**2,828**	**4,360**	**3,561**	**3.637**

3.2 Household Energy Utilization Patterns: Stoves, Fuels, Kitchens, Pots and End-uses

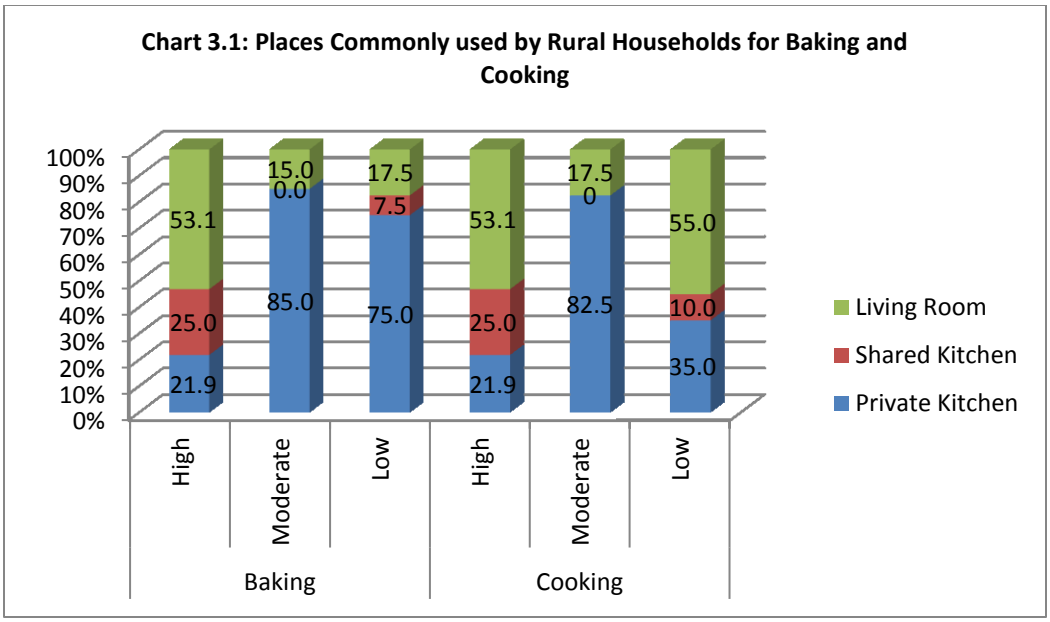
With regard to types of stoves, the three stone fire place is the single most important type of stove or cooking technique adopted by all rural households. However, few households in wood scarce areas (e.g. Haise village near Hosaena) had had Mirt biomass Injera stoves in their kitchen. But, although the study team came across a household that was actively using twin Mirt Injera stoves (one for Injera and the other for Kocho baking, see Photo 3.1 & 3.2), the new stoves remained largely uninstalled for more than five months in many households in the vicinity of Hosaena.

With few exceptions in wood scarce areas, all rural households freely collect their supplies and firewood and BLT are the two most important fuels among the households. Cow dung and crop residue are also used commonly, though seasonally, in wood scarce areas. Very few rural (less than five percent) households reported to have been using charcoal for cooking. As one would expect it, the majority of households in wood scarce areas (between 60 percent and 70 percent) reported that a single round trip (including collection time) to collect firewood takes them three to four hours. On the other hand, the majority of households in areas with relative biomass abundance collect firewood between one and two hours. It should be noted that all households, irrespective of woody biomass endowment levels, perceived increase in firewood collection time over the years; and the increase is due to growing scarcity of supplies.

Photo 3.1:Mirt Stove waiting to be installed in a rural household, near Hosaena town

Photo 3.2: Twin Mirt stoves (one for Injera & the other for Kocho in use in a rural household, near Hosaena town

Results of the rural household surveys showed that well over half of the households use their living rooms both for baking and cooking. However, more than 80 percent of rural households in wood scarce areas use separate kitchens to cook food (Chart 3.1). Only 4 out of 112 rural households reported that they are engaged in preparing food and drinks for sale.



Our inquiry in to willingness of rural households to purchase an improved stove that could reduce wood consumption by up to half revealed that overall, 88 percent of rural households are willing to purchase the stove; and the proportion is relatively higher for wood scarce areas. With regard to ability to pay, three-quarters of the rural households reported that they pay up to Etb 75 for an improved stove.

On the average, rural households in SNNPR own and use 2.5 pots for cooking and about 30 percent of the pots are made of ceramic while the remainder is aluminum. The proportion of ceramic pots increases as one goes from wood-rich areas to wood scarce areas of the region. According to results of the survey, nearly 62 percent of households use pot sizes between 20 and 29 cm diameter. Over a quarter of pots used by rural households were bigger pot sizes (see Table 3.2 for details.).

Tabl3 3.2: Percentage Distribution of Rural Households by Diameter of Cooking Pots Commonly Used

Diameter	High	Moderate	Low	All
< 15	3.1	-	-	0.9
15 – 19	21.9	7.5	2.5	9.8
20 – 24	46.9	27.5	30.0	33.9
25 – 29	25.0	30.0	27.5	27.7
30 – 34	3.1	22.5	30.0	19.6
35 -39	0.0	12.5	10.0	8.0
Total	**100.0**	**100.0**	**100.0**	**100.0**

According to results of the survey, while all rural households in wood scarce areas bake Injera regularly, the proportions decline to about half as one goes from areas labeled as "Moderate" and "Low" woody biomass endowment. Reportedly, however, rural households in SNNPR bake Injera about 2.3 times per week, which is very similar to that of their urban counterparts i.e., 2.2 times per week for urban households. Again, owing to dependency on diets other than Injera, households in wood rich areas of the region tend to bake fewer numbers of Injeras per baking session. On the average, however, rural households in SNNPR bake about 24 Injeras per baking session (Table 3.3) – slightly more than their urban counterparts, which was 22 Injeras per session.

Table 3.3: Percentage Distribution of Rural Households by Frequency of Injera Baking Sessions per Week

Frequency per week	High	Moderate	Low	All
Less than once	-	30.0	-	10.7
Once	6.3	15.0	2.5	8.0
Twice	53.1	2.5	72.5	42.9
Three Times	9.4	2.5	25.0	13.4
Do not bake at all	31.3	40.0	-	23.2
No. of baking sessions per week	**2.0**	**1.5**	**2.2**	**2.3**
No. of Injeras baked per session	**15.6**	**25.9**	**22.4**	**23.5**

Regardless of frequency of baking and the number and types of breads baked per baking session, the survey results showed that all rural households bake and consume various types of breads other than Injera. Of course, the majority of rural households bake non-Injera bread in addition to Injera. Nearly, 40 percent of the households bake non Injera bread on a daily basis. Another 40 percent of the rural households bake between once and three times a week, which is much less frequent than the previous group. According to the survey results, however, rural households in SNNPR bake non Injera bread, on the average, 2.9 times per week; and the figure is twice as much for households designated as "moderate" woody biomass endowment. Results of the surveys further revealed that rural households in SNNPR bake average of 6.1 non Injera breads per session, but the figure is as much as 14.2 in areas with better woody biomass endowment. It is interesting to note that in areas of better woody biomass endowment households appear to be compensating for fewer number of Injeras baked per session (see Table 3.3) by baking larger number of non Injera bread (see Table 3.4), which is the most natural thing to do.

Table 3.4: Percentage Distribution of Rural Households by Frequency of Non-Injera Bread Baking Sessions per Week

Sessions Per Week	High	Moderate	Low	All
Once	25.0	-	5.0	8.9
Twice	3.1	7.5	20.0	10.7
Three Times	18.8	15.0	27.5	20.5
Four Times	-	5.0	32.5	13.4
Five Times	6.3	2.5	5.0	4.5
Six Times	9.4	-	-	2.7
Seven Times (Daily)	37.5	67.5	7.5	37.5
Eight & More	-	2.5	2.5	1.8
No. of Non-Injera bread baking sessions	**4.4**	**5.9**	**3.6**	**2.9**
No. of Non-Injera breads baked per session	**14.2**	**6.3**	**5.1**	**6.1**

IV. Household Energy Supply and Consumption in SNNPR

As part of the baseline study, efforts were made to capture useful household energy information both from the supply side and demand side. The supply side information included estimation of the volume and weight of woody biomass inflow, retail prices of fuels and profiling of suppliers, while demand side information collected included biomass fuels consumption estimates (based on actual measurements) and types and frequencies of cooking end-uses various stoves and fuels were used for. Main findings of both the supply side and demand side information collected as part of the baseline survey are presented below.

4.1 Biomass Fuels Supply and Marketing

In an effort to quantitatively estimate the supply of various types of biomass fuels entering urban areas, inflows of traditional fuels transported by various types of carriers were counted on all major roads leading to the study towns. The inflow survey was conducted for three to four days – of which one was necessarily a market day - in each town and for about 12 hours (day time) each day.

4.1.1 Biomass Fuels Inflows

Biomass fuels inflow surveys were conducted on a total of 19 major inflow routes (roads) coming in to the three survey towns. The inflow surveys were conducted for two non market days and one market day in Yirgalem and Bonga towns and three non market and one market day in Hosaena town. The surveys were conducted between mid February and end arch, 2011.
In spite of the fact that the town is surrounded by a patch of dense forest all around and firewood can be obtained within an "arm's stretch", an estimated 484 carriers were counted supplying various biomass fuels daily to the town of Bonga – a medium-size town with a population of about 21,000 in 2007. Although biomass fuels were entering the town through all major inflow routes surveyed, Masgid road (old road linking Bonga and Mizan through the southern route) stands out with a contribution of about 36 percent of the total daily inflow. Maskal Adababay and Shatta roads are the two important supply routes in Bonga.

Table 4.1: Daily Biomass Fuels Inflow (volume) by Inflow Routes

Woody Biomass Endowment	Inflow Route	Number	Percent
	College Road (new road to Mizan)	44	9.2
	Masgid Road (old road to Mizan)	173	35.7
	Maskal Adababay	98	20.3
	Shata	100	20.7
	Geter Mangad	68	14.1
High (Bonga)	***High Total***	***484***	***100.0***
	Arada	126	13.8
	Fura	179	19.6
	Bera	145	15.9
	Kera	131	14.3
	Gane	85	9.3
	Leku	92	10.1
	Mesfin Mefelfeya	84	9.2
	Amanuel	71	7.8
Moderate (Yirgalem)	***Moderate Total***	***913***	***100.0***
	Synodos Road	62	4.9
	Lisana Road	70	5.5
	Gonbora Road	349	27.5
	Soro Road	538	42.3
	Ashe Road	173	13.6
	Wolaita Road	79	6.2
Low (Hosaena)	***Low Total***	***1270***	***100.0***

Although it may not be comparable with Bonga, woody biomass fuels are more or less easily available and physically accessible in Yirgalem town. The challenge in Yirgalem inflow survey was the multiplicity of inflow routes. There are about a dozen of major and small roads (some are foot paths) leading to different parts of the town. Inflow surveys were conducted on eight selected routes which are believed to contribute over 90 percent of the daily inflow. In Yirgalem, the contribution of each road appears to be evenly distributed with Fura road contributing slightly higher (20 percent) than others.

On the other hand, in Hosaena town where biomass fuels are scarcer than in the other two towns, remarkable differences were observed in the contribution of various inflow routes to the daily biomass fuels inflow. Soro road and Gonbora road, with their respective contributions of about 42 percent and 28 percent to the daily inflow, are the two most important biomass fuels supply routes in Hosaena. These two routes are adjacent to Gibe Valley with a long stretch of woodland patches from which firewood and charcoal are produced.

One of the most striking findings of the inflow surveys is the magnitude of people (the human factor) engaged in traditional fuels supply business – including production, transport and marketing – as a livelihood activity. According to results of the inflow surveys, depending on the size of the towns, between 484 (in Bonga) and 1,320 (in Hosaena) people - using various transport means - were counted daily supplying various biomass fuels in the towns studied (Table 4.1). Traditional fuels business providing employment and income to large numbers of people may not be unique to SNNPR, But, based on the sheer number of people engaged in traditional fuels supply business, it could be argued that no other single industry in the study towns provides employment and sustainable livelihood to so many people as traditional fuels supply does.

Table 4.2: Percentage Distribution of Weekly Fuels Inflow by Carrier Type

Carrier	High	Moderate	Low	All
N = (Daily Inflow)	***484***	***913***	***1,320***	***2,699***
Donkeys	0.2	30.9	42.0	30.9
Women	41.0	2.7	10.9	13.5
Men	31.6	27.2	6.0	17.7
Girls	12.2	3.0	8.4	7.3
Boys	13.4	26.7	7.0	14.7
Animal Cart	0.1	7.3	21.8	13.1
Vehicles	1.4	2.2	3.8	2.8
All	**100.0**	**100.0**	**100.0**	**100.0**

With regard to contribution of each type of carrier to total volume of inflow, donkeys (31 percent), followed by men (18 percent) and boys (15 percent) are the most important means of transporting biomass fuels in SNNPR. Unlike Addis Ababa where women supply between two-third and three-quarters of the total volume of traditional fuels, the role of women as transporters of fuel in SNNPR is much lower (only about 14 percent of the total volume). However, the importance of different carriers varies with biomass endowment levels. For example, while donkeys are the most important means of transport in areas with moderate and low woody biomass potential, women and men, or human transport in general, are most important fuel carriers in areas with higher forest cover. Animal driven carts, in addition to their much higher carrying capacities compared to humans, are second only to donkeys in woody biomass scarce areas of SNNPR (see Table 4.2).

Results of fuel/carrier inflow surveys further revealed that, in terms of weight, an estimated 167 tons of biomass fuels were supplied daily to the three towns surveyed. Firewood constituted about 62 percent and charcoal 22 percent of the total biomass fuels inflow (Table 4.3). It is important to mention at this juncture that despite the fact that more than 90 percent of the

inflow was captured; the volumes appear to be lower particularly for Bonga and Yirgalem towns. Lower inflow volumes for these two towns is primarily due to the fact that massive quantities of wood is generated within their municipal boundaries resulting in reduced demand for biomass fuels, hence the inflow, coming from outside the city boundaries.

Table 4.3: Daily Weight Inflow (ton) of Biomass Fuels by Types of Fuels and Woody Biomass Endowment

Woody Biomass Endowment	Wood	BLT	Charcoal	Cow Dung	Crop Residue	Total
High	2.68	1.61	3.66	-	-	7.95
Moderate	31.35	3.4	3.27	-	-	38.01
Low	69.78	14.47	30.42	0.15	6.01	120.83
All	***103.81***	***19.48***	***37.34***	***0.15***	***6.01***	***166.79***
Percent	***62.2***	***11.7***	***22.4***	***0.1***	***3.6***	***100.0***

4.1.2 Biomass Fuels Marketing (Suppliers) and Market Prices

4.1.2.1 Who are Biomass Fuels Suppliers

Information on the socio-economic profile of biomass fuels suppliers showed that very often than not, traditional fuels suppliers are socially and economically disadvantaged members of the community. Based on interviews with suppliers themselves and discussions held with key players in the sector, traditional fuels suppliers are socially and economically disadvantaged groups including the urban and rural poor, women (female household heads in particular) and children. This group of people has very little or no formal education. Cash incomes from their traditional fuel supply business are not only very low, but they are also unreliable, because their businesses operate informally without business licenses – a key issue leading to harassment of suppliers by law enforcement agencies, hence, increasing vulnerability of their businesses. This characterization applies to all traditional fuels suppliers throughout urban areas of Ethiopia including SNNPR. But, there is another dimension which appears to be unique to Kaffa, Bonga. That is, traditional fuels supply business is an exclusive vocation to certain ethnic minority known as "Manja"in Kaffa Zone. Manja ethnic minority group deserve a separate social and anthropological study on their own right. For the purpose of this study, it suffices to briefly describe who Manjas are and what they do to earn a living.

Manjas are ethnic minority group residing inside Kaffa forests. They are basically indigenous forest people whose livelihoods are derived from sale of mainly non timber forest products (NTFPs) and also pottery products to some extent. Manjas are occupational cast and as such they heavily discriminated against. As a cast group, communities in Kaffa keep Manjas away

from the mainstream societal life. They are highly despised and are unable to sell anything but firewood and clay pots to non-Manja. As a people living inside dense forests of Kaffa, their livelihoods are intimately associated with natural resources NTFP in particular. As such, they are sole suppliers of firewood and charcoal to urban consumers in Kaffa Zone (see Photos 4.1 & 4.2). Their role as fuelwood suppliers has often brought them to collision with local officials who claim to be the guardians of forest resources.

Arising from their role as fuelwood suppliers, the official attitude towards Manjas has been, and still is in some cases, negative, because they are often viewed as perpetrators of environmental degradation (deforestation in this particular case) by non-Manja communities and local officials around them. Traditionally, Manjas had managed forest resources in a sustainable manner. According to a Participatory Forest Management Project (PFMP) of Farm Africa (an international NGO), the "tragedy of commons" struck in Kaffa when Manjas and other forest user groups were alienated from the resource as a result of centralized forest management policies of the defunct regime in the 1980s.

Photo 4.1 Manja woman peddling firewood (Bonga town)

Photo 4.2: Manja woman transporting charcoal to Bonga town

Be that as it may, Manjas continued to dominate the traditional fuels supply scene in Kaffa; and this calls for more targeted interventions, in addition to PFM efforts, to diversify their livelihoods and improve their social status. The Mirt and Gonzie improved stoves provide a unique opportunity to address some of the challenges faced by Manja cast group. While the production and marketing of these two and other designs of improved stoves provide income and sustainable livelihood to Manjas, they also contribute to the conservation of Kaffa high forest which, many agree, is depleting rapidly in recent years through thinning from inside and shrinking from outside each passing year.

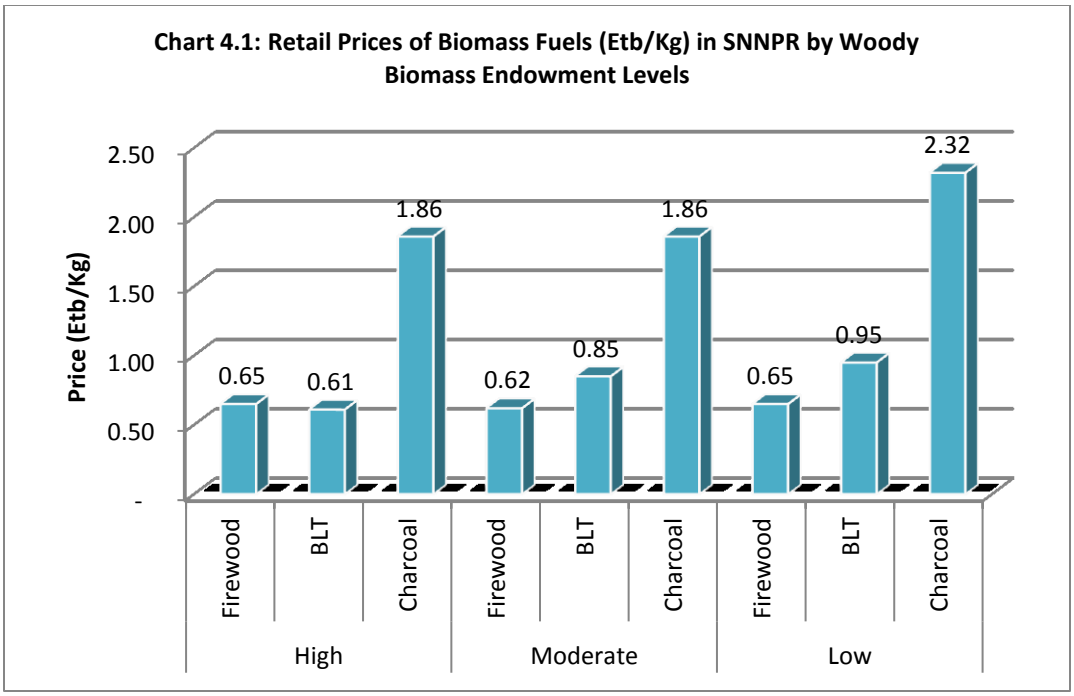
4.1.2.2. Biomass Fuels Prices

Like many other commodities, in perfect markets, prices of biomass fuels are determined by the law supply and demand. Over 200 weight and price measurements were conducted for various carrier and fuel combinations in the study towns. Average weights of firewood, BLT and carried by various carriers are summarized in Table 4.4 below.

Table 4.4: Average Weight (Kg) of Fuels Transported by Various Carriers

Woody Biomass Endowment	Traditional Fuels	Donkeys	Women	Men	Children	Animal-Driven Carts
High	Firewood	-	25.6	27.2	-	-
	BLT	-	20.8	16.7	19.4	-
	Charcoal	-	18.7	20.8	9.2	127.0
Moderate	Firewood	27.3	14.0	25.2	15.2	394.8
	BLT	-	13.7	25.2	6.8	-
	Charcoal	40.7	-	19.2	14.5	158.9
Low	Firewood	56.6	18.7	12.1	-	265.6
	BLT	-	6.6	-	5.1	-
	Charcoal	81.3	32.0	8.5	7.9	381.0

Information collected on retail market prices of the three major biomass fuels (firewood, BLT and charcoal) confirms the common sense that retail prices of traditional fuels are higher in areas where woody biomass cover is lower and vice versa. Despite some similarity of prices of fuels in areas designated as having "High" and "Moderate" woody biomass cover, retail prices are distinctly higher in areas with "Low" woody biomass cover. For example, retail price of charcoal was about 25 percent higher in "Low" endowment areas compared to the other two categories (see Chart 4.1). Market information such as fuel prices are useful in shading light on the processes of price setting, awareness raising and the overall process of designing strategies for commercial dissemination of improved stoves.



4.2 Results of Household Fuel Consumption Monitoring

Measurement of household cooking fuels consumption was monitored for ten consecutive days in a total of 120 urban households in three towns each representing "High", "Moderate" and "Low" woody biomass endowment in SNNPR. Findings of household fuels consumption monitoring survey are presented below.

4.2.1 Household Cooking Fuels Consumption

Firewood, BLT and charcoal are the three most important cooking fuels commonly used by urban households in SNNPR. However, as a coping strategy, households in wood scarce areas tend to diversify their fuel mix more and use low grade cooking fuels such as cow dung and sawdust, to a limited extent though. In the proceeding discussion of household cooking fuels consumption, it is important to note that BLT is included as firewood, but dung and saw dust (both fuels used only in Hosaena town) and coffee husk (used exclusively in Bonga town) were also included in the analysis.

Results of the monitoring surveys showed that urban households in SNNPR consumed 6.92 Kilograms of wood equivalent (Kgwe) per day per household for baking (Injera and non Injera bread) and other cooking purposes. This is equivalent to 1.65 Kgwe per day per capita, which is

almost exactly identical to daily per capita consumption (1.68 kgwe) of urban households at the national level (Petroleum Pricing Study, 1997). Similarly, finding of annual per capita traditional fuels consumption of 601 Kgwe in this study is slightly lower, but closely identical to those estimates made by WBISPP (640 kgwe annual per capita) for urban households in SNNPR in mid 1990s (WBISPP, 2001). Paradoxically, however, urban households in wood scarce areas consumed more, on per capita basis, than those in relatively wood abundant areas. In fact, per capita consumption was the lowest (521 Kgwe) among urban households in areas with "Moderate" woody biomass endowment (see Table 4.5). Such seemingly contradictory patterns of traditional fuels consumption (contradictory, because per capita consumption patterns that appear to go against widely held common sense) could be explained by the fact that an average family size of 4.2 persons per household (CSA, 2007) was used uniformly for all urban households in the SNNPR. When actual family sizes obtained in the baseline study is considered, daily per capita consumption of urban households in woody biomass rich areas would become the highest.

Table 4.5: Traditional Cooking Fuels Consumption in Urban Households in SNNPR, 2011 (wood equivalent)

Description	High	Moderate	Low	SNNPR Total
Urban Population (mid 2011)	434,928	626,296	678,487	1,739,710
Daily Consumption per HH (Kgwe)	7.07	6.00	7.69	6.92
Daily Consumption per Capita (Kgwe)	1.68	1.43	1.83	1.65
Annual Per Capita (Kgwe)	615	521	668	601
Total Annual Consumption (ton wood equiv.)	**267,314**	**280,279**	**453,451**	**1,045,549**

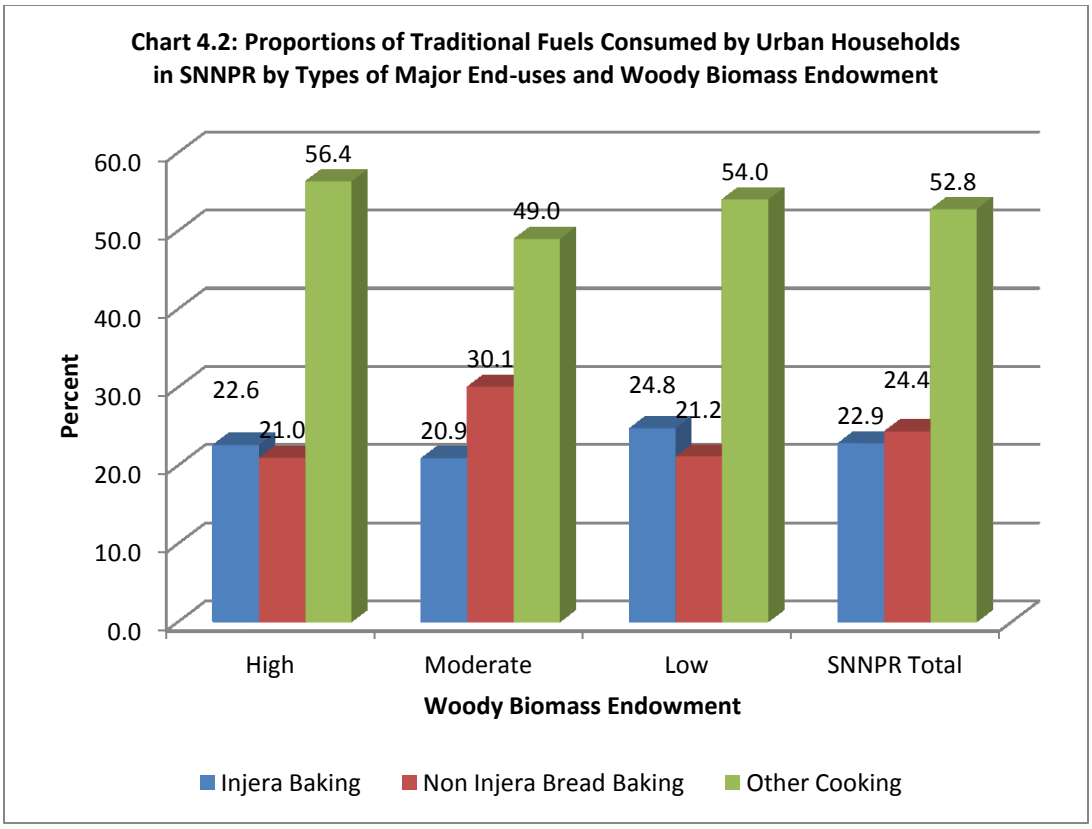
In terms of relative contributions of different fuels used, a lion's share of the consumption (79 percent) was met by firewood and BLT and charcoal (19 percent). The share of other fuels including dung, coffee husk and sawdust was negligible. With respect to internal variation in importance of fuels used is concerned, use of charcoal for cooking is almost non-existent in areas with moderate woody biomass endowment (see Table 4.6). This could be due to differences in the extent of enforcement of laws that discourage or even ban charcoal use as a cooking fuel in different Zones and Special Woredas within SNNPR. The other notable finding is that household in wood scarce areas diversify their fuel use more and use low grade fuels including cow dung and sawdust. It is also important to note that the use of charcoal has grown in importance as a household cooking fuel in recent years – perhaps an indication of laxed control on charcoal trafficking and marketing as a compensation for removal of subsidy on kerosene two years ago.

Based on findings of actual fuel consumption measurements in survey households, cooking energy consumption for urban households in SNNPR is estimated to be 1.01 million tons of wood equivalent per annum.

Table 4.6: Traditional Fuels Consumption of Urban Households in SNNPR by Fuel Types, 2011 (wood equivalent)

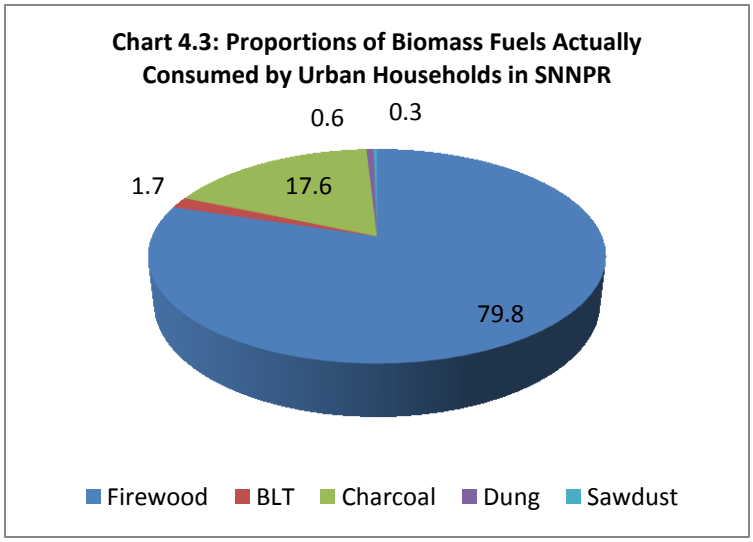
Description	High	Moderate	Low	SNNPR Total	Percent
Firewood and BLT	205,817	280,277	340,132	824,697	78.9
Charcoal	60,914	2	102,723	195,279	18.7
Dung	-	-	7,045	6,229	0.6
Other (coffee husk, sawdust)	584	-	3,551	19,343	1.9
All	**267,314**	**280,279**	**453,451**	**1,045,549**	**100.0**
Percent	**25.6**	**26.8**	**43.4**	**100.0**	

With respect to energy consumption of major end-uses, results of the survey further showed that Injera and non Injera bread baking together consumed nearly half (47 percent) of the household cooking fuels consumption and the remainder (53 percent) was consumed for other types of cooking. Another striking finding of fuel consumption monitoring surveys is the importance of non Injera bread baking in SNNPR. Disregarding geographical variations associated with differences in forest endowment in the region, non Injera bread baking consuming about 24 percent of the total household cooking fuel supplies, is an important end-use in SNNPR. In fact, the proportion of fuels consumed for non Injera bread baking (24 percent) is slightly higher than that of Injera (23 percent). Thus, it is crucially important for improved biomass burning stoves to accommodate (in their designs as well as marketing strategies) such non Injera baking needs and preferences of consumers in SNNPR. The proportion of cooking fuels consumed for non Injera baking was highest in areas with "Moderate" forest endowment (30 percent) – perhaps an indication of reliance on Kocho bread rather than Injera as a staple. Similarly, fuel consumption for other cooking is highest in woody biomass rich areas, because households in those areas rely more on non-Injera, non-bread diets such as tubers and root crops (Chart 4.2).



4.2.2 Cooking Fuels, Stoves and End-uses

According to results of the monitoring surveys, firewood, BLT and charcoal are the three most important fuels commonly used by urban households in SNNPR. About 80 percent of cooking energy consumed by urban households in SNNPR was firewood. With 18 percent contribution to household cooking fuels consumption, charcoal comes in the next place; and BLT (2 percent) in a third place. Consumption of other biomass fuels such as cow dung and sawdust was not only negligible, but it was also confined to areas with wood scarcity.



Further analysis of the survey results indicated that different stoves were used 6,197 times for different types of cooking purposes during the ten days of monitoring in 120 households. With a lion's share of 65 percent, Openfire was the most frequently used stove followed by Lakech charcoal stove (20 percent) and traditional charcoal stove (14 percent). With respect to purposes for which different stoves were used, coffee brewing (17 percent) and Wot sauce making (16 percent) are the two important end-uses for which the stoves were used most frequently. As we have already indicated elsewhere in this report, non Injera bread is baked more frequently than Injera signifying the influence of cultural diversity of SNNPR on people's diet (see Table 4.8 for details about stoves and end-uses).

Table 4.8: Number of Times Different Stoves were used During Survey Period (10 Days) for Cooking Food by Type of End-use

Type of Stove Used	Three Stone Fireplace	Traditional Charcoal	Lakech Charcoal	Kerosene	Traditional Enclosed	All Stoves	Percent
Injera baking	372	-	-	-	16	388	6.3
Bread baking	543	-	-	-	4	547	8.8
Wot (sauce) cooking	584	199	233	1	-	1,017	16.4
Wot (sauce) heating	287	88	208	-	-	583	9.4
Water heating	362	68	128	1	-	559	9.0
Coffee boiling	539	252	271	1	-	1,063	17.2
Tea boiling	152	167	209	1	-	529	8.5
Porridge	101	11	15	-	-	127	2.0
Abseet making (for Injera)	307	5	10	-	-	322	5.2
Vegetable cooking	385	36	67	1	-	489	7.9
Meat cooking	38	15	18	-	-	71	1.1
Roasting grains	200	9	38	-	-	247	4.0
Boiling grains	35	-	5	-	-	40	0.6
Other	114	36	65	-	-	215	3.4
All End-uses	**4,019**	**886**	**1,267**	**5**	**20**	**6,197**	**100.0**
Percent	**64.9**	**14.3**	**20.4**	**0.1**	**0.3**	**100.0**	
Frequency of stove use per day	**1.15**	**0.25**	**0.36**	**0.00**	**0.01**	**1.78**	

Results of the survey showed that significant differences in cooking end-uses exist within urban households of SNNPR. For example, households in wood rich areas tend to cook food more frequently than their counterparts. This could be related to not only relative abundance of wood, but also to notable difference in local diets. That is, households in farther southern and western frontier areas such as Kaffa and Sheka Zones rely more on non-Injera diets such as root crops, beans and tubers (see Table 4.9 for details).

Table 4.9: Percentage Distribution of End-uses by Woody Biomass Endowment Levels in SNNPR

Type of End-uses	No. of Observations	High	Moderate	Low	All
Injera baking	388	32.2	29.6	38.1	100.0
Bread baking	547	30.9	42.6	26.5	100.0
Wot (sauce) cooking	1,017	34.0	33.7	32.3	100.0
Wot (sauce) heating	583	47.3	29.8	22.8	100.0
Water boiling	559	44.7	32.0	23.3	100.0
Brewing coffee	1,063	31.9	34.6	33.5	100.0
Brewing tea	529	28.0	28.7	43.3	100.0
Porridge	127	26.8	33.9	39.4	100.0
Abseet making (for Injera)	322	37.0	26.1	37.0	100.0
Cooking vegetable sauce	489	40.7	38.7	20.7	100.0
Meat cooking	71	14.1	52.1	33.8	100.0
Roasting grains	247	49.4	13.8	36.8	100.0
Boiling grains	40	47.5	37.5	15.0	100.0
Other	215	40.6	27.6	31.8	100.0
All End-uses	**6,197**	**36.3**	**32.9**	**30.9**	**100.0**

V. Assessment of Non-Renewable Biomass Use for Cooking

5.1 Background

This chapter focuses on assessment of forest resources of the SNNP Regional State and estimation of the fraction of non-renewable biomass use for cooking in the Region. All assessments and estimations of forest resources under this study were based on secondary information available from various sources. The major limitation of this assessment was absence of updated and adequate information on biomass resource and use in the Region.

For estimation of emission reductions due to dissemination of more efficient improved cook stove that help reduce unsustainable biomass use, the fraction of non-renewable (unsustainable) biomass must be known. Methodologies were developed by IPCC[1] and the choice of more appropriate methodology depends on availability of information on biomass resource and use in the location of interest.

Biomass resource assessment studies have been carried out by government and other organizations in several but special areas of interest in the Region. The first comprehensive national level biomass resource assessment, with Woreda level disaggregation, was developed by Woody Biomass Inventory and Strategic Planning Project (WBISPP) under the Ministry of Agriculture in 2000. This assessment was carried out based on satellite data taken in late 1990s and extensive ground verifications. The data has also been updated for 2005. Food and Agriculture Organization of the United Nations (FAO) also conducted and updated global forest resources assessment and estimates which provide national level biomass resource information. Forest resource estimates by FAO mainly relied on information provided by mandated government organizations such as the Ministry of Agriculture in Ethiopia. FAO released an updated national level resource assessment for several countries in the World. An estimate of national level forest resources coverage for Ethiopia was prepared by FAO in collaboration with the Ministry of Agriculture for 2010. The 2010 forest resources estimate by FAO[2] is primarily an extrapolation of the 2005 WBISPP assessment. It provides only national level information without regional level disaggregation.

Apart from the WBISPP data for 2005, no official information is available for regional level forest resource coverage. This has been one of the main limitations for assessment of the current fraction of non-renewable biomass use for SNNPR. Several other assessments on biomass cover have been carried out in SNNPR[3]. Most of these assessments were done in forest rich areas of the Region. Therefore, under this study the forest cover in SNNPR has also been estimated using similar methodology that FAO used for estimation of the national forest cover.

[1] IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.
[2] Food and Agriculture Organization of the United Nations (FAO), Global Forest Resources Assessment 2010, Country Report, Ethiopia, FRA2010/065, Rome.
[3] MELCA Mahiber and African Biodivesity Network, Forest of Sheka, 2006

5.2 Methodology for Assessment of Non-renewable Fraction of Biomass Use and Estimation of Emission Reduction

5.2.1 Non-renewable Fraction of Biomass use for Cooking

For assessment of non-renewable fraction of biomass use for cooking, the standard gain-loss methodology of IPCC was applied with a Tier 2 approach using region specific data (IPCC 2001). See IPCC methodology in Annex 3.1. Region specific data for SNNPR were mostly obtained from woody biomass resource assessment report of SNNPR[4] and WBISPP[5] 2005. In some cases estimations and assumption were made for 2010 based on information from other sources including FAO Forest Resource Assessment updates for 2010. Assessment of non-renewable biomass first requires knowledge of forest (biomass) resource cover of the Region for the period of interest, 2010, which is considered in this study as base year for accounting the non-renewable fraction of biomass use. Forest coverage of SNNPR for 2010 was estimated using similar methodology that FAO used to estimate the national forest cover for 2010. This estimation is basically an extrapolation of 2005 information from WISPP study. Data was qualified using other country specific data and default values for different types of forest resources from other FAO studies.

The analysis includes estimation of areas of forest and other wood land (OWL), biomass stock, growing stock, change in forest area and removal of wood products for industrial and fuelwood consumption. Annual growth of biomass in forest and other wood land, and biomass conversion and expansion factor (BCEF) were also used to estimate the non-renewable portion of biomass use.

Biomass stock

Assumptions listed below were considered to estimate biomass stock.

1. Density of OWL is same for national and regional level for above ground and below ground biomass cover (FAO, 2010).
2. Same density data obtained for OWL for national estimation is used for SNNPR (FAO, 2010)
3. OWL is assumed to be constant over the years (WBISSP and FAO assumption)
4. OWL stock is calculated and deducted from total regional stock for 2005[6] to obtain total stock for forest, high wood land (HWL) and plantations[7] (WBISPP, 2005)
5. Density for forest, HWL and Plantations was calculated based on area of resource coverage of 2005 from WBISSP
6. Adjustment factor of 0.9644 used (FAO FRA 2010) for area in hectare correction
7. Shoot to root ration of 0.27 was used (73% of stock is above ground, 27% below ground) (FAO and WBISPP)

[4] SNNPR, 2001, A Strategic Plan for the Sustainable Development, Conservation, and Management of the Woody Biomass Resources.
[5] Ministry of Agriculture, 2005, Woody Biomass Inventory and Strategic Planning Project.
[6] FAO, 2005, Extent of Forest and Other Wood Land. http://www.fao.org/forestry/32032/en. (Accessed date 13/06/2011).
[7] FAO, 2005, Biomass stock in Forest and Other Wood Land, http://www.fao.org/forestry/32126/en (Accessed date 13/06/2011).

8. Dead wood is 17.7% of above ground stock (FAO, 2010 estimation)

Growing stock

Above ground growing stock is proportional to above ground stock. For SNNPR, above ground growing stock is calculated as a proportion of above ground stock of SNNPR to that of national value given by FAO for 2010.

Change in forest area

Annual change in forest area is calculated as a difference of forest area of the region (from WBISPP 2005 data including forest, high wood land and plantations) and estimation made for 2010 as shown in Table 6.1 below.

Removal of wood products

Removal of wood for industrial application and fuel for 2010 was estimated from timber and round wood requirement[8], and fuel consumption data for 2000[9] and forecasted based on population growth rate[10].

Biomass Conversion and Expansion Factor (BCEF)

Default values from IPCC and weighted average values were used for BCEF.

5.2.2 Estimation of Certified/Verified Emission Reduction (CER/VER)

For estimation of CER/VER, UNFCCC methodology for energy efficiency measures in thermal application of non-renewable biomass is used[11]. See methodology used below:

$$E_{ry} = B_y * (1 - \eta_{old}/\eta_{new}) * f_{NRB} * NCV * EF_{kerosene}$$

Where:

E_{ry} - Emission Reduction per stove

B_y – Average quantity of biomass consumption by household for cooking (or baking) in absence of project activity in tones.

η_{old} – Efficiency of stove being replaced

η_{new} – Efficiency of stove being deployed

f_{NRB} – Non-renewable fraction of biomass use

NCV – Net Calorific Value of biomass fuel

$EF_{kerosene}$ - Emission factor for the substitution of non-renewable biomass

[8] Ibid, SNNPR, 2001

[9] Neil Bird, et al 2003, A methodology for Assessment of the fraction of Non-renewable Woodfuel Consumption Application t National and State Level in Ethiopia

[10] FAO, 2005, Removal of Wood Products 1990 to 2005, http://www.fao.org.forestry/32046/en. Access date 13/06/2011

[11] UNFCCC, AMS II G. Version 1

Potential for emission reduction was calculated assuming that a 50% market penetration rate for improved stoves would be achieved in ten years of project intervention. Estimation was made separately for injera baking and other cooking.

5.3 Non-Renewable Biomass Use Estimation

For estimation of the non-renewable fraction of biomass use for SNNPR, it was necessary to identify the regional biomass coverage. Once the regional biomass cover was estimated, total biomass stock, growing stock, forest growth without disturbance and removal of forest products were calculated to determine the fraction of non-renewable biomass in the region.

5.3.1 National and Regional Biomass Cover Estimation

Estimation of regional biomass cover was made using WBISPP 2005 biomass coverage data and, FAO 2010 data and estimations methods. National biomass estimation by FAO for 2010 re-categorized biomass resource into two as 'Forest' and 'Other Wood Land' (OWL). Categories of 'Forest', 'High Wood Land' and 'Plantation' in WBISPP assessment were defined as 'Forest' in FAO estimation. Category of 'Other Wood Land' in FAO represents 'Low Wood Land' category under WBISPP definition. Table 6.1 shows estimates of national and regional biomass coverage. According to FAO Global Forest Assessment, Ethiopia's forest coverage is 11.1%. Using same methodology FAO used for estimation of national level forest cover, region level forest cover was estimated (Table 5.1). The aggregate of forest cover of all regions agrees with that estimated by FAO.

Table 5.1 Estimates of Regional Level Biomass Resource Cover for 2010 (hectares)

Region	Forest	Other Wood Land (OWL)	% of Land Cover		% of National Woody Biomass Cover	
			Forest (%)	OWL (%)	Forest	OWL
Oromia	6,174,643	9,457,105	17.8%	27.2%	50.2%	21.2%
SNNPR	**1,264,091**	**1,301,404**	**12.2%**	**12.6%**	**10.3%**	**2.9%**
Gambela	1,283,576	407,021	41.8%	13.3%	10.4%	0.9%
Dire Dawa	0	35,331	0.0%	28.4%	0.0%	0.1%
Harari	208	7,230	0.7%	23.0%	0.0%	0.0%
Amhara	1,077,804	7,583,582	7.1%	49.9%	8.8%	17.0%
Tigray	9,626	2,059,628	0.2%	43.2%	0.1%	4.6%
Benishangul	2,417,500	1,365,958	50.9%	28.7%	19.7%	3.1%
Afar	37,802	3,057,053	0.4%	32.9%	0.3%	6.8%
Somali	22,979	19,375,452	0.1%	69.0%	0.2%	43.4%
Addis Ababa	7,619	0	12.7%	0.0%	0.1%	0.0%
Ethiopia	12,295,848	44,649,764	11.1%	40.4%	100.0%	100.0%

The estimation of Forest and Other Wood Land cover in SNNPR are 1.26 million and 1.30 million hectares correspondingly covering 12.2% and 12.6% of the Region's land area. Forest and Other Wood Land in SNNPR represent 10.3% and 2.9% of the national forest cover respectively. SNNPR takes the fourth position representing 10.3% of the national forest.

Table 5.2 Annual deforestation rate by region

Region	hectares/year	Rate of deforestation (%)
Oromia	108,357	1.6
SNNPR	21,866	1.6
Gambela	5,829	0.4
Dire Dawa	0	0.0
Harari	0	0.0
Amhara	1,597	0.1
Tigray	0	0.0
Benishangul	3,235	0.1
Afar	0	0.0
Somali	0	0.0
Addis Ababa	0	0.0
Ethiopia	140,883	1.1

Estimation of area of deforested land includes only biomass cover in Forest areas (it does not include Other Wood Land). Comparison of forest cover of the Region in 2010 to the forest cover in 2005 shows that the annual deforestation rate in SNNPR is 1.6%, one of the highest in the country. This translates into an annual loss of about 22 thousand hectares of forest land in the Region. Annual deforestation rate at national level is 1.1%.

Such a high rate of deforestation has also impacted households in terms of access to fuelwood. The finding of the baseline assessment also confirmed the high rate of deforestation in the region where about 64% of the surveyed households reported an increase in time for firewood collection over the past ten years. Over 50% of households interviewed reported deforestation as a reason for increased time for fuelwood collection.

5.3.2 Estimation of Non-renewable Fraction of Biomass use for Cooking

Non-renewable fraction of biomass use (NRFB) for SNNPR is estimated to be 68.1%. Estimation of the national figure for fraction of non-renewable biomass use is 84.3%.

Table 5.3 Non-Renewable Fraction of Biomass Use in SNNPR

Biomass Gains and Losses	National	SNNPR
Gains		
C_G (Mt) - Forest	78.7	14.0
C_G (Mt) - Other woodland	59.8	1.7
C_G (Mt) - Total	138.5	15.7
Losses		
C_{La} - Above ground (Mt)		
Industrial Roundwood (Mt)	12.20	0.3
Wood fuel (Mt)	588.08	33.3
Dead Wood (Mt)	-1.4	-0.2
Total (Mt)	598.89	33.3
C_{Lb} - Below ground (Mt)	285.27	15.9
C_L - Total (Mt)	884.17	49.2
Balance		
Net = C_G - C_L (Mt)	-745.6	-33.5
Non-Renewable Fraction of Biomass use	**84.3%**	**68.1%**

Reason for lower non-renewable fraction biomass use in SNNPR, compared to 84% for national level, is the higher above ground biomass growth rate (biomass yield per hectare) in the region. Even though NRFB use is lower in SNNPR, the region experiences the highest deforestation rate in the country. Agricultural investments in the region that require extensive land (for coffee plantation expansion, timber production, allocation of land for commercial farm) and uneconomical use of firewood due to availability of firewood in abundance in forest areas can be mentioned as some of the factors that are responsible for higher rate of deforestation in the region.

5.4 Potential of Improved Stoves for Carbon Dioxide Emission Reduction

Estimations were made for emission reduction potential of improved stove dissemination in SNNP regional state. It was considered that more than 70%[12] of household cooking energy is for non-injera cooking (boiling, wot cooking and bread baking). Injera baking accounts only for less than 30% of cooking energy in the households. For estimation of emission reduction, improved cook stoves with an overall thermal efficiency of 25%[13] and 18%[14] were considered for cooking and injera baking respectively.

[12] Chart 4.2 in Section 4.2 of this report .

[13] GIZ stove test result for 'Tikikil' stove (A household size rocket stove)

[14] Mirt and Gonzie stoves promoted by Ministry of Water and Energy has efficiency in the range between 18 to 20%. Various tests conducted by the ministry have proven this figure.

5.4.1 Emissions Reduction Potential of Improved Stoves for Cooking

More than 80% of urban households in SNNPR (320,000 households) use Open Fire for non-injera cooking. All households that use Open-Fire for cooking are potential market for improved cook stoves. For an improved stove to be feasible for carbon financing through Clean Development Mechanism (CDM), an average CER of 30,000 per year must be obtained. In a ten-year time frame, a penetration rate of above 30% of the potential market (over 60,000 households) in urban areas of SNNPR must have adopted improved cook stoves to attain an annual CER of 30,000.

Table 5.4 Estimation of emissions reduction per stove per household per year for cooking

No.	Estimation of CERs/VERs	Symbols	Values	Units
1	Percentage of non-renewable biomass use	f_{NRB}	68.1	%
2	Average fuelwood consumption by HHs for non-Injera cooking in absence of Project	B_y	0.484	tone/hh/yr
3	Efficiency of stove being replaced	η_{old}	10	%
4	Efficiency of stove to be deployed	η_{new}	25	%
5	Net Calorific Value of biomass	NCV	0.015	TJ/tone
6	Emission factor for the substitution of non renewable biomass	$EF_{kerosene}$	71.5	tCO_2/TJ
7	Emission Reductions per stove	Ery	0 .890	tCO_2/hh/year

Sources: 1. NRB assessment, 2. Household energy baseline survey in SNNPR GIZ 2011, 3. Various sources from, 4. GIZ ECO; 5, 6, UNFCCC

In this regard, assuming three years life time for an improved cook stove such as 'Tikikil' (a household size rocket stove), the total number of improved stoves that need to be disseminated in the region would be about 135,000 including stoves for replacement of worn out ones. Each household that would adopt the stove would generate an emission reduction of 0.890 ton of carbon dioxide per year. Over a ten year period this would generate an average CER of about 30,500 per year from all stoves that would be disseminated in the region.

However, given the current government objective of wide scale dissemination of improved cook stoves in the country, and with effective sectoral integration and promotion, a 50% penetration rate (about 204,000 households) can be reached in ten years. This will generate a total amount of over 96,000 CERs annually. To attain this, a total number of 428,000 stoves (including stoves for replacement of worn out ones) need to be disseminated in the region.

The potential gain in terms of reduction of deforestation and forest degradation is in fact much greater. With a conservative assumption of 40% fuel reduction and 50% penetration rate of improved stove for cooking in the region, a total amount of about 165,774 ton of biomass or 1,120 hectares of forest land can be saved annually[15].

[15] Forest density of 148 ton/ha is assumed for SNNPR (dense forest)

5.4.2 Emissions Reduction Potential of Improved Stove for Baking

Open-fire is used for about 95% of injera baking in the region. With an improved injera baking stove (Mirt or Gonzie stoves), a household can generate about 0.318 CER annually. An annual CER of 30,000 is required to make the intervention feasible for carbon financing through CDM. To obtain this over a ten year period, 165,000 households (40% penetration rate) should adopt improved stove for baking. This will generate an annual CER of 31,000. Assuming five years for the life span for the stove, a total number of 260,000 stoves need to be disseminated in ten years.

Table 5.5 Estimation of Emissions Reduction per Stove per Household per Year for Baking

No.	Estimation of CERs/VERs	Symbols	Values	Units
1	Percentage of non-renewable biomass use	f_{NRB}	68.1	%
2	Average fuelwood consumption by HHs for non-Injera cooking in absence of Project	B_y	0.871	ton/hh/yr
3	Efficiency of stove being replaced	η_{old}	9	%
4	Efficiency of stove to be deployed	η_{new}	18	%
5	Net Calorific Value of biomass	NCV	0.015	TJ/ton
6	Emission factor for the substitution of non renewable biomass	$EF_{kerosene}$	71.5	tCO_2/TJ
7	Emission Reductions per stove	Ery	0 .318	tCO_2/hh/year

Sources: 1. NRB assessment, 2. Household energy baseline survey in SNNPR GIZ 2011, 3. Various sources from, 4. GIZ ECO; 5, 6, UNFCCC

With existing political will of the government and international support for dissemination of improved stoves, a 50% penetration rate could be possible even for high mass stoves such as Mirt and Gonzie. At 50% penetration, 205,000 household would adopt improved baking stoves generating an annual CER of about 38,000. Considering the number of stoves needed for replacement (assuming five years life time for the stove), a total number of 320,000 stoves need to be disseminated in the region. Dissemination of Mirt or Gonzie stove at this rate would help reduce over 71,400 tons of fuelwood per year. This can be translated to over 480 hectares of dense forest land. Considering the high mass of baking stoves and the relative gain of fuel reduction, dissemination of stoves for cooking seems to be relatively easier than dissemination of baking stoves.

VI Assessment of Potential, Opportunities and Challenges for Improved Stoves Production and Marketing in SNNPR

The SNNPR, with its total population of about 17, million and three million households, presents a huge potential market for technologies such as energy-efficient cook stoves that could improve people's daily lives. However, sheer size of population could be one thing (theoretical potential), but the actual market - which is often much smaller than the theoretical potential – is entirely different thing, mainly because all households in the region may not purchase an improved stove for a wide range of reasons. This where and why a well designed marketing strategy – identification of intervening variables a detailed outline of how to address them – would be needed. Without such a strategy a successful penetration of the market in a meaningful scale and self-sustaining manner would be difficult. Thus, among other things, the strategy should examine the market both from the supply side and demand. While the supply side should look in to how the products – improved stoves in our case – need to be manufactured, transported and distributed to retail outlets and reach wider consumers, the demand side should examine who the consumers are, what their needs are and how best their needs, preferences and constraints could be addressed. Designing a full-fledged improved stoves production, marketing and dissemination strategy is beyond the scope of the current assignment. However, based on field observation and discussions with potential and actual players in improved stoves market, we shall attempt to outline some important points on market potential, existing opportunities and challenges for a region-wide improved stoves dissemination and highlight way forward for designing improved stoves commercialization strategies for the SNNPR in the future.

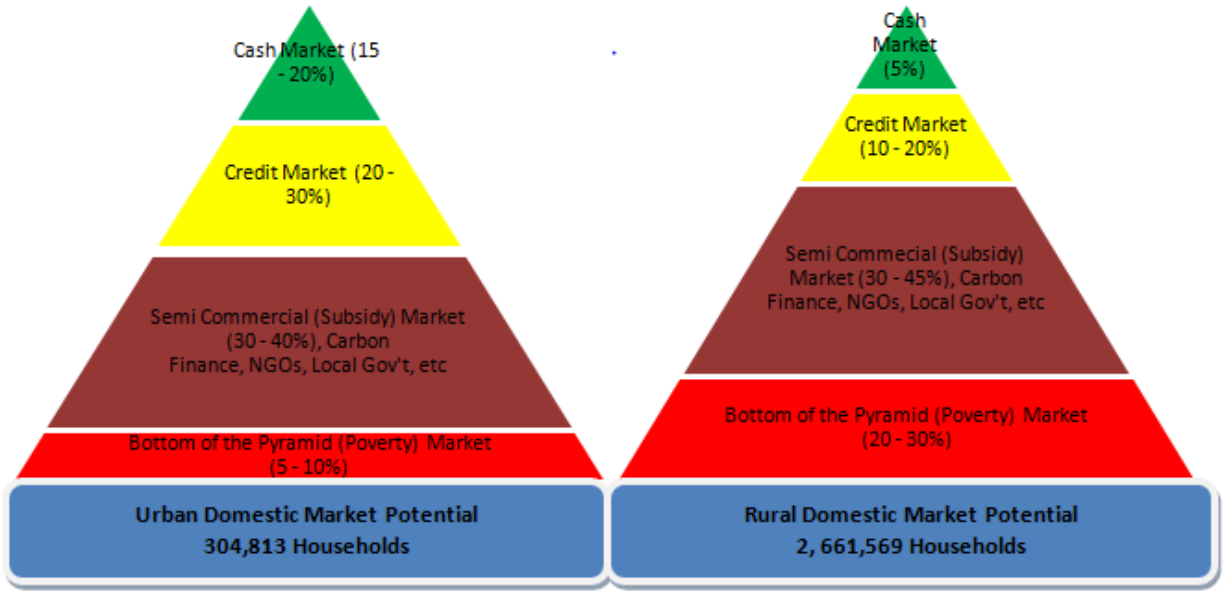
6.1 Market Potential for Improved Stoves

As, it was briefly mentioned above, theoretically, all households who cook for their members and institutions and commercial establishments engaged in food catering for large numbers of people constitute potential market for improved stoves. However, for the sake of proper understanding of the overall market behavior, the theoretical market needs to be disaggregated in to its constituent parts depending on their needs and preferences for products on offer. The first and most obvious market segmentation criterion is the urban-rural divide. Then this could be followed by sectors (household versus commercial/ institutional), types of improved stoves (Mirt, Tikikil, Gonzie, Institutional, etc), and finally consumers' willingness and ability to pay.

Based on a very crude assessment, total market for improved stoves was estimated to be between 1.5 and 2.1 million stoves in the household sector alone. It is estimated that about 70 percent of the households in the region (90 of urban households and 70 percent of rural households) would want to purchase improved stoves. It is also assumed that while up to 20

percent of urban households and five percent of rural households would constitute a cash market, the bulk of the rest of households could be reached using credit sales and other semi commercial (subsidy. Social marketing) approaches. From business perspective, at current price of for example Etb 120 for a Mirt stove, the total domestic Mirt stoves market alone is worth between Etb 180 million and Etb 252 million. If we assume that ten years would be required to reach the bottom of the pyramid (BoP) market, then the Mirt alone would constitute Etb 18 million to Etb 25 million business annually. Obviously, the annual market turnover would be much higher if we include other readily available improved stoves models and the institutional and commercial food catering sectors in to the equation. A simple illustration of potential urban and rural household market for improved stoves is presented in Fig. 6.1.

Fig. 6.1: Illustration of Market Pyramid for Improved Stoves in SNNPR



6.2 Opportunities and Challenges

There are a number opportunities in SNNPR that make improved stoves business even more attractive. Some of the most important opportunities are outlined below:

A) **Increasing Scarcity of Supplies and Rising Prices:** Results of the current baseline survey unequivocally showed that it has become increasingly difficult to obtain the supply of traditional fuels and their prices have been steadily rising over the past several years. While scarcity of supply has increased the time and effort needed by traditional fuel suppliers, the consequent rise in prices has increased cooking energy expenditure

among consumers, particularly household consumers – because, unlike businesses, households cannot pass-through such costs on to other end-users or consumers. Thus, as it has been argued several times in Ethiopian household energy literature, increasing scarcity of supply and rising expenditure on cooking energy, would serve as an incentive for consumers to rationalize their energy utilization, and hence, present an opportunity for improved stove business.

B) **Removal of subsidy from kerosene as a cooking fuel:** Kerosene was introduced in to the Ethiopian domestic cooking market in the mid 1980s as a short term measure to alleviate the burden of cooking energy expenditure on urban households and to relieve the pressure on woody biomass resources surrounding urban settlements. With a view to accelerate its adoption by domestic consumers, prices of kerosene were subsidized (by up to 30 percent). In effect, the market uptake was not only rapid, but urban households became so addicted to kerosene use as a cooking fuel to an extent that the Ethiopian government had to think more than twice to remove the subsidy. Thus, contrary to the original plan, subsidy on kerosene continued for over two decades until it removed in the second half of 2009 following the steady rise of petroleum prices in the global market. Following the recent rise of petroleum prices kerosene and LPG in particular, the urban domestic cooking energy market responded in two major ways. First of all, the use of traditional fuels has increased and this has pushed retail prices upward – a condition that serves as an incentive for consumer to invest energy-efficient technologies for cooking, i.e., improved stoves. Secondly, the rise in petroleum fuels has led to a noticeable shift by household consumers from kerosene to electricity both for Injera baking as well as non-Injera cooking, because of very low electricity tariff at the moment. At this juncture it is worth noting that with average flat rate domestic tariff of only about Etb 0.5 per Kilowatt hour (Kwh), currently Ethiopia has one of the lowest electricity tariff in the world – a situation that serves as a disincentive for domestic consumers to rationalize their energy utilization by investing in and adopting more energy-efficient cooking techniques and technologies. While the low electricity tariff for domestic customers is indisputable fact, the question remains, how long will take the utility (Ethiopian Electric Power Corporation, EEPCo) to adjust its tariff upwards. It appears that upward tariff adjustment has been delayed so far for whatsoever the reason may be. It equally appears that, it a matter of time for EEPCo to adjust its domestic electricity tariff upwards and significantly. Therefore, given the rising trend of traditional fuels and the likelihood of upward electricity tariff adjustment, demand for improved biomass stoves is set to grow in Ethiopia in general and in SNNPR in particular.

C) **Presence of proven energy-efficient technologies:** Ethiopia is one of the few countries in the developing world with a history of successful improved stove programmes. The Lakech improved charcoal stoves, Mirt improved biomass Injera stove, Gonzie and Tikikil domestic as well as institutional (more recent entrants to the market) are living examples. Thus, the presence of improved stoves mentioned above (some of which are proven in the field), presents a considerable opportunity for the GIZ supported improved stoves promotion and dissemination effort in SNNPR.

D) **Existing experience and market infrastructure:** Despite some interruption due to shift of emphasis among Regional States, GIZ-supported improved stoves initiative has been in operation in various parts of Ethiopia including SNNPR for more than a decade in Ethiopia. Over the years hundreds of stove producers were supported and production units set up, series of market promotion sessions conducted, etc all of which led to commercial dissemination of hundreds of thousands of Mirt stoves during the past 14 years or so. With less than 4,000 stoves sold annually during 2008 – 2010 period, the overall volume of Mirt sales in SNNPR is very low. But, two crucial points need to be emphasized here: firstly, sales volume mentioned above, though very low from the stand point of potential demand, it was growing at a rapid rate in recent years and secondly and most importantly, the sales occurred with no external promotional and marketing support whatsoever. In fact, of the 36 Mirt stove production units set up by previous phases of GIZ supported initiatives in SNNPR in the early 2000s, nearly 60 percent were found actively engaged in Mirt business nearly 10 years later (see Table 6.1) – again without any external support. It should also be mentioned that producers in SNNPR showed incredible resilience in their businesses despite the prohibitively high raw material prices particularly cement.

Table 6.1: Number of Mirt Stoves Sold Monthly and Annually in SNNPR in 2008, 2009 and 2010 (Source: Bio-energy Department)

Months	2008	2009	2010	Total
September	178	221	354	753
October	154	239	274	667
November	90	204	918	1,212
December	170	169	473	812
January	206	320	880	1,406
February	120	103	456	679
March	167	74	271	512
April	90	107	796	993
May	133	350	182	665
June	454	185	166	805
July	73	418	1,198	1,689

August	148	187	586	921
Total	**1,983**	**2,577**	**6,554**	**11,114**
Percent	**17.84**	**23.19**	**58.97**	**100.00**
Monthly Sales	**165**	**215**	**546**	
Sales per Reporting Producer	**6**	**7**	**27**	
Growth per Annum (%)	**na**	**30**	**154**	

Therefore, the ongoing improved stoves initiative in SNNPR is not only benefiting from a wealth of knowledge and experience gained over the years by GIZ, but existing stove producers and production units set up during previous initiatives present a unique opportunity to build the current efforts upon.

E) **Presence of other promoters and key stakeholders: The ongoing** GIZ supported improved stoves initiative in SNNPR is not alone in its effort of promoting widespread adoption of energy-efficient cooking techniques in the region. Thanks to the ability of improved stoves business to address multiple issues at the same time (e.g., reducing energy expenditure to consumers, reducing the disproportionate burden of cooking task on women, reducing indoor-air pollution hence protecting health, reducing CO^2 emission, reducing the pressure on woody biomass resources hence protecting the environment, creating employment opportunities hence improving sustainable livelihood, etc), like elsewhere in other Regional states, the business of improved stoves has attracted a number of stakeholders and promoters (local government and NGOs in particular) in SNNPR. Some of the NGOs actively promoting energy-efficient cooking technologies include World Vision Ethiopia, Christian Aid, Catholic Church and Mekane Eyesus Church. What would be needed by the project is to capitalize on these and other similar opportunities and establish working modalities with existing stakeholders and promoters who are either interested or actively engaged in the promotion of improved stoves.

F) **Carbon revenue from emissions reduction:** Despite considerable efforts to improve access to cooking energy and above all GIZ's own over a decade of experience in the promotion of improved stoves in Ethiopia, the rate of market penetration is still modest at best. In fact, market penetration of improved stoves is very poor in rural areas where no or very little dent has been made so far. Among factors often cited as barriers to large scale market uptake to the Mirt stoves are lack of portability, increasingly soaring raw material prices (cement in particular), low disposable income of the majority of rural households, and very low levels of commercialization of traditional fuels in rural areas particularly in the SNNPR. Securing revenues from carbon credits presents an ideal

opportunity for improved stoves projects such as the current one for improved stoves production and dissemination on a larger scale than public funding alone could do. Revenues from carbon credits could stimulate the production and marketing of improved stoves on a large scale, reducing purchase price to consumers making them more affordable to bottom of the Pyramid (BoP) market.

G) **Increased use of non-Injera cooking in SNNPR**: Both the rate of Injera baking and quantity of Injeras baked per session are relatively lower in SNNPR than other northern and central parts of the country. In fact, Injera is hardly part of the regular diet among the majority of rural households in SNNPR. This calls for another energy-efficient stove that cooks foods other than Injera. Fortunately, that stove appears to there already – Tikikil or the Ethiopian version of Rocket stove. With the right pricing of the stove, the majority of households in areas where beans and tubers tend to dominate the local diet constitute enormous potential market for Tikikil stoves in SNNPR.

H) **Presence of highly skilled potters:** SNNPR is the home for some of the highly skilled potters in the country. Ironically, thanks to the long established occupational cast system that continued to survive to this date, occupational caste groups such as Fuga, Manja, Hadicho, etc are all professional potters who are capable of manufacturing a wide variety of household utensils of complex designs including jars, pots, pans, stoves and pot stands. For instance, during field data collection for the current assignment, the study team came across a traditional three-stone fire place cladded with six to ten semi-circular ceramic interlocking parts making a complete circle with beautiful patterns on the top (see Photo 6.1). With this kind of skills, and if sufficient incentives are made available to them,

Photo 6.1:Three-stone fire place with interlocking semi-circular blocks making a complete circle and three pot stands in the middle, Haisie (a rural village near Hosaena town)

potters in SNNPR could very easily adapt and popularize stoves that could be mad e from clay such as Gonzie. In fact, given the volatility of cement prices it is high time for the GIZ supported improved stoves promotion project to look for improved stoves that can be manufactured from other materials that area easily available locally – and one of such products is Gonzie improved biomass stove. Moreover, the interlocking ceramic sections that are shown in Picture 6.1 offer a unique opportunity for adapting clay stoves such as Gonzie or some sort of hybrid designs. Such stove designs that are based on locally accepted and proven innovations are likely to be adopted rapidly than other designs that are imposed from outside the communities.

On the other hand, it is equally important to recognize that improved stoves business like all other businesses faces challenges and constraints that need to be overcome. In fact, challenges faced by improved stove businesses often tend to be multiple and daunting. Some of the most important challenges that would be faced by improved stove businesses in SNNPR (most of these challenges apply to the nation as a whole) at the moment include:

A. Rising prices of raw materials, cement in particular,
B. Malignant inflation eroding consumers' income hence ability to pay for stoves,
C. Difficulty of reaching out rural consumers market - physical inaccessibility,
D. Stringent rules and regulations required to access carbon finance. The crediting period and issuance of the first emission certificates, which could be sold on the carbon market, do not begin until two or more years after the onset of the project,
E. Low electricity tariff discouraging investment in energy saving technologies. For instance there are indications suggesting that consumers are shifting away from biomass use to electricity for cooking at least in urban areas such Addis Ababa and other major towns.
F. Although forest cover and hence woody biomass resource base continued to dwindle, the presence of relatively better woody biomass endowment hence low market prices coupled with low level of commercialization of traditional fuels in southern and south-western SNNPR continues to discourage consumers from investing in energy efficient cooking techniques and technologies such as improved stoves. The slow market growth for improved stoves is likely to be compounded further by sluggish tae of urbanization in SNNPR. As could be seen from Figure 6.1, both the current level of urbanization (only about 10 percent) and the rate at which the region's urbanization is growing (3.2 percentage points in 13 years) are very low.

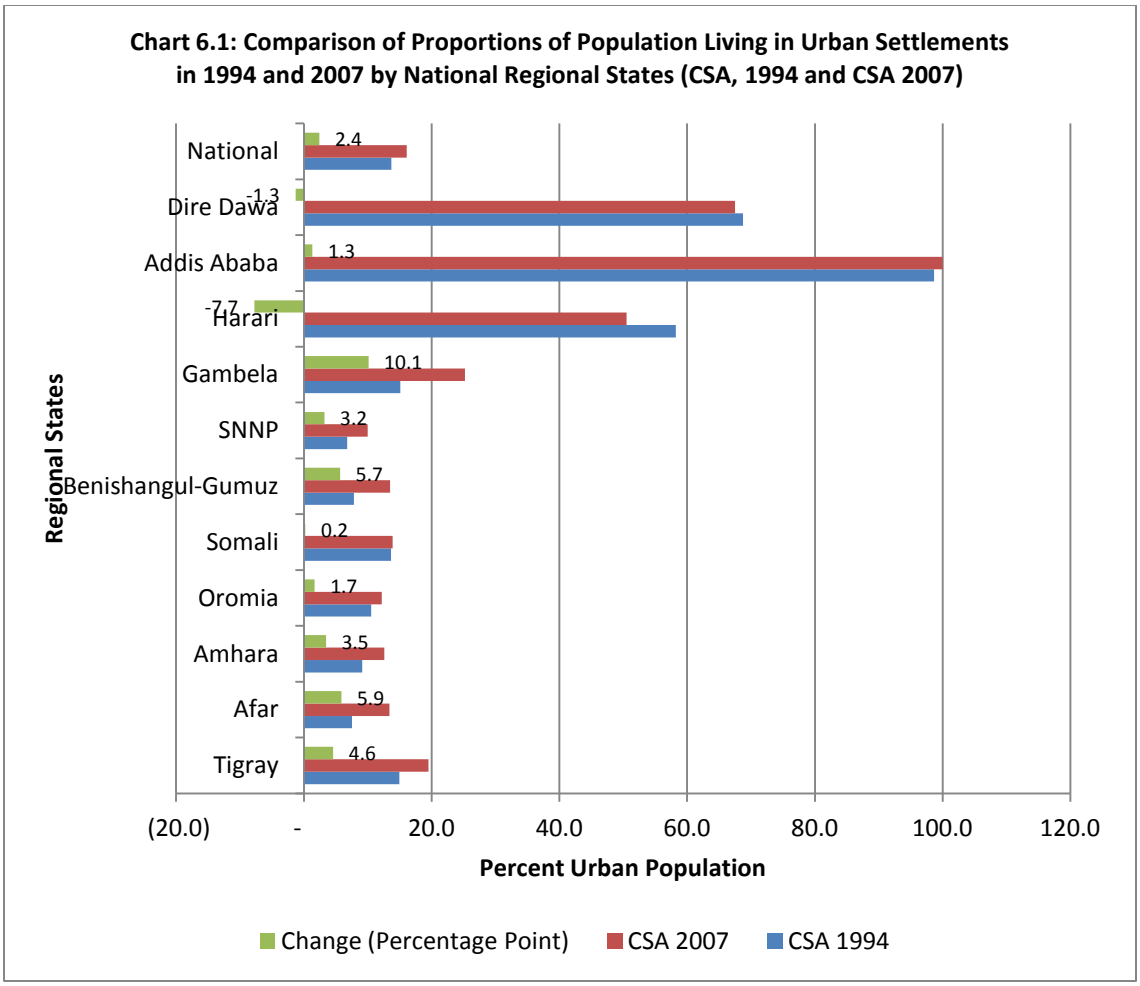


Chart 6.1: Comparison of Proportions of Population Living in Urban Settlements in 1994 and 2007 by National Regional States (CSA, 1994 and CSA 2007)
National
Dire Dawa
Addis Ababa
Harari
Gambela
SNNP
Benishangul-Gumuz
Somali
Oromia
Amhara
Afar
Tigray
2.4
-1.3
1.3
-7.7
10.1
3.2
5.7
0.2
1.7
3.5
5.9
4.6
Regional States
(20.0)
-
20.0
40.0
60.0
80.0
100.0
120.0
Percent Urban Population
Change (Percentage Point)
CSA 2007
CSA 1994

VII. Summary and Way Forward

7.1 Summary and Conclusions

Firewood and charcoal are the two most important traditional fuels commonly used by urban households in SNNPR. Although kerosene comes in the third place, it use is not wide as the other cooking fuels, which may be due to the recent removal of subsidy on kerosene that was introduced in the mid 1980s. Charcoal – often regarded as a direct substitute to kerosene - has become increasingly important cooking fuel among urban households perhaps indicating that consumers are shifting away from kerosene prices of which have risen sharply in recent years following the removal of subsidy in late 2009. Traditional fuels are increasingly commercialized in urban areas in SNNPR, but about one-third of urban households in areas with better woody biomass endowment still freely collect their supplies. Despite localized variations, all freely collecting households perceived increased effort and time for collecting firewood recently. Women, poorer men and members of socially marginalized groups (e.g. Manja, forest people in Kaffa) are the main producers and suppliers of traditional fuels in the region.

Three-stone fire is the most widely used stove among households in SNNPR. While the basic design and performance remains the same, three-stone fire in SNNPR comes with a whole lot of different names, shapes, patterns and features. Closely following the pattern of fuel use, charcoal stoves come in the second place in urban households' stove use ladder.

Urban households in SNNPR utilize mainly aluminum pots, but also clay pots to a lesser extent, for cooking food. On the average, an urban household in SNNPR owns and uses 3.3 aluminum cooking pots. The diameter of most commonly used plates range between 54 cm and 60cm. The diameter of at least 70 percent aluminum pots commonly used by urban households in SNNPR fall within in the range of 15 cm and 30 cm.

Urban households in SNNPR bake and consume both Injera and a variety of non-Injera breads (Kocho, Bursame, Torosho, Qitta, etc) as part of their regular diet. Contrary to the widely held conviction that households largely depend on non-Injera diet and local breads, the majority of urban households in SNNPR found out to bake and consume Injera more regularly. What is unique in this regard is that the frequency as well as quantity of Injera baked per baking session is lower (and much lower in south-western frontier areas) among households in SNNPR than those of other urban areas such as Addis Ababa.

Owing to relatively better woody biomass endowment, traditional fuels are originated and supplied from relatively shorter distances in SNNPR. With the exception of woody biomass

scarce areas such as northern and central Zones where traditional fuels particularly charcoal is supplied from far afield locations (River Gibe Galley in the case of Hosaena town), firewood is often supplied from within "arms-stretch" in biomass rich Kaffa Zone.

One of the most striking findings of the inflow surveys is the magnitude of people (the human factor) engaged in traditional fuels supply business – including production, transport and marketing – as a livelihood activity. Depending on the size of population of the towns, between 500 and 1,300 people supply traditional fuels to towns daily. Dominant modes of transporting traditional fuels in SNNPR in their order of importance are donkeys, men, boys, women and animal driven carts. Unlike many other urban areas in the country, the number of women engaged in the supply of traditional fuels is relatively smaller mainly due to the heavy involvement of men and boys from the occupational caste group of Manja in the trade particularly in woody biomass rich areas of SNNPR. Traditional fuels business providing employment and income to large numbers of people may not be unique to SNNPR, but, given the sheer number of people engaged in traditional fuels supply business, indisputably, no other single industry in the study towns provided employment and sustainable livelihood to so many people as traditional fuels supply did, at least at the time of the field work for the current study.

Retail prices of traditional fuels confirm common sense in that scarcity is associated with higher prices and vice-versa. Despite some similarity of prices of fuels in areas designated as having "High" and "Moderate" woody biomass cover, retail prices are distinctly higher in areas with "Low" woody biomass cover.

Urban households in SNNPR consumed 6.92 Kilograms of wood equivalent (Kgwe) per day per household for baking (Injera and non Injera bread) and other cooking purposes. This is equivalent to 1.65 Kgwe per day per capita, which is almost exactly identical to findings of other previous studies at the national level. Paradoxically, however, urban households in wood scarce areas consumed more, on per capita basis, than those in relatively wood abundant areas. In fact, per capita consumption was the lowest among urban households in areas with "Moderate" woody biomass endowment. Based on actual fuel consumption measurements conducted in survey households, cooking energy consumption for urban households in SNNPR is estimated to be 1.01 million tons of wood equivalent per annum.

Injera and non Injera bread baking together consumed nearly half (47 percent) of the household cooking fuels consumption and the remainder (53 percent) was consumed for other types of cooking. Non Injera bread baking, claiming 24 percent of the total household energy budget, is a uniquely important end-use in SNNPR that of interest to improved stove projects such as the current one. In fact, the proportion of fuels consumed for non Injera bread baking (24 percent) is slightly higher than that of Injera (23 percent).

Annual deforestation rate in SNNPR is estimated to be 1.6 percent, representing one of the highest deforestation rates in the country. This rate of deforestation translates into an annual loss of about twenty-two thousand hectares of forest land in SNNPR. Based on Gain-Loss methodology developed by IPCC, non-renewable fraction of biomass use (NRBf) for cooking in SNNPR is estimated to be 68.1 percent – much lower than the national average of 84.3 percent.

Assuming 50 percent penetration rate (about 204,000 households) for non-Injera improved stoves (say Tikikil) over a period of ten years in SNNPR, a total of over 96,000 CERs could be generated annually in SNNPR alone. The potential gain in terms of reduction of deforestation and forest degradation is in fact much greater. With a conservative assumption of 40 percent reduction in fuel consumption and 50 percent penetration rate of improved stove for cooking (excluding Injera baking) in the region, a total of about 165,774 ton of woody biomass or 1,120 hectares of forest land could be saved from deforestation annually.

Of the estimated total 3.4 million households currently residing in SNNPR, an estimated 70 percent (90 percent in the case of urban households) would want to purchase improved stoves. Based on this crude estimate, total potential market for improved stoves would be anything between 1.5 and 2.1 million stoves in the household sector alone. An estimated 20 to 30 percent of urban households and five to ten percent of rural households would constitute a cash market, and the bulk of the rest of households could be reached using credit sales and other semi commercial (subsidy. Social marketing) approaches. From business perspective, at current price of for example Etb 120 for a Mirt stove, the total domestic Mirt stoves market alone is worth between Etb 180 million and Etb 252 million.

Despite considerable experience gained and market infrastructure put in place, with only about half a million Mirt stoves sold to date, the rate of market penetration is still modest. Among reasons often cited as barriers to large scale market uptake of the Mirt stoves are lack of portability, increasingly soaring raw material prices (cement in particular), low disposable income of the majority of rural households, and very low levels of commercialization of traditional fuels in rural areas particularly in the SNNPR. Given the considerable emission reduction potential of improved stoves, this is where Carbon finance could play a catalytic role in up-scaling stove dissemination efforts. Securing revenues from carbon credits presents an ideal opportunity for improved stoves projects such as the current one for improved stoves production and dissemination on a larger scale than public funding alone could do.

Both the frequency of Injera baking and quantity of Injeras baked per session are relatively lower in SNNPR than other northern and central parts of the country. In fact, Injera is hardly part of the regular diet among the majority of rural households in SNNPR. This is an opportunity for the GIZ supported improved stoves project to introduce and popularize some

of the readily available energy-efficient stoves (e.g. Tikikil) that cook foods other than Injera in the region and beyond.

Previous phases of GIZ supported improved stove projects advocated for and strongly pursued a commercial dissemination strategy in their urban-focused energy efficiency efforts. The commercial approach was the right path to take and should remain so at least in urban areas where incentives for consumers to invest cash in energy saving technologies are attractive. It is also important to recognize the 'limitations' of the commercial approach particularly in rural settings. Therefore, in the interest of reaching out the wider rural consumers and poorer segments in urban areas, it is high time for improved stove projects to streamline their strategies in line with newly emerging realities and opportunities that were unforeseen before. Accordingly, while maintaining the commercial approach in the urban markets, it is time to rethink and strongly consider a semi-commercial approach (measured consumer subsidy using revenues from tradable emission reduction) to reach the wider rural market and poorer segments of urban market.

7.2 Way Forward

Given the multitude of socioeconomic, cultural and ecological diversities of the SNNPR coupled with emerging new challenges and opportunities a detailed strategy would needed for a successful implementation of the ongoing and future improved stoves initiatives in the SNNPR. In line with this, this section shades light on some of the key issues that need to be considered in designing of large scale improved stoves commercialization and dissemination strategy for SNNPR in the future. Some of these key issues are as follows:

1. **Revamp up existing production units and set up new ones where and as necessary:** Well over half of the Mirt stove producers trained and supported by the previous phases of the GIZ supported initiatives are actively producing and marketing the stoves in SNNPR. The other half quit the business mainly due to increasingly soaring raw material prices. Moreover, there was no external marketing and promotion support until GIZ re-started its operation about a year ago. In effect, the market uptake during the past several years has remained sluggish. Therefore, it is necessary for the project to train additional producers and set up new production workshop both as a replacement for those that quit the business and as part of the continuous expansion until the bottom of the market is reached. At this point, it is worth noting that different stove types may require entirely different types of production, distribution and even marketing strategies depending on their inherent characteristics such as portability. For instance, the Mirt

stove has always been criticized for its lack of portability and hence difficulty of transporting. To overcome this limitation the production of Mirt stoves has always been decentralized so as to bring the products as close to the consumers as possible. Such decentralized production and distribution strategy has worked for Mirt stoves and the project should continue adopting it. However, the same (decentralized production and marketing) strategy may not be appropriate for stoves such as the Tikikil stove which are more of-the-shelf type that can be transported over a long distance easily and safely. Therefore, depending on the design of the stoves (weight, shape, material/fragility) the project may need to devise and adopt both centralized and decentralized production and distribution strategies for the different stoves involved. A semi-decentralized production strategy may need to be considered in the case the Tikikil stoves in SNNPR.

2. **Address the needs of households for non-Injera cooking:** The single most important limitation of improved stove projects in this country is that despite their long existence (since mid 1980s), no project has been able to address the cooking needs of households for non-Injera purposes in rural areas. True, it can be argued that the popular Lakech improved charcoal stove is a non-Injera stove, but it is also true that the Lakech is a charcoal stove and hence its use is confined to urban consumers for charcoal is not a major cooking fuel among rural households. The limitation of not addressing non-Injera cooking needs becomes even more pronounced in the case SNNPR where, let alone rural households that almost entirely depend on non-Injera diet, even urban households tend to rely less on Injera diet. For instance, household in Bonga town bake Injera only about 1.5 times per week and they bake fewer number of Injeras (18 Injeras) per session. On the other hand, urban households in central and northern parts of the country bake Injera at least 2.3 times per week and they bake about 25 Injeras per session. The majority of rural and sizeable urban households in SNNPR frequently cook beans, tubers and vegetables for their daily meal all of which can be perfectly cooked over the Tikikil stove. Thus, it is high time for the project to scale up efforts and operate with a new vigor on production and marketing of the Tikikil stoves. It is also time to think beyond domestic stoves alone. Although the exact number of institutions and commercial establishment s that cater food for large numbers of people is not readily available, it is estimated that there are dozens of institutions (boarding schools, prisons, universities, … etc) and several thousands of commercial food catering establishments (restaurants, hotels, cafes, tea rooms, commercial Injera suppliers, … etc) in SNNPR. Such businesses and institutions that prepare food for large numbers of people constitute a considerable cash market for institutional stoves. The good thing is, institutional with proven performance are readily available at least in Addis Ababa. What is needed is popularizing the products, setting up production units in selected

locations, promoting the products and linking the producers with the market which is close by, just around the corner.

3. **Tapping in to carbon finance for a wider scale up:** Carbon finance opportunity has already been discussed above in this section and there is no need to repeat here. What is needed here is that if improved stoves had to reach the wider consumer market including rural consumers - and those at the bottom of the market Pyramid – it is absolutely important for any future improved stoves promotion effort to tap in to existing carbon finance resources. A simple justification is that a single fuel-efficient stove could reduce Co^2 emissions by up to one tCo^2 annually and a single tco^2 , if well packaged and promoted, could fetch up to US$ 10 (even when the carbon market is at its record low at the moment) in revenues in the carbon market. This is already more than adequate to cover the production and distribution cost of improved stoves such as Mirt and Tikikikl, which are retailing for US$ seven per stove. When designing a carbon activity the project may need to adopt a programmatic CDM approach – an approach that involves a set of individual small projects (CDM Programme Activities – CPA). CPAs could be implemented in different locations and timeframes within a given geographical and temporal boundaries of a Programme of Activities (PoA). Adding up emission reductions from several CPAs, PoAs can achieve much larger total emission reduction amounts than an individual CDM small-scale project. Therefore, either by debundeldling its improved stoves activities in various regions or pooling together emission reduction from its operations with various stoves, say Mirt and Tikikil, the GIZ supported project needs to develop a PoA using a Programmatic CDM approach.

4. **Create capacity for a large scale production:** In spite of the fact that large sums of money was spent on producers training, setting up production workshops and market promotion support and hundreds of thousands of Mirt stoves were distributed over the past one decade or so, the Mirt stove production and marketing has remained a small family business employing a handful of people who are often unpaid family members. This has been and still is a serious limitation throughout the Mirt and other improved stoves businesses in the country. The majority of stove producers lacked the aggressiveness that the market requires, they respond to consumers demand only reactively. In general, many producers of Mirt as well as other improved stoves lacked a proactive gesture in marketing and ability to manufacture large quantities of stoves meeting certain minimum quality standards. From the stand point of a carbon market activity, this is a huge limitation that needs to be worked on and overcome. For instance, despite their long experience and presence in the market, no Ethiopian producer has the organizational capacity to deliver an order for say a hundred thousand

stoves over a period of one year. Therefore, the future strategy session needs to look in to ways of creating capacity among at least some of the 'bigger' guys (at the national as well as regional level) to deliver large orders. When creating capacity for large scale production, it is also important to think outside the box and include potential producers who are not on the existing roaster, but who are best suited (say in terms of machinery, equipment, manpower, range of products on offer, … etc) for large scale production. On the other hand, the hope for large scale production capacity is not as bleak as it may appear now. There are a few producers (one in Addis Ababa and the other in Debre Zeit) who demonstrated not only the willingness, but have made considerable efforts to grow up and commence large scale production. For instance, when one of the GIZ supported relatively well organized producer in Addis Ababa was given an order for 12, 000 Tikikil stoves back in 2009, the stoves were delivered successfully, despite the challenges in meeting quality standards and delivery deadlines.

5. **Adopt a twin-track strategy to address the needs and constraints of the different sets of consumers:** In the past, GIZ supported improved stove projects advocated for and strongly pursued a commercial dissemination strategy. The commercial approach was the right path to take and should remain so at least urban areas where consumers' willingness to invest their meager cash in energy saving technologies is higher relative to rural consumers. However, we need to remind ourselves that despite enormous efforts made and resources committed to the promotion of improved stoves – Mirt in particular – during the past one decade and half, with only about 200,000 Mirt stoves sold in urban areas throughout the country in 15 years, the rate of success in penetrating even the urban market is modest at best. No doubt, it is important to build upon strengths and good practices and plan the way ahead. But, it is equally important to recognize the limitations of previous approaches and reshape them to suit to newly emerging realities and opportunities that were not foreseen before. Accordingly, while maintaining the commercial approach in urban markets, it is time to rethink and strongly consider a semi-commercial approach for the wider rural and market and poorer segments of urban markets. Given the limited incentive for households to invest their meager cash resources on energy saving technologies coupled with the physical difficulty of making products accessible to rural consumers, despite its market-disturbing effects, subsidizing consumer prices should be considered seriously if the market uptake had to be accelerated and the benefits of scale economies reaped. Carbon finance lends itself for such a hybrid strategy of commercialization. Moreover, there are a number of groups such as NGOs, CSOs, Women's Affairs Offices, …etc that are actively promoting the adoption of Mirt stoves within their respective constituencies. These groups often adopt varying forms of semi-commercial approaches in their

initiatives. Therefore, it is important for the current project to reach out those groups, establish working modalities, provide them with the necessary technical assistance and guidance and fully embrace their embrace their initiatives on improved stoves as part and parcel of its dissemination strategy at the regional as well as national levels. It is only when such operators and their operations are synchronized with the project's overall strategy that the hitherto unserved or underserved rural market could be reached out in a meaningful scale.

REFERENCES

FAO, (2005): ***Removal of Wood Products 1990 to 2005***, http://www.fao.org.forestry/32046/en. Access date 13/06/2011

FAO, (2005): ***Extent of Forest and Other Wood Land***. http://www.fao.org/forestry/32032/en. (Accessed date 13/06/2011).

Federal Democratic Republic of Ethiopia, Population Census Commission, (2008): ***Summary and Statistical Report of the 2007 Population and Housing Census***, Addis Ababa

FEWSNet. (2006). "***Southern Nation, Nationalities, and People's Region, Ethiopia – Livelihood Profiles***." Accessed at: http://www.dppc.gov.et/livelihoods/Downloadable/Regional%20Overview.pdf

Food and Agriculture Organization of the United Nations (FAO), (2010): ***Global Forest Resources Assessment 2010, Country Report, Ethiopia***, FRA2010/065, Rome.

GIZ – HERA (2011): Carbon Markets for Improved Cooking Stoves: A GIZ Guide for Project Operators, 4th Revised Edition, January 2011, Eschborn.

IPCC (2006): ***IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme***, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

MELCA Mahiber and African Biodivesity Network, (2006): ***Forest of Sheka***, Addis Ababa.

Melessaw Shanko and Mekonne Lulie, (1999): ***Household Energy Baseline Survey for Debark and Dabat Woredas, North Gondar, Amhara National regional State***, GTZ/HEPNR, Addis Ababa

Ministry of Agriculture, (2005): ***Woody Biomass Inventory and Strategic Planning Project***, Addis Ababa.

Neil Bird, (2008): ***A methodology for Assessment of the fraction of Non-renewable Woodfuel Consumption Application at National and State Level in Ethiopia***.

OECD-DAC (2001): ***Poverty-Environment Gender Linkages,*** DAC Journal, Volume 2, No. 4.

SEED, (1999): ***LPG Stoves Development and Market Support Study***, Ministry of Mines and Energy, Ethiopian Energy Studies and Research Center, Addis Ababa.
Tsedeke Abate (ed.) (1996): ***Enset-Based Sustainable Agriculture in Ethiopia***, Proceedings of the International Workshop on Enset held in Addis Ababa, 13 – 20 Dec. 1993, IAR, Addis Ababa.

WBISPP, MoA, (2001): ***SNNPR, A Strategic Plan for the Sustainable Development, Conservation, and Management of the Woody Biomass Resources***, Addis Ababa.

ANNEXES

Annex 1: List of Persons Contacted

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2	Ato Ayalew Adelo	Bonga Town Administration	Mayor	0912444481
3	Ato Elias Ersado	Hosaena, Sech Duna Sub City Administration	Chief Administrator	Na
4	Ato Alazar Tesema	Hosaena, Jalo Naramo Kebele Administration	Manager	Na
5	Ato Dagne W/Yohannes	Hadiya Zone, Water, Mining and Energy Office	Alternative Energy Expert	0911533234
6	Ato Birhanu Teshome	Hosaena, Licha Amba kebele Administration	Manager	0912072990
7	Ato Temesgen Taye	Hosena, Mel Amba Kebele Administration	Manager	0913815825
8	Ato Muidin Abamecha	Bonga Town Administration	Deputy, Mayor	0917333192
9	Abadere Abagse	Kaffa Zone Environmental Protection and Biodiversity	Process Owner	0913962062
10	Tefera w/ Gebrael	One Environmental Protection and land Administration	Process Coordinator	0917824323
11	Ketema Tesfaye	Bench Maji Zone Small Scale Technologies supply and Follow up	Process Coordinator	0917825878
12	Mesfne shferaw	Bench Maji Zone Women, Youth and Children's Affairs	Gender Coordinator	0911725689
13	Mekurya T/ Mikael	Bench Maji Zone Natural Resources Administration	Head	09178224662
14	Ato Mekonnen Dengamo	Yirgalem - City Administration	Personnel Head	Na
15	Ato Eliyou	Yirgalem - Mesento Kebele	Kebele Administrator	0912122815
16	Ato Aschalew	Yiralem – Aposto Kebele	Kebele Administrator	0916 164263
17	Ato Adisu	Yirgalem – Mehal Ketema Kebele	Kebele Administrator	0916 868387
18	Ato Abera Mulat Sagaro	SNNPR Natural Resource and Environmental Protection Authority	General Manager	Na
19	Ato Mehamed Nur Faris	SNNPR Natural Resource and Environmental Protection Authority	Forestry expert	Na
20	Ato Bergena	SNNPR – Bureau of Finance and Economic Development	GIS Expert	0916 861549
21	Ato Tigine Eshete	Wondo Genet Forestry College	GIS Expert	0916 827511
22	Ato Befekadu	MELCA Mahiber, Addis Ababa	Program Officer	0911 656605
23	Ato Mesfin Tekle	Bonga, NABU	Program Director	0911 966304

Annex 2: IPCC Gain-Loss Methodology for Assessment of Non Renewable Biomass use for Cooking

i. The annual change in carbon stocks in forests remaining forests is given by:

$$\Delta C_{B,t} = \Delta C_{G,t} - \Delta C_{L,t}$$

Where

$\Delta C_{B,t}$ annual change in carbon stocks in biomass (the sum of above-ground and below-ground biomass) in year t, tonnes C yr^{-1}

$\Delta C_{G,t}$ annual increase in carbon stocks due to biomass growth in year t, tonnes C yr^{-1}

$\Delta C_{L,t}$ annual decrease in carbon stocks due to biomass loss in year t, tonnes C yr^{-1}

If $\Delta C_{B,t} > 0$ then the forest are managed renewably. If $\Delta C_{B,t} < 0$ then the forests are managed non-renewably and losses or removals exceed growth.

ii. Increases in carbon stocks (supply)

A. Growing stock

The annual increase in carbon stocks is estimated by:

$$\Delta C_{G,t} = \sum_i \left(A_{i,t} \bullet G_{TOTAL,i,t} \bullet CF_i \right)$$

Where

$\Delta C_{G,t}$ Annual increase in carbon stocks due to biomass growth in year t, tonnes C yr^{-1}

$A_{i,t}$ Area of forest type i in year t, ha

$G_{TOTAL,i,t}$ The mean annual biomass growth of forest type i in year t, tonnes d. m. ha^{-1} yr^{-1}

CF_i Carbon fraction of dry matter in forest type i (default = 0.5)

And $G_{TOTAL,i,t}$ is calculated from:

$$G_{TOTAL,i,t} = \sum_i \left(I_{V,i,t} \bullet BCEF_{I,i} \bullet (1 + R_i) \right)$$

Where

$G_{TOTAL,i,t}$ The mean annual biomass growth of forest type i in year t, tonnes d. m. ha^{-1} yr^{-1}

$I_{V,i,t}$ Net annual increment data for forest type i in year t, m^3 ha^{-1} yr^{-1}

$BCEF_{I,i}$ biomass conversion and expansion factor for conversion of net annual increment in volume (including bark) to above-ground biomass growth for forest type i, tonnes above-ground biomass growth (m^3 net annual increment)$^{-1}$ –

R_i ratio of below-ground biomass to above-ground biomass for forest type i, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$. R must be set to zero if assuming no changes of below-ground biomass allocation patterns

B. Dead wood and litter

It is important to note that mean annual biomass growth is measured net losses due to mortality. The Tier 1 method assumes that the change in carbon stocks in deadwood and litter is zero. Therefore, they are not included in the supply.

iii. Decreases in carbon stocks (demand)

The annual decrease in carbon stocks due to biomass loss, $\Delta C_{L,t}$, is estimated using:

$$\Delta C_{L,t} = L_{wood-removals,t} + L_{fuelwood,t} + L_{disturbance,t}$$

Where

$\Delta C_{L,t}$ annual decrease in carbon stocks due to biomass loss in forests in year t, tonnes C yr^{-1}

$L_{wood-removals,t}$ annual carbon loss due to wood removals in year t, tonnes C yr^{-1}

$L_{fuelwood,t}$ annual biomass carbon loss due to fuelwood removals in year t, tonnes C yr^{-1}

$L_{disturbance,t}$ annual biomass carbon losses due to disturbances in year t, tonnes C yr^{-1}

And

$$L_{wood-removals,t} = \sum_i \left(H_{i,t} \bullet BCEF_{R,i} \bullet (1+R_i) \bullet CF_i\right)$$

Where

$L_{wood-removals,t}$ annual carbon loss due to wood removals in year t, tonnes C yr^{-1}

$H_{i,t}$ annual wood removals of species i in year t, roundwood, m^3 yr^{-1}

$BCEF_{R,i}$ biomass conversion and expansion factor for conversion of removals in merchantable volume to total biomass removals (including bark), tonnes biomass removal (m^3 of removals)$^{-1}$ See Table 4.5**Error! Bookmark not defined.**

R_i ratio of below-ground biomass to above-ground biomass for forest type i, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$. R must be set to zero if assuming no changes of below-ground biomass allocation patterns (Tier 1)

CF_i Carbon fraction of dry matter in forest type i (default = 0.5)

Fuel wood is comprised of two parts, living trees and dead wood. If possible the fuel wood volume to biomass should be separated. Only the removals of living trees should be included in the estimate of the annual change of forests. For this portion:

$$L_{fuelwood,t} = \sum_i \left(FG_{trees,i,t} \bullet BCEF_{R,i} \bullet (1+R_i) + FG_{part,i,t} \bullet D\right) \bullet CF_i$$

Where

$L_{fuelwood,t}$ annual carbon loss due to fuelwood removals in year t, tonnes C yr^{-1}

$FG_{trees,i,t}$ annual volume of fuelwood removal of whole trees of species i in year t, m^3 yr^{-1}

$BCEF_{R,i}$ biomass conversion and expansion factor for conversion of removals in merchantable volume to total biomass removals (including bark), tonnes biomass removal (m^3 of removals)$^{-1}$ See Table 4.5**Error! Bookmark not defined.**

R_i ratio of below-ground biomass to above-ground biomass for forest type i, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$. R must be set to zero if assuming no changes of below-ground biomass allocation patterns (Tier 1)

$FG_{part,i,t}$ annual volume of fuelwood removal as tree parts of species i in year t, m^3 yr^{-1}

D basic wood density, tonnes d.m. m^{-3}

CF_i Carbon fraction of dry matter in forest type i (default = 0.5)

iv. Treatment of dead wood

For countries with significant extraction of fuel wood that has been ongoing for an extended period, we will assume that most branches have already been removed. Therefore the annual volume of fuel wood from tree parts comes from dead wood production

The annual amount of dead wood production can be estimated from mortality using:

$$FG_{Deadwood,i,t} = A_{i,t} \bullet I_{V,i,t} \bullet m$$

Where

$FG_{Deadwood,t}$	annual volume of fuelwood from dead wood of species i in year t, m^3 yr^{-1}
$I_{V,i,t}$	Net annual increment data for forest type i in year t, m^3 ha^{-1} yr^{-1}
m	mortality rate expressed as a fraction of above-ground biomass growth

Therefore:

$$FG_{part,i,t} = FG_{Deadwood,i,t}$$

and

$$FG_{Trees,i,t} = FG_{Total,i,t} - FG_{Deadwood,i,t} \quad 1$$

Annex 3: Computation of Non Renewable Fraction of Biomass use for Cooking in SNNPR for 2010

Southern Nations Nationalities and Peoples Region (SNNPR)						
Stocks						
Forest		Other Wood Land		Total		
Area (1000 ha)	1,264	Area (1000 ha)	1,301	Area (1000 ha)	2,565	
Stocks	**Mt**	**Stocks**	**Mt**	**Stocks**	**Mt**	
Above ground	147	Above ground	10.7	Above ground	158	
Below ground	40	Below ground	5.1	Below ground	45	
Dead Wood	26.1	Dead Wood	2.2	Dead Wood	28	
Total	213	**Total**	18.0	**Total**	231	
Density	**t/ha**	**Density**	**t/ha**	**Density**	**t/ha**	
Above ground	116.5	Above ground	8.2	Above ground	61.6	
Below ground	31.5	Below ground	3.9	Below ground	17.5	
Dead Wood	20.6	Dead Wood	1.7	Dead Wood	11.0	
Total	168.6	Total	13.8	Total	90.1	
Growing Stock		**Growing Stock**		**Growing Stock**		
Above ground (Mm3)	105.8	Above ground (Mm3)	3.0	Above ground (Mm3)	108.9	
Above ground (m3/ha)	83.7	Above ground (m3/ha)	2.3	Above ground (m3/ha)	42.4	
Equivalent BCEF (t/m3)	1.392	Equivalent BCEF (t/m3)	3.547	Equivalent BCEF (t/m3)	1.451	
$BCEF_R$ (t/m3)	1.44	$BCEF_R$ (t/m3)	10.0	$BCEF_R$ (t/m3)	1.68	
R	0.270	R	0.476	R	0.284	
Forest Growth without Disturbance						
Forest		**Other Wood Land**				
	t/ha/yr		**t/ha/yr**			
Above ground	8.70	Above ground	0.9			
Below ground	2.35	Below ground	0.4			
Total	11.05	Total	1.3			
Mortality rate	0.0177	Mortality rate	0.0177			
Change in Area (Afforestation, Reforestation and Deforestation)						
Forest		**Other Wood Land**		**Total**		Deforestation
Area (1000 ha)	-21.9	Area (1000 ha)	0	Area (1000 ha)	-21.9	-1.7%
Stocks	**Mt**	**Stocks**	**Mt**	**Stocks**	**Mt**	
Above ground	-2.5	Above ground	0	Above ground	-2.5	
Below ground	-0.5	Below ground	0	Below ground	-0.5	
Dead Wood	-0.3	Dead Wood	0	Dead Wood	-0.3	
Total	-3.3	**Total**	0	**Total**	-3.3	
Volume Loss (Mm3)		Volume Loss (Mm3)	0	Volume Loss (Mm3)	??	
Removal of Wood Products						**% of growing**
Industrial Roundwood		**Wood Fuel**		**Total**		**stock**
Volume (1000m3)	197	Volume (1000m3)	19,850	Volume (1000m3)	20,047	18.9%
$BCEF_R$ (t/m3)	1.44	$BCEF_R$ (t/m3)	1.68	$BCEF_R$ (t/m3)	1.674	
Above ground (Mt)	0.28	Above ground (Mt)	33.28	Above ground (Mt)	33.56	23%
Below ground (Mt)	0.08	Below ground (Mt)	15.83	Below ground (Mt)	15.91	
Total (Mt)	0.36	**Total (Mt)**	49.11	**Total (Mt)**	49.47	
$Frac_{nrb}$ Calculation						
Gains						
C_G (Mt) - Forest	14.0					
C_G (Mt) - Other woodland	1.7					
C_G (Mt) - Total	15.7					
Losses						
C_L - Above ground (Mt)						
Industrial Roundwood (Mt)	0.28					
Wood fuel (Mt)	33.28					
Dead Wood (Mt)	-0.2					
Total (Mt)	33.32					
C_L - Below ground (Mt)	15.91					
C_L - Total (Mt)	49.22					
Balance						
Net = C_G - C_L (Mt)	-33.5					
FRACnrb	**68.1%**					

Annex 4: Survey Questionnaires

Annex 4.1: Household Energy Baseline Survey Questionnaire

I. Identification:

1.1 Name of Household Head: _____
1.2 Zone: _____
1.3 Woreda: _____
1.4 Survey Site (Urban / Rural): _____
1.5 Name of Kebele Administration: _____
1.6 House Number (if urban): _____
1.7 Name of Respondent: _____
1.8 Relationship of Respondent to Household Head: _____
1.9 Sex of Respondent: _____
1.10 Name of Enumerator: _____
1.11 Interview Date: _____
1.12 Name and Signature of Supervisor: Name: _____ Sign._____

II. Demographic and Socio-economic Characteristics of the Household Head:

2.1 Gender: Male /_____/ Female /_____/

2.2 Please indicate the number of family members living in the household. _____ (Total number)

2.2.1 Age & Gender	**2.2.2 Number of People**
2.2.1.1 Children 0 -14 years	2.2.2.1 _____ (Write number)
2.2.1.2 Males 15+ years	2.2.2.2 _____ (Write number)
2.2.1.3 Females 15+ years	2.2.2.3 _____ (Write number)

2.3 Level of Education:

2.3.1 No formal education		/_____/
2.3.2 Non-formal education (read & write, traditional education)		/_____/
2.3.3 Elementary School (Grades 1 to 6)		/_____/
2.3.4 Junior Secondary	(Grade 7 & 8)	/_____/
2.3.5 Senior Secondary	(Grades 9 to 12)	/_____/
2.3.6 Certificate or Diploma	(Grade 12 + 1 or 2 Years	/_____/
2.3.7 First Degree or equivalent		/_____/
2.3.8 Second Degree and Above		/_____/

2.4 Main occupation of the household head:

Major Occupational Groups	(√)	Specific Occupation
2.4.1 Salary/Wage Employment (Civil Service, NGO, …etc)	/_____/	_____
2.4.2 Self-employed (Merchant, Mason, Carpenter, … etc)	/_____/	_____
2.4.3Petty Trade (Market stall, grain, food stuff, local liquor)	/_____/	_____
2.4.4 Casual Labour	/_____/	_____
2.4.5 Unemployed	/_____/	
2.4.6 Farmer (Smallholder), Indicate size of landholding (ha)	/_____/	_____ (ha)
2.4.7 Other (specify) _____		

III Stoves, Fuels and End-uses:

3.1 Which of the following stoves do you use for baking **INJERA** or other types of **BREAD**?

3.1.1 Stoves	3.1.2 Frequency of use			
	Always	Mostly	Sometimes	Rarely
1 Open fire	/_____/	/_____/	/_____/	/_____/
2 Trad. Enclosed Injera	/_____/	/_____/	/_____/	/_____/
3 Mirt Biomass Injera	/_____/	/_____/	/_____/	/_____/
4 Electric Mitad	/_____/	/_____/	/_____/	/_____/
5 Other Injera stove (specify)	/_____/	/_____/	/_____/	/_____/

3.2 Which of the following stoves do you use for **NON-INJERA** or **NON-BREAD** cooking?

3.2.1 Stoves	3.2.1 Frequency of use			
	Always	Mostly	Sometimes	Rarely
1 Open fire	/_____/	/_____/	/_____/	/_____/
2 Trad. Metal charcoal	/_____/	/_____/	/_____/	/_____/
3 Lakech charcoal	/_____/	/_____/	/_____/	/_____/
4 Kerosene wick stove	/_____/	/_____/	/_____/	/_____/
5 Electric stove	/_____/	/_____/	/_____/	/_____/
6 Other stove (specify)	/_____/	/_____/	/_____/	/_____/

3.3 Among your household members, who is usually responsible for purchasing or collecting traditional fuels (firewood, charcoal, BLT, cow dung, agri-residue)?

	Wife	Husband	Male Child	Female Child
3.3.1 Purchasing	/_____/	/_____/	/_____/	/_____/
3.3.2 Freely collecting	/_____/	/_____/	/_____/	/_____/

3.4 What are the major types of fuels that your household usually uses for cooking food? Please also indicate mode of acquisition for all biomass fuels that the household uses.

3.3.1 Fuel Type	**3.3.2 Usage**	**3.3.3 Mode of Acquisition**	
	Yes/No	Purchased	Freely Collected
3.4.1.1 Firewood	/_____/	/_____/	/_____/
3.4.1.2 BLT	/_____/	/_____/	/_____/
3.4.1.3 Crop Residue	/_____/	/_____/	/_____/
3.4.1.4 Cow Dung	/_____/	/_____/	/_____/
3.4.1.5 Charcoal	/_____/	/_____/	/_____/
3.4.1.6 Kerosene	/_____/	/_____/	/_____/
3.4.1.7 Electricity	/_____/	/_____/	/_____/
3.4.1.8 Other (Specify) _____	/_____/	/_____/	/_____/

3.5 If your household collects biomass fuels freely, please indicate the FREQUENCY of collection and TIME spent on collecting various biomass fuels that the household uses.

3.5.1 Fuel Type	3.5.2 Frequency (Per Week)	3.5.3 Time Spent (Hrs/ Round Trip)	Unit	Quantity
3.5.1.1 Firewood	_____	_____	_____	_____
3.5.1.2 BLT	_____	_____	_____	_____
3.5.1.3 Crop Residue	_____	_____	_____	_____
3.5.1.4 Cow Dung	_____	_____	_____	_____
3.5.1.5 Charcoal	_____	_____	_____	_____
3.5.1.6 Other (Specify)	_____	_____	_____	_____

3.6 If your household freely collects biomass fuels, please indicate how distance travelled for collecting biomass fuels has changed over the last ten years.

3.6.1 Increasing	/_____/	3.6.1.1 Why? _____
3.6.2 No Change (Same)	/_____/	
3.6.3 Decreasing	/_____/	3.6.3.1 Why? _____

3.7 If the answer to question 3.6 above is "**INCREASING**", then ask the respondent to estimate the extent of the increase in terms of time (hours) spent on collecting the same quantity of biomass fuel in the past and at present.

3.7.1 Ten Years Ago	3.7.2 Five Years Ago	3.7.3 Today (At Present)
_____ (Hrs)	_____ (Hrs)	_____ (Hrs)

3.8 If there is any seasonality in the supply and usage of biomass fuels your household uses, please RANK (in order of importance) the three most important fuels you usually use during the dry and wet or rainy seasons.

3.8.1 Dry Season	**3.8.2 Wet (Rainy) Season**
3.8.1.1 _____	3.8.2.1 _____
3.8.1.2 _____	3.8.2.2 _____
3.8.1.3 _____	3.8.2.3 _____

3.9 If your household has been adversely affected by scarcity of supplies in recent years, please tell me what strategies you have adopted to cope with the situation.

3.9.1 Reduce cooking	/_____/
3.9.2 Use fuels more sparingly/economically	/_____/
3.9.3 Collect wood freely instead of buying	/_____/
3.9.4 Obtain supplies in large quantities	/_____/
3.9.5 Shift to inexpensive but less desirable fuels	/_____/
3.9.6 Invest in energy-efficient cooking devices	/_____/
3.9.7 Other (Specify) _____	

3.10 Please tell me three most important cooking fuels (ranked in order of importance) used in your household five years ago and today.

3.10.1 Five Years Ago (Rank)	3.10.2 Today or currently (Rank)
1 _____	1 _____
2 _____	2 _____
3 _____	3 _____

3.11 Where do you usually cook food on your stoves (tick more than one as appropriate)?

3.11.1 Indoors separate private kitchen	/_____/
3.11.2 Indoors shared kitchen	/_____/
3.11.3 Indoors, living room	/_____/
3.11.4 Outdoors	/_____/
3.11.5 Other (specify) _____	

3.12 Do you cook food (including Injera and other bread) for **COMMERCIAL** purposes?

3.12.1 Yes	/_____/
3.12.2 No	/____/

3.13 Who is responsible for cooking food in your household?

3.13.1 Wife	/_____/
3.13.2 Daughter	/_____/
3.13.3 Housemaid	/_____/
3.13.4 Other (Specify)	_____

3.14 If you were provided with a fuel-efficient improved stove that could save up to half of your fuel wood used for cooking, would you be willing to buy one?

3.14.1 Yes	/_____/
3.14.2 No	/_____/

3.15 If the answer to (Q3.11) above is "Yes", then how much would you be able and willing to spend on a new improved stove? Enumerator! Please do not read out the choices below.

3.15.1 Less than Etb 50	/_____/
3.15.2 Etb 51 to 75	/_____/
3.15.3 Etb 76 to 100	/_____/
3.15.4 Etb 100 to 150	/_____/
3.15.5 Etb 151 and more	/_____/

3.16 How many aluminium and clay pots do you own/use in your household?

3.16.1 Aluminium Pots: (Insert Number)	_____ (Number)
3.16.2 Clay Pots: (Insert Number)	_____ (Number)

3.17. Please show me all pots and pans you use for end-uses other than *Injera* or bread.
Note *for Enumerator! Please ask the respondent to show all pots that the household uses for cooking, measure the width at the bottom and record the diameter in Centimetres below.*

3.17.1 Pot one	_____ 00.00 (cm)
3.17.2 Pot two	_____ 00.00 (cm)
3.17.3 Pot three	_____ 00.00 (cm)
3.17.4 Pot four	_____ 00.00 (cm)
3.17.5 Pot five	_____ 00.00 (cm)
3.17.6 Pot six	_____ 00.00 (cm)

3.18 How many times do you bake *Injera* or other type of bread per week? Please also indicate the average number of pieces of *Injeras* or loaves of bread baked per session.

3.18.1 Number of baking sessions:	_____ per week
3.18.2 Number of *Injeras* loaves baked:	_____ per session

3.19 The German International Cooperation (GIZ) in collaboration with the SNNPR government intends to conduct actual fuel consumption monitoring for ten days in randomly selected households in your area. In addition to regular interviews, the study will involve weighing biomass fuels in order to determine the quantity of traditional fuels actually consumed in a given household. The measurement and interviews will take place for a period of 10 consecutive days. If your household is selected at a random, are you willing to participate in the proposed study?

3.19.1 Yes /_____/
3.19.2 No /_____/

THANK YOU FOR YOUR CO-OPERATION!!!

Annex 4.2: Introductory Interview

Note for Enumerators:

As this is your first day in the household, introduce yourself and then explain that this household is selected for a longitudinal MONITORING of biomass fuel consumption. Please also explain that the study entails daily interviews and weighing of biomass fuel in the household for two consecutive weeks before and another two consecutive weeks after introducing a new model of improved stove to the household. Please also confirm once more whether the respondent is willing to participate in this study. If the respondent is willing, then continue the interview as shown below. If the respondent is not willing, then contact your Supervisor to find a suitable substitute for the study and continue the interview.

1. ***Enumerator***: Please ask the HHH/respondent to introduce you to someone, if different than him/herself, who will be available daily and responsible for the regular interview and take down the name. _____

2. ***Enumerator***: In consultation with the HHH and or the respondent, please fix convenient time for the regular interview and write down below: _____

3. ***Enumerator***: Please ask the respondent to show you amount of firewood that s/he thinks would last them at least one day; weigh and record it carefully, set it aside separately; and tell respondent to use ONLY and ONLY from the weighed firewood until you come back tomorrow to measure the remainder and set aside another portion.

   3.1 Biomass fuel 1 (INSERT NAME OF FUEL) _____ weighed and set aside. _____ (00.00 kgs)

   3.2 Biomass fuel 2 (INSERT NAME OF FUEL) _____ weighed and set aside. _____ (00.00 kgs)

   3.3 Biomass fuel 3 (INSERT NAME OF FUEL) _____ weighed and set aside. _____ (00.00 kgs)

Enumerator: Before leaving the household, please tell the respondent that you will come back tomorrow at the time agreed upon (see 1.2 above) and explain the following rules that should strictly be observed by the household during the study period:

- *Do not use firewood before it is weighed and set aside for you to use it (both from your own supplies or borrowed from others)*
- *Do not lend fuel from fuel that is weighed and set aside for your household use*
- *If your weighed firewood supply is exhausted before the enumerator comes back, then you will have to either wait with patience or contact your enumerator, who should not be very far from your village, to weigh and set aside additional fuel for you to use.*
- *Do not mix weighed fuels with any un-weighed fuel in the household.*
- *Do not add un-weighed fuel to the one that is set aside for your HH use*
- *Keep weighed and set aside fuel as dry and clean as possible.*
- *Be punctual for and honest during the interview*

Annex 4.3: Longitudinal Monitoring Interview Questionnaire

I. Identification:

1. Name of Head of Household (ID): _____
2. Name of Respondent: _____
3. Name of Enumerator: _____
4. Date: _____

II. End-uses and Stoves Used:

2.1 Please indicate types of end-uses and number of times you used your **OPEN FIRE** since I left your household yesterday.

2.1.1 End-uses	**2.1.2 Frequency**	**2.1.3 Quantity (If Injera or bread)**
2.1.1.1 Injera baking	2.1.2.1 _____	2.1.3.1 _____
2.1.1.2 Bread	2.1.2.2 _____	2.1.3.2 _____
2.1.1.3 Prepared Wot	2.1.2.3 _____	
2.1.1.4 Reheated Wot	2.1.2.4 _____	
2.1.1.5 Boiled water	2.1.2.5 _____	
2.1.1.6 Made Coffee	2.1.2.6 _____	
2.1.1.7 Made Tea	2.1.2.7 _____	
2.1.1.8 Cooked Porridge	2.1.2.8 _____	
2.1.1.9 Prepared "ABSIET"	2.1.2.9 _____	
2.1.1.10 Cooked Vegetables	2.1.2.10_____	
2.1.1.11 Roasted/fried meat	2.1.2.11_____	
2.1.1.12 Roasted grain	2.1.1.12_____	
2.1.1.13 Other (Specify) _____	2.1.2.12_____	

2.2 Please indicate types of end-uses and number of times you used your **Traditional CHARCOAL** stove (metal or clay) since I left your household yesterday.

2.2.1 End-uses	**2.2.2 Frequency**
2.2.1.1 Prepared Wot	2.2.2.1_____
2.2.1.2 Reheated Wot	2.2.2.2 _____
2.2.1.3 Boiled water	2.2.2.3 _____
2.2.1.4 Made Coffee	2.2.2.4 _____
2.2.1.5 Made Tea	2.2.2.5 _____
2.2.1.6 Cooked Porridge	2.2.2.6 _____
2.2.1.7 Prepared "ABSIET"	2.2.2.7 _____
2.2.1.8 Cooked Vegetables	2.2.2.8 _____
2.2.1.9 Roasted/fried meat	2.2.2.9 _____
2.2.1.10 Other (Specify) _____	2.2.2.10 _____

2.3 Please indicate types of end-uses and number of times you used your **Lakech Improved CHARCOAL** stove since I left your household yesterday.

2.3.1 End-uses	**2.3.2 Frequency**
2.3.1.1 Prepared Wot	2.3.2.1_____
2.3.1.2 Reheated Wot	2.3.2.2 _____
2.3.1.3 Boiled water	2.3.2.3 _____
2.3.1.4 Made Coffee	2.3.2.4 _____
2.3.1.5 Made Tea	2.3.2.5 _____
2.3.1.6 Cooked Porridge	2.3.2.6 _____
2.3.1.7 Prepared "ABSIET"	2.3.2.7 _____
2.3.1.8 Cooked Vegetables	2.3.2.8 _____
2.3.1.9 Roasted/fried meat	2.3.2.9 _____
2.3.1.10 Other (Specify) _____	2.3.2.10 _____

2.4 Please indicate types of end-uses and number of times you used your **Kerosene Wick** stove since I left your household yesterday.

2.4.1 End-uses	**2.4.2 Frequency**
2.4.1.1 Prepared Wot	2.4.2.1_____
2.4.1.2 Reheated Wot	2.4.2.2 _____
2.4.1.3 Boiled water	2.4.2.3 _____
2.4.1.4 Made Coffee	2.4.2.4 _____
2.4.1.5 Made Tea	2.4.2.5 _____
2.4.1.6 Cooked Porridge	2.4.2.6 _____
2.4.1.7 Prepared "ABSIET"	2.4.2.7 _____
2.4.1.8 Cooked Vegetables	2.4.2.8 _____
2.4.1.9 Roasted/fried meat	2.4.2.9 _____
2.4.1.10 Other (Specify) _____	2.4.2.10 _____

2.5 Please indicate types of end-uses and number of times you used your **ELECTRIC INJERA MITAD** stove since I left your household yesterday. (Specify type of stove) _____

2.5.1 End-uses	**2.5.2 Frequency**	**2.5.3 Quantity (If Injera or bread)**
2.5.1.1 Injera baking	2.5.2.1 _____	2.5.3.1 _____
2.5.1.2 Bread	2.5.2.2 _____	2.5.3.2 _____
2.5.1.3 Prepared Wot	2.5.2.3 _____	
2.5.1.4 Reheated Wot	2.5.2.4 _____	
2.5.1.5 Boiled water	2.5.2.5 _____	
2.5.1.6 Made Coffee	2.5.2.6 _____	
2.5.1.7 Made Tea	2.5.2.7 _____	
2.5.1.8 Cooked Porridge	2.5.2.8 _____	
2.5.1.9 Prepared "ABSIET"	2.5.2.9 _____	
2.5.1.10 Cooked Vegetables	2.5.2.10 _____	

2.5.1.11 Roasted/fried meat 2.5.2.11 _____
2.5.1.12 Other (Specify) _____ 2.5.2.12 _____

2.6 Please indicate types of end-uses and number of times you used your **OTHER** stove since I left your household yesterday. (Specify type of stove) _____

2.6.1 End-uses	**2.6.2 Frequency**	**2.6.3 Quantity (If Injera or bread)**
2.6.1.1 Injera baking	2.6.2.1 _____	2.6.3.1 _____
2.6.1.2 Bread	2.6.2.2 _____	2.6.3.2 _____
2.6.1.3 Prepared Wot	2.6.2.3 _____	
2.6.1.4 Reheated Wot	2.6.2.4 _____	
2.6.1.5 Boiled water	2.6.2.5 _____	
2.6.1.6 Made Coffee	2.6.2.6 _____	
2.6.1.7 Made Tea	2.6.2.7 _____	
2.6.1.8 Cooked Porridge	2.6.2.8 _____	
2.6.1.9 Prepared "ABSIET"	2.6.2.9 _____	
2.6.1.10 Cooked Vegetables	2.6.2.10 _____	
2.6.1.11 Roasted/fried meat	2.6.2.11 _____	
2.6.1.12 Other (Specify) _____	2.6.2.12 _____	

2.7 Number of people food was prepared for during the day (write number) _____

III. Fuel Acquisition & Consumption:

3.1 Have you or anyone in this household **purchased** any Biomass fuels (INSERT NAME OF FUEL) _____ today?

3.1.1 Yes /_____/ If yes, 3.1.1.1 Unit of purchase _____
3.1.1.2 Quantity purchased _____
3.1.1.3 Amount paid _____ Etb
3.1.2 No /_____/

3.2 Have you or anyone in this household **freely collected** any Biomass fuels (INSERT NAME OF FUEL) _____ today?

3.2.1 Yes /_____/ If yes, 3.2.1.1 Unit of collection _____
3.2.1.2 Quantity collected _____
3.2.1.3 Time spent _____ (Hours)
3.2.2 No /_____/

Note for Enumerators:

Accuracy of weight measurements you are going to record below are critically important to this study. Therefore, please use the right type of weighing scales, calibrate the scale, do the weighing with utmost care and record the weights in the space provided for the respective fuels below!!!

A) Weights of fuels remaining from yesterday's set aside:

3.3 Weight of biomass fuel 1 (INSERT NAME OF FUEL) _____ remaining from that set aside previously. _____ (00.00 kgs)

3.4 Weight of biomass fuel 2 (INSERT NAME OF FUEL) _____ remaining from that set aside previously. _____ (00.00 kgs)

3.5 Weight of biomass fuel 3 (INSERT NAME OF FUEL) _____ remaining from that set aside previously. _____ (00.00 kgs)

B) Weights of fuels newly weighed and set aside today:

3.6 Weight of biomass fuel 1(INSERT NAME OF FUEL) _____ weighed and set aside for the next day. _____ (00.00 kgs)

3.7 Weight of biomass fuel 2 (INSERT NAME OF FUEL) _____ weighed and set aside for the next day. _____ (00.00 kgs)

3.8 Weight of biomass fuel 3 (INSERT NAME OF FUEL) _____ weighed and set aside for the next day. _____ (00.00 kgs)

3.9 Observations, comments (Enumerators): _____

_____

Note for Enumerators:

Make sure that all fuels are weighed and recorded properly before you leave the household!!!

THANK YOU !!!

Annex 5: Terms of Reference

Introduction

Access to Modern Energy Services-Cooking (AMES-C) is a component of the GTZ Energising Development Program (EDP) that is implemented under the GTZ Energy Coordination Office (ECO) in collaboration with the Ministry of Mines and Energy.

AMES-C is the continuation of two consecutive household energy projects named as Household Energy Protection of Natural Resources (HEPNR) and Sustainable Utilization of Natural Resources for Improved Food Security Program (SUN: Energy) which were jointly implemented by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH and the Ministry of Agriculture and Rural Development (MoARD), under a bilateral cooperation agreement since 1998.

During GTZ HEPNR projects phases, between 1998 and 2005, the project has been intervening in Southern Nations and Nationalities Peoples Regional State (SNNPRS) in the development and promotion of 'Mirt' biomass saving stove. During the aforementioned period, the project has managed to establish 36 Mirt stove producers in 17 towns which are located in 16 woredas covering 7 zones out of the total 13 zones of the region.

Later, when the project was structured under the GTZ SUN program, the project withdrew from the region as it was not the intervention area of the SUN program. However, the project tried to maintain the follow up of the existing producers and has been collecting sales data from the existing producers and provided different promotional materials to the stove producers based on the request. Moreover, we believe that the region is also benefiting from the national promotional campaigns like TV and radio programs. Currently, there are only six active producers in the region who are engaged continuously in the stove production business as per our monitoring result which is based on the information acquired from stove producers.

Following the merging of GTZ SUN Energy into GTZ Energy Coordination Office (ECO) program starting 2010, the project got the opportunity to renew the cooperation and working relationship with SNNPRS. Currently, AMES-C is working on some basic ground works prior to formal commencement of the interventions.

The new EnDEV2 program is functioning from 2010-mid 2012 (for two and half years). In this program AMES C is working in Oromia, Amhara, Tigray, SNNPRs, Addis Ababa, Harari and Diredawa Recently, AMES C has defined a plan of action for the year 2010 together with partners from federal and regions.

AMES-C is aiming to scale-up the development and promotion of efficient utilization of energy from biomass in SNNPR and designed its project in such a way that it will have a vital contribution in both environmental protection (through reduced carbon emission and reduced demand for biomass) and reducing the burden of domestic energy expenditure on biomass fuel consumers in the region.

The forthcoming cooking energy baseline survey will be conducted as part of the formal project designing process for SNNPRS and contributes to the broader program support of the energy sector of the region. Therefore, this TOR is developed with the aim of looking for an appropriate consultant who can conduct a comprehensive cooking energy baseline study in SNNPRS.

General Objective of the Baseline Assessment

The objective of the study is to provide AMES-C with baseline information in cooking energy demand and supply outline, cooking and fuel consumption, biomass production and supply, assess private business sectors engaged on energy service provision, and the use of cooking energy technologies in SNNPRS. The baseline survey report will also be used as reference data for future monitoring and evaluation.

Specific Objectives

- To establish a strong gender sensitive baseline which serves as yardstick against which project achievements could be assessed or even measured.
- To collect current data and information in cooking energy supply and demand situation, acquisition and utilization patterns and on marketplace dynamics all of which are required for the designing and implementation of a forthcoming improved cook stoves promotion project in the region;
- To establish a cooking energy baseline for SNNPRS which could be used, among other things, in the assessment of the potential of the underlying project to generate carbon credits in a meaningful scale and;
- To review and assess biomass production and supply for the region in order to establish the proportion of fuel wood use for cooking (sector specific i.e. households, institutions etc) in the region that comes from Non-Renewable Biomass (NRB) resource base.
- To assess the framework conditions of the private business sector on energy saving stoves & to propose a strategy to develop a sustainable private business sector on energy saving stoves.
- To assess the environment in the rural communities and the possibility of using CBOs to promote the project (AMES C) interventions.

Duties of the consultant

The consultant shall:-

- Assign qualified personnel to execute the intended tasks at field level
- Be committed to all points (timeframe, the steps of the study, deliverables etc)
- Prepare the survey instrument
- Present the inception report of the study to AMES-C for review and approval
- Present the pretest survey result to AMES-C and also shall agree on the contents of the survey instruments for the final survey
- Conduct baseline assessment based on the technical proposal agreed by both parties
- Make sure that the assessment meets the stated objectives
- Assemble, analyze the baseline data and submit a draft report
- Present findings of the study/assessment
- Conclude and submit the final baseline report based on the given feedback

The baseline study:

The following points should be addressed:

- The type of food cooked in the region (with ranking from the most frequent one to the least).
- Number and type of cook stoves currently being used in households as well as institutions and others (for productive use purpose, etc) with respect to each cooking needs in SNNPRS.
- Details on mode of acquisition of the stove
    - Commercialized, self made, freely given, etc
    - The price of the stove (if it is purchased)
    - How do they able to construct the stove (self initiation, other involvement, etc)
    - If it is freely given (who is involved in the process, etc).
- Average lifespan of currently-used cook stoves, the fuel types being used (fuel wood (What type?), charcoal, dung, kerosene, LPG, electricity etc).

- The source of the fuel, for the case of biomass, especially fuelwood and charcoal (unsustainable or sustainable?). If unsustainable (i.e. if the use of fuel wood is leading to a depletion of standing wood biomass), how can we demonstrate this?
- The quantity of each type of fuel being used for cooking in SNNPRS by all sectors (households, institutions & others/productive use).
- The market price of fuel wood and charcoal and its trend over time (past and future).
- The quantity of fuel being used (from the specific stove perspective (efficiency of cook stoves) – which will indicate the potential greenhouse gas emission reductions that could be achieved by the CDM project.
- Willingness and ability of the population and the institutions to purchase new, more efficient cook stoves.
- How is the demand for cook stoves trending over time? Expected population / household change in the region – how fast is the population growing?
- Proposed strategy for pricing the new cook stove.
- Cultural issues – possible cultural reluctance to use new (unfamiliar) cook stove designs.
- Any dynamic trends that might affect the baseline over the coming years. For example, are people gradually switching away from fuel wood to charcoal or from charcoal to kerosene (etc.)? Is the rise in fossil fuel prices causing increased usage of fuel wood? Will clean cook stoves be introduced into the market anyway, independent of this planned GTZ initiative?
- Are there any barriers to rolling out clean cook stoves?
- Details of other GOs and NGOs program who are active in the promotion of cooking energy & their intervention strategy
- Opportunities to engage CBOs (associations, cooperatives, micro finance institution, idir, equb, etc) in stove supply, promotion, financing, etc.
- Current state of private business sector for energy saving stoves
    - On production/supply,
    - On retailing.
- Types of energy saving stoves currently available in the market.
- Conditions that are favoring/hindering the development of a sustainable private business sector on energy saving stoves.
- Perspectives and tendencies of the private stove business market (competitive situation).
- Proposed strategy to develop the private business sector for energy saving stoves.

Brief Profile of SNNPRS

Location

- South west part of Ethiopia
- Astronomically lies between 4 o.43 - 8 o.58 North latitude & 34 o.88- 3o.14 East longitude
- Bordered with Kenya in South, the Sudan in West Southwest, Gambella region in Northwest and surrounded by Oromiya region in Northwest, North and East direction.

Area

Area 110,931.9 sq. km. (10 Percent of the country)

Population

- Population size: 15,042,531 in 1999 E.C.(2007 Census)
- Population density: 136 persons per sq.km.
- Rural population: 13,496,821 in 1999 E.C.
- Urban population: 1,545,710 in 1999 E.C.
- According to central statistical agency in 1999 E.C, total population of the region amount to 15, 33,328 out of which 90% rural dweller
- Currently there are about 2,966,382 household sizes

Ethnic Groups

There are 56 ethnic groups (with distinct geographical location, language, cultures, and social identities).

Administrative Divisions

- 13 Zone sub-divided in to 126 woredas
- 8 special woredas
- 3,714 rural kebeles.
- 238 urban kebeles.
- 22 Town Administrations
- 114 Certified Towns (with municipality)

Location

Towns and villages of the SNNPRS to be defined

AMES C

- Shall avail all important documents in the project that contributes on designing of the quality assessment tools and producing valuable study results as per the request of the consultant.
- Shall play a facilitation role in collaboration with the regional energy bureau so as to ease the overall process of the survey

Challenges for the study

- The nature of the existence of different ethnic group in the region needs a systematic selection of samples so as to come up with representative survey findings via addressing the aforementioned objectives of the study.
- As the project has prior interventions in some towns of the region the selection of samples should also consider this issue. Same is true for the area where the regional energy bureau has related interventions.

Condition of the contract

- Deviation from the points stated in the ToR without the consent of the project will lead to from reduction of the consultancy fee to the termination of the contract.
- If the consultant will not be abide by the timeframe that is stated in the offer, the consultancy fee will be reduced by 5% by each of the extended week. However, the total entailed reduction should not exceed 25% of the agreed amount. If the consultant fail to submit the report for more than five weeks leads to the cancellation of the contract.
- The final report of the study should fulfill the expected quality with respect to the use of terminologies, readability, be inviting to read and easy to understand. Lack of these qualities entails 10% of loss from the agreed amount.

Mode of payment

- 30% upon signing of the contract
- 20% upon submission, presentation & approval of the inception report

- 20% upon submission of the draft report and presentation of the findings
- 30% upon submission and formal acceptance of the final report

Reporting

- Comment on TOR;
- Inception report that outlines the methodological approach to be applied;
- Draft report subjected to comments
- Final report (soft & hardcopy) that consists of the result of the baseline study, conclusions drawn and recommendations made for follow-up actions.

Time frame

The time frame for this study will be defined as per the proposal submitted by the consultant. The stated time frame shall be amended via a written mutual agreement if needed.

Confidentiality and Ownership

All information and documentation given to the service provider institution is strictly confidential and may be used only for the purposes of completing this assignment. All documentation and illustration material must be returned immediately on completion or termination of the assignment to AMES-C.