

Tapping the Potential of *Proalcool* for the Household Energy Sector

Narratives of House Visits in the three communities of Salinas, Dom Orione, and Ponte Nova in the state of Minas Gerais, Brazil June 2006
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Introduction

James Murren and Cheryl O'Brien of The Stokes Consulting Group/Project Gaia visited Minas Gerais, site of Project Gaia's 100 CleanCook (CleanCook) stove pilot study in Brazil. Under the direction of Project Gaia/Brazil Director Regina Couto, they visited the three project communities of Salinas, Dom Orione, and Ponte Nova.

To determine user reaction to the CleanCook stove, they visited families in their homes and carried out informal conversations with family members. A few questions guided the conversation:

- How would you compare the CleanCook stove with your LPG stove?
- How long does your LPG canister last?
- How much does the LPG canister cost?
- Do you gather or buy wood?
- How long does it take you to gather wood?
- How much does wood cost? etc.

The stove users were willing to share their thoughts and suggestions about cooking with ethanol, about the CleanCook stove itself, and about the use of LPG and wood to meet daily cooking needs. The team took notes to ensure that the final translation from Portuguese to English would be as accurate as possible.



View of the neighborhood of Santo Antonia, Salinas, Minas Gerais

Thirty-two narratives (from individual homes and one child care center) and campground interviews were collected from 90 locations that are using the CleanCook stove in Minas Gerais, Brazil.

Salinas. A small city in the northeast of Minas Gerais, Salinas is called the World Capital of Cachaça, a sugarcane-derived liquor of high alcohol content. For those without a CleanCook stove, LPG and woodfuel is used. Wood costs around 25 R (USD\$ 11.35) per cart load. The woodpile stack (left photo) equals two cart loads.



One cart load lasts them one month when used for cooking in combination with the LPG stove. The seller goes out to collect wood over night when needed for selling. Fifteen narratives were collected in Salinas, where forty CleanCook stoves are used in Salinas homes, a pre-school, and the Federal Agro-Technical School.

Narratives from households using CleanCook stoves

1. Gilza's story - Santo Antônio - Family size: 4

'If I can buy alcohol little by little in small amounts, it would be better for me... Sometimes I can't afford to buy the LPG tank. It's too much money. If the alcohol price goes lower, I will cook with the CleanCook stove only'.

Before the CleanCook, her husband collected wood every Sunday. With the CleanCook, he gathers wood once a month for about 4 hours to use for heating bath water.



The CleanCook stove replaced wood for cooking, and she stopped using LPG. Before the CleanCook, 13 kg of LPG at 35 Reais (R) lasted 48 days when used with the woodstove for cooking. She explains that the CleanCook takes about an hour to cook a meal, whereas LPG took about 40 minutes, but she stresses that with LPG she used 4 burners rather than two.

2. Maria - Bairro Santo Antônio - Family size: 2



'I bought wood for cooking before the CleanCook. Now I cook only with the CleanCook. I don't buy wood anymore,' says Maria. Regina Couto interviews Maria with the wood stove and its soot visible behind. Maria states, 'Two burners are fine

because my wood stove has two burners.' She cooks coffee on the CleanCook and has stopped using her LPG stove.



3. Morília - Bairro Santo Antônio - Family size: 5

Morília informs us, 'I prefer cooking with the CleanCook because it is safer than gas and just as fast. 4 of the 6 gas burners didn't work, so the CleanCook is the same for me [regarding burners]. She explains that her LPG stove was leaking, and she used 2 LPG tanks a month and then it caught on fire. She says the CleanCook is faster than LPG.



Morília notes that they were mostly cooking with wood before the CleanCook, but now her husband has stopped collecting wood. She adds that there is also a CleanCook at the childcare center for milk, formula, and coffee. Morília says we can speak to her daughter about the LPG fire. Morília's 18 year old

daughter speaks about the gas stove that dangerously spread the fire. 'Many times the LPG explodes. Gas escapes below the burners and flares up because of leaks below the burners. Now we only use the CleanCook and we stopped using LPG. The CleanCook is faster than LPG. The CleanCook doesn't smell at all.'

4. Lia - Child Care Center Staff Creche - Bairro San Antonio

Lia explains that the child care center uses the CleanCook to heat milk and baby formula for the children and coffee for the staff. They use a large LPG stove for cooking large meals. Lia notes, 'But, the CleanCook has made it easier for cooking small amounts of food when needed.'



5. Maria - Family size: 3

Maria bakes bread and sells it from her home, burning wood only for bread baking. She says that her LPG tank lasted 30 days before she received the CleanCook, but since then she has not used her LPG. Maria states, 'I would prefer cooking with alcohol if it could be bought in small amounts. I don't always have the money to buy the LPG tank... The CleanCook cooks faster than LPG.' (Photo: Maria with Regina Couto, PG/Brazil Director)



6. Antônio and his wife Rita - Family size: 4



Rita states, 'Before the CleanCook, I gathered wood once a week for about three hours and I used the neighbor's wood stove. I don't have a wood stove, so before I used LPG most of the time. Now I don't cook with wood or LPG. Now I use only the CleanCook. I prefer using the CleanCook stove. It's easy to use.' Rita's 13 kg LPG tank lasted 30 days before the CleanCook was introduced.

She explains that it takes 45 minutes to 1 hour to cook beans in a 4 L pressure cooker pot on the CleanCook, and that the beans last one week and feed 4 people. Photo shows surveyor taking notes with Rita in the background.

7. Suely - Family size - 7

'Before the CleanCook stove, I cooked on my neighbor's woodstove. Now I cook with the CleanCook stove only,' Suely explains while holding her youngest of five children. Suely says she needs only 4 L ethanol/week to cook meals. Suely and her husband cannot afford LPG; they are very poor and we notice very little food in the house.



8. Laurinda's Household - Family size: 3

'Cooking with wood is a lot of work. The alcohol stove is easier to use. I have back problems from when I was younger and had to collect wood to cook . I'm afraid to change the LPG tank. But I have no fear of filling the tanks on the CleanCook stove. My daughter uses the CleanCook too. My pots clean easily with soap when they're used on the CleanCook. Five liters of ethanol per week is sufficient. The CleanCook is faster than LPG.'



She pays 36.00 R for a 13 kg LPG tank, which lasted two months before the CleanCook was introduced. Laurinda adds, 'The CleanCook would make it nice to be able to buy alcohol in small amounts, because I do not always have the money available for LPG when the LPG tank empties.' Laurinda takes pride of her CleanCook, keeping it covered when not in use .

9. Regina - Family size: 4



Regina speaks while holding her baby. 'If gas and ethanol were the same price, I would use ethanol because it cooks faster than my LPG stove'. She used LPG before the CleanCook, but now she uses only the CleanCook, except on very few occasions when she uses the LPG oven for baking cakes. She suggests that four burners on the CleanCook would be better. Like other study participants, Regina says she takes pride in having a CleanCook and keeps it covered when not in use as seen in photo at right.

10. Maria (wife) and Manoel (husband) - Family size: 2

Manoel explains 'I am the cook of the house because my wife works all day. Before the CleanCook, I bought wood because I am too old to gather it ... Now I cook with the CleanCook only. Two burners are enough for us.

I prefer cooking with alcohol because it's faster than LPG.' He says that five liters of ethanol/week is sufficient. Before the CleanCook stove, a 13 kg LPG tank lasted one month for his household.



11. Jonas (President, Association of the Citizens of Bairro Santo Antonio) and his wife D. Josefina Maria de Jesus

'Project Gaia has united the neighborhood. The Association is stronger now. Others without the stoves are supported by those with stoves to get them stoves,' Jonas exclaims.



As President of his local Association of the Citizens, he explains that there are 400 families in Barrio San Antonio, and 60 more families joined 'because of Project Gaia and a water project' in the neighborhood. People from two other neighborhoods are moving into Barrio San Antonio, because they see the neighborhood as being very organized. 'People are requesting CleanCook stoves,' he says. He buys ethanol at 2.42 R/L at the pump, but he says a friend buys ethanol at 1.20 R/L in Sao Paulo. Since receiving the CleanCook, his household does not use LPG

12. Noême - Family size: 3



'If the unit price of ethanol and LPG were the same, I would cook with the CleanCook because it cooks faster than the LPG stove,' Noême says. She explains that it takes only 45 minutes to cook beans on the CleanCook. For rice it takes 15 minutes on the CleanCook rather than 25 minutes on the LPG. She smiles and notes, 'I cooked everything on the CleanCook stove for the holiday festival...The 2 burner CleanCook is sufficient, but 4 burners would be better.' She prefers alcohol to gas, but says sometimes the alcohol smells. five liters of ethanol is enough for her family of three.

Noême says that a 13 kg LPG tank lasts 45 days and costs 35 R. Her husband collects wood and sells some of it; he is constructing a wood stove for her to bake and sell bread and biscuits. Now they are using only the CleanCook for cooking meals.

13. Rosalina - Bairro Santo Antônio - Family Size: at least 4

'The CleanCook stove is easy to use, practical, and cooks very fast. Wood stoves are very difficult to light. I prefer cooking with alcohol.' Rosalina's household uses the CleanCook for cooking daily meals. Rosalina uses the wood oven to bake bread, and 5 sticks of wood

cooks 2 batches of biscuits. Before the CleanCook, she walked 6 km to collect wood and used the wood stove only. Her LPG stove is broken. She says five litres of ethanol per week is enough, and her husband cooks coffee and her 11 year old daughter (shown) cooks noodles on the CleanCook.



14. Alexandra's Household - Family size: 4



Alexandra (and her two daughters) is shown cooking meat using a pressure cooker pot on the CleanCook stove. The 12 year old daughter also cooks on the CleanCook.

Alexandra says, 'Five liters of ethanol per week is plenty for the family. I would use the CleanCook instead of LPG if they were the same unit price.' She stopped using LPG, and now cooks only with the CleanCook.

She notes the following: a 13 kg LPG tank lasted a month before the CleanCook; rice cooks for 20 minutes on the CleanCook versus 25 minutes on LPG; beans only take 30 minutes to cook on the CleanCook.

15. Maria das - Bairro Santo Antonio Family size: Varies as grandchildren often visit

'Thank God for this stove [CleanCook]. It cooks fast,' Maria states in photo at left. She still uses her wood stove (shown) for beans and when killing and plucking chickens.



Notice the soot on the wall from her wood stove; the kitchen has no windows and only one door for ventilation. Maria's husband gathers wood on his way home from working every day. She primarily cooks rice and vegetables on the CleanCook, and she does not use LPG.

Dom Orione, Betim, Minas Gerais.



Dom Orione is a small farming village of 39 homes situated about 10 minutes from Betim. Twenty-eight families have CleanCook stoves, ten of which were visited.

16. Carlos and Otilia - Family size: 2 + family and friends



Carlos says they 'put tin foil on top of the stove to keep the CleanCook clean and beautiful.'

Their property includes fruit trees and cows. In addition to the CleanCook, they use a wood stove and gas stove. They are able to get wood from their own farmland, noting that it is customary to cook beans and breads on the woodstove.

Prior to the CleanCook, their 13 kg LPG tank (costing 33-34 Reais) lasted for 3 months while using it with the wood stove. While they are more accustomed to gas, Carlos and Otilia prefer the alcohol stove, stating that the CleanCook 'is faster than LPG.' Five liters of ethanol lasts for 10 days.

17. Rosa - Family size: 7 (6 adults and 1 baby)

Rosa says she needs 7 liters of ethanol/week for her household. They use alcohol more than gas now, but she cooks breads in the gas oven. She prefers cooking some foods like beans on wood. Rosa says, 'Alcohol cooks faster than LPG.' She used more wood than LPG before the CleanCook, when a 13 kg LPG tank lasted a month. Since the CleanCook, the 13 kg LPG tank lasts 2 ½ months.



The LPG dealers bring gas (2 R delivery fee to Dom Orione from Betim), and quickly on a motorbike, and sometimes the neighborhood orders together to share the delivery cost.

Rosa adds, 'At times, it's difficult to find the money to buy the LPG tank, so we had to use wood.' Her son says, 'Before the CleanCook I carried wood on my back and had back pain. I've had surgery twice on my back. I collected wood once per week, 2 hours each time.'

18. Rosana - Family size: 7 (2 adults and 5 children aged: 6, 10, 13, 17, 18).

Rosana uses the CleanCook and a wood stove, and she has just increased the quantity to seven liters per week, since five liters was insufficient. She would like four burners on the CleanCook, and adds that 'it takes the same time cooking with wood and alcohol once it's cooking, but getting the woodstove hot takes a long time.'



Both her sons used to collect wood before the CleanCook stove. Her husband, and all five children collected wood three times each week (2-3 people each time; 1 adult and 2 children) for 30 minutes each time. The children carried wood across their stomachs or chests (by pulling it close to their bodies) and on their shoulders. Rosana and her husband carried wood on their shoulders. After receiving the CleanCook, only Rosana collects wood once per week for 30 minutes.

19. Carina and Alfonso (President of the Community Association) Family size: 6

Carina's LPG stove has 6 burners, and she says that '4 burners on the CleanCook would be nice.' She states that five liters ethanol/week are sufficient, because she still uses 'a little LPG' too. They very rarely use wood. Carina adds, 'Alcohol is faster than LPG,' including when cooking beans.



20. Pedro and wife Vilma (who did not want photos taken) - Family size: 2 (but also cooks for her 3 workers)

Vilma explains that she cooks a lot, because they have three workers for their flower greenhouses. She states that 'LPG costs too much to cook for everyone,' but she still uses LPG. She does not use wood, and she used only LPG before the CleanCook. LPG lasted 30 days before the CleanCook; now with the CleanCook, LPG lasts 45 days. She cooks outside with the CleanCook due to the alcohol's smell, which sometimes bothers her. Though LPG doesn't bother her, she says, 'The CleanCook is faster than LPG, so I would choose the CleanCook over LPG if they cost the same unit price.'

Vilma thinks the periodic bothersome smell of the alcohol is the result of the gas station placing additives in the alcohol. Project Gaia Staff explain that the CleanCook flame should be blue, and if it is orange, then there are impurities in the alcohol. She adds, 'Four burners on the CleanCook would be better.'

21. Edward and Karina - Family size: 7

Karina still uses wood sometimes for cooking beans, because she prefers the taste of beans on the wood stove. Her 13 kg LPG tank lasted 30 days before the CleanCook, and it lasts 50 days since the CleanCook was introduced. She still uses gas, 'because the family size is 7' and she is unable to meet all the cooking needs with five liters per week of ethanol.



Karina's ethanol was burning with a very strong smell the week the visit took place. Projeto Gaia Staff ask to view the flame on her CleanCook, noting that the alcohol has impurities since the flame's color was orange rather than blue. Despite this, Karina stated that she preferred using the CleanCook, because it cooks faster than her LPG, making the CleanCook 'more economical.' She added that the CleanCook has a stronger flame than her LPG stove.

22. Vilma and Jose -Family size: 4 (including 3 year old daughter)



On a recent visit to Vilma's house, her friend, 'wanted to buy the CleanCook on the spot.' Vilma used LPG and a wood stove before the CleanCook, but now she only uses the CleanCook. Before the CleanCook, Vilma's husband collected wood with a cart, and now he does not collect wood.

The photo shows Vilma's daughter standing in front of the traditional stone pots on the CleanCook. When asked about any problems or suggestions for improving the CleanCook, Vilma states, 'Four burners would be better on the CleanCook.'

She, too, had noticed a smell when burning this batch of ethanol, 'but after it burned a few minutes, the smell dissipated.' Also, she had cut her fingers while cleaning around the CleanCook's chimney, and she states that she has to buy more soap to clean her pots/pans when using the CleanCook, so 'this is an added cost.'

On cold mornings she dips a twig into the ethanol bottle to get a big flame for lighting the stove rather than using a match. Vilma says that she has not experienced any problems with CleanCook stove function. Vilma and her husband Jose ask if there is an alcohol-powered oven, and Jose exclaims, 'This is one of the best stoves I have ever seen! It is a great stove.'

Vilma states that Doce de Leite (a sugar and milk candy) is 'easier to cook on the CleanCook as it doesn't boil over like it does on the LPG stove'. She explains that on her LPG stove, she has to stir it or it will boil over. Vilma's husband Jose and his fishermen friends noted that the 'CleanCook is very practical to take' with them to heat food. They assert that five liters ethanol/week is not enough for their family.

23. Elza - Family size: 3 (in her family + 3 neighboring families)



'Before, I used a lot of firewood, and now with the CleanCook I have more time to do other things. The CleanCook is much faster than the LPG stove. My kids and some neighbors come to my house to use the CleanCook,' Elza states. She cooks for three neighbors who don't have a CleanCook, 'because it's faster for everyone, especially rice and coffee.'

After the CleanCook was introduced, she stopped using wood, which she previously bought for 25 R/load that lasted about a month. She does not like using wood because 'it is a lot of work to light it and keep it going all day.' She says five litres of ethanol/week is sufficient.

24. Nelci and Joao - Family size: 11

With a family size of 11, Nelci says that five liters of ethanol/week is not sufficient. She adds that a large burner for large pots would be good, and four burners would be great. She cleans pots after using the CleanCook with soap only, and she says ethanol does not smell.

She uses the wood stove for beans, and she and her daughters cook rice, meats and vegetables on the CleanCook. Nelci has completely stopped using LPG. Before the CleanCook, a 13 kg LPG tank lasted 30 days. If the unit price of ethanol and LPG were equal, Nelci says, 'I would use CleanCook because it cooks faster than LPG,' explaining that the CleanCook's flame is stronger than LPG's. CleanCook is 'the best stove.' Before the CleanCook, Nelci and her husband Joao collected wood every day for about 2-3 hours each time. Since the CleanCook, they collect wood once/week for about 2-3 hours.



25. José and Cristiane - Family size: 4 (+ 2 workers on their farm as well)



This higher income household did not use wood before or after the CleanCook. Before the CleanCook, their 13 kg LPG tank lasted 30-35 days. With the CleanCook, the same LPG tank lasts 50 days.

They use both the LPG and CleanCook stoves, mostly using the CleanCook for breakfast to heat milk and coffee. She states that the CleanCook needs more burners, and five liters of ethanol/week is enough for her household.

She says the CleanCook is not good for small pots, because they are unbalanced. Project Gaia Staff showed her how to place a grill on top of the CleanCook as other households have done for small pots. If ethanol costs the same as LPG, Cristiane says, 'I would use the CleanCook, because it cooks faster.'

Ponte Nova

Twenty stoves were placed in several communities in the vicinity of the main large town of Ponte Nova, southeast of Belo Horizonte. Seven homes were visited and narratives were collected in Uruçania—Usina de Jatiboca.

26. José and Adione - Family size: 4



'I would prefer cooking with alcohol because it's much faster than LPG and we could save money if it costs the same as gas [LPG] because we would use a smaller amount,' Jose states.

When Jose cooks, he uses gas and wood, because he does not know how to refill the empty CleanCook canisters. Five L ethanol/week is enough for their household. They still use wood for cooking beans and to heat water for bathing.

27. Hélio - Family size: 6

'I go to work at 5:30 and need to make food quickly. When my children get home from school, around 12:30, they heat the food on the CleanCook,' she states. Since five liters of ethanol lasts about 6 days, she would like more ethanol. She has stopped using LPG, but she still uses wood sometimes to heat bath water.



Before the CleanCook, a 13 kg LPG tank lasted 3 months and they collected wood every day, four hours each time, or her husband paid 25 R for a stack that lasted about a month. Since the CleanCook, they have stopped collecting wood. She prefers ethanol because it is faster than LPG. Even with beans, she says, the CleanCook is faster than wood and LPG when cooking in a pressure cooker.

28. Maria— Jatiboca - Family size: 5



'The CleanCook is a very good stove. It burns hotter than the LPG stove,' Maria says. She notes that five liters ethanol/week is enough, and she has stopped using LPG. Before the CleanCook, a 13 kg LPG tank lasted 30-40 days while also using wood. She still collects wood 1 day/week using a cart, taking about 2 hours each time; she uses wood to heat bath water.

She detects no smell with the CleanCook and says that the CleanCook is faster and more powerful than her LPG stove. She notes that her pots do not fit well on the CleanCook. Project Gaia Staff show her how to fit the grill from her LPG stove over the CleanCook stove as other households have done. She says that perhaps she will use less wood now as a result of using the grill on the CleanCook.

29. Geraldo and Maria - Jatiboca - Family size: 5



Maria stopped using LPG after the CleanCook was introduced (about 40 days ago), but she still uses wood for heating bath water and cooking beans.

She fills the CleanCook canisters twice/week and she reports no problems of dirty/stained pots. If ethanol's price were equal to LPG, she says she would use the CleanCook because it cooks faster than LPG.

Before the CleanCook, her husband collected wood every Sunday, and he has collected wood only once since using the CleanCook. She adds that 4 burners would be nice.

30. José and Sandra - Jatiboca - Family size: 3

Sandra states that she only uses the CleanCook, except for cooking beans on the wood stove. She says she has stopped collecting wood and cooking with LPG. She uses traditional stone pots.



She would like four burners on the CleanCook. She fills CleanCook canisters every 3 days. Using the CleanCook about an hour or so a day, Sandra cooks in the mornings and then reheats food for other meals.

She asserts that she prefers cooking with the CleanCook over LPG, and adds that 'it would be cheaper to cook with the CleanCook.' Her husband Jose says he is investigating the costs and savings of using the CleanCook versus the LPG.

31. José and Shirley - Jatiboca - Family size: 6 (including her son who is in the photo)



'Alcohol is not as dangerous as LPG. If the CleanCook had more burners, I would use it all the time,' states Shirley, 'The CleanCook is a very good, economical stove for cooking.'

She says that five liters ethanol/week is enough for her household, and she would prefer four burners on the CleanCook.

She has stopped using LPG, but she still uses wood for beans and heating bath water. Before the CleanCook, a 13 kg LPG tank lasted 2-3 months, because they also cooked with wood. Shirley says, 'The CleanCook is faster than the LPG stove.' She shows that her pots fit fine on the CleanCook with the LPG grill on top. Shirley adds, 'I prefer the CleanCook over LPG, because it's a better, faster stove, and is much safer.'

32. Carlos - Jatiboca - Family size: 3

Carlos cooks some of the family meals in the morning, while his wife works. She then reheats meals throughout the day.



Before the CleanCook, a 13 kg LPG tank lasted 25 days and they collected wood twice/month for about an hour each time. Now they have stopped using LPG and wood. If the unit price of ethanol equaled LPG, he says he would prefer cooking with the CleanCook, because it is faster than LPG and would use less fuel and be cheaper than cooking with LPG.

Serra do Cipo National Park.

Five CleanCook stoves are available for rent to campers and cabin renters at the YMCA Campground. Two groups who had experience using the stove were approached. The first group was renting one of the cabins for the weekend. They had used the CleanCook to cook breakfast and were very impressed with how quickly it heated water for coffee and tea. They mentioned that the match sticks were too short for lighting. We told them we were going to buy longer matches at a local store and that the campground would bring the matches to them. The second interview was with a husband and wife who had used the CleanCook a few weeks earlier. They did not like that their pots were stained from using the CleanCook. They noted that with LPG, pots do not stain. The husband said that methanol would be better to use in the CleanCook because it would eliminate all soot. They loved the design of the stove, but felt that it is better suited for tent campers than for the permanent weekend trailer home they had at the campground. They pointed out that a grill is needed for the top of the stove so that all pot sizes and shapes can fit on it, pointing out that the stove was likely made for Europe and with the developed world in mind. However, they agreed that the aim of the project is a good one, and with adaptation (more burners, grill to go over the burners) the stove would be a likely success in Brazil.

Conclusion

Thirty-two narratives (from homes and one child care center) and campground interviews were collected out of 90 settings (homes, institutions, campground) that are using the CleanCook stove in Minas Gerais, Brazil. Feedback indicates user satisfaction with the CleanCook is very high.

- Ease-of-use
- Improved cooking time over traditional and even modern LPG stoves
- Perceived economical gains
- Cleanliness

These were cited as benefits of using the ethanol-powered CleanCook stove. All households stated that if the unit price of ethanol and LPG were equal, they would cook with ethanol because the cooking time is faster and less fuel would be used.

On average:

- Homes cooked with 5 liters of ethanol per week, bringing a monthly total to an estimated 20-25 liters of ethanol.
- Nearly all households suggested increasing the burner number from 2 burners to 4 burners. Brazilian cooking typically includes a pot of beans, a pot of rice, a pot of meat, and a pot of vegetables on a daily basis.

- Through their own ingenuity, many household cooks placed a small grill from the standard LPG stove in use in most homes over the CleanCook burners. This adaptation allowed for all pot styles and sizes to fit on the CleanCook stove.
- Most insightful was that many homes are finding it difficult to purchase the 13 kg LPG canister when it comes time for refilling. With a price ranging from 32-36 Reais per canister, and lasting an average of 25-30 days, it is becoming increasingly difficult for families to cook with LPG.

Nearly all homes do some cooking on their woodstove, and several families talked of cooking with wood until they were able to put together the money to buy another LPG canister. Having experienced such economic challenges related to cooking over the past few years, many families spoke of the desire to be able to purchase cooking fuel in small amounts on a daily basis. They posited that if alcohol were sold in small amounts, and were to be economical, they would cook with the CleanCook stove because they were more likely to have a few Reais from day-to-day rather than having 35 Reais to buy fuel in bulk.

For the purpose of assessing families' willingness to pay for ethanol, a staggered pricing mechanism was determined by the field team. Ethanol was provided free of charge to the families during the first month of the study. A local sugar company in the Ponte Nova region continued to provide ethanol at no charge to the twenty households in and around Jatiboca for the duration of the study. In Salinas and Dom Orione, however, study participants began paying a portion of the ethanol cost at the beginning of week five. For weeks five and six, families were charged R\$ 0.50 per liter of ethanol. In weeks seven and eight, families paid R\$ 1.00 per liter, and in weeks nine and ten, a price of R\$ 1.50 per liter of ethanol was passed on to the consumer. During weeks eleven and twelve, households in Salinas and Dom Orione paid the equivalent of the liter cost of ethanol at local fuel pumps. In Salinas, this average price was just over R\$ 2.00. In Dom Orione, the average local price came in around R\$ 1.80.

Ethanol is a ubiquitous, domestically-produced fuel in Brazil, with which Brazilians are well acquainted, but when it is sold at the pump for automotive fuel use, it's pricing is affected by the price of gasoline, which is an expensive fuel and which is highly sensitive to worldwide pricing pressures. Therefore, strong inflationary forces drive the pricing of ethanol as a vehicle fuel and affect the pricing of ethanol for any use in Brazil. To make ethanol available cheaply for household fuel use, the ethanol will have to remain outside of the vehicle fuel market and be sheltered from the inflationary effects of the petroleum fuels markets, which dominate fuels pricing.

One way in which this might be achieved is by linking household fuel use of ethanol to the burgeoning micro-distillery movement in Brazil. Micro distilleries would produce specifically for the household fuel market, and sell directly to the user in a local market. This might be characterized as a 'distributed energy' production and supply model.

Project Gaia/Brazil should expand the pilot study to develop a demonstration project centered on a community cooperative or a local business that owns and operates a small distillery (< 5000 liters output per day) that can provide ethanol directly to a dedicated local stove fuel market. Many distilleries produce beverage alcohol (*cachaça*)

for sale, discarding residues that could be further distilled to make additional ethanol for fuel, were there to be a use for it. These distilleries thus have, or have the potential for, extra capacity. Linking stoves in a local market to an operating distillery to test this distributed energy model could provide a valuable case study.

Project Gaia could build upon the experience of this pilot study to run a demonstration project with a micro distillery that can provide ethanol to stoves in a local market. Commercial sustainability would be tested. If sustainable, this project could be replicated. The opportunity for widespread replication is apparent. The enthusiastic response by the study participants to the performance of the stove indicates that the desirability of, and likewise the need for, the stove would help to drive the project.

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