Efficient Cookstoves
in the Bahian Recôncavo Region

Project Design Document
Submitted to The Gold Standard

Prepared by:

Ambiental PV Ltd.
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CLEAN DEVELOPMENT MECHANISM

PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)

Version 03 - in effect as of: 22 December 2006

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Annexes

List of Acronyms

AAC	Autoclaved Aerated Concrete
CER	Certified Emission Reduction
CDM	Clean Development Mechanism
CO_2-eq	Carbon dioxide equivalent
EF	Emission Factor
ER	Emission Reduction
GHG	Greenhouse Gas
GWhr	Giga-Watt Hour
ICS	Improved Cook-Stove
IBGE	Brazilian Institute of Geography and Statistics
IPCC	Intergovernmental Panel on Climate Change
KS	Kitchen Survey
KPT	Kitchen Performance Test
LPG	Liquid Petroleum Gas
MME	Ministry of Mines and Energy (Brazil)
NGO	Non-Governmental Organization
NRB	Non-Renewability
ODA	Official Development Assistance
UNFCCC	United Nations Framework Convention on Climate Change
VER	Voluntary Emission Reduction

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Efficient Cookstoves in the Bahian Recôncavo region

A.2. Description of the small-scale project activity:

The Efficient Cookstoves Project is an initiative developed and executed by the Brazilian NGO Instituto Perene (Perennial Institute, in English) that reduces greenhouse gas emissions by substituting common rudimentary cookstoves with a more efficient technology for domestic use. Five thousand low-income rural families in the Recôncavo region of Bahia state in northeastern Brazil will directly benefit from the project, with especially positive impacts for women and children.

In rural areas of the Bahian Recôncavo region, wood is the main fuel used for combustion for cooking by the low income population. The typical cookstoves used by the local population are associated with a number of problems:

- Global warming, due to the emission of unnecessary amounts of greenhouse gases;
- Degradation of the surrounding forest, resulting from the high consumption of wood; and
- Damages to health, mainly for women and children who are the victims of indoor air pollution because they are subjected daily to the smoke and particulates produced by typical rural stoves.

This project intends to substitute the use of rudimentary wood cookstoves with efficient wood cookstoves designed to achieve: high energy efficiency; elimination of indoor smoke; long durability (10 years); easy maintenance; and use of local materials and technical capacity. The improved cook-stoves (ICS) distributed under this project activity are more efficient in transferring heat from the fuel to the pot, thus saving fuel compared to traditional stoves in the Bahian Recôncavo region.

With the implementation of ICS, the project will achieve the following goals:

- Reduce emissions of greenhouse gases by an estimated 50%;
- Contribute to the protection of Atlantic Rainforest fragments; and
- Improve the health conditions within homes.

The main project activities are

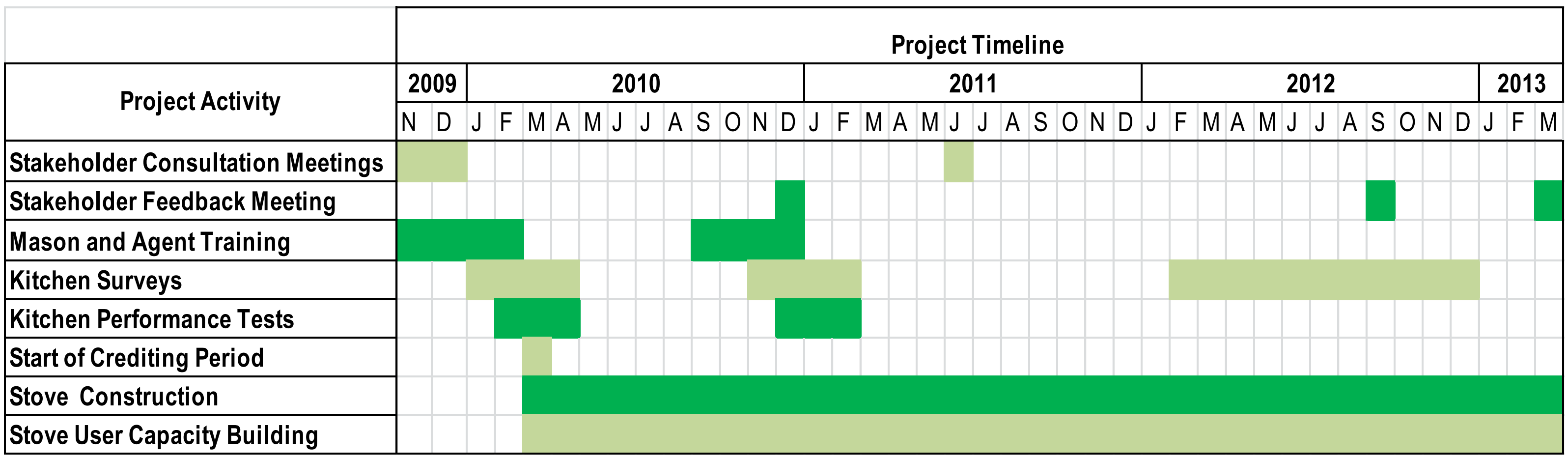
1. Participatory design of the regional stove model in partnership with Aprovecho Research Center.
2. Community engagement and identification of participating families;
3. Training of women to be community agents;
4. Execution of field testing (Kitchen Surveys and Kitchen Performance Tests) to establish baseline and actual change in wood consumption ;
5. Training of installers;
6. Capacity building for users;
7. Installation of 5,000 units of ICS;
8. Monitoring of ICS performance in the participating rural communities.

Current status

At the time of the PDD revision (June 2012), the status of the project is as follows:

- 2,430 stoves constructed
- Baseline and project KPT complete
- Stakeholder Feedback Round complete - held on December 10, 2010.
- First round of KS (110 homes with old stoves and 100 homes with new stoves) concluded.
- Technology transfer/capacity building milestone: legal, administrative and financial support provided to local entrepreneur in establishing a small construction business.

Below is the project implementation timeline, detailing activities for the first three years of the project. By March 2013 all 5,000 are scheduled to be installed. The crediting period extends from March 2010 to March 2020.



Through the installation of 5,000 efficient cookstoves, this project activity is expected to reduce **8,834 tons of CO_2-eq per year over 10 years, totalling 88,340 tons of CO_2-eq**.

According to the new Micro-scale Scheme Rules[1] (released in Nov 2011),: "project activities are eligible under the micro-scale scheme if the annual emission reductions achieved are limited to a maximum of 10,000 tonnes of CO2e in each and every year of the crediting period."

Since the annual emissions reduction of this project is estimated to be 8,834 tons of CO_2-eq per year, and this is less than 10,000 tons of CO_2-eq per year, this project is classified as a "micro" scale voluntary emissions reduction project. A contract with the stove-users transfers the carbon credit rights to Instituto Perene, and a separate contract transfers the carbon credit rights from Instituto Perene to their final owner, the Brazilian company Natura.

Prior to this initiative, efficient wood-burning cookstoves have not been available in the region because of cost limitations, technology limitations, and the predominance of traditional cookstove practices.

[1]Available at http://www.cdmgoldstandard.org/wp-content/uploads/2011/11/New-micro-scale-scheme-rules_Final.pdf

The technology employed uses locally available materials and labor. It is constructed using regular and refractory bricks, regular and refractory mortar, a metal plate with 2 openings, a rocket-elbow combustion chamber, autoclaved aerated concrete for insulation, and a ceramic chimney[2]. The photo below shows a completed stove. This model was designed with the technical assistance of Aprovecho Research Center.

Figure 1: Completed stove in use.

This project is financially supported through the Natura Carbon Neutral Program. Natura is a Brazilian cosmetics company that, as of 2007, voluntarily committed to offset the greenhouse gas emissions produced by its activities. As part of its commitment to sustainability, Natura has compiled an emissions inventory generated by its activities. After reducing emissions as much as possible, Natura offsets remaining emissions through reforestation, agro-forestry, and renewable energy projects. The Efficient Stoves Project is one of the projects selected by Natura to offset its emissions. To read more about the Natura Carbon Neutral Program please access http://www2.natura.net/Web/Br/Inst/CarbonoNeutro2009/src/EN/Default.asp.

Confirmation that the proposed project activity is a voluntary action by the coordinating/managing entity

Since there are no laws, policies, or mandatory requirements in Brazil stipulating the adoption or dissemination of efficient cookstoves by households, the proposed small-scale project activity is clearly a voluntary action by the coordinating/managing entity, Instituto Perene, and by the ultimate owner of the carbon credits, Natura.

Contribution of the proposed project activity to sustainable development

Environmental benefits:

- *Air quality*: Indoor air pollution will be reduced. Due to its high efficiency, the ICS drastically reduces the amount of smoke produced. Furthermore, the little smoke that is generated does not contaminate the home as it exits the chimney.

[2] The original Perene/Aprovecho design included a metal chimney. However, in many cases these began to show signs of corrosion and have subsequently been replaced with ceramic chimneys. Instituto Perene has adapted the stove design and now uses only ceramic chimneys.

Other harmful substances like Products of Incomplete Combustion (PICs) are low as the combustion is nearly complete and only small quantities of ash need to be removed.

- *Water quality*: The decrease in wood gathered from the project area is expected to help preserve woody vegetation in areas around water sources, thus contributing to preservation of the natural forces that filter and maintain the water supply.
- *Soil condition*: The preservation of woody vegetation expected as an outcome of this project protects against soil erosion and compaction.
- *Biodiversity*: The project will have a positive impact on biodiversity as it will help preserve habitat by reducing degradation of the surrounding Atlantic Forest fragments and mangroves. The Atlantic Forest constitutes one of the greatest repositories of biodiversity on the planet, with more than 20,000 known species of plants alone. Fragments of this forest are home to dozens of endemic and threatened flora and fauna species. Once spanning the entire coast of Brazil, the Atlantic Forest has been almost entirely deforested. Only 7% of the original Atlantic Forest cover remains (SOS Mata Atlântica, 2009).

Social and Economic benefits:

- *Quality of employment*: This project creates employment opportunities for local men and women (construction, maintenance, monitoring). Full-time construction workers are formally registered in accordance with Brazilian labor law.
- *Livelihood of the poor*: Time necessary to gather fuel-wood will be reduced and health of the stove users will also be improved by dramatically decreasing exposure to indoor air pollution.
- *Access to affordable and clean energy services*: This project makes ICS available to interested community members within the project area.
- *Human and institutional capacity*: The project activity generates new jobs for manufacturing, maintaining and operating the ICS, requiring special training and new skills. Women, besides being the most significant direct beneficiaries of this new cooking technology, also participate in the project as Community Agents, being trained and paid for instructing other cookstove users, assisting in KPT, KS and other monitoring activities. In addition, an important step in human/institutional capacity was achieved with the creation, by a local community member, of a small-scale construction company to build cookstoves. Through the Project, Instituto Perene and partner Ambiental PV provided the legal, administrative and financial support that enabled a local entrepreneur to become a first-time business owner. The company, *Roque Pereira De Souza Construção-ME*, became operational in November, 2011.
- *Quantitative employment and income generation*: The project activity generates new jobs for constructing, maintaining and operating the ICS. These jobs require higher technical skills than typical jobs available in the project area, and salaries and benefits are above-average in the region
- *Technology transfer and technological self-reliance*: This project introduces a new technology for use in a region in which this technology was previously unavailable. Through the project, masons are trained in stove installation, including construction of the internal rocket-chambers, and become self-reliant in all the construction steps of the ICS. Design specifications and modifications were discussed and agreed upon with a local machine shop, which will provide the chimneys, iron griddles, fuel shelves, and chimney support plates. The specifications and skills required in the metalwork are completely transferred to the local manufacturer.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as a project participant (Yes/No)
The project is voluntary: no Kyoto party participates	• Instituto Perene	The project is voluntary: no Kyoto party participates
	• Brazil	No

Instituto Perene (Coordinating entity)

Instituto Perene, the developer and executor of this initiative, is a non-governmental organization (NGO) founded in 2006 in Salvador, Brazil. Instituto Perene's mission is to develop mechanisms for conservation and sustainable use of natural resources, generating long-term environmental, economic, and social benefits. Instituto Perene projects seek to reconcile the restoration and conservation of Bahia state's threatened biomes with the economic and social needs of their local communities.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

Recôncavo region of the state of Bahia, Brazil

A.4.1.1. Host Party(ies):

This project is implemented in Brazil, however it is a voluntary project and therefore is not hosted nor invested in by a party to the Kyoto Protocol.

A.4.1.2. Region/State/Province etc.:

Country of Brazil - State of Bahia

A.4.1.3. City/Town/Community etc:

Municipalities of Maragogipe and Sao Felipe, within the rural communities of:

Maragogipe : Água Boa, , Capanema, , Encruzilhada, Giral Grande, Guaí, Guaruçu, Lagoa, , , Rio dos Paus, Rio das Pedras, , Samambaia, Serraria, Tabatinga and Tamancas.São Felipe: Araça, Barlavento, Benigno Soares, Benvenuto Noia, Boa Vista, Bom Gosto, C. Boa Esperança, Campo das Flores, Camargo, Cangalheiro, C. Do Ferreiro, Conceiçao Velha, Copioba, Fazenda Cabloco, Fazenda Andrade, Fazenda Baixa de Areia, Fazenda Bate Quente, Fazenda Mirim, Fazenda Camarão, Fazenda Cascalheira, Fazenda Chapada, Fazenda Coelho, Fazenda Corais, Fazenda Ferreira Chaves, Fazenda Jenipapo, Fazenda Mutum, Fazenda Patiobinha, Fazenda Pequi, Fazenda Pitinga, Fazenda Lazaro, Fazenda Retiro, Fazenda Rio da Cruz, Fazenda Rio das Varas, Fazenda Terrao, Fazenda Tabocas, JJ Seabra, Loteamento Bela Vista, Mariano, Mombaça, Morrinho, Mutum, Nova Esperança, Novo Paraiso, Paudalho, Povoado Três Irmãos, Queimadas, Raspa-pau, Sapezinho, Sao Felipe, Sitio, Tabocas, Tabua, Travessa Laranjeira, Umbuzeiro, Vai Vem, and Xango.

Improved cookstoves will be installed in 5,000 households within the municipalities of Maragogipe and São Felipe.

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

Figure 2: Map shows Project target area, within the Recôncavo region of Bahia state, Brazil.

	Coordinates
Latitude	12° 46′ 40″ S
Longitude	38° 55′ 8″ W

Instituto Perene is the implementing organization and will conduct the project onsite and from its office in Salvador, Bahia:

Contact person: Guilherme Monteiro do Prado Valladares

Address: R. Belo Horizonte, 64, sala 310

Salvador, Bahia 40140-380

Phone: +55 (71) 3264-3199

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The type of project activity proposed is an End-use Energy Efficiency Improvement, reducing the amount of energy required for domestic cooking in rural households. This project is eligible under the Gold Standard classification of "Improved distributed heating and cooking devices (e.g. cookstoves), and distributed micro-scale electricity generation units." The project reduces the amount of greenhouse gases emitted through the use of firewood as cooking fuel by introducing widespread use of an improved stove technology that replaces inefficient stoves.

There is no authorization required at any government level, federal, state or local, to install a cookstove in one´s home. Because of the small-scale, pulverized nature of the project, with domestic stoves being installed in individual homes, there is no need for government consent or licenses, nor is an Environmental Impact Assessment (EIA) necessary. Resolution 001[3] of the National Environmental Council of the Ministry of the Environment, dated January 23, 1986, in Article 2 describes the activities which require an EIA. None of these activities, which include roads, dams, landfills, industries and other large-scale undertakings, are applicable. The only mention of activity at all related is found in Article 2, item XVI: "Any activity that uses charcoal, derivatives or similar products in quantity above 10 tons/day." Since the project uses wood, not charcoal, this item is not directly applicable. However, even if the interpretation were made that the 5,000 homes, spread over 450 sq. kilometres, should be considered one single fuel consumer, and furthermore, that the fuel wood is similar to charcoal, the project´s scale would not be large enough to require an EIA. The ratio of wood to charcoal in charcoal production is approximately 7:1 (FAO, 1987), therefore, the EIA minimum limit of 10 tons/day is equivalent to 70 tons/day of fuelwood. Based on the results of the KPT , the project fuelwood consumption is 18 tons/day, less than one-quarter of the minimum established by law, considering the equivalent amount of charcoal.

Minimum quantity of charcoal or similar that requires Environmental Impact Assessment	Project fuel use
10 tons/day charcoal, equivalent to **70 tons/day of wood**	**18 tons/day of wood** (3.6 kg/day/stove * 5,000 stoves)

The transfer of credits ownership throughout the investment chain is transparent through written contracts. Each project beneficiary signs a contract, the *Authorization and Carbon Credits Rights Transfer*, transferring the ownership rights to the carbon credits to Instituto Perene. The cookstove end-users are fully aware of and willing to give up their rights on emission reductions, and this has been documented through video footage of the stakeholder meetings. The English translation of the individual contract is:

Terms of Authorization and Transfer

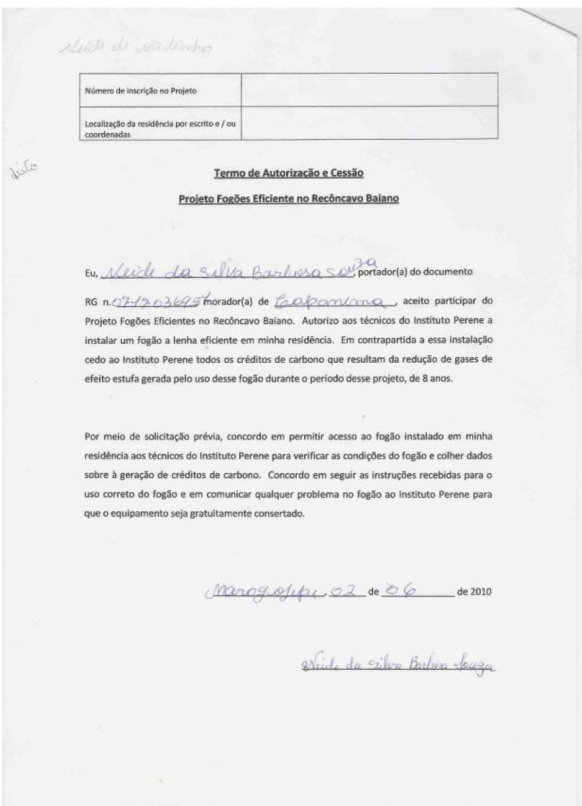
[3] Document can be found on the CONAMA website at http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=23

Project Efficient Cookstoves in the Bahian Reconvavo

I, (name), carrier of national identification document no. (number), resident of (district), agree to participate in the Efficient Cookstoves in the Bahian Recôncavo Project. I authorize the technicians from Instituto Perene to install one efficient wood-burning cookstove in my home. In return for this installation, I transfer all rights to the carbon credits resulting from the reduction of greenhouse gases generated by using this stove during the project lifetime of 8 years to Instituto Perene.

Upon previous request, I agree to allow access to the stove installed in my home to the technicians from Instituto Perene so that they may collect data about the generation of carbon credits. I agree to follow the instructions received for correct use of the stove and to communicate any problems with the stove to Instituto Perene so that they may fix the problem free of charge.

Two sample contract are copied below:



Número de inscrição no Projeto	
Localização da residência por escrito e / ou coordenadas	

Termo de Autorização e Cessão

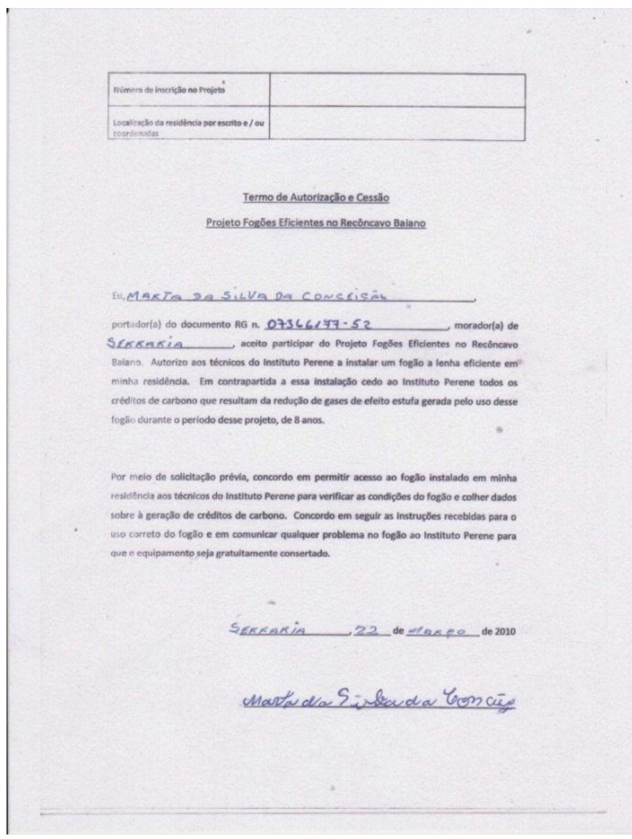
Projeto Fogões Eficiente no Recôncavo Baiano

Eu, Neide da Silva Barbosa Souza, portador(a) do documento RG n. 0712036954 morador(a) de Capanema, aceito participar do Projeto Fogões Eficientes no Recôncavo Baiano. Autorizo aos técnicos do Instituto Perene a instalar um fogão a lenha eficiente em minha residência. Em contrapartida a essa instalação cedo ao Instituto Perene todos os créditos de carbono que resultam da redução de gases de efeito estufa gerada pelo uso desse fogão durante o período desse projeto, de 8 anos.

Por meio de solicitação prévia, concordo em permitir acesso ao fogão instalado em minha residência aos técnicos do Instituto Perene para verificar as condições do fogão e colher dados sobre à geração de créditos de carbono. Concordo em seguir as instruções recebidas para o uso correto do fogão e em comunicar qualquer problema no fogão ao Instituto Perene para que o equipamento seja gratuitamente consertado.

Maragogipe, 02 de 06 de 2010

Neide da Silva Barbosa Souza



Número de inscrição no Projeto	
Localização da residência por escrito e / ou coordenadas	

Termo de Autorização e Cessão

Projeto Fogões Eficientes no Recôncavo Baiano

Eu, MARTA DA SILVA DA CONCEIÇÃO,

portador(a) do documento RG n. 07366177-52, morador(a) de SERRARIA, aceito participar do Projeto Fogões Eficientes no Recôncavo Baiano. Autorizo aos técnicos do Instituto Perene a instalar um fogão a lenha eficiente em minha residência. Em contrapartida a essa instalação cedo ao Instituto Perene todos os créditos de carbono que resultam da redução de gases de efeito estufa gerada pelo uso desse fogão durante o período desse projeto, de 8 anos.

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SERRARIA, 22 de MARÇO de 2010

Marta da Silva da Conceição

The term of the contract is 8 years because the original crediting period of the project was to be 7 years. The crediting period has since been modified to 10 years. Therefore, for those stoves installed in Project Years 1 and 2, and which are still operating by Project Year 9, new 2-year contracts will be signed. For those stoves installed in Project Year 3, the existing, 8-year contracts suffice.

This voluntary emission reduction Project Activity is expected to reduce 8,834 **tons of CO_2-eq per year over 10 years**, through the installation of 5,000 efficient stoves. Since the annual emissions reduction is less than10,000 tons of CO_2-eq per year, this project is classified as a "micro" scale voluntary emissions reduction project, under the revised Micro-scale Scheme Rules (released 11/22/2011).The project activity will be implemented by Instituto Perene and will consist of a series of activities:

1. Community engagement and identification of participating families: Representatives from Instituto Perene visit the communities in person, hold meetings with the stakeholders to explain the project, and invite interested members of the community to participate in the project. A Stakeholder Feedback Meeting will be held to gather information from stove users on the performance of the stoves, their level of satisfaction with the project, and any comments, criticisms or suggestions. (update: Feedback meeting was held Dec. 10, 2010 – please see Section E)

2. Training of women to be Community Agents: Women from local communities are invited to represent Instituto Perene as Community Agents. These women will be trained by Instituto Perene in the efficient stove operation and maintenance so that they can communicate with local households clearly about the project. They will be in continuous contact with project participants. These women will also participate in monitoring of the efficient stoves.

3. Training of installers: Local masons are trained in the efficient stove construction, including construction of the internal rocket-chambers, becoming be self-reliant in all the construction steps of the ICS.

4. Capacity building for users: The community agents visit households during stove construction and operation to train users in stove operation and maintenance, thus maximizing the useful life of the stove.

5. Construction of ICS: Materials will be procured and distributed, and improved cook stoves will be constructed in households agreeing to participate in the project.

6. Monitoring of ICS performance in the participating rural communities: Monitoring will be carried out according to the Monitoring Plan outlined in Annex 4.

The project boundary encompasses the western half of Maragogipe municipality and all of the neighboring São Felipe municipality, both located in Bahia state, Brazil. The project activities will be implemented within this boundary and below a maximum emission reduction of 10,000 tons of CO_2-eq per year.

Instituto Perene and its associated technicians are responsible for the installation and maintenance of ICSs. The operation of the ICS is carried out by the user, and training on how to operate and maintain the ICS is given by the representatives from Instituto Perene. Physical maintenance of the ICS will be provided by Instituto Perene and its technicians.

Instituto Perene will follow the monitoring plan and procedures for identifying each stove installed during the course of the project and those which are still in use so that the appropriate number of emission reductions is claimed. To facilitate this process, each improved stove will be identified by its owner name and government-issued identity number, community and GPS location.

Technologies and measures to be employed by the small-scale project activity

This project will disseminate ICS that are constructed individually by local trained technicians. The stoves are made of materials that are mostly available locally, including bricks (regular and refractory), mortar (regular and refractory), a ceramic chimney[4] of 100 mm diameter, an iron plate with two holes for burners, auto-claved aerated concrete (AAC) as insulative material surrounding the combustion chamber, and a small metal grate that serves as a fuel shelf on which the pieces of wood are set within the combustion chamber. See the figures below that show the construction process of the efficient stoves.

The ICS distributed through this project are more efficient than traditional stoves because they reduce heat loss and maximize

Figure 3: Construction of the efficient cookstove: clockwise from top left, installation of the "rocket" combustion chamber within the stove body, insulation around the combustion chamber, installing the iron stovetop, completed efficient stove showing flames in first burner.

combustion. The current domestic model designed for the project activity has been observed in the field to use less than half of the firewood to cook the same amount of food in comparison to traditional stoves. Fuel reduction will be determined during post-installation Kitchen Performance Testing.

The efficient stove design is based on principles originally laid out by Dr. Larry Winiarski and Aprovecho Research Center (Bryden, Still, Scott, & Hoffa, 2002). The following design principles were incorporated into the efficient stove model used in this project:

[4] The original design included a galvanized metal chimney, which was replaced by a ceramic chimney when the former material showed signs of corrosion.

1. **Insulate the fire**. A hot fire burns cleaner, reducing emissions, and can deliver more energy to the food, reducing the time to cook. Insulation prevents heat from escaping to the body of the stove, in effect directing heat only to where it is useful: to the pot or griddle. Insulation should be made of lightweight, heat-resistant, and readily available materials.

2. **Place a short chimney directly above the fire**. When properly sized, the chimney will provide an adequate draft, making the fire burn hot, and increasing the contact between the flames and the smoke. The chimney should be insulated, and its length should be three times its diameter.

3. **Heat and burn the tips of the sticks as they enter the fire**. This principle refers to stove operation, although the stove design, with its narrow entry for firewood, encourages this practice. Heating only that part of the wood that is actually combusting reduces smoke and other harmful emissions.

4. **High and low heat is regulated by how many sticks are in the fire**. The temperature can be controlled by increasing or decreasing the amount of sticks burning at the same time.

5. **Maintain a good fast draft through the burning fuel**. An adequate supply of air will help ensure a hot fire.

6. **Too little draft will result in smoke and excess charcoal**. On the other hand, too much air will cool the fire.

7. **Maintain the cross-sectional area of the air flow constant.** This means that the opening into the fire, the size of the spaces within the stove through which hot air flows, and the chimney should all be about the same size.

8. **Use a grate under the fire.** This lifts the sticks off the floor of the combustion chamber and ensures that air flows under and up through the sticks, for better combustion.

9. **Insulate the heat flow path.** Heat that goes toward raising the temperature of the stove body does not help cook the food. Using insulation to direct the heat toward the pot or griddle ensures that heat is not wasted and decreases cooking time, therefore saving wood.

10. **Maximize heat transfer with properly sized gaps.** This principle refers to stoves, like the ones in this project, in which the stove top has openings over which pots are placed. Getting heat into pots or griddles is best done with small channels, forcing hot flue gases through these narrow channels to the pot.

Instituto Perene ICS Specifications - Cross-Sections.:

Fuel Entry & Combustion Chamber:	132 cm^2
Stove body:	~100 cm^2
Chimney:	78.5 cm^2

The combustion chamber of the efficient stove model in this project uses the principle of the "rocket" elbow, invented by Dr. Larry Winiarski and further refined by the Aprovecho Research Center. This innovative design, shown in the sketch below, reduces the production of carbon monoxide, unburned particles, and other products of incomplete combustion.

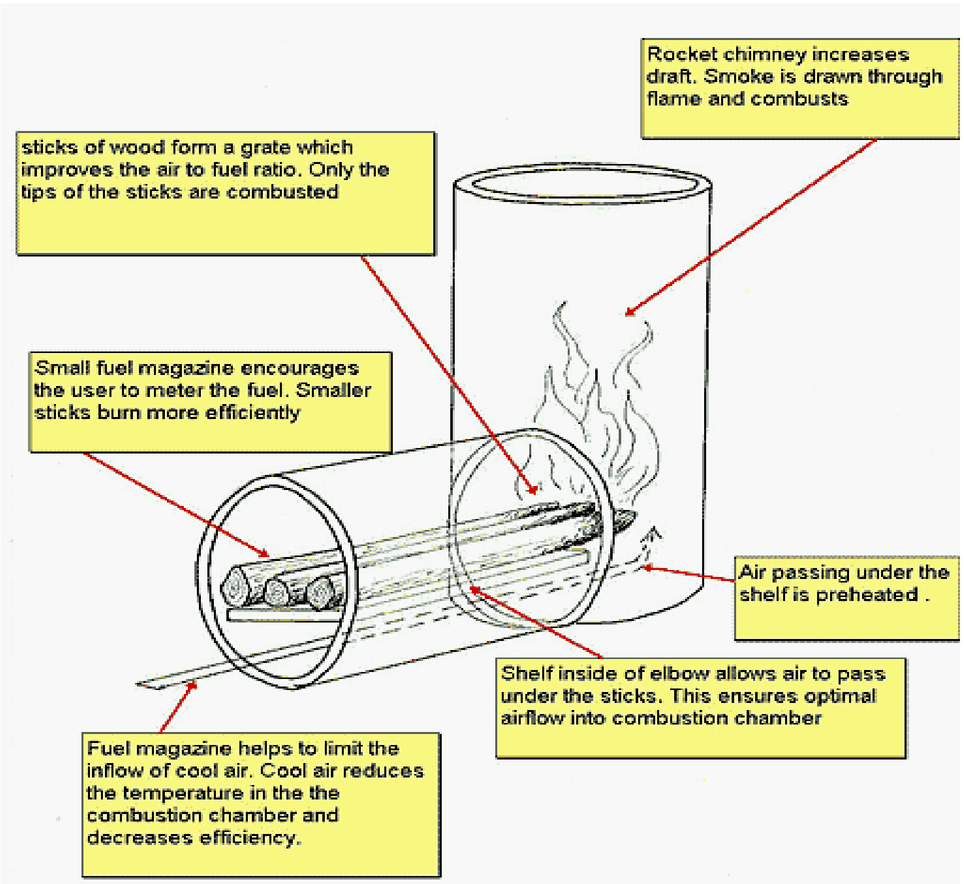

Figure 4: Rocket elbow combustion chamber and design principles, developed by Dr. Larry Winiarski and Aprovecho Research Center.

Figure 5. Durable combustion chamber made of refractory material.

The main characteristics of the efficient stoves used in this project are:

1. The "rocket" combustion chamber is made of refractory tiles (22cm x 11cm x 2.5cm, with fuel entry 11cm x 12cm) and is insulated with autoclaved aerated concrete (AAC). The blocks of AAC come from the manufacturer with dimensions 60cm x 30cm x 10cm and are trimmed lengthwise so that the final pieces fit around the combustion chamber and within the stove body. The rest of the stove body is filled with dirt. All this insulation keeps the fire as hot as possible and maximizes the amount of heat reaching the pots as opposed to the rest of the stove body.
2. The combustion chamber includes the recommended short, insulated upright chimney described in Principle 2. This internal chimney allows for greater draft, more complete mixing of the combustible gases with air before reaching the pots, and more time for combustion to occur, resulting in more complete combustion. The cross-sectional area remains about 100 cm^2 from the point of fuel entry to the point of exit at the top of the chimney.
3. A shelf inside the combustion chamber, on which the wood sticks are placed side-by-side, ensures more air flow in and around the material to be burned and pre-heats the incoming air. The placement of the sticks in this manner ensures that only the part of the wood burning (the tips) is being heated.
4. The small size of the fuel magazine reduces excess cool air from entering the chamber and encourages the user to meter the wood more carefully.
5. The chimney (10 cm diameter) directs smoke away from the living space, thus protecting the family by reducing exposure to pollutants and health risks. The hot gases in the improved stove design flow from the entry to the combustion chamber, then below the pots, then over the insulation in the stove body, then finally exit vertically through the chimney.

Figure 6: Left to right, Combustion chamber ready to be placed into the stove body, and the fuel wood placed on the shelf in the combustion chamber.

Stove Maintenance

The maintenance required for this stove design is simple and helps maximize the combustion efficiency and heat transfer to the pots.

Daily: Remove ashes from the combustion chamber.

Weekly: Remove soot from the underside of the cast iron plate.

Monthly: Clean chimney by lightly tapping on the exterior to knock soot down into the compartment from where it can be removed.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Period	Annual estimation of emission reductions (Tons CO2e)
2010/2011	814
2011/2012	3,599
2012/2013	8,349
2013/2014	10,918
2014/2015	10,918
2015/2016	10,918
2016/2017	10,918
2017/2018	10,918
2018/2019	10,918
2019/2020	10,099
Total emission reductions (tons CO2e)	**88,340**
Total number of crediting years	**10**
Average annual reductions	**8,834**

over the crediting period (tons of CO_2e)	

A.4.4. Public funding of the small-scale project activity:

None. All funding is private.

A.4.5. Operational and Management Plan for the small-scale project activity:

Instituto Perene is responsible for planning, implementing and monitoring the project. Instituto Perene trains and directly contracts masons to build the stoves. Full-time masons work through formal work permits with Instituto Perene and receive monthly salaries for their work, in addition to health insurance for themselves and their families. Stove materials are purchased from local manufacturers when possible (chimney, stovetop, fuel shelf, cement and bricks), and purchased from distributors in other cases (AAC insulation and refractory brick).

Community Agents selected and trained by Instituto Perene are the local, onsite representatives for Instituto Perene. They assist in communicating with local residents and obtaining signatures of interested residents wish to participate. They will be in continuous contact with members of the community about the project, providing onsite guidance for stove users on how to clean and maintain the efficient cookstove.

At the time of the installation of each efficient stove, technicians from Instituto Perene collect the following information:

- Name of stove user
- Identification number (government-issued “Registro Geral”)
- Address, including GPS coordinates
- Date of installation

The data are transferred to an electronic database managed by Instituto Perene. All records are checked by Instituto Perene by carrying out spot visits and maintaining continuous contact with users in the field. Hard copies of the contracts signed with the individual households will be stored at the office of Instituto Perene, and electronic copies kept on file.

A.4.6. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

De-bundling is the fragmentation of a large project activity into smaller parts. A small-scale project that is part of a large project activity is not eligible to use the procedures for small-scale projects.

The proposed small-scale project activity is not a debundled component of a large scale project activity, as there is no registered small-scale voluntary project activity or an application to register another small-scale voluntary project activity

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The project activity will be the first ICS project in Brazil generating carbon credits.

SECTION B. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to the small-scale project activity.

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

This project will follow the methodology approved by the Gold Standard: Methodology for Improved Cook-Stoves and Kitchen Regimes V 2. This methodology covers both the baseline and monitoring requirements for such a project.

This methodology also applies the most recent version (V 5.2) of the UNFCCC "Tool for the Demonstration and Assessment of Additionality".

B.2 Justification of the choice of the project category:

The project category of "micro" voluntary emissions reduction project is applicable because this project is expected to reduce 8,834 tons of CO_2-eq per year, and this value is less than 10,000. The type of project activity is an End-use Energy Efficient Improvement, defined by the Gold Standard as the reduction in the amount of energy required for delivering or producing non-energy physical goods and services.

This initiative generates credible greenhouse gas emissions reductions, has environmental integrity and contributes to local sustainable development by introducing improved cook-stoves and practices to households and institutions within a distinct geographical area. This project is eligible under the Gold Standard classification of "Improved distributed heating and cooking devices (e.g. cookstoves), and distributed micro-scale electricity generation units."

The Gold Standard Cookstove Methodology V 2 is applicable to activities introducing improved cookstoves and practices to households within a distinct geographic area, which are the activities proposed by this project. The project activity is implemented by a project coordinator who acts as a project participant (Instituto Perene).

The methodology addresses the project activities' switch from traditional domestic cookstoves and kitchen regimes with significant greenhouse gas emissions to those having considerably less or zero emissions.

The type of project activity is an End-use Energy Efficient Improvement, defined by the Gold Standard as the reduction in the amount of energy required for delivering or producing non-energy physical goods and services. The category of "small" voluntary emissions reduction project is applicable because this project is expected to reduce 8,834tons of CO_2-eq per year, or approximately 15 GWh/yr, and this value is less than 60 GWh/yr (limit for energy efficiency projects).

Each home will have only 1 stove, and the useful energy output of the stove is less than 50kW. From the study *Design Principles for Wood Burning Cook Stoves*: "A typical Winiarski designed stove with a square, 12 cm x 12 cm combustion chamber burns wood at approximately the rate of 1.5 kg/hr at high power. " (Bryden, Still, Scott, & Hoffa, 2002, p. 21) Table 3 of the same reference shows that this burning rate corresponds to a firepower of 8.3 kW. As described extensively in section 1.4.2 above, the Instituto Perene model is a Winiarsky-design rocket stove with an 11 cm x 12 cm opening, and so can justifiably be considered to have approximately 8 kW of firepower, which meets the Gold Standard cookstove methodology´s condition of being below 50 kW.

Unique stove identification is achieved by recording the GPS location of each home in which a stove installed, together with the name and government-issued personal identification number (*Registro Geral – RG*) of the head of the household. This data is entered in the project database, created and maintained using MicroSoft Access software. MS Access automatically assigns a unique identification number (denominated ContractID in Perene's database) to each entry. Below is a sample of the stove installation database:

ContractID	RG	Name	Community	GPS Coord	Installed	Date of Installation
009518	0802786472	Helena Candida de Almeida	Serraria	12°44.755' S 39°00.446' W	Yes	10/15/2010
009527	0738129356	Iraci Silva de Jesus	Serraria	12°44.650' S 39°00.490' W	Yes	10/15/2010
009551	0512129517	Joana Correia Caldas	Serraria	12°44.675' S 38°59.506' W	Yes	10/15/2010

The methodology requires surveys and quantitative measurements to be carried out in the kitchens of the ICS users. Fuel consumption reductions due to the project activities are sensitive to locally determined factors, therefore requiring measurements in sample households is appropriate.

B.3. Description of the project boundary:

The Project Boundary is defined by the domestic kitchens of the project population (households within the Bahian Recôncavo) using the specific model of improved cook-stoves and the specific GHG-reducing measures introduced by the project.

The Target Area is the region or town in which this project has a target population. The target area is the municipality of Maragogipe, specifically the western region, where the most severe deforestation has occurred, leaving only 7% of the original forest cover, and the municipality of Sao Felipe, which has less than 5% of its original forest cover. Both municipalities are completely contained within the Atlantic Rainforest biome, meaning that they were once covered with dense rainforest and mangroves.

When analysed in terms of geomorphology, Maragogipe can be divided into two territories due to what is known as a rift valley effect (Falieri, 2011). The western lands of Maragogipe constitute the target area for this municipality and contain 24,826 ha, representing over half of the total area of the municipality. These 24,826 ha are the favourable arable lands and thus the location of most of the rural population and where the high use of wood as domestic fuel for cooking is most evident. Out of the 24,826 ha, only 1,635 ha of the western lands was classified as areas with woody biomass, ranging from very early successional stages of degraded pastures with few mature trees to well defined forest fragments in late secondary stages of succession.

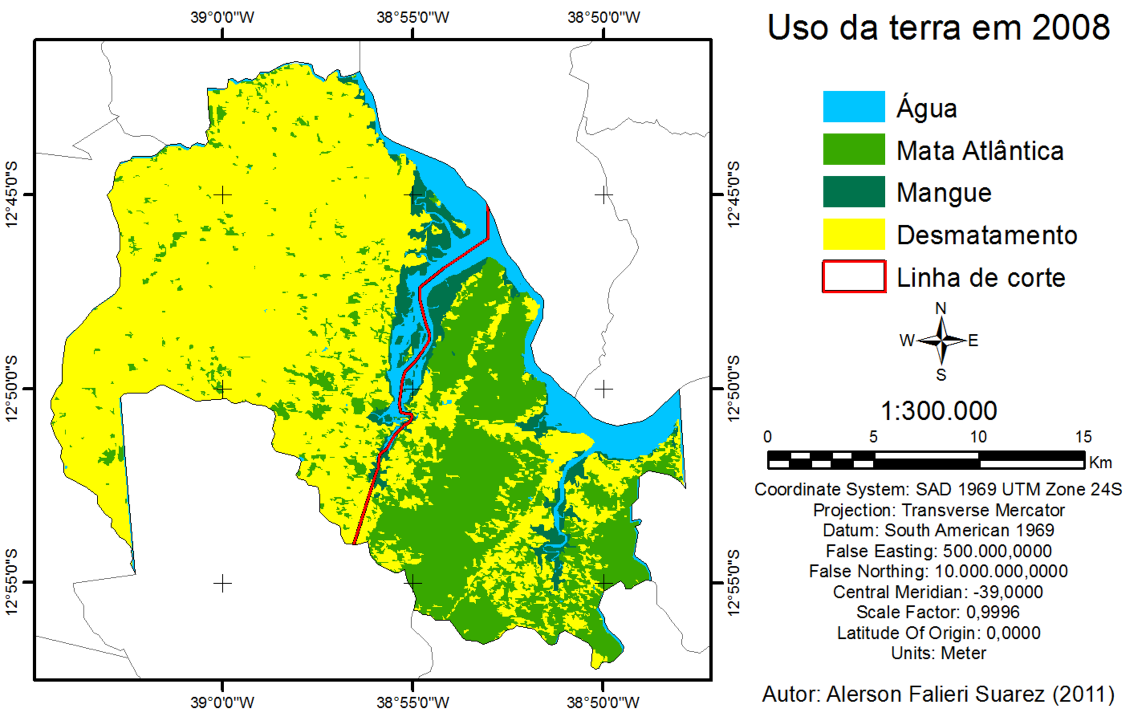

Figure 7. Maragogipe municipality, showing different land uses and division (red line) drawn between eastern and western areas for the purposes of this Project. (Falieri, Análise do desmatamento no Municipio de Maragogipe - BA, 2011)

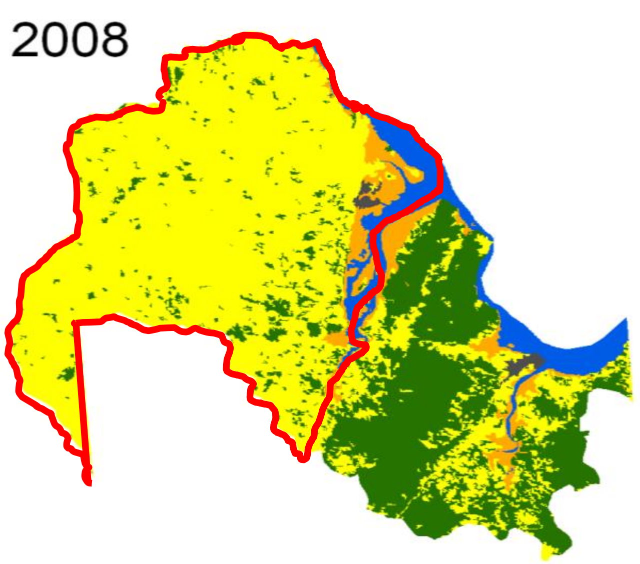

Figure 8. Western Maragogipe, enclosed in red, is within Project boundary (Falieri, Análise do desmatamento no Municipio de Maragogipe - BA, 2011).

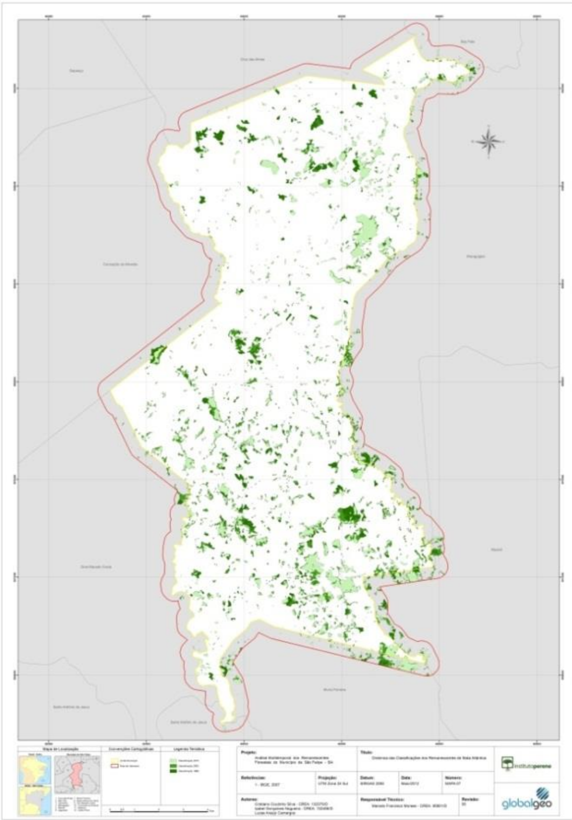

Figure 9. São Felipe municipality, showing the sparse remnants of the Atlantic Forest, which once covered the entire Reconcavo Region. All of Sao Felipe is within the Project Boundary.

The Fuel Collection Area is the area within which the biomass is produced and supplied, or could reasonably be expected to be produced and supplied. In this project, the fuel collection area is the remaining forested areas of São Felipe and western Magagogipe, totalling 55,420 hectares.

Emissions sources included in or excluded from the project boundary:

	Source	**Gas**	**Included?**	**Justification/Explanation**
Baseline	Cooking, production of fuel, and transport of fuel	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Can be significant in some fuels
Project activity	Cooking, production of fuel, and transport of fuel	CO_2	Yes	Important source of emissions
		CH_4	Yes	Important source of emissions
		N_2O	Yes	Can be significant in some fuels

B.4. Description of baseline and its development:

The baseline scenario is the one experienced by each household receiving an ICS, prior to installation of the new stove. The baseline scenario is the continuation of the current situation in which the vast majority of rural residents in the project area use inefficient wood-burning stoves for cooking.

In this project, the ICS are installed during the first year of the project period. In addition, no changes to the baseline are expected in the project region for the next 10 years. The region has been economically stagnant for decades and no major changes have occurred over the past decades to the cooking practices of local residents. Therefore, the baseline is fixed. Fixed baselines do not require continuous monitoring.

The baseline study was carried out in accordance with the Gold Standard Methodology for Improved Cook-Stoves and Cooking Regimes V 2 as set out in the steps listed below.

Step	Description
1	**Determine customer groups or “clusters”**
1.1	Establish a pilot Installation Record
1.2	Provisionally assess fuel types, fuel mix, and kitchen regimes
1.3	Analyze renewability status of wood-fuels
1.4	Divide pilot Installation Record into customer groups or clusters
1.5	Carry out a qualitative survey (Kitchen Survey)
2	**Calculate baseline emissions**
2.1	Estimate expected variation and improvement in emission reductions
2.2	Specify the units of emission reduction or fuel consumption
2.3	Make quantitative measurements (Kitchen Performance Tests)
2.4	Calculate baseline

<u>Step 1: Determine customer groups or “clusters”</u>

Step 1.1: Establish a pilot Installation Record

In this step, names of people who have signed up to receive an ICS were registered. Some of these households would be the subjects of surveys and tests characterizing kitchen practices prior to use of the improved stoves. This record was created just before the Kitchen Surveys and Kitchen Performance Tests, so that cooks could best describe pre-intervention behavior.

In this project, households that had not yet received the ICS were chosen to be the subjects of surveys and tests characterizing kitchen practices prior to use of the ICS.

Step 1.2: Provisionally assess fuel types, fuel mix, and kitchen regime

The households participating in this project use non-renewable woody biomass for combustion fuel for domestic cooking. A small amount of Liquid Petroleum Gas (LPG) is used in many homes for light cooking and quick meals such as making coffee and re-heating food. However, the cost of LPG ($25/refill of 13kg tank) and its delivery are too high for the residents of the project area to use on a regular basis. The remote setting and the low incomes typical of the project area make it difficult to obtain LPG. This project intends to reduce the consumption of wood-fuel for domestic cooking. The use of the secondary fuel LPG is expected to follow its usual pattern.

The initial assessment of the project area along with Kitchen Surveys showed that households use their stoves to prepare food for the members of the family and a small number of households serve food for income. In the rainy season, households use stoves to heat water for bathing. Fuel wood is collected manually, sometimes with a donkey carrying the collected wood, but most often carried by hand by people. Fuel wood is usually kept in a covered shelter, but in the rainy season it has a high moisture content.

Figure 10: A donkey is used to gather fuel wood for domestic use.

The average household consumption in the project area was found to be nearly 2.5 tons/household/year.

Step 1.3: Analyze renewability fraction of wood-fuels

The residents of the project area collect wood for domestic cooking from degraded areas of the Atlantic Rainforest, typically within about 2 km of their households. Studies commissioned for the project show that the Project target area has been severely deforested, with only 7% and 5% of the original forest cover remaining in western Maragogipe and São Felipe, respectively (Falieri, 2011) (GlobalGeo, 2012). Annex 3 in this PDD demonstrates that in the project target region, the fraction of non-renewability of the biomass is 0.81.

Note on Project Boundary modification: The original PDD, submitted in April 2011, included the entire municipality of Maragogipe. However, it became clear from a follow-up NRB study ((Falieri, 2011) that, from the stand-point of the non-renewability of the local biomass, Instituto Perene should concentrate its improved cookstove initiative in the western half of Maragogipe, where the deforestation is most starkly evident. Therefore the project boundary was modified from the initial PDD to exclude the eastern portion of the municipality. Those communities in the east in which stoves had already been installed (Angolá, Dende, Mutamba, Porto da Pedra and São Roque), are now outside the project boundary, and the 275 stoves built in these communities have been excluded from the Project Database.

The Maragogipe and São Felipe NRB reports are uploaded to the Gold Standard Registry.

Step 1.4: Divide pilot Sales Record into major groups or clusters

The kitchens into which these cook-stoves are installed depend almost entirely on wood for combustion fuel for cooking. The stoves are used for domestic cooking as well as occasionally for preparing shellfish, animal feed, oils and other agricultural by-products for income.

The five thousand families, located in dozens of communities within the municipalities of Maragogipe and Sao Felipe, Bahia, live under very similar conditions. The same efficient stove model is being installed for all 5,000 homes. The characteristics of the households involved in the project region are:

- rural
- low-income
- population of African descent
- gather firewood from local forest fragments
- cook primarily with wood
- prior to the project – cooked on open-air fires.

Because of these similarities, and the fact that the same stove model is being used for all households, the target population in the municipality of Maragogipe is therefore grouped together into a single cluster.

Step 1.5: Carry out a qualitative survey (Kitchen Survey)

The Kitchen Surveys (KS) are carried out in each sample household by representatives of Instituto Perene, always accompanied by a local resident, visiting households before and after the installation of an ICS.

Analysis of the initial Kitchen Surveys was used to decide how to carry out the Kitchen Performance Tests (KPT). The Gold Standard Methodology for Improved Cook-stoves and Kitchen Regimes (V 2) describes a "subsumed fuel KPT" and when it is the best approach for a project:

> A subsumed fuel KT is one which ensures the sampled households follow their usual pattern of use of secondary fuels (for example gas cooking for very light and quick meals such as breakfasts) while measuring only primary fuel consumption for the old and new stove. Its results reflect the effect of secondary fuel consumption without the need for quantification of secondary fuels. In cases where the KS assesses secondary or alternative fuels as contributing less than 50% of total cooking energy, [this approach] is legitimate (page 8).

Households in the project area use a secondary fuel, namely LPG, for very light and quick meals such as breakfasts or making coffee. In addition, in the project region, LPG contributes much less than 50% of total cooking energy. For these reasons, the subsumed KPT is the recommended approach for this project. The sampled households will follow their usual pattern of use of secondary fuel (LPG, in this case), and only consumption of the primary fuel (solid wood) is measured for the old and new stove. The omission of a possible decrease in LPG use in homes that have adopted the new stove is a conservative approach, as it does not include these additional emissions reductions. The monitoring KS include a question about LPG use (see sample KS form, Annex 5), allowing Instituto Perene to identify any changes in the current pattern.

Results from Kitchen Surveys

Between March 2010 and January 2011, 210 Kitchen Surveys were applied to households participating in the Efficient Cookstoves in the Reconcavo Region project. Households were randomly selected from the project participant list of communities of Guaí, Capanema, São Roque, Tamancas and Guaruçu. Random selection was achieved using the software MS Excel, listing all the stove user names, attributing a random number to each name using the Excel function *rand()*, and then ordering the list in increasing value.

The Methodology for Improved Cook-stoves and Kitchen Regimes V 2 (p. 7) sets out the following guidelines as to minimum sample size:

Group size < 300: Minimum sample size 30

Group size 300 to 1000: Minimum sample size 10% of group size

Group size > 1000 Minimum sample size 100

As our project involves the construction of 5,000 stoves, the sample size of 100 households applies. One hundred-ten surveys were conducted in households using their original stove, and 100 were conducted after installation of the ICS. All surveys were conducted by means of house visits – no telephone interviews were conducted (Obs.: fixed telephone lines are rare in the project area, and although cell phones are not uncommon, reception is weak and unreliable. Furthermore, it is very difficult to convey questions and receive accurate answers by telephone in the local culture). Surveys were conducted by a volunteer from the organization Global Citizen Year, accompanied by the Community Agent of each community. Surveys are based on the sample provided in the Cookstove Methodology, and were translated into Portuguese and slightly adapted using more informal language.

Findings from the baseline and monitoring surveys confirm that the population has similar characteristics, and that these characteristics remain constant (percentages presented for old stove/new stove):

- Rural (100% / 100%)
- low-income (94% / 93%)
- cook primarily with wood (94% / 97%)
- also use LPG stove (88% / 94%)
- use firewood gathered from local forest fragments (100% / 100%)

Because of these similarities, and the fact that the same stove model is being used for all households, the target population in the municipalities of Maragogipe and São Felipe is therefore grouped together into a single cluster.

The following recommendations results from the Kitchen Surveys:

- One cluster is appropriate for this project
- This is a case of “subsumed fuel” scenario, with wood as the primary and LPG as the subsumed fuel, both in the baseline and project scenarios.

Step 1.6: Refine demarcation of clusters and populate Project Database

Using results from the Kitchen Surveys and field observations, all the people receiving ICS through this project belong to one group, or cluster, because of their similar wood consumption and socioeconomic characteristics. Should significant changes in economic conditions or practices be detected over the course of the project through the Kitchen Surveys, one or more new clusters may be defined.

<u>Step 2: Calculate baseline emissions</u>

Step 2.1: Estimate expected variation and improvement in emission reductions

The Kitchen Performance Tests were conducted according to the methodology developed by Aprovecho Research Center. KPTs are the main field-based procedure to demonstrate the effect of stove interventions on household fuel consumption. Because this test is carried out in the homes of stove users, when conducted carefully, it is the best way to understand a stove's impact on household fuel use and on general household characteristics and behaviors. On the other hand, it is a difficult way to test stoves because it disturbs the daily activities within households, and has many more variables than laboratory testing.

The test is designed to compare the average fuel consumption using the traditional stove and the improved stove. In this project, this is done using a *paired-sample* test, where a single group of families is evaluated as they use the old stove and then reevaluated after they switch to the new stove.

From the Kitchen Performance Test Version 3.0 (January 2007) by Rob Bailis et al:

> We recommend doing the paired-sample study, where the same households are measured using the old stove and then the new stove(s). This test measures the fuel consumption in each family as they make the transition from a traditional to an improved stove […] It also permits stove testers to use a smaller sample size than the cross-sectional method for a desired level of statistical significance.

The number of families included in the KPT is related to statistical factors, namely the Coefficient of Variation (CV) and the Detectable Difference in means (DD). In designing the KPT for this project, an in accordance with the KPT guidelines for initial sampling size, Instituto Perene assumed a 40% CV and conservatively assumed a 30% detectable difference. This was a conservative approach because field observations point toward a higher difference in fuel consumption between traditional and improved cookstoves. A 40% CV and 30% DD require testing 14 households, as shown in the Table below. Instituto Perene will test at least 20 homes, according to the recommendation of the authors of the KPT guidelines, in order to allow for errors, drop-outs or failed tests.

Table 1: Sample size required to show statistically significant reductions in fuel consumption (95% confidence) (Bailis, Smith, & Edwards, 2007)

SAMPLE SIZE REQUIRED FOR THE PAIRED-SAMPLE TEST METHOD

	Pooled CV of measurements												
Detectable difference in means	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1**	**1.1**	**1.2**	**1.3**
10%	8	31	71	126	196	283	385	502	636	785	950	1130	1326
20%	2	8	18	31	49	71	96	126	159	196	237	283	332
30%	1	3	8	**14**	22	31	43	56	71	87	106	126	147
40%	0	2	4	8	12	18	24	31	40	49	59	71	83
50%	0	1	3	5	8	11	15	20	25	31	38	45	53
60%	0	1	2	3	5	8	11	14	18	22	26	31	37
70%	0	1	1	3	4	6	8	10	13	16	19	23	27
80%	0	0	1	2	3	4	6	8	10	12	15	18	21
90%	0	0	1	2	2	3	5	6	8	10	12	14	16
100%	0	0	1	1	2	3	4	5	6	8	9	11	13

Step 2.2: Specify the units of emission reduction or fuel consumption

In domestic improved stove projects, it is suitable to use the units of emission reduction per year of stove use (carbon dioxide equivalents per year, or CO_2-eq/yr). This project will use these units.

Step 2.3: Make quantitative measurements (Kitchen Tests)

The Kitchen Performance Test used in this project had two main goals: 1) the quantitative measurement of daily cooking fuel consumption and 2) qualitative assessment of field performance and acceptability of the ICS to the households using it.

This project performed the KPT as a paired-sample study, with the intention of testing the same households before and after stove installation, thus reducing variability due to external factors. The testing period was 4 consecutive days (KPT guidelines recommend at least 3 days). Both testing periods (before and after stove installation) occurred during the 9-month dry season (September through May).

Prior to the start of the testing, representatives from Instituto Perene, including a local resident, explained to each selected household the purpose of the test and arranged to measure their fuel wood consumption at the same time each day. Households are encouraged to keep their cooking practices as close to normal as possible during the testing period. The weight and moisture content of the initial stock of fuel wood was measured. Each family was asked to keep newly acquired fuel separate from the fuel already measured. All wood collection practices were to remain the same as usual; households gathered their own wood and cooked their meals just as they normally do. Each household was visited at roughly the same time each day. The number of people that ate their meals in the household since the last visit was recorded along with the gender and age of each person. The remaining wood was weighed to determine the fuel consumption over the previous 24 hours. When necessary, additional wood was weighed and its moisture content measured, and the new total stock recorded.

Results from KPT

Table 2. Summary of KPT Results			
Avg. dry wood consumption OLD STOVE (baseline)	6.8 kg/day/HH	Standard Deviation	2.2
		CV	32%
Avg. dry wood consumption NEW STOVE (project)	3.6 kg/day/HH	Standard Deviation	1.6
		CV	44%
Daily Difference	- 3.2 kg /HH		
Annual Difference	- 1.17 tons/HH		
Difference in wood consumption (Detectable Difference)	- 47%		
T-test (see attached statistical analysis	< .0001		

in PDF)	

Step 2.4: Calculate baseline

Fuel mass or energy content is converted to GHG emissions using emission factors. Wherever possible the emission factor values used are ones measured in actual baseline and project conditions or in similar conditions. When such are not available, relevant IPCC defaults are used. The KPT measured fuel consumption of the primary fuel, wood, only. The KPT treats the quantity of any secondary fuel as zero because the effect of any fuel mixing (in this case, with LPG) is to reduce the saving made in primary fuel (wood) between baseline and project scenarios. This sub-sumed approach is legitimate because the effect on emission reduction projections and calculations is conservative.

The Gold Standard Methodology for Improved Cook-stoves and Kitchen Regimes (V 2) describes a "subsumed fuel KPT" and when it is the best approach for a project:

> A subsumed fuel KT is one which ensures the sampled households follow their usual pattern of use of secondary fuels (for example gas cooking for very light and quick meals such as breakfasts) while measuring only primary fuel consumption for the old and new stove. Its results reflect the effect of secondary fuel consumption without the need for quantification of secondary fuels. In cases where the KS assesses secondary or alternative fuels as contributing less than 50% of total cooking energy, [this approach] is legitimate (page 8).

From the Kitchen Performance Test, baseline wood consumption was determined to be 6.8 kg/day per household, or 2.48 t/yr per household (see Table 2 above).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The ICS developed for this project is the product of a participative process that included Instituto Perene, Aprovecho Research Center, local masons and stove-users in the project region. Mike Hatfield, a consultant from Aprovecho Research Center with over 10 years of experience in stove design and construction brought his international expertise in stove-building to the project.

The prevailing technology in the Bahian Recôncavo region of Brazil is an open fire using wood for combustion.

Wood-burning stoves release CO_2, CO, CH_4 and other greenhouse gases and products of incomplete combustion into people's

Figure 11: Typical inefficient wood-burning stove in the project region

homes and into the atmosphere (Smith, 1994). The improved cook-stoves designed for this project dramatically reduce the volume of wood consumed. The reduction in the volume of wood burned in turn reduces the amount of anthropogenic GHG emissions. In the absence of this project, the baseline scenario would be the continued use of larger quantities of wood for cooking. Therefore, the emission reductions are calculated based on the annual savings of non-renewable biomass multiplied by an emission factor for wood-based cookstoves.

Participation in the proposed project is completely voluntary. No national laws, policies, or requirements exist in Brazil that mandate the adoption of improved cook-stoves by households. This project is a voluntary action of the coordinating entity, Instituto Perene.

Based on years of experience in the Recôncavo region of the state of Bahia, Instituto Perene identified the main barriers to the implementation of a cook-stove dissemination project in the region. The key challenges include: the cost of the stoves, which is prohibitive for the target population; the technology used for the ICS, which is the result of decades of research and is not available in the project region; and the fact that the dissemination of ICS is not a common practice in the region.

Assessment and Demonstration of Additionality

The information presented here shall constitute the demonstration of additionality of the project activity as a whole.

This project activity will reduce the amount of GHGs emitted by residents of rural areas in the Bahian Recôncavo who use traditional cooking stoves to prepare food. The ICS designed and installed by this project burn significantly less non-renewable fuel wood. According to the approved methodology, in the absence of the project activity, the baseline scenario would be the continued use of inefficient, traditional cookstoves that use non-renewable biomass for combustion fuel.

The total emission reductions of this project are estimated to be 88,340 **tons CO_2-eq** during the project crediting period of 10 years.

The proposed Project is a Voluntary coordinated action

Brazil has no national law, policies or mandatory requirements regarding the adoption of efficient cookstoves by households. This proposed small-scale project is a voluntary action by Instituto Perene, the project executor.

The proposed voluntary coordinated action would not be implemented in the absence of the Project

Based on Instituto Perene's previous experience in the project region, the barriers were identified and a strategy for the implementation of this Efficient Stoves project was developed. The process involves training local people to become community agents and technicians, supplying stove materials through local manufacturing units and developing awareness through demonstrations and meetings.

Assessment and demonstration of additionality of the proposed project

The Gold Standard methodology for Improved Cookstoves applies the most recent version (version 5.2) of the UNFCCC "Tool for the Demonstration and Assessment of Additionality."

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Since no laws or mandatory requirements exist in Brazil for the use of efficient biomass cookstoves, Instituto Perene is proposing to implement this project over and above the national and sectoral requirements. The emission reductions achieved by the project activity are therefore additional to any directed by Brazilian government policies.

Sub-step 1a: Define alternatives to the project activity

- Alternative 1: Implementation of the Project Activities without being registered as a voluntary project: This would only be possible if Instituto Perene were able to raise the necessary funds through either the Brazilian government or private sponsors to implement this voluntary project activity in order to distribute the cookstoves in the same manner as proposed in this project.
- Alternative 2: Implementation of the Project Activities as a commercial project with no carbon revenues. In this case, Instituto Perene would sell the efficient cookstoves to the resident population at a price that would allow reinvestment in expanding the project. Unfortunately, the cost of the stoves is too high for residents of the project area to purchase on their own. The cost of the stove materials is detailed in the table below.

Table 3. Materials Cost of Efficient Stove

Stove Component	Cost per stove US$
Stovetop	30
Chimney	28
Refractory brick and mortar for combustion chamber	18
Isolative blocks (AAC)	15
Bricks and cement for stove housing	6
Fuel shelf and other	3
Total US$	100

In addition to the materials cost, there are also the costs detailed below, necessary to build the stove and help ensure its correct operation.

Table 4. Labor Cost of Efficient Stove

Item	Cost per stove US$
Installation - labor	37

Material transport	5
Community Agent work	2
Maintenance/chimney replacement	17
Total	61

Together, the material and implementation costs of the efficient stoves equal US $161. Average income in rural Northeast Brazil is reported by the government entity *Institute of Applied Economic Research* to be R$293, or US$ 168 (IPEA, 2010). The cost of the stove, therefore, is nearly a full month´s income, prohibitively high for the local population.

- Alternative 3: A switch to alternative fuels: A switch to liquid petroleum gas (LPG) or electricity would achieve high efficiency results as well, however, residents of the project area already have access to LPG stoves, and they are unable to afford the continuously rising price to refill their LPG tanks, which currently cost R$40 each (about US$25) (Sindigas, 2010). According to the 2010 IPEA report cited in Alternative 2 above, monthly income in the project area is approximately US$168, little over half the national minimum wage, so the price of an LPG tank is nearly 15% of a typical monthly salary in the project area. The cost of LPG increases each year, as shown by data from Brazil´s Union of LPG Distributors[5].
- Alternative 4: Continuation of the current situation: Instituto Perene does not implement this project and households continue to use inefficient stoves to prepare food. This is the mostly likely scenario.

Sub-step 1b: Consistency with mandatory laws and regulations

All four alternative scenarios described above are consistent with Brazilian law.

Legal aspects of Alternative 1: There is no law prohibiting the use of domestic wood-burning cookstoves. Proof of this is the publically-funded stove distribution program sponsored by the government of Ceará state, and implemented by The Institute of Sustainable Development and Renewable Energy (Instituto de Desenvolvimento Sustentável e Energias Renováveis – IDER). In addition, there is no law prohibiting the use of woodfuel for domestic use. Law 11.428[6], enacted 12/22/2006 and known as the *Atlantic Forest Law*, states:

> Art. 9º Exploitation, without direct or indirect commercial purpose, of native flora species, for use on properties or land possessions of traditional populations or small rural producers, dispenses authorization by the relevant authorities .

[5] http://www.sindigas.org.br/Estatistica/Default.aspx?ano=2011&cat=5

[6,5] The full text of the law can be found at the federal webpage http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2006/lei/l11428.htm

Legal aspects of Alternative 2: There is no law prohibiting the sale of domestic wood-burning stoves. Selling wood-burning stove is a legal activitiy, as proven by the existence of a few legally-constituted manufacturers, such as Ecofogão (www.ecofogao.com.br) and Clarice Eletrodomesticos (www.clarice.com.br), which offers a deluxe wood-burning stove model for approximately US$600. Legal aspects of burning wood from native forests are the same as described in Alternative 1, above.

Legal aspects of Alternative 3. LPG is a legal fuel in Brazil and has been produced/imported and distributed for decades. The distribution of LPG is regulated by the National Petroleum Agency, as laid out in Law nº 9.847/1999.

Legal aspects of Alternative 4. The continued use of inefficient stoves by the target rural population has no legal impediment, as the use of native wood as fuel is allowed for domestic use by traditional populations and small rural producers, according to Law 11.428[7], described above in Alternative 1.

Step 3: Barrier Analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed project activity

The implementation of the proposed project entails significant investment to overcome the following realistic and credible barriers:

- **Investment barrier:** The cost of the materials and direct labor for the cookstove, around R$290[8], is prohibitively expensive for the target population, whose income is on average about *half* the minimum Brazilian monthly salary of R$510 per month (IPEA, 2010).In addition, the project would not be viable without additional investments that would not be covered by users, including technician training, development costs, marketing, and transport of materials, among other activities.

  Although there are real and perceived risks associated with doing business in Brazil, these do not constitute the most significant barrier to raising private capital (domestic or international) for an ICS project. The inability of the target population to purchase the stoves – due to the high cost of the stove in relation to household income – is by far the greatest barrier to direct commercialization as a mechanism of promoting ICS in the region.

  Without the revenue generated through the sale of carbon credits, disseminating 5,000 stoves in the project area would be unviable. From the start, public communication regarding project has always explicitly stated that the project is a carbon-financed one. Mention of the project can be found on the websites of Instituto Perene (www.perene.org.br), partner Ambiental PV (www.ambientalpv.com), and Natura (www.natura.net). Funding for the project comes 100% from the sale of the carbon credits, as evidenced by the contract with Natura – see copy of contract uploaded to Registry (CONFIDENTIAL). Perene obtained funding for the project by submitting a proposal in answer to Natura´s Call for Proposals 2008, as part of its program Natura Carbon Neutral, which aims to offset the company´s yearly carbon emissions through different offset projects. To date, this is the only corporate carbon offset program in Brazil that has a selection process to identify offset projects. In addition, Efficient Cookstoves in the Bahian Reconcavo Region is the first carbon-financed ICS project in Brazil.

[8] About US$100, using exchange rate 1 USD = 1.75 BRL, Nov. 2010.

Funding from donors and charity sources was pursued prior to adopting the carbon-financed approach, but these efforts were unsuccessful. Among the funders that were approached are: 21st Century Riders (proposal submitted Nov. 2007); UNESCO Criança Esperança (submitted October 2008); and Rotary Club (submitted May 2009).

- **Technological barriers:** The design concepts and principles used to build the efficient stoves are the product of decades of research and improvement by specialists. Without an initiative such as this one, the efficient stove technology would remain out of reach of the people who can most benefit by it, that is low-income residents of rural areas, such as the project area. Proper operation and maintenance are two critical aspects for achieving the desired emission reductions, and these aspects are part of the capacity building of this project. In addition, selected materials are not found within the region. Although all efforts were made to maximize the use of local materials, three components that must be shipped from southern Brazil were chosen for their durability and efficacy. These are the refractory bricks and mortar, which are manufactured in Santa Catarina state, and the isolative blocks of Aerated Autoclaved Concrete – AAC, which are manufactured in São Paulo state. As there are specialized materials used only in certain types of civil construction, they are not available in the project region, hence presenting another technological barrier to the local construction of efficient stoves.

The technological barrier also includes a lack of skilled labor with the know-how to build efficient stoves. Although masonry is commonly used in building houses, and is a common form of livelihood among low-income populations, the specific application to the construction of domestic stoves is unknown, as evidenced by the lack of any other efficient stove project in the region. In order to form a team of skilled workers, it was necessary to train the masons and assistants to build the efficient stoves. Training was imparted with the participation of an ICS expert from Aprovecho Research Center and Instituto Perene´s own mechanical and civil engineers. Below is an excerpt from the MOU between Aprovecho and Perene (uploaded to Registry):

> *Collaboration between Aprovecho Research Center and Instituto Perene began in April 2009 on the design of an appropriate stove model for Perene´s target population, low-income rural homes in the state of Bahia. A field visit made in May 2009 by Mike Hatfield, Aprovecho Research stove specialist, resulted in:*
>
> - *Development of a local stove model*
> - *Construction and testing of prototypes*
> - *Training of local masons and users in stove construction, operation and maintenance*
> - *Transfer of know-how to Perene´s team*
>
> *The stove model developed in partnership with Aprovecho has been adopted by Instituto Perene in its stove program.*

The training consisted of a week-long workshop with 4 local masons, during which 6 demonstration stoves were built. The principles of efficient stove design, developed by Dr. Larry Winiarski and Aprovecho Research Center (Bryden, Still, Scott, & Hoffa, 2002), and cited in section A 4.2, were discussed with the masons, and experience was gained through the hands-on construction. The masons´ performance is accompanied by Instituto Perene´s team on a weekly basis.

- **Common practice:** In the project region, the Bahian Recôncavo as well as the rest of the state of Bahia, the dissemination of efficient stoves does not exist. The predominant situation is the use of extremely inefficient, rudimentary stoves, and without the systematic introduction of an alternative and the capacity building that must accompany it, the target population would not have any contact with this new practice.

Figure 7: Typical rudimentary stove.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

The barriers described above affect Alternatives 1, 2, and 3, but not Alternative 4, the continuation of the current situation.

- Alternative 1: Implementation of the Project Activities without being registered as a voluntary project: This would only be possible if Instituto Perene were able to raise the necessary funds through either the Brazilian government or private sponsors to implement this voluntary project activity in order to distribute the cookstoves in the same manner as proposed in this project.
- Alternative 2: Implementation of the Project Activities as a commercial project with no carbon revenues. In this case, Instituto Perene would sell the efficient cookstoves to the resident population at a price that would allow reinvestment in expanding the project. Unfortunately, the cost of the stoves is too high for residents of the project area to purchase on their own. Average income in rural Northeast Brazil is reported by the Institute of Applied Economic Research - IPEA, based on the National Research by Sample Households study, to be R$293, or US$ 168 (IPEA, 2010).
- Alternative 3: A switch to alternative fuels: A switch to liquid petroleum gas (LPG) or electricity would achieve high efficiency results as well, however, residents of the project area already have access to LPG stoves, and they are unable to afford the continuously rising price to refill their LPG tanks, which currently cost R$40 each (about US$25) (Sindigas, 2010). According to the 2010 IPEA report cited in Alternative 2 above, monthly income in the project area is approximately US$168, little over half the national minimum wage, so the price of an LPG tank is nearly 15% of a typical monthly salary in the project area. The cost of LPG increases each year.
- Alternative 4: Continuation of the current situation: None of the barriers prevents this alternative, and it is the mostly likely scenario.

Outcome of Step 3: The only alternative scenario not prevented by any barrier is Alternative 4, the continuation of the current situation. This is the **baseline scenario**.

Step 4: Common Practice Analysis

Sub-step 4a: Analyze other activities similar to the proposed activity

No other projects similar to the one proposed here exist in the project region. The common practice in the project region is the widespread use of rudimentary inefficient stoves.

Other efficient stove projects and models do exist in Brazil. The Institute of Sustainable Development and Renewable Energy (Instituto de Desenvolvimento Sustentável e Energias Renováveis - IDER) developed a different design for their own stove dissemination project in the northern coast of Brazil in the state of Ceará (1,300 km away from the project boundary of this PDD). The IDER model includes a metal frame and brick stove body. This was a publicly-funded program sponsored by the government of the state of Ceará, through which approximately 20,000 stove units were installed in that state.

The company EcoFogão (EcoStove, in English) in the capital of the state of Minas Gerais (about 1,400 km away from the project boundary of this PDD) manufactures wood-burning stoves of various types. Prices range from R$230 to R$933 (US $130 to 530)[9] EcoStoves offer similar benefits in terms of indoor air pollution, efficiency, and lowering GHG emissions, however the cost is higher (compare to Tables 3 and 4 in Section B.5), and being a portable model it does not have the robustness of Perene´s fixed model. The ICS designed by Instituto Perene and Aprovecho Research Center is a local model, designed specifically for the project region, and is highly durable.

In addition, the Instituto Perene project offers important social and economic benefits to the project area: local production of its components and on-site installation generates jobs and revenue, while training of masons and Community Agents transfers technology and builds capacity among the local population.

Sub-step 4b: Discuss any similar options that are occurring

The initiatives described above are occurring in different states of Brazil. Brazil is a very large country and thus the distances between states and regions are very great, making it much more feasible to execute projects at the state or regional level or even smaller. For instance, distributing stoves manufactured in another state such as Minas Gerais would entail very large transportation costs, and the project region would receive no benefits in terms of the use of local materials and labor. Instituto Perene has made a commitment to use as many locally available materials as possible and to contract local labor for the required community agents, masons, and monitoring agents.

The IDER project model was not used for this project because it does not include the “rocket” combustion chamber and insulation as recommended by the Aprovecho Research Center. In addition, it includes a metal frame within the masonry structure, and this design practice was not desired by Instituto Perene because it may rust once embedded in the masonry. This is a potential problem specific to this project area, which is near a marine bay and salt in the air causes metal to oxidize quickly. Rusting within masonry could cause cracking in the stove structure.

The Instituto Perene efficient stove is one specially developed for the project area through a participative design process, and it has received positive feedback from members of the project community. Instituto Perene is the only organization with an efficient stove initiative in the project region, and the only carbon-financed stove program in Brazil.

Conclusion

Carbon finance through this proposed voluntary project has been identified as the only realistic and adequate source of finance having the scale and consistency over time necessary to implement and expand the installation of efficient cookstoves in the Bahian Recôncavo. The carbon funding allows installation of the efficient stoves with a relatively low cost to the users: bricks and cement for the stove base. In addition, the carbon funding covers transportation costs, maintenance and monitoring over the lifetime of the stove, and marketing and capacity building activities with the target population.

[9] www.ecofogao.com.br

B.6. Emission reductions:

Emissions reductions are calculated following the Gold Standard Methodology for Improved Cook-stoves and Kitchen Regimes (V 2).

B.6.1. Explanation of methodological choices:

The project activity consists of the installation of ICS, which by definition are small appliances providing energy efficiency improvements in the thermal applications of non-renewable biomass, in accordance with the Gold Standard Improved Cook-Stove and Kitchen Regime Methodology (V 2).

In accordance with the methodology used, it is assumed that in the absence of the project activity, the baseline scenario would be the use of unnecessary amounts of non-renewable wood biomass for cooking fuel within domestic kitchens in the Bahian Recôncavo.

Baseline emissions

From the Gold Standard Methodology for Improved Cook-stoves and Kitchen Regimes (V 2), Section 4.1 (p. 13)

1. Approach 1 is specific to each representative Unit of each cluster and applies values of mass for each fuel in the mix:

$BE_y = X_{nrb,bl,y} . B_{bl,y} . EF_{bl.bio,CO2} + \sum(AF_{bl,i,y}. EF_{af,CO2,i})$
$+ \sum(\text{Non-CO2 emissions during cooking})$
$+ \sum(\text{GHG emissions during production of the fuels})$ ……….Eqn B.1a

Where

BE_y = baseline emissions in year y (in tonnes CO2e per year) specific to cluster and Unit chosen

$X_{nrb,bl,y}$ = the non-renewable fraction of the woody biomass harvested in the project collection area in year y in the baseline scenario

$B_{bl,y}$ = the mass of woody biomass consumed during cooking in the baseline in year y (tonnes/year).

$EF_{bl.bio,CO2}$ = the CO2 emission factor for use of the biomass fuel in the baseline scenario in tonnes CO2 per tonne fuel

$AF_{bl,i,y}$ = The mass of alternative fuel i in the baseline in year y in accordance with trends projected throughout the project period, in tonnes. This mass can be set to zero in cases where the KT is appropriately designed to subsume alternative fuels (approach 3).

$EF_{af,CO2,i}$ = The CO2 emission factor for use of the alternative fuel i in the baseline in tonnes of CO2 per tonne fuel

Non-CO2 emissions during cooking = $\sum (B_{bl,y} . EF_{bl.bio,non\text{-}co2,i}) + \sum(AF_{bl,i,y} . EF_{af,i,non\text{-}co2\ gas\ i})$ Eqn B.1b

GHG emissions during production of the fuels = $X_{nrb} . B_{bl,y} . EF_{bio,prod,co2} + \sum(AF_{bl,i,y} . EF_{af,prod,co2,i})$
$+ \sum (B_{bl,y} . EF_{bio,prod,non\text{-}co2\ gas\ i})$
$+ \sum(AF_{bl,i,y} . EF_{af,i,prod,non\text{-}co2\ gas\ i})$ …Eqn B.1c

Where

$EF_{bl.bio,non\text{-}co2,i}$ = Emission factor for GHG gas i in the baseline scenario in units of tonnes gas per tonne wood-fuel

$EF_{af,i,non\text{-}co2\ gas\ i}$ = Non-CO2 Emission factor during cooking for alternative fuel i for GHG gas i in tonnes gas per tonnes fuel

$EF_{bio,prod,co2}$ = CO2 Emission factor for wood-fuel during production in tonnes gas per tonnes fuel

$EF_{af,prod,co2,i}$ = CO2 Emission factor for fuel i during production in tonnes gas per tonnes fuel

EFbio,prod,non-co2 gas i= Non-CO2 Emission factor for wood-fuel during production in tonnes gas per tonne fuel

EFaf,i,prod,non-co2 gas i= Non-CO2 Emission factor alternative fuel i for GHG gas i during production in tonnes gas per tonnes fuel

Project Emissions

From the Gold Standard Methodology for Improved Cook-stoves and Kitchen Regimes (V 2), Section 4.1 (p. 16)

1. Approach 1 is specific to each representative Unit of each cluster and applies values of mass for each fuel in the mix:

$$PE_y = X_{nrb,pj,y} \cdot B_{pj,y} \cdot EF_{pj.bio,CO2} + \sum(AF_{pj,i,y} \cdot EF_{af,CO2,i}) + \sum(\text{Non-CO2 emissions during cooking}) + \sum(\text{GHG emissions during production of the fuels}) \quad \text{……….Eqn P.1a}$$

Where

$X_{nrb,pj,y}$ = the non-renewable fraction of the woody biomass harvested in the project collection area in year y in the project scenario

PE_y = project emissions in year y (in tonnes CO2e per year) specific to cluster and Unit chosen

$B_{pj,y}$ = the mass of woody biomass consumed during cooking in the project in year y (tonnes/year).

$EF_{pj.bio,CO2}$ = the CO2 emission factor for use of the biomass fuel in the project scenario in tonnes CO2 per tonne fuel

$AF_{pj,i,y}$ = The mass of alternative fuel i in the project in year y in accordance with trends projected throughout the project period, in tonnes. This mass can be set to zero in cases where the KT is appropriately designed to subsume alternative fuels (approach 3).

$EF_{af,CO2,i}$ = The CO2 emission factor for use of the alternative fuel i in the baseline in tonnes of CO2 per tonne fuel

$$\text{Non-CO2 emissions during cooking} = \sum(B_{pj,y} \cdot EF_{pj.bio,non\text{-}co2,i}) + \sum(AF_{pj,i,y} \cdot EF_{af,i,non\text{-}co2\ gas\ i}) \quad \text{Eqn B.1b}$$

Where

$EF_{pj.bio,non\text{-}co2,i}$ = Emission factor for GHG gas i in the baseline scenario in units of tonnes gas per tonne wood-fuel

$EF_{af,i,non\text{-}co2\ gas\ i}$ = Non-CO2 Emission factor during cooking for alternative fuel i for GHG gas i in tonnes gas per tonnes fuel

B.6.2. Data and parameters that are available at validation:

<table>
<tr><td>Data / Parameter:</td><td>$X_{nrb,bl,y}$</td></tr>
<tr><td>Data unit:</td><td>Fraction</td></tr>
<tr><td>Description:</td><td>Non-renewable fraction of the woody biomass harvested in the project collection area in year y in the baseline scenario.</td></tr>
<tr><td>Source of data used:</td><td>The table below shows the source used for each variable in the calculation of the non-renewable biomass fraction.

<table>
<tr><th>Parameter</th><th>Source – Maragogipe</th><th>Source – São Felipe</th></tr>
<tr><td>MAI - Mean Annual Increment (forest growth)</td><td>Siqueira 2007</td><td>Siqueira 2007</td></tr>
<tr><td>Fuel Collection Areas</td><td>Falieri 2011</td><td>GlobalGeo 2012</td></tr>
<tr><td>H – Total Annual Harvest (forest loss)</td><td>Falieri 2011</td><td>GlobalGeo 2012</td></tr>
<tr><td>Total Forest Stock</td><td>Metzker et al 2009</td><td>Metzker et al 2009</td></tr>
</table>

Fuel Collection Areas and Total Annual Harvest values were obtained from NRB studies commissioned for this project. Both studies have been uploaded to the Gold Standard Registry.</td></tr>
<tr><td>Value applied:</td><td>0.81</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures actually applied :</td><td>The fraction of NRB was determined according to the Gold Standard Methodology,

$$f\text{NRB} = (\text{NRB}/\text{H})$$
$$\text{NRB} = \text{H} - \text{MAI}$$
Where:

NRB is the non-renewing biomass or excess harvest.

H is the total annual harvest of woody biomass from the fuel collection areas;

MAI is the sum of mean annual increments of the wood species.</td></tr>
</table>

	The result of applying this analysis is: Maragogipe = 0.812 Sao Felipe = 0.837 In order to maintain a conservative approach, and to simplify the calculations of emissions reductions, the lower of the two values will be used for the whole project.
Any comment:	See Annex 3 for details

Data / Parameter:	$B_{bl\ y}$
Data unit:	Tons/year
Description:	Mass of woody biomass consumed during cooking in the baseline in year y (tons/year).
Source of data used:	Kitchen Performance Test performed by Instituto Perene.
Value applied:	12,400
Justification of the choice of data or description of measurement methods and procedures actually applied :	The KPT followed the methodology Improved Cook-Stoves and Kitchen Regimes, V 2. A paired sample study was carried out in 28 homes before and after adoption of the ICS, and wood consumption was recorded over 4 consecutive days. On average, each household was found to consume 2.48 tons of fuelwood per year. Summing the 5,000 households involved in the project, therefore, the baseline consumption is 12,400 tons/year.
Any comment:	On a per stove basis, the KPT determined baseline fuelwood consumption to be 2.48 tons/stove/year.

Data / Parameter:	$B_{pj\ y}$
Data unit:	Tons/ year
Description:	Mass of woody biomass consumed during cooking in the project in year y (tons/year).
Source of data used:	Kitchen Performance Test performed by Instituto Perene.

Value applied:	6,550
Justification of the choice of data or description of measurement methods and procedures actually applied :	The KPT followed the methodology Improved Cook-Stoves and Kitchen Regimes, V 2. A paired sample study was carried out in 28 homes before and after adoption of the ICS, and wood consumption was recorded over 4 consecutive days.
Any comment:	On a per stove basis, the KPT determined the project fuelwood consumption to be 1.31 tons/stove/year.

Data / Parameter:	$EF_{bl, bio CO2}$
Data unit:	Tons CO_2/tons biomass
Description:	Emission factor for the use of wood for combustion for domestic cooking
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 2.5 *Default Emission Factors for Stationary Combustion in Residential Category*.
Value applied:	2.13 (= 112 tCO_2/TJ * 0.019 TJ/t)
Justification of the choice of data or description of measurement methods and procedures actually applied :	112 tCO_2/TJ is the default value for CO_2 emissions from stationary combustion of wood/wood waste for residential applications. 19 MJ/kg (or 0.019 TJ/t) is the net calorific value of the fuelwood in the project region. See $NCV_{biomass}$ below.
Any comment:	

Data / Parameter:	$EF_{pj, bio CO2}$
Data unit:	Tons CO_2/tons biomass
Description:	Emission factor for the use of wood for combustion for domestic cooking
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 2.5 *Default Emission Factors for Stationary Combustion in Residential Category*.
Value applied:	2.13 (= 112 tCO_2/TJ * 0.019 TJ/t)

Justification of the choice of data or description of measurement methods and procedures actually applied :	112 tCO_2/TJ is the default value for CO2 emissions from stationary combustion of wood/wood waste for residential applications. 19 MJ/kg (or 0.019 TJ/t) is the net calorific value of the fuelwood in the project region. See $NCV_{biomass}$ below.
Any comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/ton
Description:	Net Calorific Value of the wood used as cooking fuel
Source of data used:	National Biomass Reference Center – CENBIO; Biomass Database – Fuelwood species http://cenbio.iee.usp.br/saibamais/bancobiomassa.htm
Value applied:	0.019
Justification of the choice of data or description of measurement methods and procedures actually applied :	Average of the species of trees most commonly used for fuelwood in the Recôncavo region, Murici *Byrsonima verbacifolia* Cocão *Erythroxylum deciduum* Aroeira *Myracrodruon urundeuva* Candeia *Piptocarpha rotundifolia*
Any comment:	Energy content values for several other tree species used in the region, such as Paupombo, Murta and Araçá, were not available from a published source.

Data / Parameter:	$EF_{bl.bio,non-co2}$
Data unit:	Tons CO_2/tons biomass
Description:	Non-CO2 emission factor.
Source of data used:	EF from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 2.5 *Default Emission Factors for Stationary Combustion in Residential Category*. Global Warming Potential (GWP) from UNFCCC publication Climate Change

	1995, The Science of Climate Change: Summary for Policymakers and Technical Summary of the Working Group I Report, page 22.
Value applied:	0.143
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default IPCC values for CH4 and N20 emissions, CH_4 value = 300 kg/TJ N_2O value = 4 kg/TJ 100-year (GWP): CH_4 value = 21 N_2O value = 310 NCV = 0.019 TJ/t $EF_{bl.bio,non-co2} = (300 \cdot 21 + 4 \cdot 310)*0.019/1000 = 0.143$
Any comment:	

Data / Parameter:	$EF_{pj.bio,non-co2}$
Data unit:	Tons CO_2/tons biomass
Description:	Non-CO2 emission factor.
Source of data used:	EF from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 2.5 *Default Emission Factors for Stationary Combustion in Residential Category*. Global Warming Potential (GWP) from UNFCCC publication Climate Change 1995, The Science of Climate Change: Summary for Policymakers and Technical Summary of the Working Group I Report, page 22.
Value applied:	0.143
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default IPCC values for CH4 and N20 emissions, CH_4 value = 300 kg/TJ N_2O value = 4 kg/TJ 100-year (GWP): CH_4 value = 21 N_2O value = 310 NCV = 0.019 TJ/t $EF_{pj.bio,non-co2} = (300 \cdot 21 + 4 \cdot 310)*0.019/1000 = 0.143$
Any comment:	

Data / Parameter:	LE_y
Data unit:	Tons CO_2-eq per year
Description:	Leakage from transport
Source of data used:	Distance travelled by project vehicles from project records. Emissions factors from EPA http://www.epa.gov/oms/climate/420f05001.htm
Value applied:	5.1 (Years 1-3) 1.7 (per year – Years 4 through 10)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated from expected distances travelled by project vehicles and from EPA emissions factors: CO_2 emissions from gasoline = 2.32 kg/liter CO_2 emissions from diesel = 2.66 kg/liter
Any comment:	See Section B.6.3 for details

B.6.3 Ex-ante calculation of emission reductions:

In order to determine the emissions reductions of the project, the baseline and project emissions must first be calculated.

Calculation of Baseline Emissions

Using equation B.1a from Section B.6.1 above, and simplifying it by eliminating the variables related to alternative fuels and to GHG emissions resulting from production of fuel (as these are not relevant to our case), we have:

$$BEy = Xnrb,bl,y\,.\,Bbl,y\,.\,EFbl.bio,CO2 + \sum(Non - CO2\ emissions\ during\ cooking)$$

Inserting the values from the parameters described above:

$$BEy = 0.81 * 12400\ t/yr * 2.13\ \ tCO2e/t + 12400\ t/yr * 0.143\ \ tCO2e/t$$

BEy = 23,167 tCO2e/yr

Therefore, the baseline emissions of the 5,000 households involved in the project are equal to:

23,167 tCO2e/yr

Calculation of Project Emissions

In the same manner, equation P.1a can be simplified to calculate the project emissions:

$$PEy \; = \; Xnrb, pj, y \; . Bpj, y \; . EFpj. bio, CO2 \; + \; \sum(Non - CO2 \; emissions \; during \; cooking)$$

Inserting the values from the parameters above yields:

$$PEy = 0.81 * 6550 \; t/yr * 2.13 \; tCO2e/t + 6550 \;\; t/yr * 0.143 \;\; tCO2e/t$$

PEy = 12,237 tCO2e/yr

Therefore, the project emissions generated by the 5,000 households using the improved cookstove are equal to: **12,237 tCO2e/yr**

Calculation of Emissions Reductions

From the Gold Standard Methodology for Improved Cookstoves and Kitchen Regimes, Section 7, page 19, equation ER.1a, emissions reductions are calculated as follows:

Emission reductions

$ER_y = BE_y – PE_y – LE_y$

Where

ER_y Emission reductions in year y in tCO_2/year

PE_y Project emissions in year y in tCO_2/year

BE_y Baseline emissions in year y in tCO_2/year

LE_y Leakage emissions in year y in tCO_2/year

The following table shows the year-by-year baseline, project and leakage emissions, as well as the resulting emissions reductions.

Table 5. *Ex-ante* Emissions Estimate

Year	Period	No. Stoves built during year	Average stove-years in each period*	BEy (tCO_2e/yr)	PEy (tCO_2e/yr)	LEy (tCO2/yr)	ERy (tons CO_2e/yr)
1	2010-2011	750	375	1738	918	5.1	815
2	2011-2012	1800	1650	7645	4038	5.1	3602
3	2012-2013	2450	3775	17491	9239	5.1	8247
4	2013-2014	0	5000	23167	12237	1.7	10928
5	2014-2015	0	5000	23167	12237	1.7	10928
6	2016-2017	0	5000	23167	12237	1.7	10928
7	2017-2018	0	5000	23167	12237	1.7	10928
8	2018-2019	0	5000	23167	12237	1.7	10928
9	2019-2020	0	5000	23167	12237	1.7	10928
10	2020-2021	0	4625	21429	11320	1.7	10108
						Project Total (tons CO2e)	**88340**

*The calculation of stove-years accounts for the fact that not all stoves installed in a given year can be considered operational for that entire year. For example, in Year 1, 750 stoves were installed at approximately a constant construction rate over 12 months. On average, therefore, each stove installed in that year operated for half of the year. 750 stoves * 0.5 yr = 375 stove-years in Year 1.

The operating life of the stove has been defined by Instituto Perene to be 10 years. As explained above, Instituto Perene´s stove model, developed together with Aprovecho Research Center, is similar to the Justa stove, with the same robustness that comes from being a fixed model with a brick and mortar stove housing. The Justa stoves have proven in the field to have a useful life near 10 years (Peter Scott, p. 11) . Furthermore, Perene´s estimation is justified by the selection of extremely robust materials used in the stove:

- Combustion chamber made of refractory brick of 2.5 cm thickness, and refractory mortar. The thickness was chosen to avoid the fracture that sometimes occurs when firewood is pushed too far in the stove, hitting the back of the chamber. Refractory brick is made to withstand high temperatures while having low thermal conductivity. According to the manufacturer´s specifications, the bricks are 38% Al_2O_3, resistant to 1280º C and can withstand compression of 250 KgF/cm^2. (Gabriella Refratarios)
- AAC used as isolative material. Autoclaved Aerated Concrete is widely used for its characteristics of thermal isolation, lightweight and long durability, this material is described as follows: "A cement-based material, AAC resists water, rot, mold, mildew, and insects." (Portland Cement Association)

- Brick and mortar housing. Differently from metal structures or other portable models, the fixed model has the proven durability of masonry.
- Ceramic chimney. When the original chimneys, made of galvanized steel, began to corrode, the projecct replaced all the units with ceramic chimneys, and now uses only ceramic chimneys. According to Aprovecho Research Center, chimneys of this material have a durability of 10+ years (Peter Scott, p. 12)

Leakage

All of the following forms of leakage have been assessed for this PDD:

a. Some users of the ICS may respond to the fuel savings by increasing consumption of fuels with GHG emission characteristics, to the extent that project emissions are higher than those calculated from the assumption that cooking energy is constant.
b. The project activity stimulates increased use of a high emission fuel either for cooking or for other purposes outside the project boundary.
c. By virtue of promotion and marketing of a new model and type of stove with high efficiency, the project stimulates substitution of a cooking fuel or stove type with relatively high emissions by households who commonly use a cooking fuel or stove type with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.
d. The project population compensates for loss of the space heating effect of inefficient cook-stoves by adopting some other form of heating or by retaining some use of inefficient stoves.
e. The traditional stoves displaced are re-used outside the boundary in a manner suggesting more usage than would have occurred in the absence of the project.
f. Significant emissions from transportation or construction involved in the project activity, including emissions associated with production/transport of the efficient stoves themselves, or production/transport of project fuels.

The quantitative results of the KPT subsume the potential sources of leakage in case (a). Since the KPT represents fuel savings in actual households, the results already incorporate the effects of these potential leakages. Also, any additional fuel wood used will lower the number of emission reductions. Ultimately, stove users are not expected to change their daily cooking habits, as the type of food they commonly prepare for their families and their income generating activities have been very similar for generations and will not likely change during the project activities.

The activities of this project are small-scale and are expected to affect only the communities in which ICS are distributed. Thus, case (b) is not expected to be a source of leakage for this PDD. There is nothing indicating a link between the activities of this project and the increased use of high emission fuels outside of the project boundary.

In the case of (c), both the much lower disposable income levels and the continuing practice of self-collection of fuel wood prevent a transition by stove users from wood to charcoal or to LPG. This is a very unlikely scenario because of the commitment (including the in-kind contribution of bricks and cement, worth approximately 20 US dollars) made by rural residents in the project area in an ICS, an investment made due precisely to the lack of availability and the expense of lower-emission fuels, such as charcoal and LPG.

Leakage source (c) is also addressed through the Kitchen Survey which is a continuous monitoring requirement and a leakage factor can be applied in the future if significant fuel switching from wood to other fuels is observed.

Leakage source (d) is not relevant for the project region since traditional stoves are not typically used for space heating. Minimum temperature is 21ºC in the municipality of Maragogipe, which marks the project boundary. Stoves are sometimes used to heat water during the 3-month rainy season, and this is a practice that will likely continue in the future, using the ICS installed by this project.

Leakage source (e) is also not relevant for the project region since traditional stoves are not typically transportable or transferred between households. Traditional stoves are made of bricks, mud and clay and, once dismantled, are not re-usable.

All the potential sources of leakage described above will be monitored throughout the project lifetime. Fuel-switching will be continuously monitored in the Kitchen Surveys.

Leakage source (f), transport, is considered in the emission reduction equation (a). The only leakage calculated for this project is due to transport of people and materials during the installation and monitoring processes. During the stove installation process early in the project, Instituto Perene extrapolated what transport would be like for the entire project activity. In the construction phase, 1gasoline-fuelled vehicle and 2 diesel-fuelled vehicles are necessary. For the monitoring phase, it was estimated that a light vehicle would travel 30 km/day for150 days during the period of 7 years. The emission factor used is from the United States Environmental Protection Agency.

Table 6. PROJECT LEAKAGE

	Item	Fuel type	Vehicle use (km/week)	Vehicle use (km/year)	Fuel consumption (km/l)	EF (kgCo2e/liter)	Emissions (tCO2e)
YEARS 1-3	Building team	gasoline	150	7500	10	2.32	1.7
	Management	diesel	150	7500	10	2.66	2.0
	Materials	diesel	50	2500	5	2.66	1.3
						Leakage during construction phase (tCO2e/yr)	5.1
YEARS 4-10	Monitoring	gasoline	150	7500	10	2.32	1.7
						Leakage during Monitoring phase (tCO2e/yr)	1.7
						Total project Leakage (tCO2e)	27.2

<u>SOURCE</u> EPA http://www.epa.gov/oms/climate/420f05001.htm

CO_2 emissions from gasoline = 2.421 grams/gallon x 0.99 x (44/12) = 8.788 grams = 8.8 kg/gallon = 2.32 kg/liter

CO_2 emissions from diesel = 2.778 grams/gallon x 0.99 x (44/12) = 10.084 grams = 10.1 kg/gallon = 2.66 kg/liter

B.6.4 Summary of the ex-ante estimation of emission reductions:

Estimated emission reductions over the crediting period for this project activity:

Project Year	Estimated emission reductions (Tons CO2e/yr)
1	815
2	3,602
3	8,247
4	10,928
5	10,928
6	10,928
7	10,928
8	10,928
9	10,928
10	10,108
Total emission reductions (tons CO2e)	**88,340**
Total number of crediting years	**10**
Average annual reductions over the crediting period (tons of CO2e)	**8,834**

B.7 Application of a monitoring methodology and description of the monitoring plan:

The monitoring protocol to be followed is that included in the methodology "Improved Cook-Stoves and Kitchen Regimes, version 2" approved by the Gold Standard Foundation.

A Total Installation Record, Detailed ICS User Database, and Project Database are maintained continuously, while periodic Kitchen Surveys will be conducted to measure or estimate parameter values and review and revise the cluster lists held in the Project Database; emission reduction calculations are carried out on the basis of the KPT results.

Initial Kitchen Surveys (before new stove installation) will be applied 100 project participants, conducted by Instituto Perene. Monitoring KS will then be applied in 100 households after the installation of the new stove. Subsequent Monitoring KS will be carried out biannually again to at least 100 homes each time, spread out over the four quarters of the year to account for seasonal variation.

It is important to note that although the Gold Standard Monitoring Methodology states that Monitoring KS be repeated every 3 months, this should apply to projects with on-going sales/installations. From Methodology for Improved Cook-stoves and Kitchen Regimes V 2, p. 23: "[For the Monitoring KS] households are randomly selected from the Sales Record of the relevant period (in this case purchases made in the previous and/or current quarter)." Since this project has a pre-defined number of stoves (5,000) and time-frame for installation (3 years), after the installation period there will be no new stoves coming into operation.

All the Kitchen Surveys will be conducted personally by a member of Instituto Perene, accompanied by a Community Agent, in the homes. In this way, the chances of miscommunication are minimized, and the quality of the information gathered is the best possible.

The specific activities included in the monitoring plan are listed in Annex 4.

B.7.1 Data and parameters monitored:

Data / Parameter:	N_{stoves}
Data unit:	Stoves
Description:	Quantity of stove installations on date x
Source of data to be used:	Records of date of each installation kept by Instituto Perene
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Derived from stove installation records
Description of measurement methods and procedures to be applied:	Instituto Perene keeps a paper and electronic record (Microsoft Access) updated weekly
QA/QC procedures to be applied:	Representative from Instituto Perene supervises the project activities and provides training, guidelines, and templates to facilitate accurate record keeping.
Any comment:	Each stove is identified by the head of household name and government-issued identification card number, as well as community name and GPS location. In the database, each stove is identified by a unique Stove ID number automatically assigned by the MS Access database software.

Data / Parameter:	N_x
Data unit:	Days
Description:	Number of days the stoves installed on date x have been operating
Source of data to be used:	Records of date of each installation kept by Instituto Perene
Value of data applied	Derived from stove installation records

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Instituto Perene keeps a paper and electronic record. MS Access software allows tracking stove age in days, automatically updated.
QA/QC procedures to be applied:	Representative from Instituto Perene supervises the project activities and provides training, guidelines, and templates to facilitate accurate record keeping.
Any comment:	Database is updated on a monthly basis, at which time all stoves built in that month are entered.

Data / Parameter:	D
Data unit:	km
Description:	The number of kilometers travelled by project vehicles, used to calculate leakage
Source of data to be used:	Log of project travel
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Expected travel distances
Description of measurement methods and procedures to be applied:	Travel distances will be logged by Instituto Perene
QA/QC procedures to be applied:	Representative from Instituto Perene supervises the project activities and provides training, guidelines, and templates to facilitate accurate record keeping.
Any comment:	

Data / Parameter:	$B_{y,savings}$/stove (Age z)
Data unit:	Tons/stove-year
Description:	Biomass saved by each stove of Age z
Source of data to be used:	Random samples of ICS users using stoves of age z
Value of data applied for the purpose of calculating expected emission reductions in	1.7

section B.5	
Description of measurement methods and procedures to be applied:	Kitchen surveys and Kitchen performance tests
QA/QC procedures to be applied:	Representative from Instituto Perene supervises the project activities and provides training, guidelines, and templates to facilitate accurate record keeping.
Any comment:	

Data / Parameter:	Usage in year y
Data unit:	Fraction
Description:	Percentage of stoves of age x remaining in use in year y
Source of data to be used:	Kitchen surveys
Value of data applied for the purpose of calculating expected emission reductions in section B.5	n/a
Description of measurement methods and procedures to be applied:	Application of Kitchen Surveys by means of interviews in at least 100 homes
QA/QC procedures to be applied:	Representative from Instituto Perene, accompanied by Community Agents, carries out the surveys.
Any comment:	

Sustainable Development Indicator	**Data type**	**Data variable**	**Data unit**	**Measured (m), calculated (c), estimated (e)**
Air quality	Survey	Combustion residues, health improvements	Survey and observations	Estimated through home interviews and observations as to inside/outside cooking. Air quality indicators include soot residue on ceilings and pans as well as improvements in health (less coughing, fewer vocal problems, pulmonary health).
Livelihood of the poor	Survey	Financial impact	Surveys	Estimated through home interviews and biannual kitchen surveys in randomly selected households

Employment	Survey	Numbers	Employees	Direct employees of Instituto Perene are counted (measured) and any other employment resulting from this initiative will be estimated
Access to energy services	Survey	Fuel cost, consumption, ease of collection	Tons/year, prices, walking distances	Estimated through kitchen tests and surveys
Human and institutional capacity	Survey	Skill levels	Observations	Estimated through the spinoff achievements in business, marketing, and technology areas, also estimated in female earned income over the project lifetime
Technological self-reliance	Survey	Achievement	Observations	Estimated through observations and records of technical innovations and developments that are spinoffs of the stove model disseminated by this project

The recording frequency of the parameters detailed above reflects the maximum interval; in practice Instituto Perene and any third parties may take certain measurements more frequently, for instance, when they happen to be in the project area for other project activities, and update any calculations accordingly.

B.7.2 Description of the monitoring plan:

The monitoring plan has been developed according to the Gold Standard methodology. Sample sizes will be the same as those defined for the baseline procedure.

The project activities will be monitored separately and will generate an annual count of emission reductions. Instituto Perene is responsible for maintaining a detailed installation record so that no double-counting occurs. A detailed monitoring plan is attached in Annex 4. The monitoring plan is designed to eliminate any risk of double-counting, as each stove constructed is identified in the database with a unique ID number, and the stove owner is identified by name, government-issued identification card number and GPS location. In summary the Monitoring Plan includes the following elements:

Continuous Monitoring Tasks:

1. Maintenance of a Total Installation Record
2. Maintenance of a Detailed Customer Database

Periodic Monitoring Tasks:

1. Non-renewability fraction of wood-fuels
2. Leakage
3. Kitchen Surveys
4. Aging-stove KPT
5. Social and economic impact of the project

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

The Baseline and Monitoring studies are expected to be completed by January 2011, performed by Instituto Perene.

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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

January 2010: first funds received from Natura to begin stove construction training and informational meetings.

Start of construction/Start of crediting period: March 15, 2010.

C.1.2. Expected operational lifetime of the project activity:

10 years

C.2 Choice of the crediting period and related information:

10 year fixed crediting period.

Starting date: March 15, 2010.

SECTION D. Environmental impacts

The objective of this small-scale project activity is the installation of ICS in the Recôncavo region of Bahia state in northeastern Brazil. Due to its small scale, along with its positive social and environmental benefits, the environmental analysis is undertaken at the project level. The impacts of installing 5,000 efficient stoves in the project region are better assessed from a macro perspective than from the individual user level.

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

No record from the Brazilian national regulations was found to require an Environmental Impact Assessment for the installation of efficient cookstoves. Based on the arguments detailed below in section D.2, no environmental impact assessment will be conducted for this project activity. Resolution 001[10] of the National Environmental Council of the Ministry of the Environment, dated January 23, 1986, in Article 2 describes the activities which require an EIA. None of these activities, which include roads, dams, landfills, industries and other large-scale undertakings, are even remotely applicable. The only activity that could at all be considered related to domestic woodburning stoves is item XVI: *Any activity that uses charcoal, derivatives or similar products in quantities above 10 metric tons/day*. However, the efficient stoves use wood, not charcoal, and even so, the scale for which an EIA is required is at least 3 orders of magnitude greater than the wood use of a domestic stove, which, according to the field testing performed is approximately 0.004 t/day.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Environmental benefits:

- *Air quality*: Indoor air pollution will be reduced. Due to its high efficiency, the ICS drastically reduces the amount of smoke produced. Furthermore, the small amount of smoke that is generated does not contaminate the home as it exits the chimney. Other harmful substances like PICs (Products of Incomplete Combustion) are low as the combustion is nearly complete and only small quantities of ash need to be removed. Air pollution from cooking with solid fuel is a key risk factor for childhood pneumonia as well as many other respiratory, cardiovascular and ocular diseases. The reduction in fuel wood used for cooking will cause a reduction in the emissions from the stove (outdoor air pollution).

- *Water quality*: The decrease in wood gathered from the project area is expected to help preserve woody vegetation in areas around water sources, thus contributing to preservation of the natural forces that filter and maintain the water supply.

  Forests along rivers and around lakes and reservoirs (known as riparian forests) affect water quality by reducing sediments, nutrients and other pollutants that enter streams, lakes, and other surface waters (Klapproth & Johnson, 2000). In addition to water quality, riparian forests affect water retention and help reduce floods, stabilize stream banks, provide shade and maintain temperature, provide habitat for birds and other animals, and can be used by the community for recreation (Anderson & Masters, 2007).

  Studies overwhelmingly show the critical role of riparian forests in the protection and enhancement of water resources (Anderson & Masters, 2007). Riparian forests should be considered a part of any comprehensive land management plan (Klapproth & Johnson, 2000). The activities of this project will reduce the amount of wood needed for domestic cooking fuel. This outcome is expected to bring positive impacts for the area's water and soil resources.

  In fact, in early 2010 during the initial stages of this project, the natural springs serving the community began to dry up due to a long dry spell, making water availability a particularly sensitive issue. Community members are forced to collect water at a source further away and bring it home in containers for use in bathing, cleaning, and drinking. Due to the uneven terrain and difficult access to the water sources, all of this work is done on foot, several times each day. Reducing forest degradation in the area is hoped to alleviate these serious problems for the local community.

- *Soil condition*: The preservation of woody vegetation expected as an outcome of this project protects against soil erosion and compaction.

[10]Document can be found on the CONAMA website at http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=23

During the *lixiviation* process, soil materials are carried by water to rivers and rivulets, depositing sediments into them. This process washes away the minerals in the soil. Soil degradation accelerates the river's silting processes. Once soil is degraded, a river's recharge process is damaged, thus decreasing the river flow.

- *Biodiversity*: Pressure on habitats will be reduced and even improved by a decrease in forest degradation, thus reducing pressure on endangered wildlife for which these forests are crucial.

  This project is expected to help preserve habitat by reducing degradation of the surrounding Atlantic Forest fragments and mangroves. Because it was long isolated from the other major rainforest blocks of South America, this forest has an extremely diverse and unique mix of vegetation and forest types. The Atlantic Forest constitutes one of the greatest repositories of biodiversity on the planet, with more than 20,000 known species of plants alone. Fragments of this forest are home to dozens of endemic and threatened flora and fauna species. Once spanning the entire Brazilian coast, the Atlantic Forest has been almost entirely destroyed. Only 7% of the original forest remains[11], and the fragments are highly degraded.

No negative impacts can be identified or are considered significant.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The formal stakeholder consultation process for this project began in November 2009, when Instituto Perene was informed by Natura that the proposal was approved. Between November and December 2009, three community meetings were held in different districts of Maragogipe municipality, involving approximately 90 members of the local population, mostly women. A fourth stakeholder meeting was held in the municipality of Sao Felipe, on June 11, 2011, in the community of Acupe, gathering over 30 participants, the majority, again, female.

Stakeholder engagement is an on-going process in this project and will continue until all 5,000 participants have signed up for the project and received their stoves and related training. In addition to community meetings, participants are engaged through the work of Community Agents who make house-to-house visits to explain about the project and gather signed contracts.

Local people impacted by the project are personally invited to participate in the informative meetings that included a demonstration of the ICS. The active participation of local residents is crucial to the success of this project, and so all residents of the project area are considered relevant stakeholders. All residents in the project area, regardless of gender, age, or ethnicity, are invited to the meetings. Meetings are held progressively as the project expands into new districts within the project area to install ICS.

The method for engaging the local community through physical meetings is a slow but effective process. First, a home is identified in which to install a demonstration stove. After completion and working with the stove user on how to operate the efficient stove, Instituto Perene monitors the stove performance and the user observations. After a few weeks of the stove's operation, a meeting was planned at that location. The stove user herself presents her experiences with the stove and demonstrates how to use it to all those present at the meeting. This way, the members of the community receive first-hand accounts of the efficient stoves from their neighbors and peers.

[11] Fundação SOS Mata Atlântica, 2009

The project area does not have a local newspaper, so this medium of communication was not a possibility for inviting participants and publicizing the project. The local residents also have limited access to radio, so this was also not considered an option for project developers to contact potential participants. Another important factor that led Instituto Perene away from using written invitations is the fact that a large number of the residents of the project area are functionally illiterate. Written communication is not the optimum choice for communicating within this area. In the São Felipe meeting, by suggestion of the local Community Agent, a loudspeaker service was hired, consisting of a car equipped with speakers that circulated around the town, playing a recorded announcement about the meeting purpose, place and time.

In Maragogipe, the leader of a local organization, the *Guaipanema* Community Association, was contacted to help lead the informative meetings and invitation process in the first district, Guaí. This person also leads the local "quilombola" movement, a social movement in communities that are descendents of slaves to gain their community property rights as due by Brazilian law.

In São Felipe, members of the community association *Associação Patiobinha* were engaged to help find a location and most convenient date and time for the meeting, as well as to spread the word to the local population about the project.

Since the project area is very rural and homes are widely dispersed with limited telephone access, involvement and leadership by these individuals was crucial. Residents of the communities were invited personally by word of mouth and by telephone (if available). Local contacts had about one week to get the word out to the community before each informative meeting.

Figure 8. Stakeholder meeting in São Felipe, June 2011

No local policy makers or authorities are invited to the informative meetings as this project intends to be independent of any local government entities. This precaution eliminates any association with a political party and reduces any effects from political changes in the area. In addition, limiting any involvement of the local government reduces the occurrence of corruption.

No nearby organizations are known to be working on topics relevant to this project.

Letters were sent to the Designated National Authority inviting a representative to both the Stakeholder Feedback Meeting Dec. 10, 2010 in Maragogipe as well as the June 11, 2011 meeting in São Felipe. Gold Standard-supporter entities were also invited to these meetings (see Local Stakeholder Consultation Report for details).

E.2. Summary of the comments received:

Stakeholder comment	Was comment taken into account (Yes/ No)?	Explanation (Why? How?)
Stove should have more openings for pots	Yes	The idea of a 1-burner stove was discarded during the design phase, based on stakeholder input. The current model is a 2-burner stove top, which is considered adequate by most cooks. Request for additional burners were voiced by a few people, but, as explained at the time, cost restrictions do not allow the addition of other pot openings at this time.
Stove should have an oven	No	Currently cost-prohibitive, a different model would be necessary
Stove should be higher	Yes	The height of the stove was increased to make it more accessible to users on foot. This was achieved by adding a base of bricks 50-60 cm high, the materials for which are purchased by each household receiving a stove.
Share cement for base with a neighbor	Yes	Each pair of houses can purchase cement jointly for the base.
Each household receiving a stove should stock materials prior to arrival of bricklayers, to speed construction	Yes	Each household receiving a stove should have base materials prepared: 30 bricks, 2 wheelbarrows of sand, empty powdered-milk can, and cement - this way construction schedule is not hindered
Bricks should be laid along their horizontal axis	Yes	Initial recommendations from Aprovecho included a construction technique of laying the bricks along their vertical axis, but this was not acceptable to local masons. The first design followed the local building technique. Later, the design changed again, with agreement of the masons, to include some bricks laid vertically in order to reduce the necessary number of bricks.

A container could be attached to the roof near the chimney to make use of the heat dispelled in order to boil water	No	Cost-prohibitive for the project. However, future designs could include this mechanism; this concept may be suggested to stove users so that they can construct it themselves
Complaints about the durability of the chimney after the first stove was functional for 6 months	Yes	A thicker galvanized metal sheet will be used for all future chimneys
Isolate bottom portion of the chimney by surrounding it with a material such as wood to protect users and children from hot surface	Yes	This simple concept is now suggested to stove users so that they can construct it themselves
Misunderstanding regarding material transport fee	Yes	This issue is particular to São Felipe, as the contractor hired by Instituto Perene has planned to provide the above materials to households that prefer to have them delivered to their door as opposed to have to provide themselves. However, this had already caused certain misunderstanding. It was made clear to all the participants that all households have the choice to provide their own materials, and in the case that they do, they do not have to pay any transport fee to the contractor.

<u>Stakeholder Feedback Round</u>

On December 10, 2010 the Stakeholder Feedback Meeting was conducted in the community of Guaí, Maragogipe municipality, Bahia state. This was the first community to have participated in the project, and has therefore been using the stove for the longest time. The meeting was held at the local elementary school *Escola Municipal São José*, and gathered thirty-one participants (Attendance List in Annex 5).

Figure 14. Stakeholder Feedback Meeting

Also invited were representatives of the official Gold Standard NGO supporters that work internationally: WWF, HELIO International, Greenpeace, Mercy Corps and REEEP, as well as the two NGOs based in Latin American that officially support Gold Standard: Fundacion Ecodiversidad Colombia and Fundación MDL de Honduras. The text of the invitation, sent by email, is below.

TEXT OF INVITATION TO STAKEHOLDER FEEDBACK MEETING

Dear Sir/Madam,

We are pleased to share with you news of the progress of our Efficient Cookstoves project in the Bahian Recôncavo of Brazil. Implemented by Instituto Perene, this project is constructing 1,000 efficient stoves for domestic use in rural homes in order to reduce GHG emissions and forest degradation, while improving the health and safety of the participating families. The carbon credits being generated by this initiative have been purchased by the Brazilian private company Natura, as part of its voluntary corporate offset program.

This project is being developed in accordance with The Gold Standard. As part of the process of Stakeholder Consultation, we invite you to participate in the Stakeholder Feedback meeting to be held at the São José State Elementary School, located at: Rod BA 420 Km 185, Distrito do Guaí, Maragogipe, Bahia state, Brazil

Date: December 10, 2010
Time: 15:00 hs.

If your organization has a representative in Brazil, or a member who will be traveling in our country during this time, and who would be interested and available to attend the meeting, we look forward to his/her participation.

Below is the summary of the written evaluations filled out by the local stove-users, followed by sample original evaluations. Feedback overall was very positive and the project is widely approved in the community.

Results of Evaluation Forms from Stakeholder Feedback Meeting December 10, 2010 - Guaí, Maragogipe, BA		
	Questions	Frequency
1	**What did you think of the meeting?**	
	Total answers	25
	Very good/Excellent/Liked it very much	14
	Good	8
	Others	3
2	**What do you like about the project?**	
	Total answers	27
	Everything/Like it very much	20
	Reduces fuelwood	3
	Pots don´t get blackened	2
	No smoke inside house	2
3	**What do you dislike about the project?**	
	Total answers	24
	Chimney corroding	6
	Stove should have an oven	2
	Fuel entry should be larger	2
	New stove uses more wood	1
	Don´t dislike anything	13

	Projeto Fogões Eficientes no Recôncavo Baiano Instituto Perene / NATURA Reunião de Avaliação 10/12/2010 Guaí, BA
Nome	Rita Maria Pinto Vias
O que achou da reunião?	eu achei bom
O que gosta do projeto?	eu achei bom eu gosti muito
O que ñao gosta do projeto?	não tem como não gostar.

	Projeto Fogões Eficientes no Recôncavo Baiano Instituto Perene / NATURA Reunião de Avaliação 10/12/2010 Guaí, BA
Nome	Claúdia Bárbara Almeida de Assis
O que achou da reunião? Ótimo	Ótimo
O que gosta do projeto?	Economiza lenha
O que ñao gosta do projeto?	Enferrujou a chaminé rapido

	Projeto Fogões Eficientes no Recôncavo Baiano Instituto Perene / NATURA Reunião de Avaliação 10/12/2010 Guaí, BA
Nome	Juciaria dos Santos
O que achou da reunião?	Achei interessante porque esclareceu algumas duvidas.
O que gosta do projeto?	gosto porque enconomiza lenha e a panela não enche de carvão.
O que ñao gosta do projeto?	Até agora não tenho o que reclamar.

Participants were asked to complete the Blind Sustainable Development Matrix exercise. Four women agreed to fill out the forms, and the results are shown below, followed by a sample form.

Blind SD Matrix

Place and date: GUAÍ, December 10, 2010		
If you think the project will have a **POSITIVE** impact., write	**+**	
If you think the project will have **NO** impact., write	**0**	
If you think the project will have a **NEGATIVE** impact., write	**-**	
INDICATOR	**Score (Frequency)**	**Comments**
Air Quality	+ (4)	-Less/No smoke
Quality and Quantity of Water	+ (2) 0 (2)	
Soil Conditions	+ (2) 0 (2)	
Biodiversity	+ (3) 0 (1)	
Quality of Employment	+ (4)	
Quality of Livelihood	+ (4)	-more comfort -improved vision
Access to Clean and Affordable Energy	+ (3) 0 (1)	
Capacity of People and Institutions	+ (4)	-more conscientious about the

		environment
Transfer of New Technology to the Community	+ (4)	-this project didn't exist before

AVALIAÇÃO DO PROJETO FOGÕES EFICIENTES NO RECÔNCAVO BAIANO

Local e Data: 10/12/2010

INDICADOR		
Se acha que **melhorou**, marque	**+**	
se acha que ficou **igual**, marque	**0**	
se acha que **piorou**, marque	**-**	Comentários
Qualidade do Ar	+	menos fumaça
Qualidade e quantidade de Água no meio ambiente	0	
Condições do Solo	0	
Biodiversidade	+	
Qualidade de Emprego	+	
Qualidade de Vida	+	melhorou a vista
Acesso à Energia limpa e econômica	+	
Capacitação de pessoas e instituições	+	
Transferência de nova Tecnologia para as comunidades	+	não tinha este projeto

Lucimete Pinheiro de Jesus

E.3. Report on how due account was taken of any comments received:

As shown in the table in section E.2 above, which summarizes all comments and explains why and how the comments were taken into consideration, several modifications were made during the design process of the stove due to user comments. The main design changes in the stove resulting from stakeholder comments include the addition of a stove base and the construction technique for laying the bricks. Many design suggestions, such as the inclusion of more burners and an oven, may be considered in future models. Some design additions, such as the chimney protector and the container for heating water, are now suggested to stove users in case they wish to build them themselves.

It is important to note here that the entire design process for the regional stove model was participatory, with the active participation of local community members to design an appropriate stove for their needs.

The main alteration made based on the Stakeholder Feedback Round was the substitution of the corroding metal chimneys with ceramic ones. The Perene team was already aware of the problem, and the information from the participants of the stakeholder meeting confirmed the fact that many of the chimneys were starting to corrode. A chimney replacement plan was executed to substitute the original metal chimneys with ceramic ones. As of May 2012, all damaged metal chimneys in the project region were replaced with durable, ceramic chimneys.

Alterations in the meeting design were also made based on stakeholder comments. For instance, women from the community were invited to speak during the meetings about their experiences with the improved stove and to engage other members of the local community. In addition, meetings were scheduled based on comments regarding the availability of the local community. These alterations resulted in very good participation results.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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E-Mail:	guilherme@perene.org.br
URL:	www.perene.org.br
Represented by:	Guilherme Monteiro do Prado Valladares
Title:	Executive Director
Salutation:	Sr./Mr.
Last Name:	Prado Valladares
Middle Name:	Monteiro do
First Name:	Guilherme

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable

Annex 3

BASELINE INFORMATION

Baseline information regarding fuel consumption measurements is provided in section E. above; baseline information regarding non-renewability assessment for the project activity is provided here.

Non-Renewable Biomass Assessment

Introduction

This NRB assessment was conducted in accordance with the Gold Standard accreditation, focusing on the municipality of Sao Felipe and the western portion of the municipality of Maragogipe, both in the state of Bahia, Brazil. A rigorous and transparent figure for NRB is required for projects to be credited with the reductions in carbon emissions, and Instituto Perene in partnership with Ambiental PV Ltda and other consulting firms have developed a method presented herein.

The purpose of this section is to demonstrate the very high fraction of non-renewable fuel wood used by the project participants in the Bahian Recôncavo. This demonstration is based on evidence, presented below, that the few wood collection areas remaining in the project region from which firewood has been historically extracted and from which it continues to be extracted, are being constantly degraded, transformed into pastures, agricultural fields and other low woody biomass land use types; that sustainable management initiatives focused on providing fuel wood do not exist in the region; and that the national forestry and nature conservation legislation is widely disrespected.

As specified by the Gold Standard, project proponents may choose one of two options to estimate the fractional non-renewability of woody, either adopt a similar approach to CDM-approved methodology AMS II.G v02 or follow the quantitative/qualitative assessments detailed under Gold Standard's own Technologies and Practices to Displace Decentralized Thermal Energy Consumption Methodology. Our choice was to follow the Gold Standard methodology.

Quantitative Assessment

The boundary for this project activity is the municipality of Sao Felipe and the western lands of the municipality of Maragogipe, totalling 55,420 hectares (GlobalGeo, 2012) (Falieri, 2011). These two municipalities are completely contained within the Atlantic Rainforest biome, meaning that these lands were originally completely covered with dense rainforest.

The western lands of Maragogipe contain 24,826 ha, representing over half of the total area of the municipality. When analysed in terms of geomorphology this municipality can be divided into two territories due to what is known as a rift valley effect (Falieri, 2011). These 24,826 hectares of Maragogipe's western portion, together with the 20,600 hectares of the Sao Felipe municipality, are some of the most favourable arable lands of the region (IBGE 2012) and thus the location of most of the rural population, and where the high use of wood as domestic fuel for cooking is most evident. In the latest study commissioned by Instituto Perene, only 1,635 ha of the western lands of Maragogipe and 920 ha of Sao Felipe could be classified as areas with woody biomass, ranging from very early successional stages of degraded pastures with few mature trees to well defined forest fragments in late secondary stages of succession.

The maps of Maragogipe below show the distinct contrast, in both altitude and forest cover, between the eastern and western areas of this municipality. Once the NRB study had been completed, it became clear that, from the stand-point of the non-renewability of the local biomass, Instituto Perene should concentrate efforts in improved cookstoves in the western half of Maragogipe, where the deforestation has been most severe. Therefore the project boundary was modified from the initial PDD (submitted April/2011) to exclude the eastern portion of the municipality.

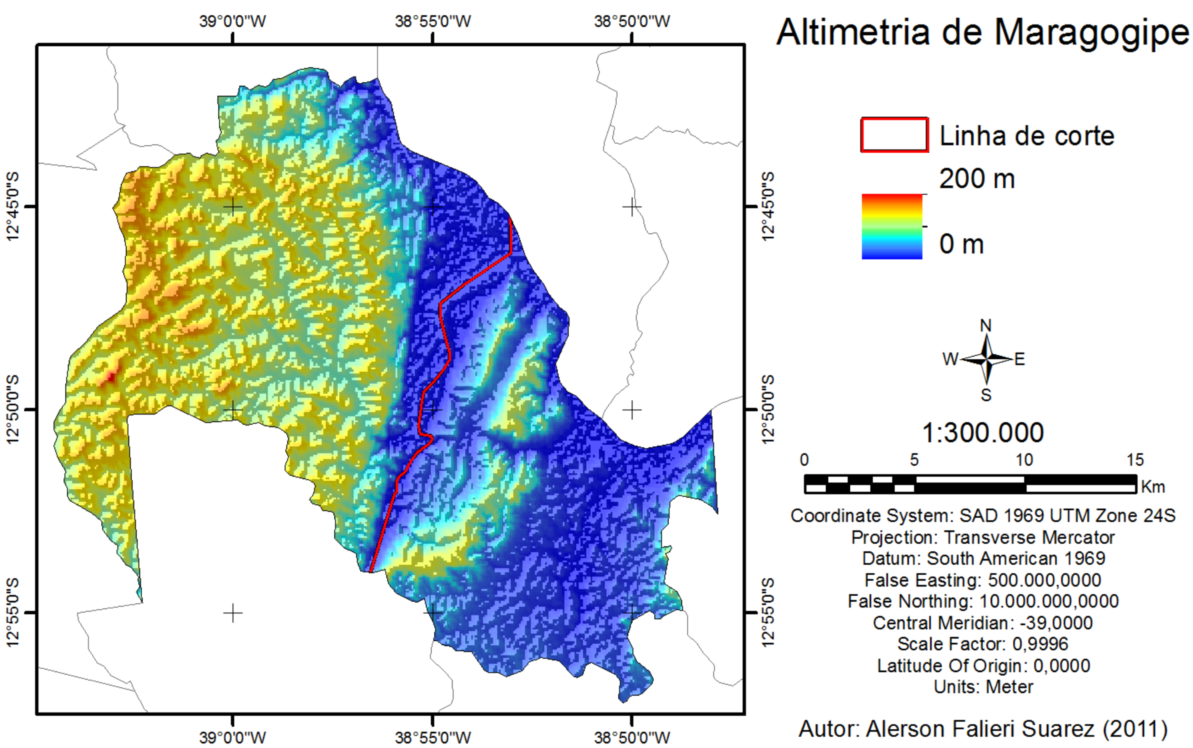

Figure 1. Maragogipe municipality, showing division between western highlands and eastern lowlands (Falieri, Análise do desmatamento no Municipio de Maragogipe - BA, 2011)

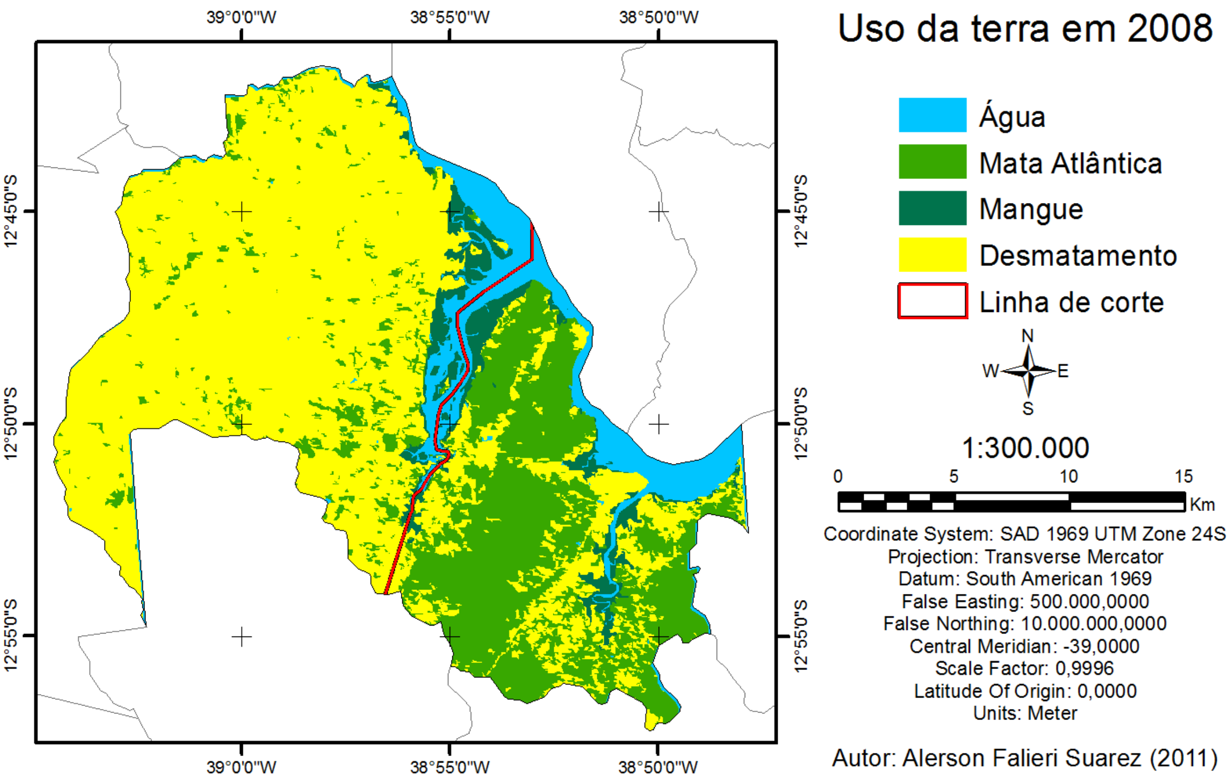

Figure 2. Maragogipe municipality, showing different land use and project dividing line in red (Falieri, Análise do desmatamento no Municipio de Maragogipe - BA, 2011)

São Felipe municipality neighbors Maragogipe on the west, and has the same characteristics of land use and severe deforestation. The map below shows the scattered forest remnants of the Atlantic Rainforest that once covered the entire surface of the municipality.

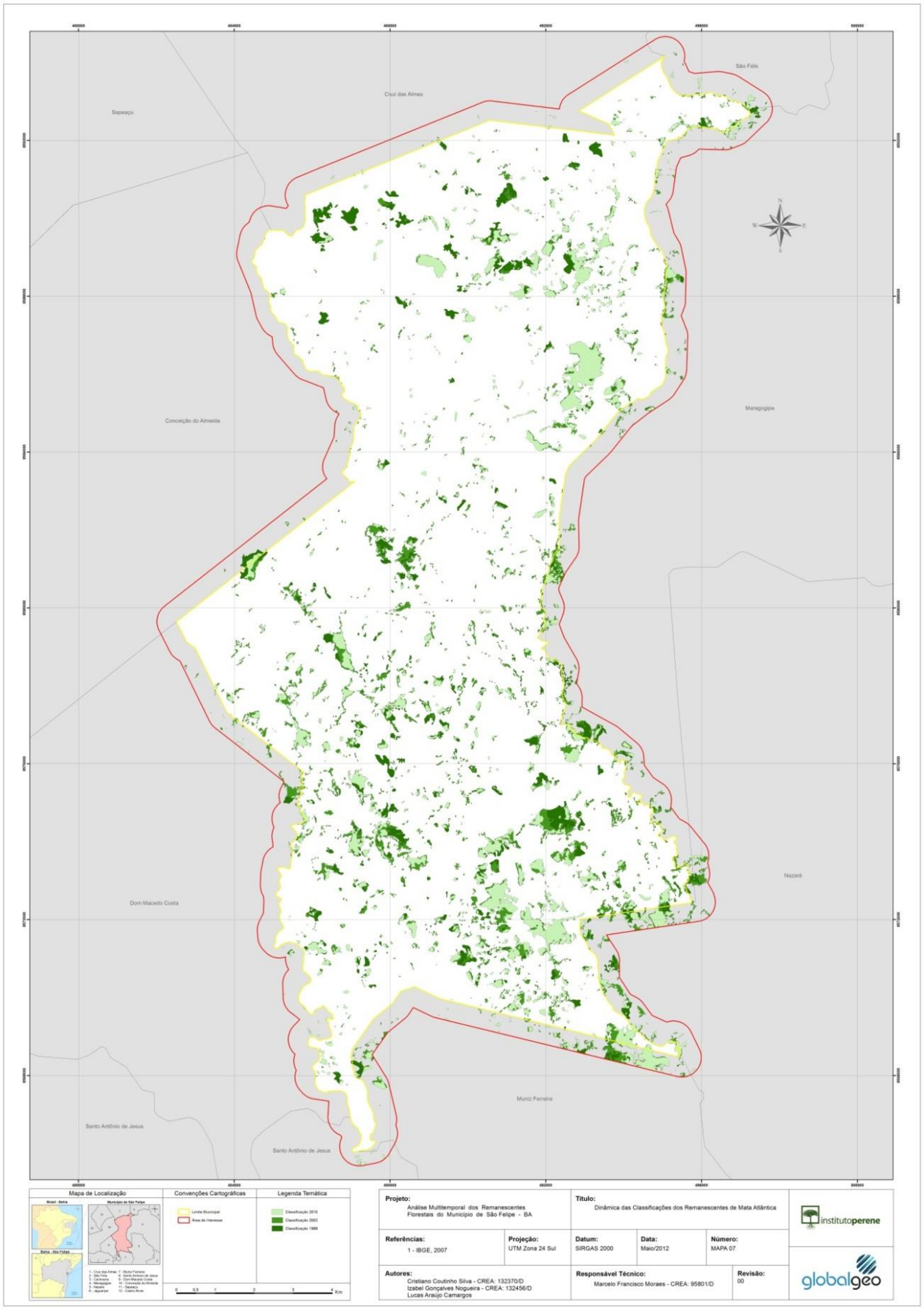

Figure 3. Sao Felipe municipality, showing sparse vegetation cover (GlobalGeo, 2012)

Since there were two different land-use analyses conducted for western Maragogipe and São Felipe, two separate NRB fractions were calculated. At the end of the analysis, the lower of the two values was selected, in order to maintain a conservative approach, while simplifying emissions reductions calculations by having a single NRB value for the entire project.

As defined by the Gold Standard methodology the formula for determining the fraction of non-renewable biomass is expressed in the following terms:

$$f\text{NRB} = (\text{NRB}/\text{H})$$

$$\text{NRB} = \text{H} - \text{MAI}$$

Where:

H is the total annual harvest of woody biomass from the fuel collection areas;

MAI is the sum of mean annual increments of the wood species;

NRB is the non-renewing biomass or excess harvest.

In order to determine H a series of steps were taken. Multi-temporal land use analysis were conducted by Falieri (2011) and GlobalGeo (2012) to determine the average number of hectares of forest clearing per year; and the baseline study determined the average use of woody biomass per household.

For the woody biomass consumption by domestic stoves, the total number of rural households was obtained from the Brazilian Geographic and Statistical Institute - IBGE, which is the federal agency responsible for the national census .It is important to note that other significant uses of woody biomass were not taken into consideration due to lack of references such as the use as fuel in the production of cassava flour which is a very common practice in the region, as well as the use of fencing posts and general rural construction. By not accounting these other significant uses this assessment is consistent with a conservative approach.

In order to estimate total forest loss a value for total amounts of forest biomass per hectare was chosen from a list of three references, one being a Tier 1 and the other two references Tier 2. The choice was based on a conservative approach, always choosing a Tier 2 reference as well as the lowest total amount per hectare.

The sources were:

- Tier 1 - *2006 IPCC Guidelines for National Greenhouse Gas Inventories* – Table 4.7
- Tier 2 - Samir G. Rolim, Renato M. Jesus, Henrique E. M. Nascimento, Hilton T. Z. do Couto and Jeffrey Q. Chambers. *Biomass change in an Atlantic tropical moist forest: the ENSO effect in permanent sample plots over a 22-year period*.
- Tier 2 - Thiago Metzker, , Tereza C. Spósito, Mariana T. F. Martins, Marise B. Horta, and Queila S. Garcia. *Forest dynamics and carbon stocks in Rio Doce State Park – an Atlantic rainforest hotspot.*

Total Stock tons biomass/ha		
Samir et al	**Metzker**	**IPCC**
334	185	300 (120-400)

A mean annual increment representative of local forests was also chosen from three different sources, and as done for the total stock value one source was Tier 1 and the other two Tier 2. The choice was also a Tier 2 based on a conservative approach, in this case choosing the highest increment rate.

The sources were:

- Tier 1 - 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Table 4.9
- Tier 2 - Gusson, E., & Santos, J. (2006). Desenvolvimento de espécies arbóreas nativas em plantios consorciados na UHE de Promissão - SP. USP, Núcleo de Apoio à Cultura em Educação e Conservação Ambiental-NACE. São Paulo: NACE/ESALQ/USP.
- Tier 2 - Siqueira, L.P, and C.A.B. Mesquita. Meu Pé de Mata Atlântica. Rio de Janeiro: Instituto BioAtlântica, 2007.

MAI tons biomass/ha/yr		
Gusson	**Siqueira**	**IPCC**
3.1	3.4	3.1 (1.5-5.5)

Therefore, for western Maragogipe:

Assumptions	Value	Units	Source
Fuel Collection Areas	1635.35	ha	Falieri 2011
MAI	3.40	t/ha/yr	Siqueira 2007
Forest Loss	107.40	ha/yr	Falieri 2011
Total Forest Stock	185.00	t/ha	Metzker et al 2009
biomass cookstove	2.48	t/HH/yr	Perene 2010
total households	3936.12	HH	IBGE

H	**29630.57**	t/yr
NRB	**24070.38**	t/yr
ƒ NRB	**0.812**	

For São Felipe:

Assumptions	Value	Units	Source
Fuel Collection Areas	919.9	ha	GlobalGeo 2012
MAI	0	t/ha/yr	Siqueira 2007
Forest Loss	45	ha/yr	GlobalGeo 2012
Total Forest Stock	185	t/ha	Metzker et al 2009
biomass cookstove	2.48	t/HH/yr	Perene 2010
total households	4388	HH	IBGE

H	19207.24	t/yr
NRB	16079.58	t/yr
ƒ NRB		

Qualitative Analyses

The Atlantic Forest constitutes one of the greatest repositories of biodiversity on the planet, with more than 20,000 known species of plants alone. This forest is a complex of ecosystems that includes Dense Ombrophylous Forest on slopes and mountain tops with very high diversity and endemism indexes. Fragments of this forest are home to dozens of endemic and threatened flora and fauna species. Once spanning the entire coast of Brazil, the Atlantic Forest has been almost entirely deforested. Only 7% of the original Atlantic Forest cover remains, and the remnants are typically highly degraded (SOS Mata Atlântica, 2009).

Landowners in the project region began creating pastures near the end of the nineteenth century, and this practice intensified during the 1930s and 40s (Ranulfo dos Santos & al, 2007). Cattle for milk and beef production for regional consumption have gained importance in the region since that time. The Recôncavo region covers 892,590 ha, or about 1.6% of the total area of Bahia. Today, the Recôncavo is home to approximately 280,973 head of cattle, or almost 3% of the total cattle in Bahia (IBGE, 2007). The land used for agriculture and livestock in this region is 561,396 ha, with about 224,457 ha used for pastures, according to the 2006 Agriculture and Livestock Census. Most of the pastures are covered with *Brachiara decumbens*.

Deforestation continues today. According to the latest report by SOS Mata Atlântica, 24,148 ha of native forest fragments in the state of Bahia were deforested between 2005 and 2008 (SOS Mata Atlântica, 2008).

Instituto Perene carried out a multitemporal analysis of the land use and land use changes for both Maragogipe and Sao Felipe. The analysis for Maragogipe classified satellite imagery from 1986 to 2008, and for Sao Felipe from 1999 to 2010.The table below shows the area of forest for years 1986, 2000, and 2008. By 1986, sixty percent of the original forest had been already cleared. By 2008, this number had increased to 70%. Following a scenario using the deforestation trends of the years 2000 to 2008, in 2040 only 22% of the original forest would remain. These deforestation trends suggest an average forest loss rate of 3% per year during the period of study.

Table 1. Maragogipe forest data resulting from multi-temporal analysis (Falieri, 2009)

Year	Total Forest Area (ha)
Original	43,600
1986	15,665
2000	12,818
2008	11,569
2040 (projected)	8,721

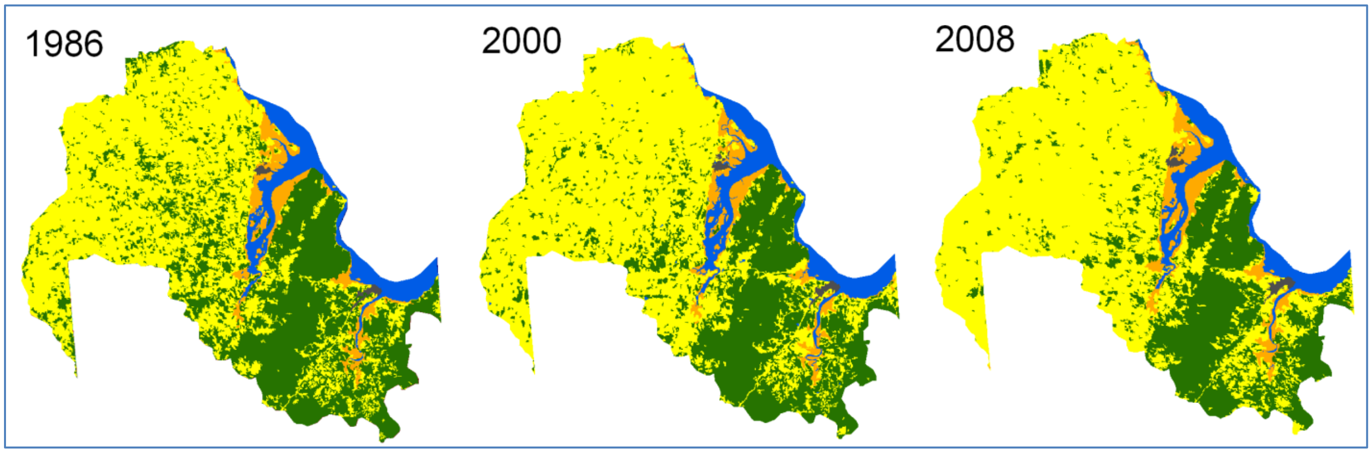

Figure 4. Land use classification in Maragogipe for 1986, 2000, and 2008. Green areas are forest, yellow areas are deforested, orange areas are mangroves, and blue areas are water. (Falieri, 2009)

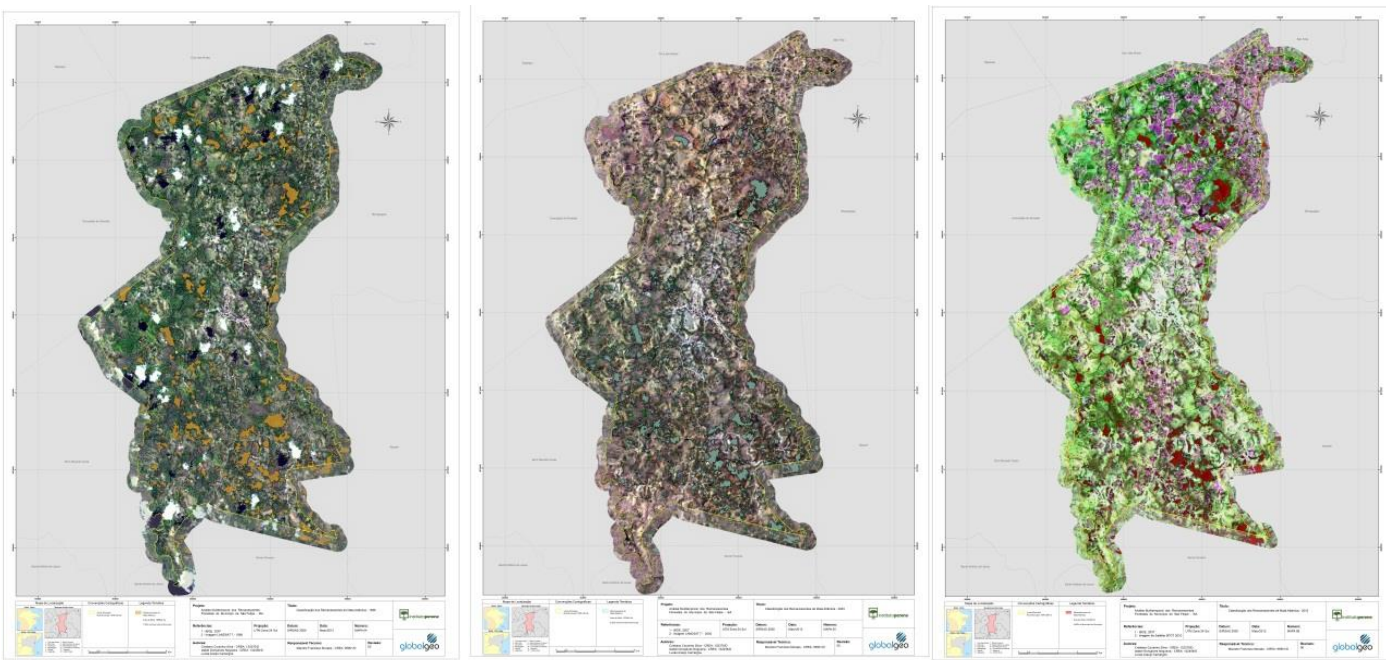

Figure 5. Land use classification for São Felipe for 1999, 2003 and 2010, showing the deforestation trend and minimal forest cover (GlobalGeo, 2012)

The studies show a clear deforestation trend over the past two decades and this trend can be expected to continue indefinitely, especially because of urbanization and the continued use of wood for energy generation, both domestically and commercially.

In 2007, Brazil produced 92.3 million tons of wood for energy generation; of this total, 25.2 million tons (more than 27%) of wood was used for residential consumption (MME, 2008). Wood and charcoal combined made up 12% of Brazil's energy matrix (MME, 2008).

Rural areas in Maragogipe and Sao Felipe depend on wood for almost all of their domestic cooking needs. Kitchen tests performed by Instituto Perene determined that on average, households use over 6 kg of fuel wood per day for cooking fuel, summing to more than 2 tons per year of wood fuel used per household. Normally the men in the households are responsible for gathering fuel wood from nearby degraded areas of the Atlantic Rainforest and from nearby mangroves. Typically, they travel on foot for up to 40 minutes, a distance of about 2 km, to reach an area from which they can gather a sufficient amount of fuel wood for their families' cooking needs.

It is important to point out that the entire Atlantic Rainforest biome is protected under federal legislation from being deforested. Federal Decree 750/1993, specific to the Atlantic Forest Biome, reinforces the restoration of degraded areas and prohibits the logging, suppression, and exploitation of primary vegetation and secondary vegetation in advanced or medium stages of regeneration. Selective exploitation is permitted with strict limitations. Federal Law 11,428 of 2006 also protects the Atlantic Forest Biome. In addition to laying out the general boundary defining the Atlantic Forest, this federal law allows sustainable and traditional activities on the land. Activities that threaten endangered fauna and flora are prohibited.

While legal framework exists to protect standing forests, the laws are poorly enforced and in the region non-compliance is widespread. In addition, reforestation initiatives do not exist in the project region, creating an unsustainable wood harvesting sector. It is less expensive to move extraction further into new forest areas than it is to recuperate and manage the current and past areas sustainably.

Currently, residents of the project area collect wood for domestic cooking from degraded areas of the Atlantic Rainforest and mangroves. During the kitchen surveys, fuel wood was commonly found to come from the following species of trees (common name, scientific name, and density):

Murici- *Byrsonima stipulata*, 0.75g/cm^3

Cocão – *Erythroxylum deciduum*, 0.81g/cm^3

Paupombo – *Tapirira guianensis*, 0.51g/cm^3

Murta – *Blepharocalyx salicifolius*, 0.76g/cm^3

Araçá – *Psidium cattleianum*, 1.12g/cm^3

Mangue – *Rhizophora mangle*, 0.42g/cm^3

The map in Figure 9, below, is a probability map based on estimates of the local probabilities of land use class transitions, called the weights of evidence. Red areas in the map have a high probability of being deforested in the future, especially in the likely scenario that land use management practices do not begin.

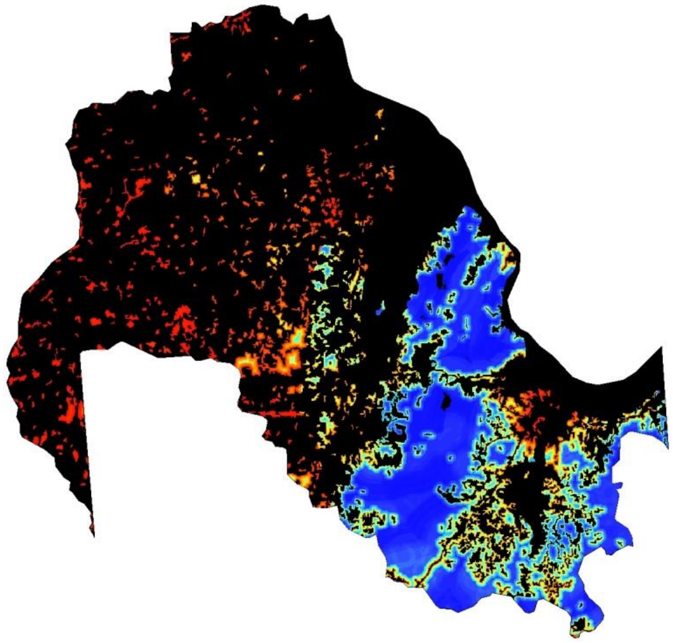

Figure 9: Probability map based on estimates of the weights of evidence. Black areas are deforested areas or areas that were never forest, such as water. Red areas have high probability of deforestation. (Falieri, 2009)

Despite the existence of Brazilian legislation regulating and protecting forest resources, studies and maps show that a lack of enforcement of these policies has resulted in widespread deforestation both in the past and present. No initiatives exist in the project region to improve the sustainability of the forest resources, and in fact, data from SOS Mata Atlântica shows that the state of Bahia is second state in Brazil with the most critically high rates of deforesting the Atlantic Rainforest.

The description of biomass in the project region presented above compiles information from literature, field visits, and experience in the project region. The information shows that:

1. The areas that supply fuel wood to rural households within the project boundary are steadily being deforested.
2. Existing forests are not currently managed sustainably.
3. Forestry and wood harvesting are currently inefficient and unregulated sectors in the project region.

Annex 4

MONITORING INFORMATION

This PDD will follow the monitoring plan described by the Gold Standard Methodology “Improved Cook-stoves and Kitchen Regimes (V 2)” The monitoring plan set out by this methodology includes some tasks undertaken continuously and some that are undertaken periodically. According to the methodology, if the fixed baseline approach is validated, then there is no requirement for continuous monitoring of the baseline.

The Continuous Monitoring Tasks undertaken by this micro-scale project:

1. Maintenance of a Total Installation Record:
2. Maintenance of a Detailed Customer Database

The project will maintain a record of all stoves installed, including the name and government-issued identification card number of the stove owner, location of the stove, and date installed. This will be part of the Project Database.

Periodic Monitoring Tasks:

1. The NRB fraction – The deforestation trends in the project area will be monitored twice over the lifetime of the project through satellite images to show that the biomass burned by ICS users is non-renewing throughout the project lifetime. Satellite images will be used to analyze the deforestation trends in the project area.
2. Leakage – Distance travelled by vehicles for the project installation and monitoring processes will be monitored and continuously recorded by Instituto Perene. Potential new leakage effects will be investigated every two years.
3. Usage Survey (to establish drop-off rates in stove usage over time) – Kitchen Surveys will be undertaken every two years to establish the drop-off rates in ICS usage over time. The sample size is the same as defined for the baseline KS (100 households), selected randomly from the project ICS users. Representatives from Instituto Perene, accompanied by Community Agents, will conduct these surveys.
4. Aging-stove KPT – These tests will be undertaken every two years to measure fuel reduction performance and other relevant factors. According to the methodology, only the new stove performance must be measured (not baseline fuel consumption).
5. Baseline monitoring KPT – If the KS reveals that baseline parameters of the type measured by KPTs may have changed significantly, or if the KS is not adequate to update evolving baseline conditions, and no New-Stove KPT is taking place to perform this function, then a Baseline Monitoring KPT will be carried out every two years among new ICS users to update baseline parameters.
6. New Stove KPT – Not Applicable. This is not deemed necessary as this applies to “new models and designs when they are launched”. Only one model is being used for all 5,000 stoves.
7. Social and economic impact of the project – These impacts will be investigated every two years and an assessment will be made of the project’s contribution, positive or otherwise, to sustainable development in the area. See table below regarding Sustainability Monitoring.

Sustainability Monitoring	
No.	1
Indicator	Air Quality
Mitigation measure	N/A
Chosen parameter	- Emissions calculated from wood consumption - User perception of air quality
Current situation of parameter	Established by Kitchen Performance Test
Estimation of baseline situation of parameter	Established by Kitchen Performance Test
Future project target for parameter	- 50% reduction in emissions - user perception of near-elimination of indoor smoke and soot
Way of monitoring	
How	KPT performed before and after stove installation (paired sample study in 30 households) Application of kitchen surveys to 10% of stoves users
When	Baseline KPT – March 2010 monitoring KPT - December 2010
By who	Instituto Perene with the help of Community Agents
Sustainability Monitoring	

No.	2
Indicator	Quality of employment
Mitigation measure	N/A
Chosen parameter	Number of registered workers (copy of registration document) Number of employees and family members covered by health insurance (copy of insurance records)
Current situation of parameter	Masons have been formally hired and have health insurance for themselves and their immediate family members.
Estimation of baseline situation of parameter	Masons were not formally employed before being hired by Instituto Perene Masons and their families had no health insurance coverage prior to being hired
Future project target for parameter	Maintain 2 masons full-time, maintain masons and their families under health insurance pla.
Way of monitoring	Work contract, monthly health insurance records.
How	Provide copies of documents
When	Annually
By who	Government records Health insurance company
Sustainability Monitoring	
No.	3

Indicator	Quality of life of the poor
Mitigation measure	N/A
Chosen parameter	Change in time to collect firewood (monitored through Kitchen Tests and Kitchen Surveys)
Current situation of parameter	Estimate of equivalent 2 full days/month are dedicated to collecting wood.
Estimation of baseline situation of parameter	KPT and KS
Future project target for parameter	Reduce wood collection time by half
Way of monitoring	Kitchen Tests and Kitchen Surveys
How	Carry out tests and surveys
When	Kitchen Test in March and December 2010 Kitchen Surveys – throughout the year
By who	Instituto Perene with the help of Community Agents
Sustainability Monitoring	
No.	4
Indicator	Access to affordable and clean energy services
Mitigation measure	N/A

Chosen parameter	Number of stoves installed, number of people benefitted.
Current situation of parameter	Baseline is zero – efficient stoves were unknown to the local population before this project.
Estimation of baseline situation of parameter	Baseline is zero – efficient stoves were unknown to the local population before this project.
Future project target for parameter	Target: 5,000 stoves installed, approximately 25,000 people directly benefitted.
Way of monitoring	Project Database, signed Agreements.
How	Each participant signs an individual *Authorization and Transfer of Carbon Credits Rights* agreement – Instituto Perene scans each document, files the original and annexes the copies to the Project Database, prepared in Microsoft Access.
When	Continuously during the period of Installation. The Project Database will be updated with information obtained from the subsequent Monitoring visits and reports.
By who	Instituto Perene
Sustainability Monitoring	
No.	5
Indicator	Human and institutional capacity
Mitigation measure	N/A

Chosen parameter	Number of women benefitted by owning a new stove, number of women with a new leadership role in their community due to the project.
Current situation of parameter	Community agents are an integral part of the project.
Estimation of baseline situation of parameter	Baseline is zero – this is the first project of its kind in the project region.
Future project target for parameter	Target: 4000 female stove owners, 6 female Community Agents participating in the project
Way of monitoring	Project Database, record of payments.
How	All stoves users are recorded in the Project Database, prepared in Microsoft Access. Payments to Community Agents (per diem) are recorded in cost control spreadsheet.
When	Project Database is updated continuously during period of installation. Community Agents are paid on a per diem basis, recorded monthly in the budget.
By who	Instituto Perene
Sustainability Monitoring	
No.	6
Indicator	Quantitative employment and income generation
Mitigation measure	N/A
Chosen parameter	Number of employees, number of day workers, number of local businesses with significant revenue generated by supplying materials/labor

	to the project.
Current situation of parameter	2 full-time employees, 2 part-time masons, 4 community agents receiving per diem payments occasionally, 2 local businesses with significantly increased revenue
Estimation of baseline situation of parameter	Baseline zero – this is the first project of its kind in the project region. Before working for the project, the masons were not formally employed and did not have dependable income. Most community agents earned sporadic income by sale of shellfish. The income generated by the community agents through this project is in addition to their baseline income.
Future project target for parameter	2 full-time employees, 4 part-time masons, 8 community agents receiving per diem payments occasionally, 3 local businesses with significantly increased revenue
Way of monitoring	Payroll, payment records.
How	Copies of payroll and receipts.
When	Compiled annually
By who	Instituto Perene
Sustainability Monitoring	
No.	7
Indicator	Technology transfer and technological self-reliance
Mitigation measure	N/A

Chosen parameter	Number of workshops and meetings organized, number of participants in capacity building activities.
Current situation of parameter	5 workshops/meetings have been held.
Estimation of baseline situation of parameter	Baseline is zero – this is the only project of its kind in the project region.
Future project target for parameter	5 meetings/workshops
Way of monitoring	Records of meetings, Project Database
How	Workshop Meetings are recorded by photographs and list of participants, Community Agents are noted in Project Database.
When	Training workshop in partnership with Aprovecho Research Center was held in May 2009, subsequent training will be held as necessary and reported. Community meetings were held in Nov 2009, Dec 2009, Nov 2010 and June 2011.
By who	Instituto Perene

Annex 5. Sample Kitchen Survey

institutoperene

TESTE DE DESMPENHO DA COZINHA - Perguntas iniciais da pesquisa

1. Data	19 março 2010	
2. Nome do entrevistador	Sabrina	
3. Código da casa	Marly da Silva Lessa	
4. ID do vilarejo		
5. ID da comunidade	Capanema	
6. Coordenados GPS (se for possível)	______ °long. ______ °lat. ______ altitude (metros)	
7. Listar sexo e idade dos moradores da casa (até 10 pessoas): 3	Sexo/Idade	Quantos
	Crianças 0-14	1
	Mulheres com mais de 14 anos	1
	Homens 15-59	1
	Homens com mais de 59 anos	
8. Atividade principal de geração de renda (circular uma):	Agricultura somente Trabalho assalariado somente Agricultura e trabalho assalariado Bolsas Família. Outras - marisco	Se for agricultura, listar os cultivos: a) b) c)
9. Quem é principalmente responsável pela preparação de comida? Marly, 30 anos.	Listar sexo e idade como pergunta 7 acima:	
10. A comida é preparada dentro da casa, fora da casa, ou ambos?	dentro - gas fora - lenha.	
11. A cozinha fica separada da casa? (circular um)		Sim/Não

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12. Quais tipos de fogões são usados? Qual é a idade e freqüência do uso de cada fogão?	Fogão/combustível	Idade do fogão (anos)	Freqüência de uso (vezes por dia, semana, ou mês)
	a) gas		todo dia.
	b) lenha.		todo dia.
	c)		

13. É costume de vocês comprarem lenha? as vezes /as vezes pega

Quanto custa?

14. Quem é o responsável por coletar combustível para cozinhar? Para cada fogão/combustível de pergunta 12, listar o sexo e idade da pessoa como pergunta 7 acima:

marido, 40 anos. a)

as vezes ela. b)

c)

15. Com que freqüência e coletada lenha? 15 dias / 1 mês

Quanto tempo leva para coletar? 1 dia inteiro.

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16. De onde é colhido o combustível e qual é a distância (mais ou menos) entre a fonte do combustível e a casa (registrar distância ou tempo necessário para ir à pé até a fonte)?	Dar respostas para cada fogão/combustível dado em pergunta 12	
	Localização	Distância da casa
	a) fazenda de Lauro.	a) 40 min - canoa motor 1 hr - a remo
	b)	b)
	c)	c)
17. Quanto é consumido e quanto que a família gasta por mês com cada tipo de combustível?	Dar respostas para cada fogão/combustível dado em pergunta 12	
	Consumo mensal de combustível	Gasto mensal com combustível
	a) 2 cargas / mês	a)
	b) 4 meses / botijão.	b)
	c)	c)

Perguntas sobre o fogão a lenha principal

18. Normalmente as tampas das panelas são usadas para cozinhar?	Sim.
19. Como é que o fogo é controlado normalmente?	

20. A família realiza manutenção no fogão novo?	Tipo de manutenção	Freqüência (circula a resposta adequada)
	Limpar as cinzas do fogão	Nunca Diaria Semanal Mensal
	Limpar o cano do chaminé	Nunca Diaria Semanal Mensal
	Conserto de fissuras	Nunca Diaria Semanal Mensal
	Outras ações - ______	Nunca Diaria Semanal Mensal

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21. O fogão é usado para outros fins que só cozinhar comida para a família (circular todas as respostas adequadas)?

Preparação de comida para pecuária

Preparação de comida/bebida para venda

Preparação de mariscos para venda

Other? esquentar água no inverno.

comida, assar peixe, carne

22. O que que a cozinheira principal gosta do fogão (listar respostas)?

rapidez

23. O que que a cozinheira principal não gosta do fogão (listar respostas)?

Sujeira, suja as mãos, cabeça.

24. Descrever a condição e a aparência do fogão a lenha principal (se for possível, faça um esboço ou tire uma foto).

25. Se a família não está usando um fogão novo, eles estão interessados em usar um? *Se a resposta for positiva, forneça informação sobre como obter um novo fogão*

26. A família está disposta a participar de um estudo mais detalhado que envolve medidas diárias do consumo de combustível?

27. A família está disposta a participar de uma pesquisa de acompanhamento para avaliar sua satisfação com o fogão novo daqui uns 3-6 meses?

sim.

28. Alguém na família tem um dos seguintes problemas de saúde:

dor de cabeça

Problemas respiratórios

Problemas com a voz

Olhos ardidos

Agradeço ao entrevistado para participar, e se eles responderam positivamente às perguntas 26 e 27, digo a eles que você vai entrar em contato com eles no futuro.

Annex 6. Stakeholder Feedback Round Attendance List

PROJETO FOGÕES EFICIENTES NO RECÔNCAVO BAIANO
REUNIÃO DE AVALIAÇÃO
10/DEZEMBRO/2010

	NOME	M/F	ASSOCIAÇÃO / COMUNIDADE
1	Maria Anita Costa	F	Guai
2	Maria Celeste Costa Pereira	F	Guai
3	Maria Conceição	F	Ass. Beneficiente Baixão do Guai
4	Antonia Regina	F	Jucimária C. Conceição
5	Maria Silva	F	Guai
6	Juciaria Santos	F	Guai
7	Claudia Raimunda	F	Guai
8	Maria de Lourdes	F	Guai
9	Valquiria Costa	F	Guai
10	Claudia Dias	F	Guai
11	Elizete Costa	F	Guai
12	Maria da Luz	F	Guai
13	Ines Maria	F	Trairas. (75) 9963-3736
	~~Crispina Barbosa~~	F	
14	Carla Barbosa Pereira	F	Guai
15	Lucinete Pinheiro Jesus	F	Guai
16	Cleidean Dias	F	Guai
17	Edna Sales Santos	F	Guai
18	Sandra dos Anjos da Silva	F	Guai
19	Ivanice Dias de Jesus	F	Guai
20	Crispina Bispo Barbosa	F	Guai
21	Periraldo Brito	M	Cafanema / RJ
22	Maria José Costa	F	Guai

PROJETO FOGÕES EFICIENTES NO RECÔNCAVO BAIANO
REUNIÃO DE AVALIAÇÃO
10/DEZEMBRO/2010

	NOME	M/F	ASSOCIAÇÃO / COMUNIDADE
23	Mª do Carmo N.	F	Guaí
24	Mª Rita Dias de Jesus	F	Guaí
25	Ana Leda S. dos Santos	F	Guaí
26	Lucelia Jesus Dias	F	Guaí
27	Terezinha Costa Soares	F	Guaí
28	Eriádina Silva dos Santos	F	Guaí
29	Valdira Dias dos Santos	F	Guaí
30	Laurencia Dias dos S.	F	Guaí
31	Rita Maria Pinto Dias	F	Guaí

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