

**Project Gaia/Brazil Trip Report: Assessment of the CleanCook Stove
Supported by Microdistillery Ethanol in Minas Gerais, Brazil, 9-25
June 2006**

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Black stone pots are quarried and crafted in Minas Gerais. They are preferred especially for cooking beans and soups, as they keep the contents hot long after being removed from the stove.

Background

James Murren and Cheryl O'Brien of the Stokes Consulting Group (SCG) landed in Belo Horizonte, Minas Gerais, around 11:00 a.m. local time on 10 June 2006 where they were met by Regina Couto, Project Gaia/Brazil Director, and Erica Morais, Financial Manager of Banco do Povo, a regional NGO and Project Gaia's facilitating partner on the ground. Banco do Povo (BP) specializes in micro-credit financing.

James and Cheryl were taken to hotel for rest and relaxation before being picked up at 4:00 p.m. for a driving tour of the foothills outside of the city. Accompanying Regina and Erica was Cesar Moreira, Executive Director of Banco do Povo. Over a dinner a traditional dishes, James and Cheryl explained the general expectations of the next two weeks: (1) visiting homes using the CleanCook stove in the three pilot study sites of Salinas, Dom Orione and Ponte Nova to make an initial assessment, (2) reviewing project expenses and setting the remaining budget, establishing an easy-to-use database, and (3) assessing other project needs, challenges and successes.

Plans were set for the following day's flight to Montes Claros. Following is a day-by-day account of James and Cheryl's trip. A summary is provided at the conclusion of this report.

Daily Activities Log

Sunday, June 11, 2006: We (James, Cheryl and Regina) flew from Belo Horizonte to Montes Claros in northern Minas Gerais, about an hour flight, arriving around 5:30 in the evening. Too late to drive on to Salinas, we stayed in a local hotel and got a good night's rest before the early morning departure for Salinas.

Monday, June 12, 2006: Waking early for a quick breakfast at the hotel, we left Montes Claros around 7 a.m. and drove 3 hours east to Salinas. We began writing narrative questions in Portuguese over breakfast, with the plan for Jim and Regina to partner and Cheryl and Selia, PG surveyor in Salinas, to partner for household interviews.

Upon arrival to Salinas, we checked into a hotel and finished writing the questions for our narratives report. (A note on the PG narratives: In Ethiopia, the surveys were lacking in general quality of life and opinion questions, so the narratives were longer. All of the Ethiopian narrative questions that were possible to place in a survey were added to the survey template that was sent to Brazil, so we knew the narrative questions could be shortened in comparison to what we did in Ethiopia. Therefore with Regina we deleted some of the original narrative questions.)

With some time before the lunch hour, we drove to the gas station where ethanol is bought for the households. Jani, owner of the gas station, explained that the price of ethanol is so high in Salinas, BRL\$ 2.42/liter, because of transport costs. She noted that the ethanol is produced not far from Salinas, but is shipped down to Belo Horizonte and then back up to Salinas. If it were delivered directly to the gas station, Jani believes the price would be around BRL\$ 1.80/liter.

While eating lunch, Regina explained that economic income classes vary from town to town, so a low income family in Salinas is poorer than families at other sites; in Salinas, a few of our study households receive a gas voucher of BRL\$ 15.00 every 2 months. Regina noted that, while doing the baseline surveys, people in general did not know the cost of their stoves. She also noted that for ethnicity, she wrote *parda* (mestizo) for those of mixed races, typically black and white.

Selia joined us at the end of lunch. We explained the narratives questions (see separate Narratives Report) to her and that we were going to conduct casual interviews with the families about their use of the CC stove. At 2:00 p.m., we drove to Bairro Santo Antonio where 39 CC stoves had been placed in homes during the last week of April. Thus these stoves had been the study homes for five to six weeks.



Selia, Project Gaia Surveyor in Salinas, visits each of the 39 families in the community once every week.

We decided to visit a few households together so that Selia and Regina would get an idea of what we wanted to achieve with the narratives, and because of concern for language barriers—James and Cheryl speak English and Spanish, Regina and Selia speak only Portuguese. Regina understands a little bit of Spanish and knows English words.

After two households, it was determined that we should all stick together. James and Cheryl needed each other to work through the Portuguese, and Regina was excellent with the families and made them feel comfortable with the process. And, because they see Selia every week, they immediately associated the entire process with the CC stove, making our team approach very effective. By the end of the day, we interviewed 11 households.

Before leaving the neighborhood, we met with Jonas Pereira de Melo, president of the neighborhood association. He explained that the neighborhood has become more united as a result of Project Gaia and the CleanCook stove. When asked what he meant by “more united,” he said “Those without a stove are requesting stoves, and those with stoves are coming to me and saying that we need to find a way to bring more stoves for the families without a stove. They want everyone to be able to cook with the [CC] stove. They like using the [CC] stove because it cooks faster than the [LPG] gas stoves.” James asked Jonas to keep a close watch on this, especially when families would have to begin paying for ethanol. Jonas responded by saying that if ethanol can be bought for a price less than LPG, he was certain that the families would continue using the CC stove over their LPG stoves.

Tuesday, June 13, 2006: After breakfast we interviewed 5 additional households.

Summary of findings from Bairro Santo Antonio, Salinas households:

- Many households were still using wood to heat water for bathing. Brazil was in the winter season. Study participants remarked that they didn't want to "waste" ethanol for heating water.
- A 13 kg LPG tank lasts approximately 30 days and costs BRL\$ 35.00.
- Lower income homes remarked that sometimes they do not have BRL\$ 35.00 to buy another tank when the one they are using empties. They cook with wood until they are able to save up the money to buy another LPG tank.
- All households said that if ethanol and LPG had the same cost per unit, they would use ethanol because the CC stove cooks faster than the LPG stoves. Nearly all households were able to meet their cooking needs with 5 liters of ethanol per week, meaning that the households estimate they will be spending less money per week to meet their cooking needs.
- Some households said they still used wood for cooking beans, saying that they prefer cooking beans on the woodstove because it tastes better. Also, wood-fired ovens for baking bread were commonplace.
- The surrounding hillsides around Salinas are well forested. Wood is both collected and bought by households. A small wagon load of wood that was reported to last for a month cost BRL\$ 25.00.



Regina, Director of Project Gaia/Brazil, visiting with a study participant in the town of Salinas in northeastern Minas Gerais.

Having concluded the home visits, we drove out to the farm of Israel Pinheiro, a local cachaça producer. He showed us his microdistillery equipment and said that he would sell it to us because he was planning to upgrade his operation. We explained that it might be a good idea if we are able to work out an agreement with the Agro-Technical School

of Salinas where they would assist with further study of the idea of using microdistilleries in rural areas with the purpose of supplying ethanol for home cooking use. Mr. Pinheiro liked the idea, but did not seem at all interested in being part of it. James interpreted the short visit as Mr. Pinheiro looking to make some money on old equipment.

Later in the afternoon, we met with Oscar William Barbosa Fernandez, a professor at the Federal Agro-Technical School with much experience in sugarcane production and economics. Professor Fernandez was very interested in what we were doing and expressed interest in collaborating with a demonstration microdistillery. But he explained that he would have to overcome some obstacles to establishing a partnership between PG and the school if the school were to be expected to sell ethanol. He informed us that if we wanted to have the school produce ethanol and then have households pay for it, the school would be in violation of a federal law that stipulates that a federally funded school cannot sell anything for any reason. When pressed as to whether or not there might be a loophole in the law, since the project would be for research rather than strictly commercial purposes, Professor Fernandez said that it might be possible, but he was not aware of any such loophole. The meeting ended with Professor Fernandez saying he would discuss it further with his colleagues. Three days later we received a phone call from him saying that the school was not going to be able to do it this year, but perhaps we could try to work something out for 2007. Regina will be following up on this.

Wednesday, June 14, 2006: Before leaving town, we met with Zonete Mendes at the Department of Culture in Salinas. Mr. Mendes is considered a local expert on ethanol production. He said, “Small family distilleries would be good because large distilleries (cachaça) don’t have an interest in helping people.” James agreed with this sentiment, noting visits to cachaça producers Seleta and Brinca do Ouro and how the proprietors did not seem interested in the idea of selling ethanol for cooking use to local people. Mr. Mendes noted two advantages of using ethanol for cooking, first, economic, in that gas is expensive and microdistillery ethanol would be a “local solution” with people “taking care of each other,” and, second, social impact: “It would give people their dignity.”

We then met with Antonio Rodriguez, a local cachaça distributor and distiller. Regina told him about our project and asked if he would be interested in working with us to produce ethanol for cooking. He said he was interested in the research and that we should keep in touch with him

Needing to get on the road, we had a quick lunch and then began our drive to Belo Horizonte, some 8 hours away. We spent the night in the colonial town of Diamantina, arriving around 7:00 p.m.

Thursday, June 15, 2006: In the morning, we walked around the historic town of Diamantina. The town was celebrating Corpus Cristi (Catholic holy day) and preparing for a procession through the village. Street paintings marked the path of the procession. After an early lunch, we drove the final 4 hours to Betim, 30 minutes southeast of Belo Horizonte, checking into the hotel around 7:30 p.m.



Above: Corpus Crist procession, Diamantina, Minas Gerais

Left: James waiting for the procession to begin

Friday, June 16, 2006: On the drive to the pilot study community of Dom Orione, we stopped at the gas station to buy ethanol for the community. We noted alcohol sold for BRL 1.84/liter.

We arrived late morning to the peaceful farming village of Dom Orione, where we have CC stoves in 28 of the 39 homes. Regina and Meire Rezende, who is the PG/Brazil Secretary and Assistant Manager, accompanied us to gather more narratives.

We were soon delayed at the first house of Carlos Ribeiro because the Landless Workers' Movement or MST, a peasant movement in Minas Gerais State, arrived to remove the community microdistillery from the premises by force.* The MST had papers showing they were permitted by the proper authorities to remove the equipment. Regina called the police and acted as moderator between the family and the MST. The police soon arrived, and determined that the papers were in order. It was learned that the community did not have legal ownership of the equipment. However, it was learned that the community of

* On the 20th of November 2003, 200 families that had occupied a disused farm in the municipality of Felizburgo, in the Valley of Jequitinhonha, in Minas Gerais State, were surprised by an attack that left 5 landless workers dead and 13 wounded. This event helped to galvanize a movement known as the Landless Workers' Movement (MST). The Land Institute of Minas Gerais said that the occupied farm had been devolved to the state and was the property of the state, not a private owner. The peasants blamed the state for their refusal to distribute the land and the former property owner for the violence, which they believed was tacitly condoned by the state. Minas Gerais has some 11 million hectares (27.1 million acres) of devolved and currently state-owned land that is slated for use in Agrarian Reform and land distribution; however, the process of land distribution has been stalled in the courts, and the Landless Workers' Movement (MST) is a response to the frustration that has developed over this situation. (From Grassroots International on the web at www.grassrootsonline.org/weblog/mst.html, July 2, 2006.)

Dom Orione would be receiving a new microdistillery from the state government. Upon hearing this news, which was confirmed by the Military Police, tension eased and Regina and Mr. Ribeiro celebrated the news that the community would be receiving a new microdistillery.



Meire, Project Gaia/Brazil Secretary and Assistant Manager, has become close with Carlos Riberio of Dom Orione.

While the confrontation played out (we had been kept away by our hosts, for safety), Newton, PG surveyor in Dom Orione, arrived and we explained to him the purpose of the narratives. Meire soon decided that she would take us around to the houses while Regina stayed behind to monitor the removal of the microdistillery.

Four homes were visited before lunch. (See Tuesday, June 20, 2006 for summary of findings for Dom Orione home visits.)

Newton, Project Gaia Surveyor in Dom Orione, displaying how the grate from most LPG stoves fits over the CleanCook stove. This allows all pot sizes to be used for cooking on the CleanCook.



Saturday, June 17, 2006: James, Cheryl and Regina drove 2 hours from Betim to the area of Serra do Cipo National Park where 5 CC stoves are available for rent to campers at the YMCA Campground. We met with two gentlemen who were renting one of the cabins with their family for the weekend. They said they were enjoying the stove, but noted that it was difficult to light with the matches provided by the campground. They were short matchbook matches. Before leaving, we went to a local store and bought 5 boxes, one for each stove, of longer matches to alleviate this problem.

We also met with a married couple who had tried the CC stove a few weeks before. They have a motor home and a small cabin. The husband was well-traveled and noted that the stove was like camping stoves he saw in Europe. He also said that methanol would be a better fuel than ethanol because it burns without any soot, while ethanol can produce some soot. His wife was not happy about her pots showing some soot when they used the CC stove. She noted that LPG does not produce any soot. They both mentioned the problem of short matchsticks and difficulty lighting the stove in the cool mornings. He recommended designing a grill to fit over the burners so that all pot sizes could be used on the stove.

Sunday, June 18, 2006: A day of relaxation, we went to an Ecological Park to watch Brazil's 2nd World Cup game while having lunch at the restaurant there.

Monday, June 19, 2006: We worked in the office of Banco do Povo, getting the expense and budget spreadsheets worked out. We also met with Tania Machado, President of Banco do Povo. Tania is very supportive of Project Gaia and expressed that she would assist us in any way to make PG successful in Brazil.

Tuesday, June 20, 2006: We finished with the house interviews in Dom Orione, visiting with an additional 6 houses, for a total of 10 household narratives.

Summary of findings for Dom Orione, Betim households:

- Some families requested additional ethanol. It was decided that 12 of the 28 homes would receive 7 liters/week instead of 5 liters/week. They were not able to meet their cooking needs with only 5 liters.
- The community is very interested in using the forthcoming new microdistillery to produce ethanol for their CC stoves.
- Wood is plentiful in the area. Houses use wood for heating bath water, bread baking, and cooking beans.
- When cooking beans on the CC stove using a pressure cooker pot, beans cook in 45 minutes. The same pot of beans on an LPG stove takes 1 hour to cook.
- All households said they would cook with ethanol over LPG if the unit costs were equal because the CC cooks faster than LPG.
- One family asked if the CC stove could be adapted to have an oven.



The pressure cooker on the right was a standard pot in all of the homes we visited. It is used mostly for beans and occasionally for beef. A pot of beans cooks in 45 minutes on the CleanCook, whereas the same pot of beans on an LPG stove takes an hour to cook.

We had lunch in Betim, and then drove 3 hours to the Urucania - Usina de Jatiboca near the town of Ponte Nova, the final pilot study site to be visited on the trip.

James and Regina, along with Rafael, Project Gaia surveyor for Ponte Nova, conducted two interviews in Urucania. We then drove to the hotel. Unfortunately, we had contracted food poisoning, and had to rest, losing half a day of work.

Rafael, Project Gaia Surveyor in Jatiboca, and his mother. Jatiboca is one of three small villages around the main town of Ponte Nova participating in the study. Twenty CleanCook stoves are located in this region southeast of Belo Horizonte, the state capital.



Wednesday, June 21, 2006: Interviews were carried out in five more houses in the morning.

Summary of findings for Urucania – Usina de Jatiboca households:

- Some households were not aware that the standard LPG stove grills would fit on top of the CC stove burners, allowing all pot sizes to be used on the CC. We instructed Rafael to inform the other houses about this helpful adaptation.
- All houses said they would cook with ethanol over LPG if the unit costs were equal because they said the CC stove cooks faster than LPG stoves.

- The local sugar company provides ethanol to the homes at no cost to the project at five liters/week/household. Rafael did not report any households needing more ethanol.
- Wood is used for heating bath water, beans, and baking bread.
- LPG was being used to re-heat food in one household we visited.

Finished with the households, we drove to the National University of Viçosa to meet with Professor Juarez de Souza. Professor Juarez was very candid about his thoughts on ethanol production in Brazil, microdistilleries, the CleanCook stove, and further study of the microdistillery concept. The following is a summation of his views:

Main Points of Meeting with Professor Juarez, National University of Viçosa

- Very few people in Viçosa use woodstoves. It is a wealthier town. LPG is used.
- In his view, a stove with only 2 burners will not work in Brazil. Brazilians cook a pot of rice, a pot of beans, a pot of vegetables, and a pot of meat, usually once a day and then they are re-heated throughout the day.
- The CleanCook stove is great for traveling and camping.
- When cooking, 1 kg of LPG = 2 kg of ethanol. More alcohol is used to meet the output of LPG. Thus, the CC is not faster because it is really using more fuel. The same fuel output of LPG would cook faster than CC stove.*
- He believes 1 liter of ethanol would have to cost no more than BRL\$ 1.00 for it to be competitive with LPG.
- Cane is bought at BRL\$ 0.70/kg.
- The University microdistillery produces 500 liters of ethanol per day.
- Ethanol in Brazil is denatured with kerosene and gas [gasoline].
- For every 2.5 liters of cachaça that is produced, 1 liter of ethanol is produced.
- 1 kg of LPG costs BRL\$ 2.00. [This appears to vary significantly by region.]
- Bolivia sells gas to Brazil at a cost of 1000 x less than the cost of Brazilian gas. Cost is incurred in transporting it from Bolivia to Brazil.
- Brazilian people pay the subsidy to keep LPG prices down by paying high gasoline prices. The price of 1 liter of gasoline in Brazil = 3 liters of gasoline in the U.S. Tax on gasoline funds the diesel and LPG subsidy in Brazil.
- As world oil prices go up, Brazilian gas prices will go up, and Brazilian LPG prices will go up. “The excess tax money goes into the pockets of the corrupt politicians. Petrobras is very rich.”
- Driving a car: 1 liter of gasoline = 15 km distance; 1 liter of ethanol = 10 km distance
- 25% of gasoline content in Brazil is alcohol
- Brazil consists of about 5000 municipalities. If each produced 1000 liters/day of ethanol, “the big companies would not allow it.”

* This was Professor Juarez’s assertion. Actually ethanol contains 60% of LPG’s energy by weight and 88.5% by volume. The CC stove generally shows a thermal efficiency gain of 5 to 7% over an LPG stove. This permits a correction of the above figures to 64% by weight and 95% by volume. Thus, the energy content of a 13 kg cylinder of LPG would be matched by ~20.3 kg or 25 ½ liters of ethanol. LPG and ethanol maximum flame temperatures are virtually the same at 1925 C and 1920 C respectively.

- 1 microdistillery/1 person/500 liters of ethanol = too expensive, would not work
- 1 microdistillery/1 community/500 liters of ethanol = affordable, will work, and the big companies would not care
- 4 burner LPG stoves cost BRL\$ 200-250.00

Despite Professor Juarez’s seeming skepticism at the outset of our meeting with him, he was very interested in partnering with Project Gaia to carry out a study investigating the use of microdistilleries by cooperatives and/or community associations to produce alcohol for household cooking use.



A microdistillery that produces cachaça and ethanol at Viçosa University. Professor Juarez de Souza is very interested in Project Gaia, and has agreed to explore a possible partnership between the university and Project Gaia to carry out an additional study on the concept of local cooperatives producing ethanol for household energy use.

We left Vicosa and drove to Ouro Preto, colonial town and center of Brazilian liberation from Portugal. We arrived to town late in the evening, all of us having soup for dinner before going to sleep.

Thursday, June 22, 2006: We walked Ouro Preto in the morning, had lunch, and returned to Betim. Tired, James and Cheryl stayed in the hotel to organize notes and go over what needed to be done before leaving.

Friday, June 23, 2006: We worked in a meeting room at the hotel in the morning before going over to Meire’s home to discuss the database. Meire’s husband, Sandro, a database developer, created a MS Access method that easily converted to Excel. We liked its ease-of-use and transferability to Excel, and decided to go forward with setting up the same Access database entry format for all of the surveys. Regina, Meire, Sandro, and Cesar will be working out the cost of designing the database.



The mountainside town of Ouro Preto

James and Cheryl invited the Project Gaia/Brazil team to dinner. We ate lots of food at a *churrascaria*—Brazilian style barbecued meats restaurant.

Saturday, June 24, 2006: James and Cheryl flew back to the U.S. from Belo Horizonte, arriving home to Pennsylvania the following day, Sunday, around 4:00 p.m.

Summary

The CleanCook stove, after more than a month of use, has become the preferred cooking choice in all households. When compared to LPG stoves, all study participants said that the CC stove cooks faster than the LPG stoves and that if made available at a unit cost equal to LPG, they would prefer cooking with ethanol over LPG. However, given Professor Juarez's expressed skepticism about the amount of ethanol needed to equal the output of LPG, empirical study of ethanol consumed compared with LPG for defined cooking tasks should be performed and would be helpful to have. This could be performed by a home economist in a "lab kitchen." This data would allow ethanol to be compared with LPG both with regard to performance and economy. A cost of BRL\$ 1.00/liter of ethanol would certainly make ethanol economical for households but a more careful study needs to be performed on appropriate pricing for ethanol as a HHE fuel.

Families are very comfortable with using the CC stove, and in all pilot study locations, surveyors mentioned that other households which do not have CC stoves are asking how they can get one. No accidents were reported. Five liters of ethanol per week was sufficient for nearly all households. Seven liters were suggested for some of the larger families in Dom Orione, the only site that spoke of not meeting daily cooking needs with 5 liters. PG/Brazil team granted the 7 liters to these families, as at the time there was only one week remaining before families would begin paying for a portion of their liters of ethanol.

Regarding the new-found knowledge that ethanol is denatured with kerosene and gasoline in Brazil, it is most important that PG/Brazil team is very watchful of the performance of the stoves and canisters. Yellow/blue flames were seen during home visits. If flames become more yellow than blue, stove performance will decrease. It may be worthwhile to "clean out" the canisters by burning a higher grade ethanol or methanol in them at the halfway point of the pilot study, in mid-July. Any denaturant residues collecting in the canister could impact the stove's performance.

At this time, it does not seem likely that a partnership with the Agro-Technical School in Salinas will happen. Waiting until 2007 would stall the project, and is not a good choice. Every effort should be made to establish a partnership with Professor Juarez at the National University of Viçosa. One interesting development with Viçosa could be an additional partnership with the University of Iowa. At the time of our visit, 6 Iowa graduate students were studying ethanol production at Viçosa through an exchange program shared between the two research institutions. None of the Iowa students were around the afternoon of the PG visit. Developing this partnership is of great importance, as it is a solid lead for extending the efforts of the pilot study. Shell Foundation should

be approached about the idea of supplying additional funds to bring about this next phase of the study in Brazil.

The database should be completed by the end of July so that data entry will not become backed up and become a reason to delay project results. PG/Brazil and Banco do Povo should determine if additional funds are needed to achieve this task and, if so, should submit in writing to Winrock International for submission to Stokes Consulting/Dometic requesting the use of contingency monies to pay for these services.

As homes begin to pay for ethanol, detailed accounting procedures should be in place to guarantee accurate assessments of household use of ethanol and to determine how much households are willing to pay for ethanol. Banco do Povo has proven their ability to set up excellent accounting spreadsheets, and should be consulted by PG/Brazil in carrying out this task.