User Responses—the Ethanol-fueled CleanCook Stove's Safety, Fuel Consumption & Efficiency Addis Ababa, Ethiopia

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Background

Over a period of 18 months between late 2004 and early 2006, 409 households representing lower, middle, and higher income groups across all 10 of Addis Ababa's sub-cities participated in a pilot study conducted by Gaia Association (GA) to determine user acceptance of a new cooking technology: the ethanol-fueled CleanCook (CC) stove. CC stoves were used in each of the homes for 3 months. One component of an extensive surveying technique included a bi-weekly survey where GA field staff questioned study participants concerning CC stove efficiency, ethanol fuel efficiency, comparisons to other stoves and fuels, among other queries, such as willingness to pay per liter of ethanol, willingness to pay for the stove, and satisfaction with the CC stove. The data analyzed in this paper accounts for 2096 bi-weekly surveys conducted during the pilot study. Percentages given in the tables below are based on the total number of surveys, and not the total number of households.

The purpose of this paper is to better understand user perception of overall ethanol and CC stove safety, their safety compared to other fuels and stoves, most specifically the kerosene stove, and to gain insight into fuel consumption rates from a qualitative viewpoint. Bi-weekly data is presented in 2 sections: Ethanol as a Cooking Fuel and CleanCook Stove Performance and Safety. Ethanol as a Cooking Fuel is broken down into four sub-groups represented by the following data tables: Overall Safety of Ethanol as a Cooking Fuel, Safety of Ethanol versus Kerosene, Overall Quality of Ethanol as a Cooking Fuel, and Quality of Ethanol versus Kerosene.

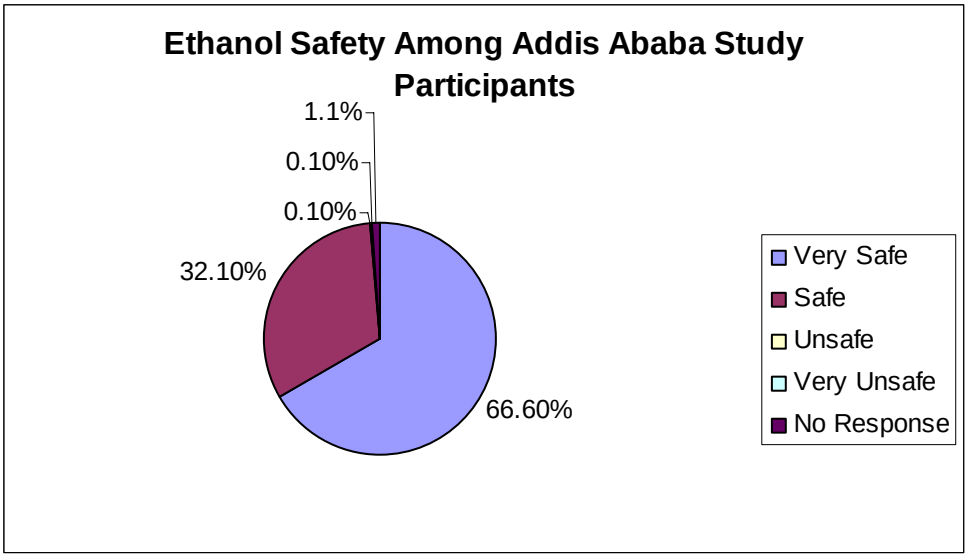
CleanCook Stove Performance and Safety is also divided into four sub-groups, which are represented by the following data tables: CleanCook Stove Fuel Consumption Efficiency, CleanCook Stove Fuel Efficiency compared to Other Stoves, CleanCook Stove replacement of Kerosene Stove During Study, and Why Kerosene Stove in use while CleanCook Stove in the Home.

Lastly, CleanCook stove user satisfaction is discussed, followed by a general discussion highlighting key findings of the study.

Ethanol as a Cooking Fuel

When asked, "How would you rate the overall safety of ethanol," 66.6% of households responded with "Very Safe," 32.1% said "Safe," 0.1% was stated for both "Unsafe" and "Very Unsafe," and 1.1% of the surveys did not have a response filled in. Nearly 99% of surveys showed that Addis Ababa households consider ethanol as a safe cooking fuel. (See Table 1)

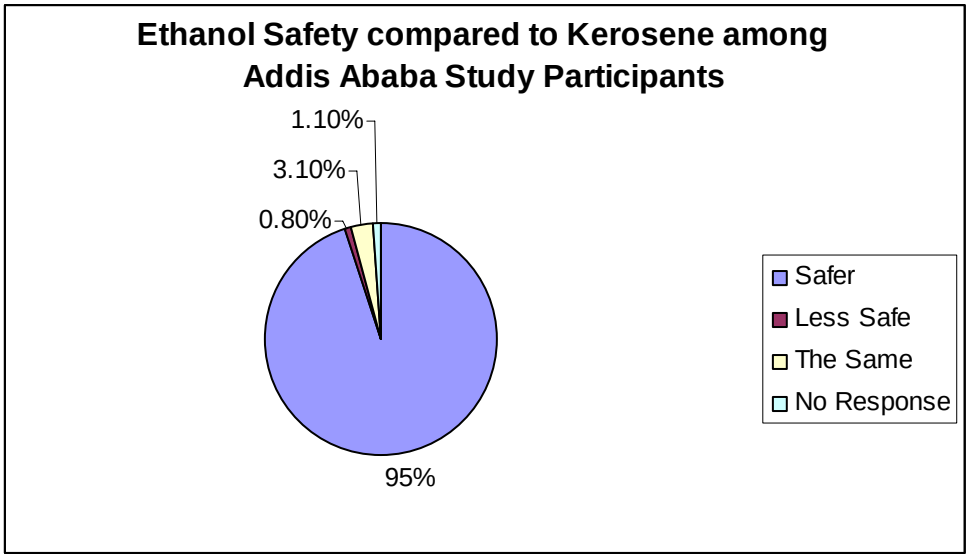
Table 1: Overall Safety of Ethanol as a Cooking Fuel



When compared to kerosene as a cooking fuel, households were given four responses to choose from when asked, "How would you rate the overall safety of ethanol compared to kerosene?" 95% of surveys selected "Safer," 3.1% had "The Same" checked off, 1.1%

had no response given. Only 0.8% of surveys stated that ethanol was "Less Safe" than kerosene. (See Table 2)

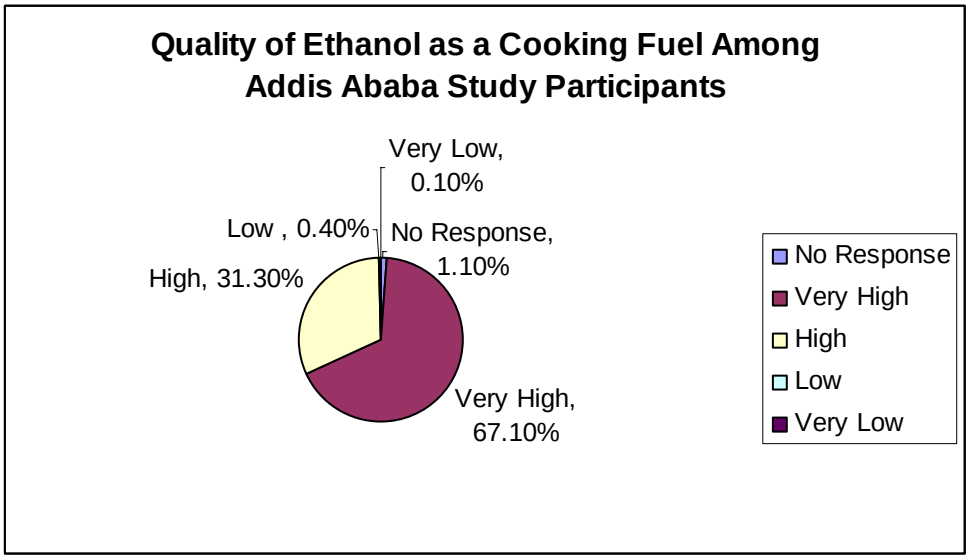
Table 2: Safety of Ethanol versus Safety of Kerosene as a Cooking Fuel



It is a really safe stove. We feel less anxious when using the stove. When we were using kerosene we always had to stay close by as we always expected there to be an accident but nowadays I confidently use the new Clean Cook Stove. –Halima, Yeka sub-city

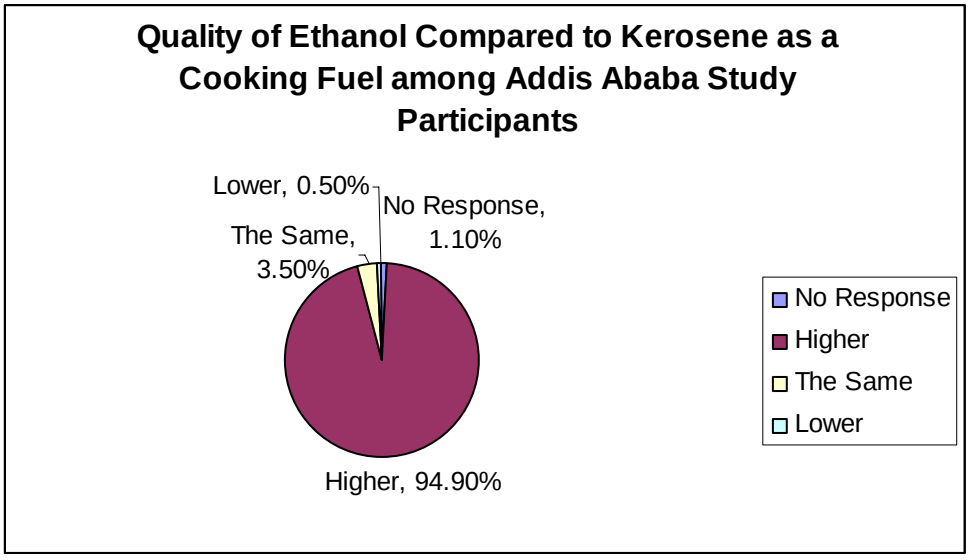
"How would you rate the overall quality of the ethanol fuel," was asked of the study participants. 67.1% responded "Very High," 31.3% said "High," 1.1% of surveys did not have a response, and .40% and .10% were given for "Low" and "Very Low" respectively. Greater than 98% of surveys considered ethanol to be a high quality cooking fuel, and less than a percent considered it a low quality cooking fuel. (See Table 3)

Table 3: Overall Quality of Ethanol as a Cooking Fuel



Comparing the quality of ethanol to kerosene as cooking fuels, "How would you rate the overall quality of the ethanol fuel compared to kerosene," found that 94.9% of surveys listed a "Higher" response, 3.5% said "The Same," and no response was given for 1.1% of the surveys. Less than one percent, only 0.5% of the 2096 surveys considered ethanol a "Lower" quality cooking fuel than kerosene. (See Table 4)

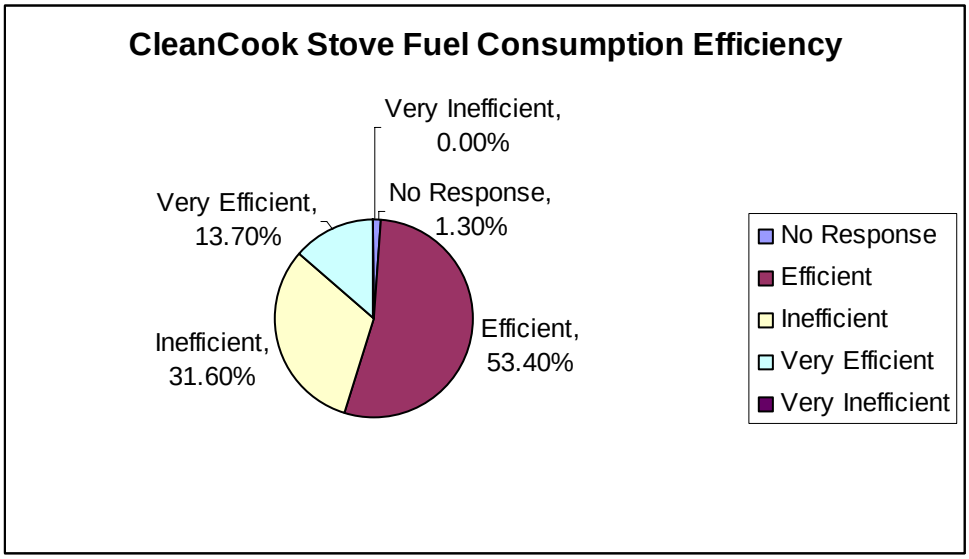
Table 4: Quality of Ethanol versus Kerosene as a Cooking Fuel



CleanCook Stove Performance and Safety

When asked, "How would you rate the fuel consumption of the CleanCook stove," 13.7% of surveys responded "Very Efficient," 53.4% answered "Efficient," 31.6% offered "Inefficient," and 1.3% of surveys did not have a response. Not one survey rated the fuel consumption of the CC stove as "Very Inefficient." (See Table 5)

Table 5: CleanCook Stove Fuel Consumption Efficiency

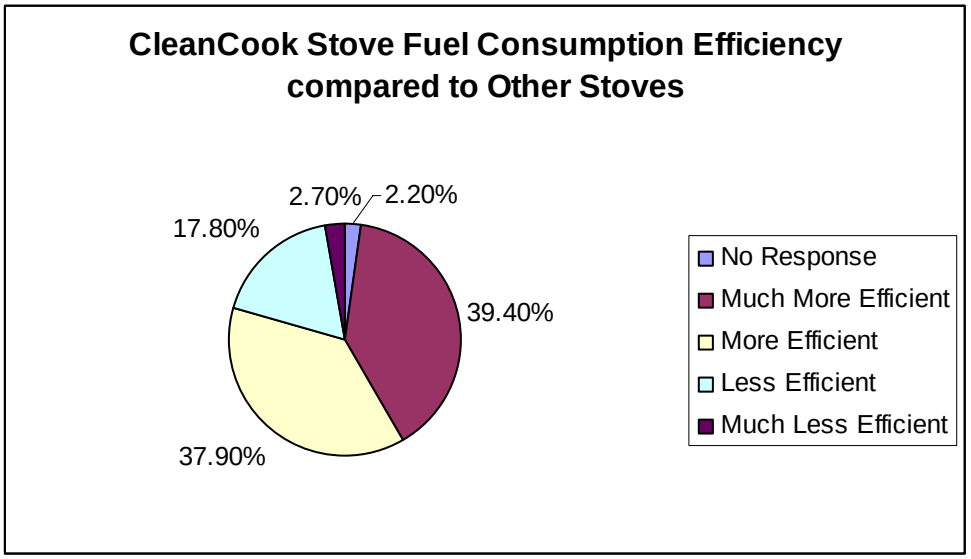


Study households were questioned regarding the fuel efficiency of the CC stove versus the other common stoves they use to meet daily cooking needs: "How would you rate the overall fuel efficiency of the CC stove compared to other stoves?" 39.4% considered the CC "Much More Efficient," 37.9% "More Efficient," while 17.8% of surveys gave a "Less Efficient" response and 2.7% were "Much Less Efficient." 2.2% of surveys did not have a response. (See Table 6)

I found this stove more efficient in terms of using fuel, time saving, even we are able to do other tasks at the same time as using this stove. About 3 hours a day is saved for me by using the CleanCook Stove.

--Wesene, Yeka Sub-city

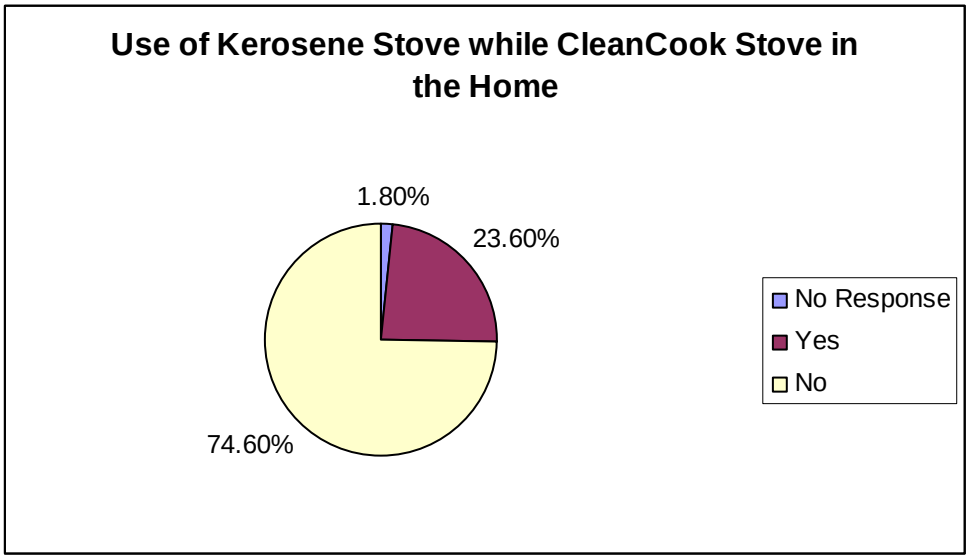
Table 6: CleanCook Stove Fuel Efficiency compared to Other Stoves



A "Yes" or "No" response was given when questioned about the use of kerosene stoves when the CC stove was in the home. Of those households that used a kerosene stove before the study, 74.6% of surveys stated that they did not use, "No," the kerosene stove in combination with the CC stove. 23.6%, "Yes," did use the kerosene stove while the CC stove was in the home. 1.8% of surveys did not have a response. (See Table 7)

Before I used the China Kerosene Stove and Charcoal Stoves. I used the former one [kerosene] because it was fast, and I preferred the charcoal stove when I prepare coffee because it is slow. But now, I use the CleanCook Stove for both, because I can make it cook fast and adjust it to cook slow. So I like the CleanCook because it substitutes the previous stoves that I used before. –Getenesh, Bole Sub-city

Table 7: CleanCook Stove replacement of Kerosene Stove During Study

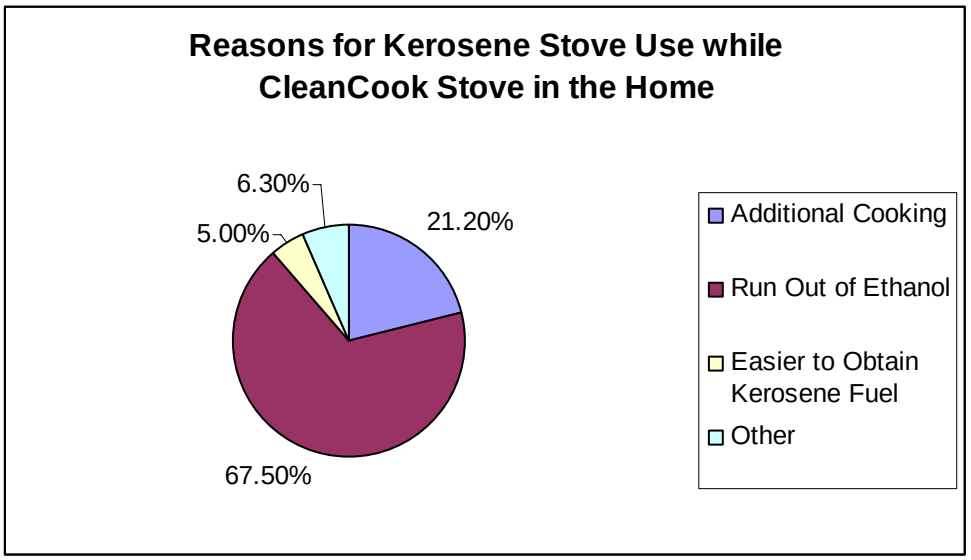


Several reasons were given for using the kerosene stove when the CC stove was in the home: 67.5% of households said they used the kerosene stove only because they had "Run Out of Ethanol." During the first month of CC stove use, participants were allotted 5 liters of ethanol per week. For bigger families, this sometimes was not a sufficient amount. Also, political instability hindered ethanol distribution in some of the sub-cities, and the ethanol delivery from the supplier was not always consistent.

21.2% of those that continued using their kerosene stove along with the CC stove responded that "Additional Cooking" needs were met with the kerosene stove. 5% said it was "Easier to Obtain Kerosene Fuel." Ethanol was available only through Gaia Association and was provided through the local *kebele* offices each Monday when Gaia Association staff was present, sometimes resulting in schedule conflicts with a few households.

6.3% of households gave "Other" reasons for using their kerosene stove: to save ethanol fuel for cooking big meals, to boil water, to make tea and coffee, initial unfamiliarity with the CC stove, among others. (See Table 8)

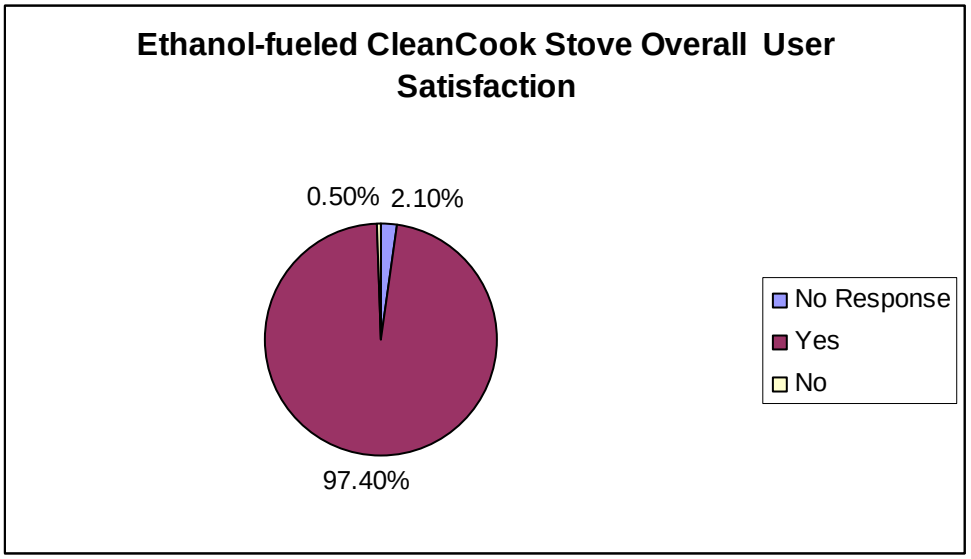
Table 8: Why Kerosene Stove in use while CleanCook Stove in the Home



CleanCook Stove User Satisfaction

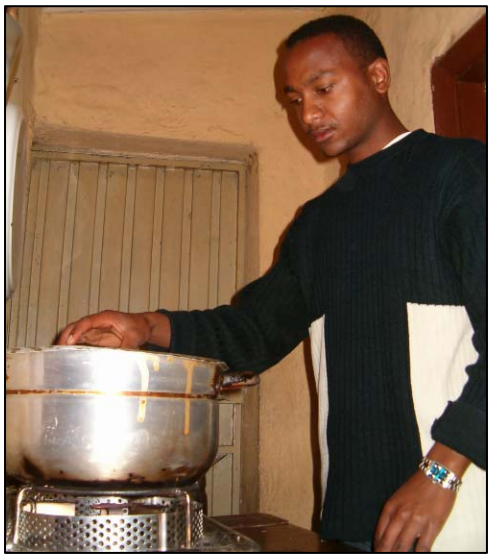
Households were asked to consider several factors when determining their overall satisfaction with using the CC stove: ease of use, fuel efficiency, stove safety, easy to clean, size, lighting the stove, smoke emissions, heat/burner regulator, stove quality. 97.4% responded "Yes" when asked, "Are you satisfied with the CC stove?" 2.1% of surveys did not have a response, and only 0.5% of the 2096 surveys had a negative response, "No," to CC stove-user satisfaction. (See Table 9)

Table 9: Overall Satisfaction with the Ethanol-fueled CleanCook Stove



Yoseph and his mother Aster

"During the rainy season, we use the charcoal stoves for heating the home, but it has smoke and danger due to the carbon monoxide of the charcoal. After I turn on the CleanCook Stove, I can put the pots on the stove immediately because it has no smell. But the charcoal stove has smoke when I light the stove; after the smoke dissipates, I put the pots on the stove. Another problem with the charcoal stove is that it takes too much time to prepare meals." --Aster, Bole Sub-city



Yoseph using the CleanCook Stove

"It has no danger as compared with other stoves. All of the women in the home use the stove, and one of my sons [Yoseph] also uses the stove, especially for preparing his own breakfast and preparing tea."

--Aster

Results and Discussion

Some 98% of the 2096 bi-weekly surveys answered by Addis Ababa residents who participated in the CleanCook stove pilot study stated that ethanol is a safe cooking fuel of high quality. When compared to kerosene, 95% of the surveys stated both that ethanol was a safer cooking fuel than kerosene, and that it was of a higher quality than kerosene.

A combined sixty-seven percent of surveys considered the fuel consumption of the CC stove to be efficient or very efficient. Compared to other stoves commonly used for cooking (kerosene, charcoal, wood), the CC stove was rated more efficient regarding fuel consumption in 77% of the surveys. Additionally, nearly 75% of surveys found that the kerosene stove was completely replaced when the CC stove was in the home. Of the 24% of surveys saying that the kerosene stove was still being used alongside the CC stove in the home, the two most common reasons for continued use were: run out of ethanol (67.5%) and additional cooking (21.2%).

Overall, nearly 98% of surveys stated that users were satisfied with the CleanCook stove when taking everything into consideration: ease of use, fuel consumption, safety, etc.

Two observations from the above data are immediate: (1) users determined that the ethanol-fueled CC stove is more fuel efficient than other cook stoves, most notably the kerosene stove, and (2) the CC stove and ethanol fuel are a safer cooking technology than the kerosene stove and fuel.

The overwhelming CC stove user satisfaction demonstrates the need for an improved fuel and cooking technology in Addis Ababa, and it suggests that the CC stove and ethanol is a well-suited choice for the people of the city. Cooking options are currently limited to inefficient stoves that are considered unsafe by their users. Moreover, considering the replacement of kerosene stoves by the CC stove during the study, and that the leading reason for continued use of the kerosene stove throughout the study was that homes ran out of ethanol, if ethanol was more readily available and less costly than kerosene, a comparably priced CC stove seems poised to replace kerosene stoves in Addis Ababa.

Throughout the above report, personal narratives of study participants are interspersed to enhance the understanding of the human impact that the CC stove has in households. User perception of stove efficiency, safety, and general satisfaction of cooking with the stove, is very important in determining the viable success of the stove once on the market and should never be underestimated as a reason for a stove's success. Whether or not people enjoy using a new cooking technology matters, as does whether or not they are spending less time cooking in the kitchen.

Note

The Yeka narratives were conducted by Fiona Lambe of the Stokes Consulting Group and Yonas Abesha of Gaia Association. The Bole narratives were conducted by Cheryl O'Brien of the Stokes Consulting Group and Getenesh Teleya of Gaia Association.