

**Ministry of Mines and Energy
Ethiopian Rural Energy Development and Promotion Center**



Clean Cook Stove
(Top)
Partial View of
Kebritayah Camp
(Right)



**Impact Evaluation of the Use of Ethanol with the CleanCook Stove in
the Kebribeyah Refugee Camp**

Lead Evaluator: Ephrem Hassen
Economics Studies and Popularization Department Head
Ethiopian Rural Energy Development and Promotion Center, Addis Ababa

October, 2006

Table of Contents

List of Figures.....	iii
1. Introduction and Background.....	1
2. Objectives of the study.....	2
3. Study Methodology.....	3
4. Household Composition by Age Group and Sex.....	3
5. Fuels used for Cooking and Baking Purposes.....	6
6. Stove Types in use by Camp Residents.....	7
7. Responsibility for Fuel Acquisition.....	8
8. Collection Time and Assumed Spending on Firewood.....	9
9. Risks Related to Fuel Acquisition.....	9
10. Advantages of Ethanol and the CleanCook Stove.....	10
11. Impact of the Ethanol and CleanCook Stove on Indoor Environment and Health.	11
12. Technical Concerns with Ethanol and the CleanCook Stove.....	14
13. Potential for an Ethanol Market.....	15
14. Comment by Focus Groups.....	16
14.1. General Situation with Firewood Collection.....	16
14.2. Comments on Ethanol Supply.....	17
14.3. Comments on Distribution of Ethanol.....	18
15. Conclusion and Recommendations.....	18
Appendix 1: EREDPC Field Questionnaire on Ethanol Use	20
Appendix 2: Data on Fuel Gathering, etc. – over 10 Households	22

List of Figures

Figure 1: Household Composition by Age Group and Sex.....	4
Figure 2: Sex Distribution by Age Group in the Study Households.....	4
Figure 3: Household Size by Age Group.....	5
Figure 4: Frequency of Ethanol Use with CleanCook in a Day.....	7
Figure 5: Fuel Collection Distance and Collection Responsibility in a Household.....	8
Figure 6: Time Required for Fuel Acquisition for Camp Residents.....	9
Figure 7: Risks related to Fuel Acquisition for Camp Residents.....	10
Figure 8: Advantages of Using Ethanol with the CleanCook Stove.....	11
Figure 9: Impact of Using Ethanol with CleanCook Stove.....	12
Figure 10: Health Impact of Traditional Fuels.....	12
Figure 11: Comparative Advantage of Ethanol Use with Firewood.....	14
Figure 12: Reasons for Appreciating Use of CleanCook.....	15

1. Introduction and Background

1. According to information from Camp administrators, the Kebribeyah Camp was established in 1991 and holds more than 16,000 Somali refugees representing various clans. The Kebribeyah camp is situated about 52Km south east of the Jijiga town. The refugees get assistance by the WFP, mainly food items and most other amenities by the UNHCR. Project Gaia, which is designed to promote clean energy (at present ethanol with its stove) to the vast majority where there is a shortage of firewood, supplied 300 Clean Cook stoves with ethanol in collaboration with the UNHCR for refugees in the camp. A further 300 stoves are due to arrive at the camp by the end of 2006. The project has arranged a storage facility in the Camp and secured about 300,000 liters of Ethanol from Finchaa Sugar Factory for further supply of ethanol to the camp residents.

2. The Project also intends to widen the distribution coverage to other locations where household cooking fuels are in scarce supply and the vegetation coverage is thinly dispersed. Therefore, this study would be one important source of information to give clue whether to continue wide-scale distribution of ethanol and the CleanCook stove which at present is not commercially available, but which could have a huge potential to meet the demand for cooking.

3. The project requested the Ethiopian Rural Energy Development and Promotion Center to study the impact of stoves that are already distributed to camp residents and the ethanol fuel. It is desirable to know the impact of the stove and fuel on the social and economic life of these refugees. With this intent, a team of two experts from the EREDPC socio-economics department conducted a two-day household fuel consumption and stoves use survey. This survey was conducted from 09 June to 10 June 1998 (Ethiopian calendar) in the camp on 40 selected households, which are already using ethanol with the CleanCook stove.

4. The results of this survey are outlined in the following sections. In Section One, responsibility and mode of fuel acquisition in the camp household and distance traveled in search of the fuels are discussed. Acquisition time and assumed spending for firewood, risks related with fuel acquisition, advantages of ethanol and use of the CleanCook are discussed in Sections Two and Three respectively. Opinion on supply of the stove and the ethanol in the market, especially in the demand side and technical issues related with use of ethanol with CleanCook are touched on in sections Four and Five respectively. Household composition by age group and sex, fuel type used for cooking and baking, stove types in use by the camp residents, impact of the ethanol with the CleanCook on indoor environment and health, are presented in brief. Finally, comments by focus groups are highlighted and the report ends up with conclusive remarks and few recommendations.

2. Objectives of the study

5. The major objective of this study is to ascertain that provision of ethanol and the stove (CleanCook) helped to solve basic social, economic and indoor environmental quality issues of households in the Kebribeyah camp.

6. Specifically :

- To check whether energy is basic issue for the households
- Review contribution of CleanCook with ethanol to solving household energy problems

3. Study Methodology

7. This study was undertaken by taking sample households in the Camp which used ethanol with the CleanCook. This means the sampling frame of this study was all the three hundred households with the ethanol and the stove. The list of these households was obtained from camp representatives. The sample size which the study team assumed for the assessment was 40 households. The sampling unit comprises of each household using the stove. The sample households were selected using the lottery method (simple random sampling) giving equal chance of inclusion for the households in the frame.

8. Then data was collected using a three-page questionnaire prepared for this purpose (Appendix 1). Four enumerators were selected who could properly understand the questionnaire and communicate to the respondents to ensure reliability of data collection. Further, the experts from the EREDPC held a focus group discussion with selected women from these households to further cross check the responses from the questionnaire, and to understand the level of their awareness about the importance of the technology.

9. Data analysis was made using MS Excel worksheet and the values used to describe the population characteristics are mostly averages and proportions.

4. Household composition by age group and sex

10. In the Kebribeyah camp most of the household management responsibility is handled by the women. This includes construction of residential houses, fuel acquisition and other socio-economic activities. The number of women compared to men is variable from place to place and even within the Kebribeyah camp from one age class to another. For instance, according to data obtained in the camp, the ratio of female to male in a household is high in the age class 0-16.

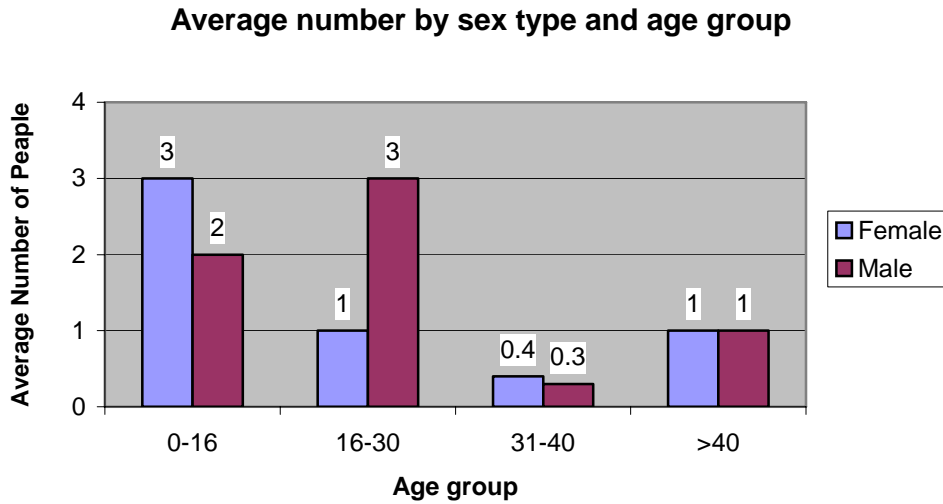


Figure 1: Household Composition by sex and age group

11. In the 16 to 30 age group, the ratio is reversed and the disparity is slightly higher. In the 31 to 40 age group, the case is again reversed. There is a high level of work pressure for this age group. Since the number of women compared to men is less and also due to family customs and traditions in the region, women’s mobility into the camp might be higher compared to men at adult age (30-40) and this could be the reason that more women of this age group are found in the camp.

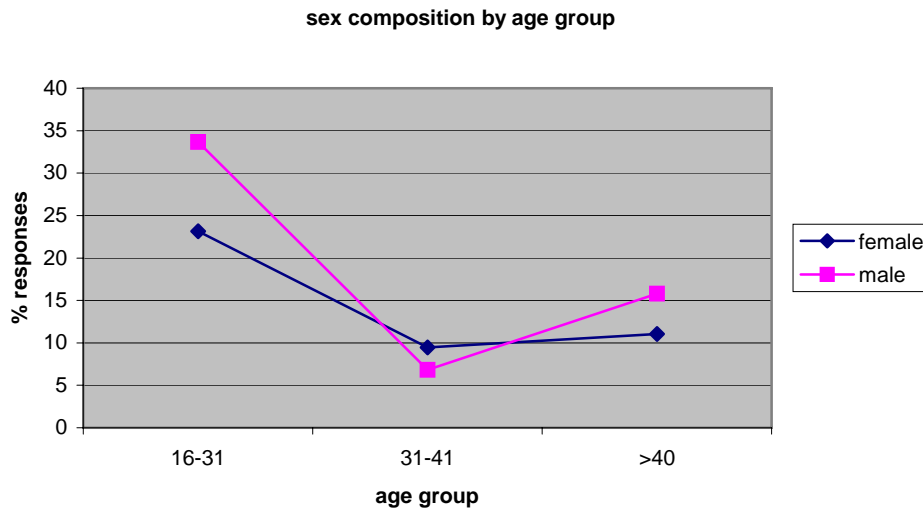


Figure 2: Sex Distribution by Age group in the Study Households

12. In most of the households considered in this study, age composition patterns are consistent. Age class 31-40 most often has two members in the family (56%). Age class >40 has 2 members in the family less often but still 51% of the time. About 36% of the studied households have 2 people in the age class 16-30 in the household and 17% of them have 4 persons with the same age category.

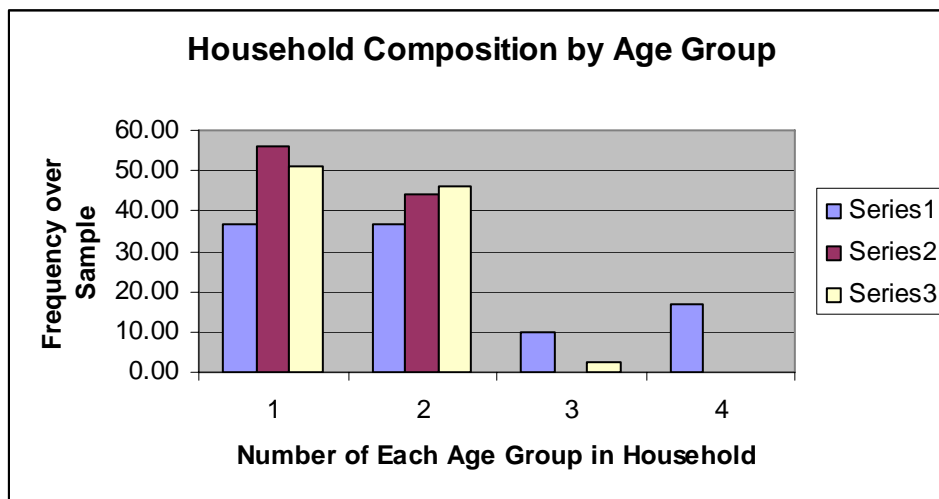


Figure 3: Household composition by Age Group over Sample

13. Family composition is more inclined to the age greater than 30 years old. Since there is no visible income generation activity in the camp, those people who are active are not involved in any productive activity. There are more dependants than active members in the camp, most probably the greatest proportion being males. As an indication, most of fuel collection/acquisition including other socio-economic responsibility lies on women.

5. Fuels used for cooking and baking purposes

14. According to the results of the survey, all of the households use firewood for both cooking and baking. Only 5% of the households mentioned that they use charcoal for cooking. Otherwise, the most frequent fuel used for cooking is firewood. In a few cases, charcoal is mentioned as being used for baking (2%). Probably this might be due to the very small diameter (not more than 10cm) of the Injera baked by the Somali refugees. According to the study, they don't have access to substitute fuels during times when firewood is unavailable.

15. On average, each household uses approximately 2012.4kg of fire wood for cooking and 1677kg for baking in a year. Comparatively, cooking consumes more wood than baking. This might be attributed to the high frequency of cooking and family size per household.

**Weighing bundles of
wood with hanging
scale before use for
cooking**



6. Stove types in use by the camp residents

16. The most frequently used household stove in the Kebribeyah refugee camp is the three stone or traditional open-fire. Only 7% of the households mentioned that they use charcoal stove.

17. The Gaia Association introduced the CleanCook stove to the camp free of charge. Less than 15% of all of the camp residents are currently using this stove for cooking. Gaia is planning to make stoves available to all camp families over time.

18. The frequency of cooking with the CleanCook stove is divided into three categories. Seven percent of the respondents cook once a day. Seventy three percent of respondents cook three times a day on the CleanCook Stove. The remaining 20% of the camp households cook twice a day with the Clean Cook.

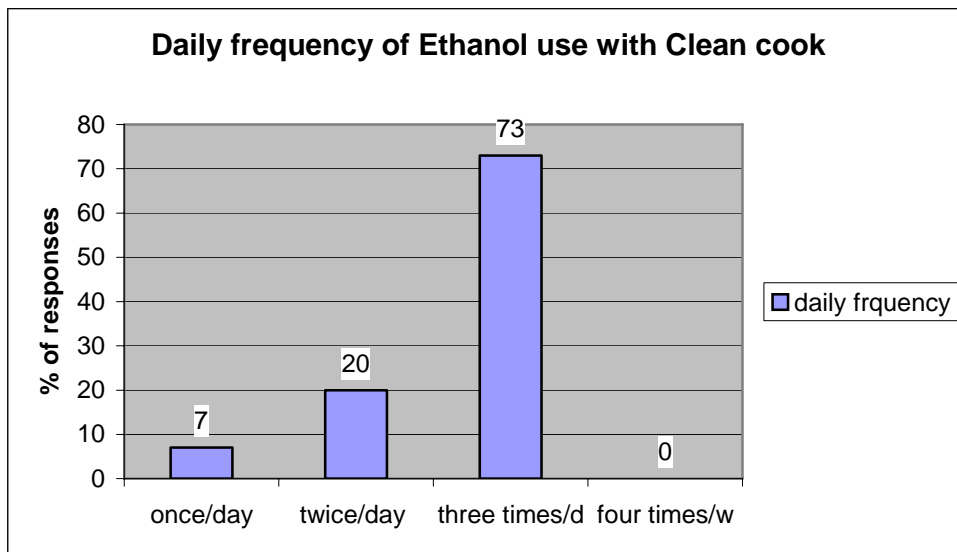


Figure 4: Frequency of Ethanol Use with CleanCook in a Day

7. Responsibility in fuel acquisition and distance

19. Fuel, mainly firewood, is obtained by women a great distance from the camp where the greatest share of their time is used for collection. It is predominantly women who are responsible for firewood collection. In some cases girls are also involved in collection. Surprisingly the responsibility lies on females only. On average they travel 8kms in search of firewood. The maximum distance they travel is generally about 15km.

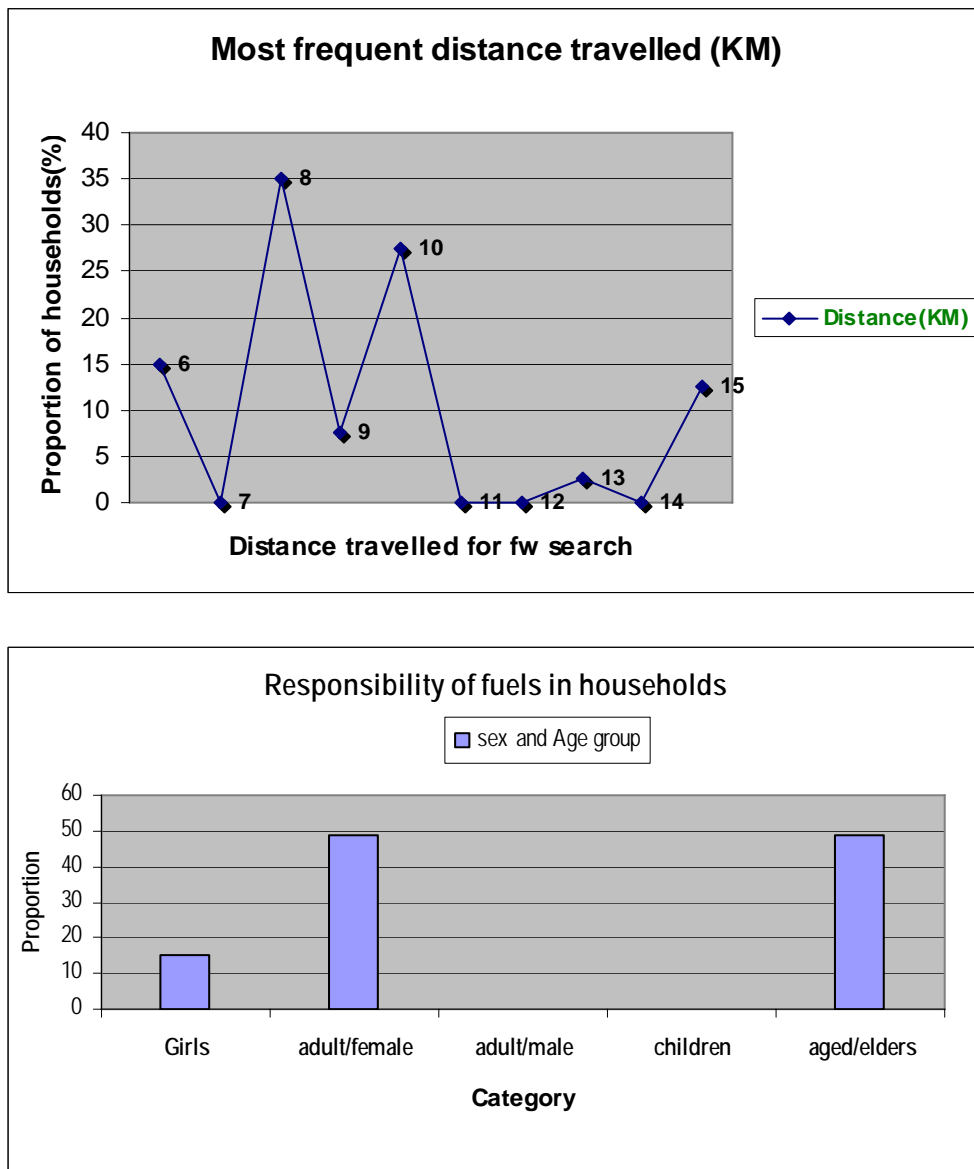


Figure 5: Fuel Collection Distance and Collection responsibility in a household

8. Collection time and assumed spending on firewood

20. Out of the total number of fuel gatherers interviewed, 85% said that firewood collection takes the greatest share of their time. Taking into consideration the locations that are referred to during interview, travel time is also significant and is 2.6 hrs per trip or more. For pregnant woman and little girls, traveling such a distance and carrying a heavy bundle of about 26kg of solid wood is unsafe. The average expenditure in a household for firewood in cases where firewood is purchased would be around 10 ETB per week. In few cases it goes as high as 20 ETB.

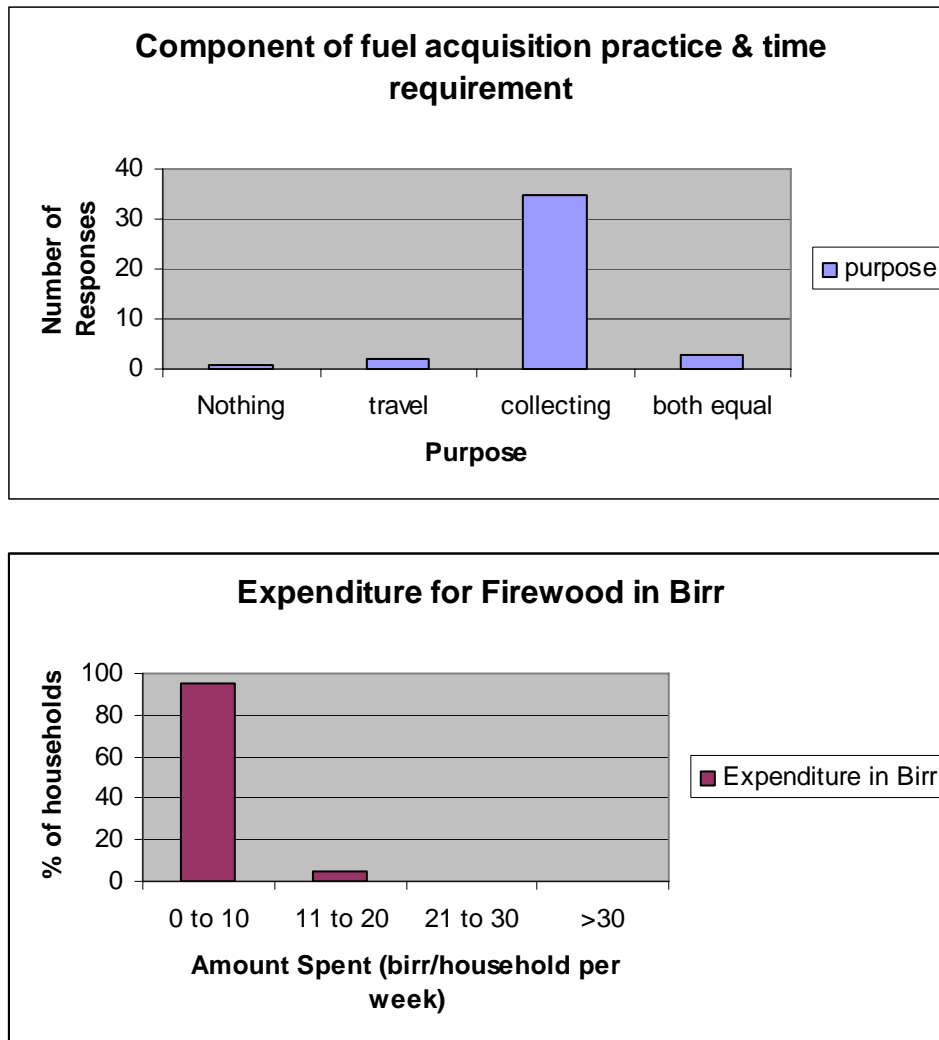


Figure 6: Time required for fuel acquisition and likely expenditure if purchased

The actual collecting fuelwood takes the greatest share of the fuelwood gatherers' time since they need to search for the wood or even cut wood in the location where collection takes place. This shows that fuelwood gathering is labour intensive, as well as time consuming.

9. Risks related with fuel acquisition

21. The camp residents have to travel for fire wood collection to the surrounding forests where they face all sorts of risks. They encounter wild animals/beasts (78%), they could even be raped (37%), and could come across burglars (56%).

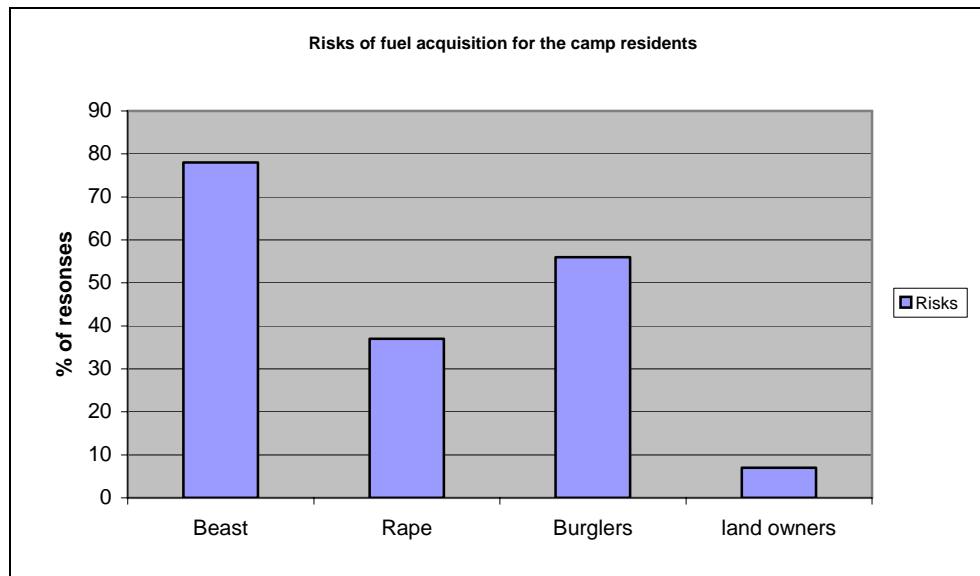


Figure 7: Risks related with fuel acquisition for the camp residents

They face other accidents like cutting their feet or any other parts of their body while collecting firewood. During the interview, the study team observed a scar on the foot of a 45-year old woman. Some times land owners at the fire wood collection place confiscate the collected wood from these women and send them away empty handed.

10. Advantages of Ethanol and use of clean cook

22. The camp residents are very well aware of the importance of ethanol for their economy, social life and environment. If ethanol is introduced, they report that they will have more time available for productive activities, mainly education (71%). They would have healthy in-door environment (76%), tree cutting will be minimized (93%), households, mainly women, would benefit from a clean kitchen (83%), the risks which occur to women due to searching for fuels would be minimized (93%).

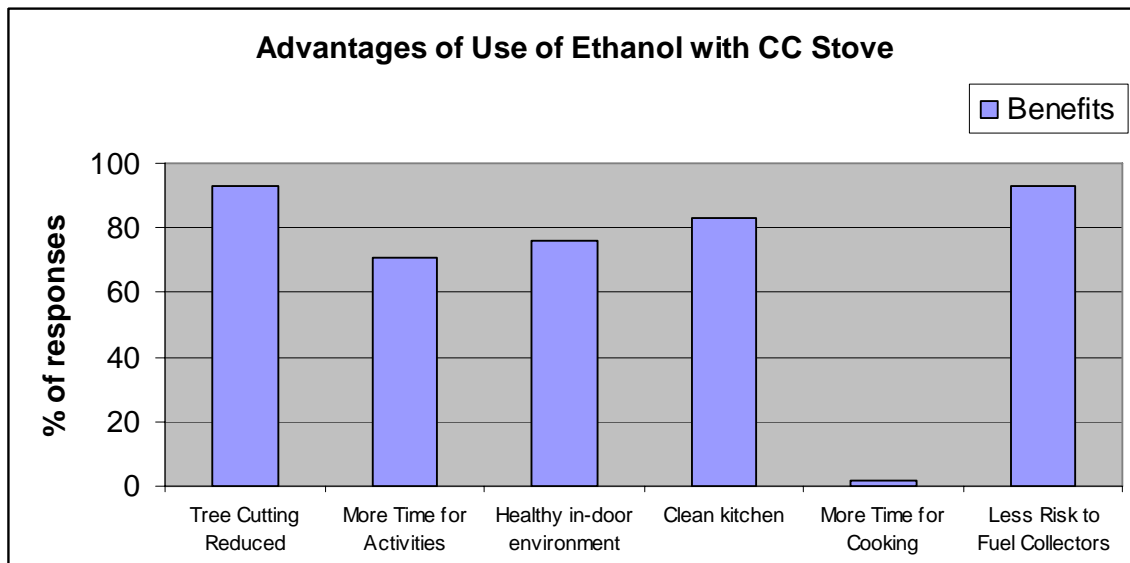


Figure 8: Advantages of using Ethanol with Clean Cook

11. Impact of the Ethanol with clean cook on indoor environment and Health

23. The residents commented that there is significant difference on the indoor environment when using CleanCook compared to other stoves. The three most important observations are highlighted by the respondents. 76% of the users appreciated that they got relief from smoke. Almost all (95%) mentioned that they don't sense any smell while cooking with ethanol. Also 85% of the users commented that the storage for ethanol is compact compared to firewood.

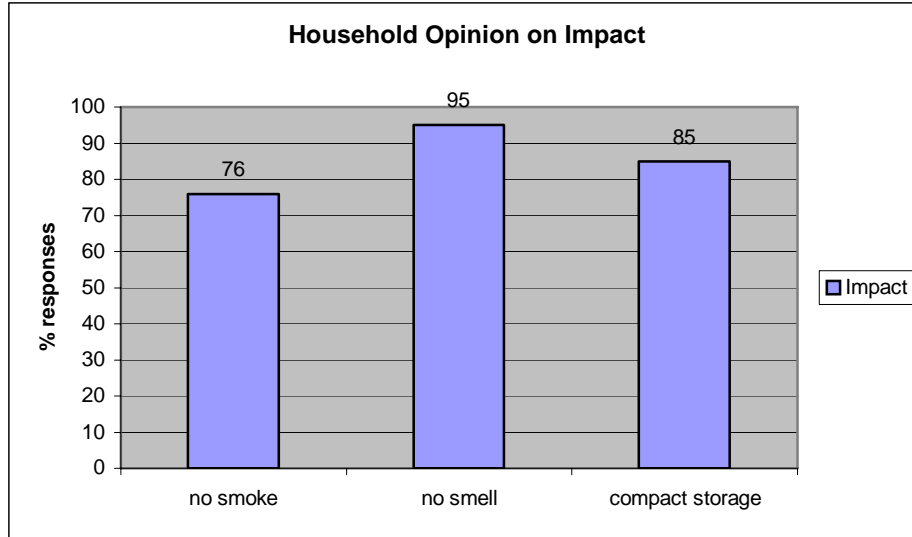


Figure 9: Impact of Using Ethanol with CleanCook

24. Previously they used to suffer different illnesses related with use of firewood. Out of the surveyed households 98% mentioned that they had eye irritation, 93% coughing and 85% headache while using firewood.

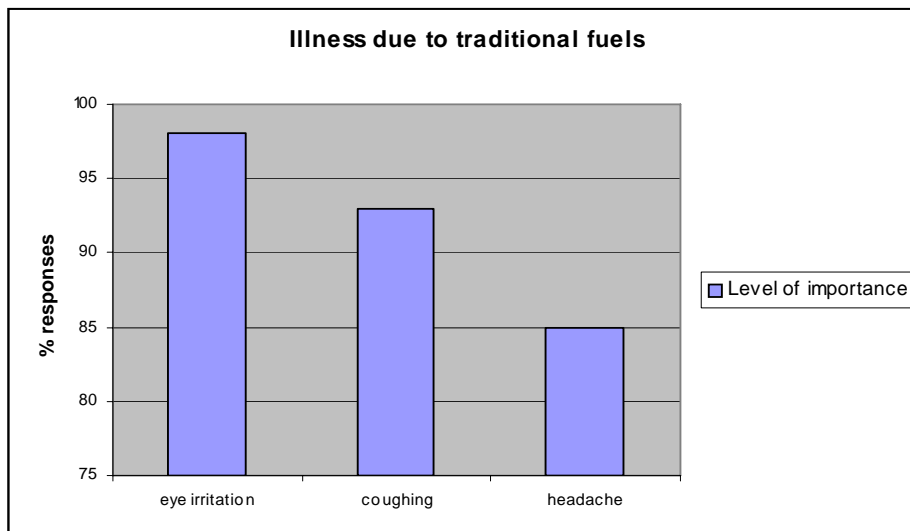


Figure 10: Health Impact of Traditional Fuels

25. Compared with fire wood, the respondents commented on the advantages of ethanol as follows. Most of them (86%), mentioned that the ethanol does not produce smoke, 40% commented that it produced no smell, 34% reported that it does not cause eye irritation and 30% reported experiencing a relief from headache. Having a clean kitchen and not coughing while cooking was also mentioned as an advantage of this technology by nearly 15% of the households who used the CleanCook.



Traditional cooking



Cooking with the CleanCook stove

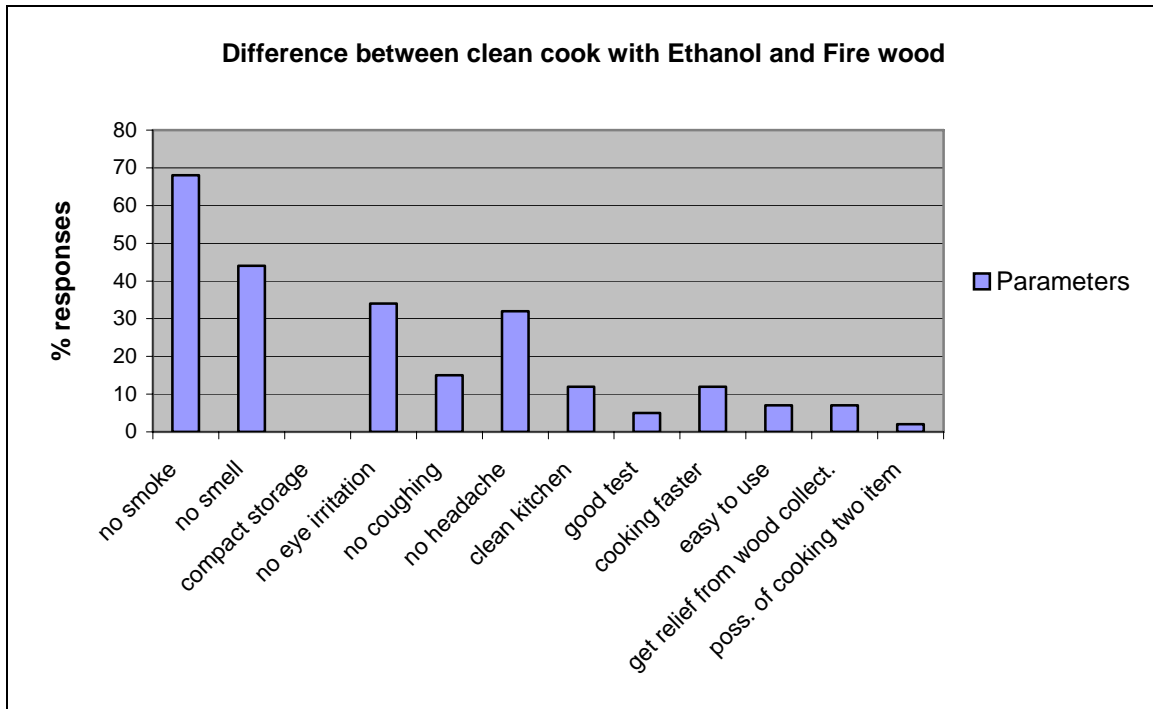


Figure 11: Comparative Advantage of Ethanol Use with Fire Wood

12. Technical concerns on Ethanol and clean cook

26. According to the respondents, the ethanol stove does not pose any harm to households with small children. The reasons stated are that they have a separate kitchen for cooking and baking purpose (22%). Most of them (95%) stated that while cooking, they take care that their children are kept away from the stove. For them, cooking with the CleanCook stove and using ethanol is treated just like using any other fuel as far as handling little children is concerned. Practically, they did not state any significant technical problem to discourage the use of the CleanCook with ethanol at the household level.

27. Rather, the concern of the respondents was access of all camp residents; even surrounding rural (non-refugee) households, to the CleanCook stove and if there is possibility to do so. It clearly contributes significantly to the alleviation of the problems stated, including relief from firewood collection, ease of use, freedom from common illness, smokeless environment, etc. (Figure 12)

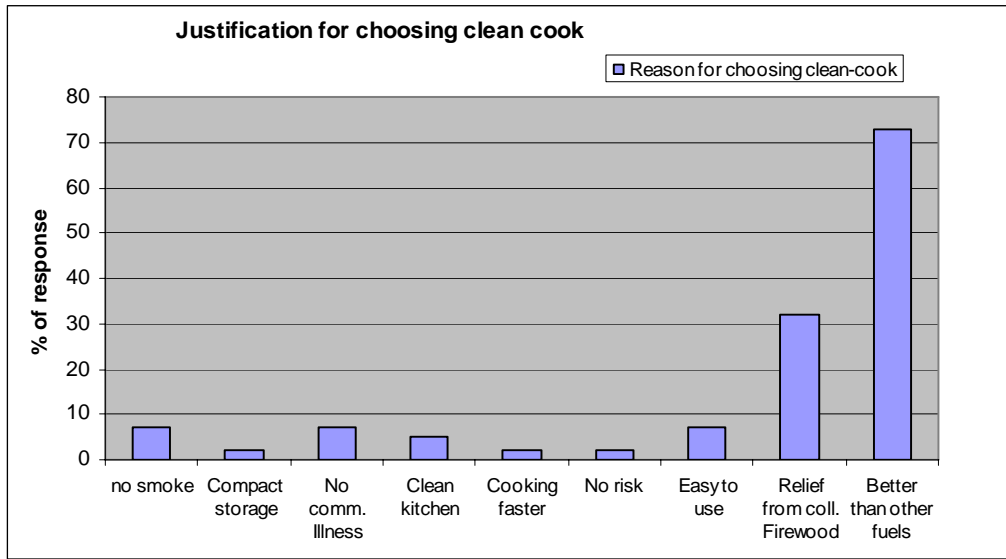


Figure12: Reasons for appreciating use of CleanCook

28. In addition, the camp residents who used the CleanCook stove commented that they need sufficient supply and consistency in the distribution of ethanol (29%). They complained that the amount provided to families with different household sizes is all the same. This was described as unfair since it constrains those families with a large household size. Further, they suggested that all camp residents need to be provided with this technology (17%). Compared to the large number of residents, the contribution of current supply is insufficient to solve the problems mentioned.

13. Potential for Ethanol market

29. Even though they believe in the use of ethanol as substitute fuel to firewood, only 20% of the respondents are willing to buy ethanol if available in the market. The only reason for this is lack of sufficient money. They would be happy to purchase ethanol from the market if they had sufficient disposable income available for such expenses.

30. They stated purchasing ethanol as preferable since it would relieve them from firewood collection from the forest which has so many risks, as previously discussed. Moreover, the stove allows them to cook two different items at a time, which contributed to time saving, permitting social and other activities. The only risk mentioned by the respondents was the possibility of not having a sustainable supply of ethanol and the likely periodic rise in the price of ethanol. (Since most of the respondents came from settled communities, they were able to respond not only as refugees but also as smart consumers.)

14. Comment by focus groups

14.1. General situation with firewood collection

31. It was stated that before the introduction of the CleanCook stove, they had been using firewood by collecting from the surrounding villages and forests. This is because they do not have disposable income to purchase the firewood or other substitute fuels in the market.

During the discussion they stated that fuel collection creates problems of :

- Discomfort and health risk to pregnant woman,
- Lack of sufficient time for school attendance or other family or self betterment activities.



Focus Group Discussion

32. They have to stay out on the average for about 7–9 hours in search of firewood. They do not have sufficient time to provide breakfast as well as lunch for their children. It was stated that sometimes after they collect the firewood, the land owners prevent them from taking it home.

33. Adult males around the firewood collection site try to rape women who are alone outside of the camp. This case is common among girls. In cases where the woman is disabled and cannot go in search of firewood, young girls are sent and are exposed to such harassment.

14.2. Comment on Ethanol Supply

34. Ethanol supply was good initially. But now the shortage of supply is forcing these people to go back to previous habits of firewood collection. They have been feeling as if they came out of darkness when they got ethanol since it served them to solve most of the problems raised during the discussion. The problem is very fierce for those who do not get ethanol at all.

35. They suggested that ethanol has to be supplied for all camp residents to help them benefit from reduced risks by no longer having to collect firewood.

36. According to the informants, the food cooked with ethanol using the CleanCook stove does not smell and is safe for eating.

37. They mentioned that they have been using ethanol for three months comfortably. Unfortunately the supply was interrupted. When that happened, they went back to previous habits of firewood collection.

38. There are few people who can afford to buy ethanol if supplied in the market. However, they are not comfortable with supply sustainability. The information they got about ethanol supply is that the source is limited and therefore its current level of supply does not satisfy the market demand.

14.3. Comments on Distribution of Ethanol

39. Family size varies from home to home. If 10 liters is provided per household to all camp residents, those who have large family size would finish earlier than the scheduled distribution and therefore discrepancy would occur. Or the household would be forced to go in search of firewood to fill the gap. So equity should be given due consideration while distributing ethanol. (Currently the scheduled ration is 1 liter per day per family, regardless of family size.)

40. The camp residents who received the CleanCook with ethanol appreciated Project Gaia and the staff for their concern and effort to make available this product to the camp residents. They stressed the supply sustainability issue and the need to provide to those who did not have access. Provision of cooking utensils, mainly dishes, by the good will of Gaia Association, was also requested in addition to the CleanCook.

15. Conclusion and Recommendation

1. Ethanol use has a double advantage because it contributes to cleaner indoor environment and has no complication while in use (it is easy and safe to use). It also does not require huge storage as compared with firewood.
2. It is obvious that both ethanol and the CleanCook cannot be supplied free of charge to all people, especially for those non-refugee settlers (IDPs). So, cost optimization at least in the supply of the ethanol needs to be considered since the stove, once obtained, could stay relatively longer.
3. Traditionally, the responsibility to provide fuel is put on women and girls – even more so in the case of the Somali people. On average, they have to travel about 8 km in search of fire wood 3 times a week. So, solving the problem related with energy supply would also address the issue of gender based violence in other areas and more pronouncedly in this region.

4. The greatest proportion of time in fire wood acquisition is spent on collection in the forest (rather than walking to the collection areas). But for women and little girls, the distance traveled is also significantly tiresome.
5. Even after traveling long distances and staying for long periods at the collection site, these women, and/or girls must encounter wild animals, become exposed to rape and sometimes the wood they collect is confiscated by people around the camp. Therefore, one can conclude that for them going out from the camp for firewood collection has high level of hardship.
6. Adoption of ethanol with the CleanCook has so many advantages such as improving the in-door environment, contributing to time saving by eliminating what is required for fire wood acquisition and avoiding the numerous risks involved in this activity.
7. Ethanol marketing is dependent on ethanol availability and price compared to existing household fuel. But fuelwood in the market is not cheap. The ethanol stove is simple and easy to use and has so significant technical risk.
8. The most common fuel used in the camp is firewood. Charcoal is also used in a few instances. Almost all of the camp residents use traditional stoves which can be fully displaced by the CleanCook.
9. The CleanCook stove provided by project Gaia is mostly used for both cooking and baking. Baking using this stove is possible due to the characteristically very small diameter of the Injera baked in the camp and in the region.
10. Where the ethanol use is compared with existing traditional fuels, significant advantages were observed by the households like smoke-free heat energy, negated eye irritation and no smell while in use. Interviews indicated that households prefer to use ethanol more than existing fuels, especially firewood.

Appendix 1

Field Questionnaire on Ethanol Use in the Somali Refugee Areas EREDPC in collaboration with Gaia Association (Conducted in Somali language)

Note to the interviewer:

1. Don't go direct to the interview; rather familiarize yourself with the respondent.
2. Try to be clear about the question about which you ask.
3. Don't ask about what you can get answer from your observation.
4. Always bear in mind about the purpose you are conducting the interview.
5. Don't forget to thank the respondent at the end of your interview.

I. Household general characteristics

Family composition	Occupation
1 elder //	1 Farming/Livestock raring //
2 teens //	2 Food catering //
3 children //	3 Other trade //
	4 Family Dependent //

II. Household Energy Characteristics

Fuel consumption pattern

- | | | |
|--------------------|----------------|--------------------|
| 1 Fire wood // | 2. Charcoal // | 3. Kerosene // |
| 4. Agri-residue // | 5. Dung // | 6. Others _____ // |

Most frequently used fuel

1. _____ // 2. _____ // 3. _____ //

Amount in local unit of the most frequently used fuel

1. _____ // 2. _____ // 3. _____ //

What purpose does Ethanol fuel used for?

1. Cooking // 2. Backing // 3. Both //

How many times do you cook with Ethanol?

- 1 twice a day // 2 once a day // 3 four times a week //
- 4 others _____ //

How long does it take to cook the same food with

- 1 Ethanol _____ hours //
- 2 Fuel of similar purpose _____ hours //

Do you observe any difference on the in-door environment while cooking with Ethanol as compared to other fuels? 1 Yes // 2 No //

If yes what is it?

- 1 _____ // 2 _____ // 3 _____ //
- 4 _____ //

What are common illnesses related with commonly use fuels?

- 1 Eye irritation // 2 Respiratory disease // 3 Headache //
- 4 Others _____ //

Do you observe any difference between before and after use of ethanol as fuel?

1 Yes // 2 No //

What major difference do you observe?

1 _____ // 2 _____ // 3 _____ //
4 _____ //

Where do you obtain your other fuels most often?

1 Near by field (0.5km) // 2 1 to 2 km from residence
3 minimum of one hour travel // 4 others _____ //

What takes the greatest share of your time for fuel acquisition?

1 travel // 2 collection // 3 both have equal weight //

What major risks do you fear in acquisition of common fuels/

1 risk of beast // 2 risk of rape // 3 risk of bandit //
4 others _____ //

What benefits did you and the environment get from using Ethanol //

1. Relief for trees from cutting //
2. More time for education and other social services //
3. healthy in door environment //
4. clean kitchen //
5. Possibility for food catering increased //
6. less risk that occurs due to search for other fuels //

Are you willing to buy Ethanol if marketed at your vicinity?

1 yes // 2 No //

Why?

1. _____ //
2. _____ //

Is the Ethanol stove convenient to use in a household where there are little children?

1 yes // 2 No //

Why? Because

1. _____ //
2. _____ //
3. _____ //

As you observed the stove and the Ethanol, what major cautions need to taken?

1. _____ //
2. _____ //
3. _____ //

Is it recommendable to be disseminated for other rural households?

1 Yes // 2 No //

Why? Because

1. _____ //
2. _____ //
3. _____ //

Do you have additional comments?

- 1 _____ //
- 2 _____ //

Thank you

Appendix 2

Data on Fuel Acquisition, Time Spent, Amount Collected, and Other – Over 10 Households

Information Provided by Firehiwot Mengesha, Gaia Association, July 3, 2006

The following questions were worked by Ato Ephrem (Rural Energy).

Data on fuel acquisition, time spent, amount collected of fire wood from 10 households (as of 18 June 2006)

Indicators	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	Total	Average
1. Time out camp for acquisition of firewood (hrs)	4	6	9	9	9	6	7.5	7	9	10	76.5	7.65
2. No of trips per week	7	3	2	2	3	3	3	3	2	2	29	2.9
3. Time per trip spent collecting firewood (hrs)	2	2	1.5	4	2	2	1.5	3	4	4	26	2.6
4. Distance traveled (km)	10	10	7.5	20	10	10	7.5	15	20	20	130	13
5. Amount of wood collected in one trip (kg)	1	1	1	1	1	1	1	1	1	1	10	1
6. Weigh of woman load (kg)	19		20			35		32	28	21	155	25.8
7. Price of one woman load (birr)	10					20		10	10		50	12.5

Note:

- From past experience it could be estimated that a man/ woman on the average can walk 5km in a hour
- According to the respondents of fuel collected in one trip is 1 woman load
- The price of 1 woman load is estimate by the respondents

Please refer to photographic documentations.

Please also see data of all Kebrebyah baselines survey, available at Gaia Association.