Verification Document for Eritrea Dissemination of Improved Stoves Program (EDISP) for Vintage 2003 Credits

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CONTENTS

Introduction

In this report we provide the CO_2 Verified Emissions Reduction (VER's) estimate for the Eritrean Dissemination of Improved Stove Program (EDISP) for two villages and an Internally Displaced Persons (IDP) camp. The background, purpose and justification for the EDISP project is provided in the project design document. The project design document also provides the description of the CO_2 emissions estimation methodology (we reprint an edited version of methodology from the project document in Appendix A). Since the project design document was written, the village interview form has been substantially modified, and is included as an appendix to this report.

The amount of VER's of vintage 2003/2004 for the 2 villages and IDP camp is estimated at more than 4902 tonnes with an average of 2.34 tonnes VER per stove. The VER per stove is lower than the 3 tonnes per stove estimated in the Project Document because the fraction of wood fuel used by households appears to be lower than the fra ction of wood fuel estimated at that time. Note that the VER estimate is very conservative, and it is likely that the carbon sequestration arising from stove projects in the villages visited exceed 7500 tonnes. See http://www.punchdown.org/rvb/mogogo/EDISPICRCEval200406.pdf for a detailed discussion and the results of a follow-up evaluation performed in June 2004.

VER Estimate

The Eritrean Department of Energy (EDOE) collected monitoring data for 2 villages and three IDP camps in the EDISP project in December 2003 and January 2004 in order to obtain VER's for these monitored villages. From December 26, 2003 to January 8, 2004, the VER verifyer, Robert Van Buskirk, Ph.D., visited Eritrea, reviewed, checked, and supervised the collection of more EDISP monitoring data, and produced the VER estimates for the two villages and one IDP camp monitored by EDOE as shown in Table 1:

Table 1: VER Estimates for Eritrean Villages and an IDP camp

Village/Camp	Stoves	VER/village (2003/4 tonnes)	VER/Stove (tonnes)
da`ero	105	115	0.85
hazega	105	71	0.68
`adi qexi	2000	4826	2.41
TOTAL	2210	4989	2.26

The VER's all have the vintage year of 2003/4 which is determined by the calendar year in which the improved stove is installed in the village household. The 2 villages and IDP camp were selected out of a total of over 50 villages and communities in the EDISP project based on the criteria of logistical convenience (for data collection) and how recent the stove installations were made. A fairly complete list of EDISP villages is provided in Appendix B.

VER Estimation Caveats and Issues

Any quantitative estimate of project impacts is subject to potentially substantial uncertainties. Reduction of errors and uncertainties to small levels often requires extensive data collection, research activities that can be quite expensive. Data collection, research and monitoring activities for the EDISP project were constrained to be less than to 15% of the value of the VER's or less than $4,000.

The VER estimates are made in a conservative and transparent mannter. The original village interview forms are available for inspection at EDOE's Energy Research and Training Center (ERTC) in Asmara; The transcribed data and VER estimation calculations are provided in a publically available spreadsheet (the spreadsheet, MogogoData20040331.xls, accompanies this report); Photo documentation of the verification visits is provided; and any interested party can visit the project villages with a translator and confirm the veracity of monitoring data through independent interviews and surveys.

There are many factors and uncertainties that can affect EDISP project greenhouse gas impacts. Different assumptions, approximations, and unaccounted -for factors may result in more, less, or unknown changes in project VER's. Fundamentally, the certainty of a VER estimate is a matter of judgement and risk evaluation.

Potential factors that may result in a lower VER estimate include:

1. Over-estimation of the total number of stoves in continuing use. (estimated at 90% of the accounted-for stove installations for the villages and 50% for the IDP camp communities).
2. Under-estimation of the water content of the measured fuel (assumed 15% by weight)
3. Over-estimation of the below-ground biomass (assumed 47% of utilized biomass).
4. Over-estimation of the average lifetime of unharvested biomass in the ecosys tem (assumed 1 year for dung, 3 years for kindling, and 9.4 years for wood).
5. Possibly the fraction of fuel that is wood is over -estimated

Factors that may result in a higher VER estimate include:

1. No accounting is made for the energy and fuel savings from cooking *qiCa* bread on the improved *moqolo* stove or sauce stove for villages with a combined stove. (The IDP camp has an improved mogogo only).
2. No accounting is made for non-CO_2 greenhouse gases.
3. Under-estimation of improved stove efficiency, below -ground biomass, or lifetime of unharvested dung and wood in the ecosystem.
4. No accounting made of soil fertility impacts from unburnt dung.
5. No accounting of positive leakage: i.e. households adopting im proved stoves outside the officiency project implementation.
6. The average fraction of fuel coming from wood may be underestimated.
7. Because wood is more expensive than dung, fuel savings and easier combustion may result in greater savings in wood than in du ng. Currently it is assumed that wood and dung fuel savings are proportional. And the savings is estimated from the improved stove fuel use measurements. Greater wood savings would result in a higher VER estimate.

Factors that may have a significant, but unknown impact on VER estimates:

1. Systematic reporting bias by households for stated fuel use and food production.
2. Errors in the estimated heat content of dung, wood and kindling.
3. Statistical cross correlations and skew in the variations in collected int erview data
4. Selection of equal-household weighting for computation of village consumption averages
5. Dependence of stove efficiency on the number of injera and *qiCa* cooked.

6. Variations in improved stove design (rocks vs. ceramic blocks, air control valve vs. no air control valve, etc)

On balance, given the various factors and their potential impact on the VER estimate, it is more likely that the VER estimate in this report is conservative: That is, the CO_2 emissions reductions estimate provided in this rep ort has a greater than 50% chance of being lower than the actual CO_2 emissions reductions provided by the stove project. In fact, in this study the IDP was visited several times, and one of the lower estimates of emissions reduction is used in this report.

Project Implementation and Monitoring

The implementation of the EDISP project is a collaborative activity of grassroots villages organizations, the local government institutions at the regional level, EDOE, and sometimes international organizations.

Village-level organizations such as the local women's committee provide the grassroots organization for community involvement and the day -to-day implementation of the improved stove project.

The local government administration discusses and communicates the project possibilities, requirements, and objectives with the local communities and manages the implementation of individual projects. It also balances the needs of different villages, setting quotas that set the amount of material distributed to different villages. The count of stoves in each village is determined by household project sign -up lists and the amount of material distributed to the different villages.

The Department of Energy of the State of Eritrea sets standards programs and procedures for project implementation and design, provides technical and design services for the communities and local governments, distributes non -local project materials and equipment to the local government administration when needed, and interacts with international funders and scientists.

Presently, the local government administration reports to the EDOE the number of stoves installed in each village project. In some villages the project implementer/organizer may be an NGO or the Ministry of Agriculture home economics office. To monitor project impacts, EDOE selected villages from the list of projects provided by the local government administration, and sent teams of interviewers to the individual villages. Interviewers contacted local project organizers and conducted 10 household interviews in each village equiped with scales and measuring tapes to measure stove dimensions, bread weight, and fuel use. The filled-in interview forms are then kept on file at the Energy Research and Training Center where they were later en tered into spreadsheets and used for carbon emissions reduction calculations. The results of the data entry and calculations are presented in and Excel spreadsheet accompanying this report

In contrast to established villages, IDP camps may be administered by international organizations like the International Committee of the Red Cross (ICRC). The ICRC provides general support for the IDP communities, while for stove projects EDOE provides technical support, training, monitoring, evaluation, and may provide some contribution of materials. In the case of `adi qexi the detailed monitoring and evaluation required for the carbon credit verification helped identify installation problems in the project. When these problems are corrected, this should help subtantia lly increase both fuel and carbon emissions savings beyond the significant savings documented in this report.

Specific Verification Activities

Specific verification activities consisted of reviewing the data from the village interviews, and visiting a relatively small subset of the more than one dozen villages and communties that had stove projects in 2003. The focus of the verification efforts was the largest stove project for the year which was in the `adi qexi IDP camp. The villages visited during the course of the verification activities from December 30, 2003 to January 6, 2004 included:

1. Visit to da`ero
2. Visit to hazega
3. Visit to `adi qexi

Data was also collected by ICRC staff for the metera and may wuray IDP camps. But with the limited available for verification activities, it was difficult to verify the quality of the data collecting during the ICRC interviews.

Visit to da`ero

A verification visit was made to da`ero on December 30, 2003. During the visit, the local women community organizer related that 60 of a total of 105 planned installations was completed. EDOE staff divided into two groups and conducted a total 10 interviews. Interview activity was photo-documented for houses #2, #3, #4, and #5, amongst others. It was found that the verified carbon credits per stove in this village were fairly small due to the very high prevalence of dung for fuel (which has a short lifetime in the ecosystem, so reduced dung harvesting does to result in much carbon sequestration). The houses in da`ero were often of traditional hidmo construction.

Visit to hazega

Hazega is a relatively small village with houses located on small hills surrounded by rocky farm land that is fallow during the dry season. A verification visit was made to hazega on December 30, 2003. During the visit, th e local women community organizer related that 35 of a total of 125 planned installations was completed. EDOE staff divided into two groups and conducted a total 10 interviews. Interview activity was photo - documented for houses #1, and #3 with improved mogogos and houses #2, and #4 with unimproved mogogos. It was found that the verified carbon credits per stove in this village were fairly small due to the very high prevalence of dung for fuel.

Visit to `adi qexi

Adi qexi is a sprawling internally displaced persons (IDP) camp consisting of thousands of families. The renewed conflict between Eritrea and Ethiopia that started in May 1998 has resulted in the displacement of tens of thousands of families from who were living in the border region. Thousands of these families are currently housed in IDP camps supported by the International Committee of the Red Cross. One of the largest such camps is `adi qexi.

The natural landscape near `adi qexi is grass savannah dotted by acacia trees that becomes rather denuded near the camp so that wood collection can take over 8 hours because of long travel times to the nearest wood sources. The vast majority of camp members buy fuel wood from wood sel lers who collect wood by the donkey load or camel load.

There were two rounds of interviews done in `adi qexi, one done by ICRC, and another done with a set of revised interview forms and more closely supervised by technical experts. The second, more careful round of interviews indicated subtantially smaller fuel savings than the earlier round of interviews, and revealed some stove installation problems. The key problem was that many of the grates where installed upside -down so that many of the holes were clogged with ash. This prevents air from flowing from underneath the fuel to increase combustion efficiency (one of the main advantages of the new design). But in spite of the problems, about half of the grates were installed correctly and free from clogging leading to substantial savings on average.

In the second round of interviews, a total of 23 households were interviewed with about half having the improved mogogo, and about half with the unimproved, traditional mogogo. Detailed demographic, cooking time, fuel consump tion, and fuel collection data were collected. In addition some data was collected on the incidents of cough. The fuel consumption was about 15% less for households that tried to install the improved stoves, but was about 50% less for a small restaurant th at likely installed the stove correctly and does not use kerosene to start the fire. Because the ICRC provides a free kerosene ration, nearly all households reported using kerosene to start the mogogo fire (a very uncommon activity in other areas). On aver age households with the improved mogogos reported about half as many family members with cough. The primary benefits of the stoves was reported to be both fuel economy and reduced smoke.

VER Calculations

The detailed VER calculations are presented in an E xcel spreadsheet (MogogoData20040331.xls). The spreadsheet contains a summary sheet that provides the list of villages and relevant data for each village including the number of stoves , the

VER's by vintage, average household sizes, bread cooking/consumption rates, stove types, and fuel use.

The survey data and VER calculations for each village are provided as individual spreadsheets that provide the data, average the survey data value s over the interviewed households, and then calculate the CO_2 emissions reductions based on the average survey values and the verified assumption that the improved stoves are about twice as efficient as the unimproved stoves. Details of the equations for c alculating VER's is provided in appendix A below.

Appendix A: VER Estimation Methodology

The VER estimation methodology is largely compliant with the methodology laid out in the EDISP project document. Some modifications have been made so that the VER estimate is easier to make given available data and resources. These modifications include:

1. VER's are calculated on a per-stove basis rather than from per-capita data since stoves rather than population is easier to count for the project area.
2. One of the local language fuel classifications is kindling which would consist of bark, wood chips, small sticks, and dried leaves. This fuel was assigned an average biological lifetime of 3 years.

The basic methodology for estimating CO_2 emissions arising from cook-stove use starts with a per-capita emissions estimate. This is because per-capita consumption is likely to be more consistent than per-household consumption due to variations in household size. For the project, emissions are estimated at the village level by first multiplying the per-capita emissions times the average number of people per stove to obtain the per -stove savings and then multiplying the per stove savings to time the number of stoves to obtain the emissions reductions from the stove improvement program in a village.

There is a substantial amount of uncertainty in the estimation of CO_2 emissions from cook-stove use. Because of this, the project will use possibly two methods for emissions estimates, based on two independent pieces of data that will be collected from village interviews. The first method estimates emissions from the starting point of per -capita food consumption. Then the factors that convert per -capita food consumption to energy, then to biomass, and then to CO_2 emissions. The second method estimates CO_2 emissions from the starting point of biomass fuel consumption. The advantage of the first method is that per-capita food consumption can be measured to greater accuracy than per -capita biomass consumption. The advantage of the second method is that fewer conversion factors are needed in order to estimate CO_2 emissions from the measured data.

Method #1: CO_2 Emissions Estimate from Food Consumption Measurement

The first method for estimating CO_2 emissions is described by the following equation:

$C0_2$/capita/FuelType = FracPerm * FuelFrac * InjC * EInj * 1/Eff * 1/EBio * BLife * 1/WetEff * (1+BGBio) * CCont

where:

- ***FracPerm*** = The fraction of the population that permanently convert to the new mogogo once they have converted their traditional stove to an improved stove.
- ***FuelFrac*** = The fraction of cooking energy obtained from a particular fuel type. The fuel energy is related to the fractional fuel mass by *FuelMass * EBio = FuelEnergy*.
- ***InjC*** = The average injera consumption per year per person in units of kilograms/year.
- ***EInj*** = The energy intensity of injera production with a 100% efficient stove in units of megajoules/kilograms.
- ***Eff*** = The efficiency of the injera stove in dimensionless units.
- ***EBio*** = The energy content of the dry biomass fuel in units of megajoules per kilogram.
- ***BLife*** = The average lifetime of biomass in the ecosystem in years defined in terms of biomass stocks that result from a change in harvest rate. It is the stock of biomass in the ecosystem that results from a unit decrease in the annual harvest rate.
- ***WetEff*** = The efficiency of burning wet biomass compared to burning dry biomass. This quantity is dimensionless.
- ***BGBio*** = The fraction of biomass that is below ground. It is as sumed that as above ground wood biomass is removed that a corresponding amount of below ground biomass is indirectly removed from stocks through decay of roots and loss of soil carbon. This quantity is dimensionless.
- ***CCont*** = The CO_2 content of biomass fuel in units of kg CO_2/kg Biomass.

In this equation, the injera consumption per capita, *InjC*, and the fuel fraction, *FuelFrac*, are estimated from surveys in the project area. The energy intensity of injera production, *EInj*, is obtained from laboratory exper iments and studies, that estimate energy intensity as a function of the final injera thickness or density. The Eritrean Department of Energy may use an average injera energy intensity, if this is not seen to vary substantially between households and villag es.

The efficiency of the cook -stove is a function of cook -stove type and features. With regards to firebox construction there are four types of cook -stoves:

1. A traditional unimproved mogogo
2. An improved mogogo made with stones and sand
3. An improved mogogo made with ceramic blocks and sand
4. An improved mogogo made with ceramic blocks, and ash insulation

In addition, improved stoves may include only the mogogo, or they may include an integrated design of three stoves that includes a mogogo (for cooking *taita* or *injera*), a moqolo (for cooking *qiCa*), and a smaller in-build stove for cooking sauces.

Other features of the stoves may include whether or not the stove has a chimney (almost all improved stoves do), and whether the chimney has a control valve.

The efficiency of the different types of stoves (Eff) are performed using a combination of laboratory and field tests. Average values of efficiency are used that correspond to an average length of cooking session that produces between 15 to 20 injera.

The variables *EBio*, *WetEff*, *BGBio*, and *CCont* are derived from references in the international literature, as is the value of *BLife* for wood. An estimate of the value of *EBio* for dung is provided in an appendix of this report.

The total CO_2 emissions are estimated as the sum of the per-capita CO_2 emissions for each fuel type times the population.

Table A-1: Emissions Estimation Parameters for Method #1

Parameter	**Low**	**Medium**	**High**	**Selected**	**Source**
FracPerm	80%	90%	100%	90%	Estimated
FuelFrac Dung Wood	 100% 0%	 60% 40%	 0% 100%	 60% 40%	 2001 Study
InjC	70 kg/year	130 kg/year	180 kg/year	130 kg/year	2001 Study
EInj	0.8 MJ/kg	1.4 MJ/kg	2.0 MJ/kg	1.4 MJ/kg	1996 Study
Eff Old Field Old Lab New A New B New C		 7% 10% 18% 23% 26%		 10% Base 20% Project	 Field Measurement 1998 Study 1998 Measurement Estimated 2000 Measurement
EBio Dung Wood		 12.0 MJ/kg 16.6 MJ/kg		 12.0 MJ/kg 16.6 MJ/kg	 IPCC 1996 IPCC 1996
BLife Dung Wood	 5.0 years	 1.0 years 9.4 years	 13.7 years	 1.0 years 9.4 years	 Estimated IPCC 1996
WetEff	70%	90%	100%	100%	Estmated
BGBio	0.23	0.47	0.85	0.47	IPCC 1996
CCont	1.6	1.8	2.1	1.8	IPCC 1996[2]

[2]Page 5.31 of *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual*. Carbon content of biomass is stated as 0.43 - 0.58 kg C/kg Biomass while CO_2 equivalent of carbon is 3.67 kg CO_2/kg C

Method #2: CO_2 Emissions Estimate from Biomass Consumption Measurement

The second method for estimating CO_2 emissions is described by the following equation:

$$C0_2/capita/FuelType = FracPerm * Biomass * (1 - WCont) * BLife * (1+BGBio) * CCont$$

where:

- ***FracPerm*** = The fraction of the population that permanently convert to the new mogogo once they have converted their traditional stove to an improved stove.
- ***Biomass*** = The annual biomass consumption of a particular fuel type per capita measured by village survey in kilograms per year.
- ***WCont*** = The fractional water content of biomass fuel. This quantity is dimensionless.
- ***BLife*** = The average lifetime of biomass in the ecosystem in years defined in terms of biomass stocks that result in a change in harvest rate. It is t he stock of biomass in the ecosystem that results from a unit decrease in the annual harvest rate.
- ***BGBio*** = The fraction of biomass that is below ground. It is assumed that as above ground wood biomass is removed that a corresponding amount of below ground biomass is indirectly removed from stocks through decay of roots and loss of soil carbon. This quantity is dimensionless.
- ***CCont*** = The CO_2 content of biomass fuel in units of kg CO_2/kg Biomass.

In this equation, the biomass consumption per capita, *Biomass*, for a particular fuel type are estimated from surveys in the project area. Ideally such surveys would be conducted both before and after the improved stove project is implemented. If this is not possible then the biomass consumption for one case will be estimated from the biomass consumption from the other case with the following formula:

$$Biomass_1 = Biomass_2 * Eff_2/Eff_1$$

The efficiency of the cook-stove is a function of cook-stove type and stove features as described above in the first emissions estimation method.

The variables *WCont*, *BGBio*, and *CCont* are derived from references in the international literature, as is the value of *BLife* for wood. An estimate of the value of *BLife* for dung is provided in an appendix of this report.

The total CO_2 emissions are estimated as the sum of the per-capita CO_2 emissions for each fuel type times the population.

Table A-2: Emissions Estimation Parameters for Method #2

Parameter	Low	Medium	High	Selected	Source
FracPerm	80%	90%	100%	90%	Estimated
Biomass Dung Wood		To Be Measured			
WCont	20%	10%	0%	15%	Estimated
BLife Dung Wood	5.0 years	1.0 years 9.4 years	13.7 years	1.0 years 9.4 years	Estimated IPCC 1996
BGBio	0.23	0.47	0.85	0.47	IPCC 1996
CCont	1.6	1.8	2.1	1.8	IPCC 1996

Preliminary Estimate of Baseline Emissions

A preliminary estimate of baseline emissions is provided here using data from the above tables and data received from a recent project test survey `adi nefas. The first estimate is obtained using the first method based on per-capita injera consumption:

$$C0_2\text{/capita/Dung} = 90\% * 60\% * 130 \text{ kg Inj/year/cap} * 1.4 \text{ MJ/kg Ing} * 1/10\% * 1/(12.0 \text{ MJ/kg Biomass}) * 1 \text{ year} * 1/100\% * (1+0.47) * 1.8 \text{ kg } CO_2\text{/kg Biomass} = 217 \text{ kg } CO_2\text{/capita/Dung}$$

$$C0_2\text{/capita/Wood} = 90\% * 40\% * 130 \text{ kg Inj/year/cap} * 1.4 \text{ MJ/kg Ing} * 1/10\% * 1/(16.6 \text{ MJ/kg Biomass}) * 9.4 \text{ years} * 1/100\% * (1+0.47) * 1.8 \text{ kg } CO_2\text{/kg Biomass} = 982 \text{ kg } CO_2\text{/capita/Wood}$$

This calculation yeilds a baseline estimate of per-capita CO_2 emissions from injera cooking as 1199 kg/capita.

Using the second method which is based on surveys of fuel use, we obtain the following estimate of per-capita CO_2 emissions:

$$C0_2\text{/capita/Dung} = 90\% * 132 \text{ kg Dung/year/cap} * (1-15\%) \; 1 \text{ year} * 1/100\% * (1+0.47) * 1.8 \text{ kg } CO_2\text{/kg Biomass} = 267 \text{ kg } CO_2\text{/capita/Dung}$$

$$C0_2\text{/capita/Wood} = 90\% * 58 \text{ kg Wood/year/cap} * (1-15\%) \; 9.4 \text{ years} * 1/100\% * (1+0.47) * 1.8 \text{ kg } CO_2\text{/kg Biomass} = 1103 \text{ kg } CO_2\text{/capita/Wood}$$

This calculation using the second method yeilds a baseline estimate of per -capita CO_2 emissions from injera cooking as 1370 kg/capita.

The two methods yield quite similar results with the second method providing a slightly higher estimate than the first.

In the VER calculations, it is generally assumed that the unimproved stoves use about twice the amount of fuel as the improved stoves. The per -capita fuel consumption is then multiplied by the average number of people in the household to estimate the per -stove VER's provided in Table 1 of this report. The values of VER per stove vary from about 1 tonnes to over 4 tonnes per stove, largely due to changes in the types of fuel used by households.

Estimation of *BLife* Parameter for Wood

A key parameter in the estimate of CO_2 emissions impacts from reduced biomass fuel consumption is BLife, the ratio of the annual consumption rate to the biomass stocks. The unit of this parameter is years. In this appendix, we estimate this parameter using data from Volume 3 of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: the Greenhouse Gas Inventory Reference Manual.

In section 5 of the Greenhouse Gas Inventory Reference Manual on Land -Use Change & Forestry, estimates of annual average aboveground bi omass update by natural regeneration are provided in table 5-2. We select for Eritrea, the dry forest regeneration rate for Africa for the first 20 years of regeneration as the figure that is most relevant to Eritrea biomass harvesting. The dry-forest regeneration rate is 4.0 tonnes/ha.

In table 5-4, total aboveground biomass is provided for different forest types for different African countries. We select as most relevant to Eritrea, the dry forest type which is estimated to have average aboveground biomass of 20-55 tonnes/ha. We select the median value of 37.5 tonnes/ha for Eritrea. This provides an estimate for BLife of 37.5/4.0 = 9.4 years.

Appendix B: Table of EDISP Villages

Below we provide a fairly complete list of a ll EDISP villages with the approximate actual or planned beginning and endi dates of the project in each village, the number of stoves installed (or planned) and the VER's estimated for the village when available.

Table 2: List of Total EDISP Villages

Village Name	Begin Date	End Date	Stoves Installed	Stoves Planned	VERs	Notes
damba (phase 1)	10/1999	12/1999	381		762	
damba (phase 2)	12/2001	11/2002	70		144	
Se`Ida krstyan	12/1999	12/2002	460		505	

`adi gerd	1/2002	6/2001	100		
temajila	1/2002	6/2001	100		
Halibmentel	1/2002	6/2001	200		
`adi qexi barka	1/2002	6/2001	60		
serejeQa kebabi	1/2002	6/2001	56		
weki dba	1/2002	6/2001	328		
tKul	3/2001	4/2003	209		
wuTuH	1/2001	6/2001	131		
maylbus	4/2001	6/2002	170		
`adi tekelEzan	6/2001	12/2002	150		
quxet	8/2001	9/2002			
`adi xmagle	6/2001	9/2002	30		
`adi habslus	6/2001	9/2002	45		
Se`azega (phase 1)	3/2001	6/2002	200		
`adi wegri	7/2001	9/2002	60		
`adi Hare	7/2001	9/2002	65		
meQerka & libon	4/2001	6/2002	200		
af`abet	6/2001	6/2002	200		
`adi gulti	9/2001	5/2003	150		
xeKa iyamo	9/2001	2/2003	260		
ksad`iqa	10/2001	5/2003		200	
weQerti & `adi zamr & zban'angeb	7/2001	5/2002	605		900
Imbaderho	2/2002	12/2002	375		1757
beleza	2/2002	1/2003	65		188
mdrzEn	12/2002	2/2003	60		134
`adi nefas	7/2001	6/2002	554		2089
`adi abeyto	10/2002	1/2003	55		116
`adi segudo	2/2001	2/2001	81		152
bEt gergix	1/2002	12/2002	1		
gezabanda Habexa	1/2002	12/2002	1		
sela`I da`Iro	1/2002	5/2002	100		156
`adi gembelo	1/2002	12/2002	170		239
`adizemat	10/2002	1/2003	60		105
`adi Senaf	1/2002	12/2002			

da`Iro Pawlos	1/2002	12/2002			
`ameSi	1/2002	12/2002	250		
`adi musa	1/2002	10/2002	100		105
xnjbluQ	1/2002	3/2002	100		150
`adi gebru	1/2002	12/2002	88		
`adi teKlay	1/2002	12/2002	92		
Se`azega (phase 2)	1/2002	12/2002	200		
quxet (phase 2)	12/2001	1/2002	150		187
weki dba (phase 2)	1/2002	12/2002	150		140
`Inagudo	1/2002	12/2002	26		
`adi xmagle (phase 2)	1/2002	12/2002	36		
`adi qexi IDP (phase 1)	1/2003	12/2003	2000		4826
may wuray IDP	1/2003	12/2003	300		
metera IDP	1/2003	12/2003	300		
afame	1/2003	12/2003	20	180	
Se`Ida krstyan (phase 2)	1/2003	12/2003	100		
Imbaderho (phase 2)	1/2003	12/2003	100		
ademSemat	1/2003	12/2003	70		
aSenaf	1/2003	12/2003	200		
ma`Ireba	1/2003	12/2003	350		
Hadix `adi	1/2003	12/2003	150		
hazega	1/2003	12/2003	35	89	24
daro	1/2003	12/2003	60	45	52
adilgas	1/2003	12/2003	420	180	
zegeb	1/2004	12/2004		200	
`adi Hawexa	1/2004	12/2004		200	
`adi ke	1/2004	12/2004		90	
merhano	1/2004	12/2004		150	
`adi riassi	1/2004	12/2004		150	
adem neger	1/2004	12/2004		150	
`adi gWadad	1/2004	12/2004		200	
mealde	1/2004	12/2004		221	
haxuxay	1/2004	12/2004		189	
ederba	1/2004	12/2004		219	
`adi fekay	1/2004	12/2004		162	

hadamu	1/2004	12/2004		230	
sheab	1/2004	12/2004		176	
wasdenba	1/2004	12/2004		215	
shebek	1/2004	12/2004		195	
fekiyabrot	1/2004	12/2004		188	
`adi zemat	1/2004	12/2004		196	
`adi array	1/2004	12/2004		187	
senafe IDP	1/2004	12/2004		700	
`adi qexi IDP (phase 2)	1/2004	12/2004		3000	
koitobie	1/2004	12/2004		2000	
korohom	1/2004	12/2004		2000	
ECD Gash-Barka	1/2004	12/2004		100	
ECD Anseba	1/2004	12/2004		310	
ECD Debub	1/2004	12/2004		500	
ECD South Red Sea	1/2004	12/2004		296	
ECD North Red Sea	1/2004	12/2004		478	
PROGRAM TOTAL	1/1999	12/2004	11,049	13,396	12,731

Appendix C: Carbon Credit Verification Data Collection, Village Interview Form:

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        HOUSEHOLD INTERVIEW FORM FOR
        CARBON CREDIT VERIFICATION
        JANUARY, 2003

Date: ____________________

Interviewer Initials: _______________

Village or location     ___________________

Family name             ___________________

Number of persons in the family:
        number of adult males   _______,
        number of adult females _______,
        number of boys under 16 _______,
        number of girls under 16 _______,


How many people have had a cold or a cough in the last two weeks?
        number of adult males   _______,
        number of adult females _______,
```

number of boys under 16 _______,
number of girls under 16 _______,

Which types of stoves do you use?
1. Traditional Mogogo ( )   Improved Mogogo ( )   No Mogogo ( )
2. Traditional Mokulo ( )   Improved Mokulo ( )   No Mokulo ( )

Do you have a second mogogo? Yes ( )   No ( )

If yes, what type is the second mogogo?
Traditional ( )   Electric ( )   LPG ( )   Improved ( )

1. For cooking taita:

How many times do you cook taita in a week? ________ times/week

If you have both traditional and improved mogogo, how often do you use each type?
_________times/week for improved mogogo
_________times/week for traditional mogogo

How many taita do you cook per session? ________

Do you cook Kicha when you cook taita? Yes ( ) No ( ) If yes, how many? ______

How long does it take to cook taita (and Kicha)? ______hrs

How much of each kind of fuel do you use?
(if there are both types of mogogo, put amounts for traditional mogogo in parentheses)

________kg wood, ________kg sticks, ________kg Kindling (gifgaf encheyti),

________kg Dung Patties (Kubo), _________kg Loose Dung (gifgaf Kubo)

________kg other types: grass( ) sawdust( ) agricultural residue( )

Do you add kerosene to start the fire? Yes ( )   No ( )

How much charcoal is left after cooking taita? _________kg dry charcoal

2. For cooking kicha separately from taita:

How often do you cook kicha separately from taita? ________ times/week

How many kicha do you cook per session? ____________

How long does it take to cook kicha? ________hrs

Do you use the mogogo or the mokulo? Mogogo ( ) Mokulo ( )

How much of each kind of fuel do you use?

________kg wood, ________kg sticks, ________kg Kindling (gifgaf encheyti),

________kg Dung Patties (Kubo), _________kg Loose Dung (gifgaf Kubo)

________kg other types: grass ( ) sawdust( ) agricultural residue ( )

Do you add kerosene to start the fire? Yes ( ) No ( )

How much charcoal is left after cooking kicha? _________kg dry charcoal

3. Diameter and weight of taita and kicha:

What is the diameter and weight of taita?

diameter of taita:________cm, weight:_________kg

diameter of mogogo plate:________cm

What is the diameter and weight of the kicha?

diameter:________cm, weight:_________kg

diameter of mokulo plate:________cm

3. For Improved Stoves (Mogogo and Mokulo)

Date of construction ________________

Is the firebox built with stones or ceramic blocks?

Flat Stones ( ) Ceramic Blocks ( )

What fills the space inside the stones or blocks?

Ash ( ) Sand ( ) Air/Nothing ( ) Gravel ( )

Are the fire grate holes clear and open, or clogged with ash?
Open/Clear Holes ( ) Clogged with Ash ( )

Is there a chimney? Yes ( ) No ( )

Is there an air control valve for the chimney? Yes ( ) No ( )

What are the 3 principal benefits of using the improved stove?

1) ____

2) ____

3) ____

What are the 3 principal problems of using the improved stove?

1) ____

2) ____

3) ____

When you move next (change your house or return to your village) will you carry the new mogogo parts (grate and chimney) to your new house?

Yes ( ) No ( ) Comment ____

4. General questions

Who participates in cooking in your family? ________

Who buys or collects the fuel for cooking? ________

Do you collect or buy the fuel for cooking taita? Collect ( ) Buy ( )

If you buy, how much do you pay for fuel? _________ Nkfa per ________ (amount)

If you collect:

How many times a week do you collect fuel? ________ times/week

How long does it take you to collect fuel? _______ hrs/round trip

Comment____

End of interview