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Global Alliance for Clean Cookstoves

Colombia Market Assessment

Colombia Sector Mapping

Accenture Development Partnerships

Introduction

- This Market Assessment was conducted by Accenture Development Partnerships (ADP), the not-for-profit arm of the global management consultancy, Accenture, on behalf of the Global Alliance for Clean Cookstoves (the Alliance). The information in this assessment is accurate as of 2012 when this study was conducted.
- It is intended to provide a high level snapshot of the sector that can then be used in conjunction with a number of research papers, consumer surveys and other sources (most published on the Alliance's website) to enhance sector market understanding and help the Alliance decide which countries and regions to prioritize.
- It is one of eighteen such assessments (as of December 2013) completed by the Alliance to:
 - Enhance sector market intelligence and knowledge.; and
 - Contribute to a process leading to the Alliance deciding which regions/countries it will prioritize.
- Full slate of market assessments include studies in: Bangladesh, Brazil, Colombia, East Timor, Ethiopia, Ghana, Guatemala, India, Indonesia, Kenya, Mexico, Nigeria, Peru, Rwanda, South Africa, Tanzania, Uganda and Vietnam.
- Each assessment has two parts:
 - Sector Mapping – an objective mapping of the sector.
 - Intervention Options – suggestions for removing the many barriers that currently prevent the creation of a thriving market for clean cooking solutions.
- In each Alliance study a combination of ADP and local consultants spent 4-6 weeks in country conducting a combination of primary (in-depth interviews) and secondary research. They used the same Market Assessment 'Toolkit' for each country so that comparisons can be made. The Toolkit is available free of charge to all organizations wishing to use it in other countries.
- **The Alliance wishes to acknowledge the generous support of the following donors for the market assessments: Barr Foundation, Dow Corning Corporation, Shell Corporation, Shell Foundation, and the governments of Canada, Finland, and Spain.**

This market assessment was produced by Accenture Development Partnerships (ADP) on behalf of the Alliance. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of the Global Alliance for Clean Cookstoves or its partners. The Alliance does not guarantee the accuracy of the data.

Content

Executive Summary

Project Approach

Sector Mapping

Macro Environment Assessment

Social Impact & Environment

Consumer Assessment

Cookstove Industry Assessment

Carbon Financing

Sector Mapping Summary

Sector Mapping Summary (1/2)

Colombia is very urbanized with 75% of the 11.5 million households living in urban areas. Its economy is growing rapidly and it is now an upper middle-income country. However, the growth is not evenly divided, and over 45% of the population still lives under the national poverty line. The liberal government has announced plans to combat this issue by adopting the National Development Plan 2011-2014 with the theme of “prosperity for all”.

Due to the accessibility of natural gas in urban areas, there is limited need for improved cookstove (ICS) interventions even among the urban poor. Since the ‘gas massification program’ in the early 1990s, all of Colombia’s cities and some rural areas have been connected to natural gas that is subsidized for the lower income strata. Most of the rural areas, however, are not connected to natural gas, and electricity is rarely used as it is expensive (and sometimes unreliable or absent). Liquefied petroleum gas (LPG) is the fuel of choice for those to whom it is available and affordable, but approximately half of the rural population still cooks over locally gathered wood fuel. Those who use LPG often use wood as a secondary fuel.

For both consumers and the government, there is very limited awareness of the health issues resulting from solid fuel use. Over the last decade, the environmental impacts of wood fuel use have started to receive increased attention. Private companies initiated large scale programs subsidizing the adoption of natural gas and LPG in rural areas, thereby increasing their customer base. There have also been some small scale projects providing improved wood burning cookstoves to poor rural households at virtually no cost. Most of these projects have been led by one of Colombia’s 33 autonomous environmental corporations and they generally also had a large reforestation component.

Scaling these projects and making them sustainable is difficult, as there is practically no market for biomass cookstoves to build upon. Households either cook on freely available stoves such as 3 brick fires or on a fixed stove that costs over \$400 USD. As poor households are not accustomed to paying for a cookstove and are likely unable to afford a fixed cookstove, creating a self-sustaining market will require significant changes in both the demand and supply sides of the sector.

Sector Mapping Summary (2/2)

Executive Summary

	Findings
<i>Social and Environmental Impact</i>	Health impacts from solid fuel use in Colombia are largely confined to the countryside, where over 50% of households still cook with solid fuels. The more disconnected from infrastructure people are (especially in the south and east), the less access they have to a cheap and reliable supply of clean fuels or improved cookstoves and the more likely they are to use wood fuel gathered at no cost. The combined effect of this is drawing concerns of deforestation and greenhouse gas (GHG) emissions more so than concerns over health.
<i>Consumers</i>	The segment in greatest need of ICS is households that are not connected to clean fuels, as well as those situated in cold areas of the Andes who spend a lot of time in the warm kitchen and consequently suffer from the impacts of indoor air pollution (IAP). Representing only 4% of consumers, this segment has little disposable income and is not accustomed to paying for cookstoves or fuel. This makes it challenging to reach these consumers, though faster cooking time and reduced smoke while cooking could drive interest.
<i>Cookstove Industry</i>	The industry suffers from a dearth of designs, with the most prevalent cookstove construed by hand for \$400 USD, which is distributed for free in several different programs. There is therefore no significant market for ICS. The variations in quality of this cookstove type are further obscured by a lack of standards and testing. In addition, there has been a large effort by the private sector to substitute solid fuels for gas.
<i>Carbon Financing</i>	Most carbon financing in Colombia is industrial, with no existing carbon financed cookstove programs. A few relevant biomass programs are in process or have received CDM (Clean Development Mechanism) registration, but the financial benefits of these projects have not yet been realized. There are multiple experienced carbon financing organizations who will have to alter their procedures exclusively for the voluntary market or Gold Standard in the future.

Content

Executive Summary

Project Approach

Sector Mapping

Macro Environment Assessment

Social Impact & Environment

Consumer Assessment

Cookstove Industry Assessment

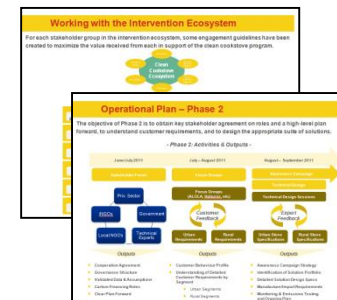
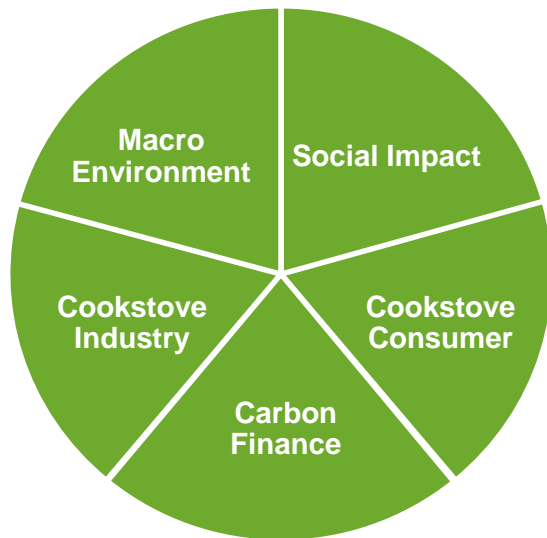
Carbon Financing

Sector Mapping Summary

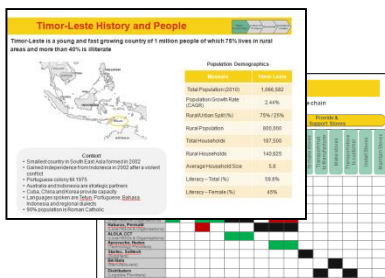
Project Approach

A structured approach first assessed the market for a cookstove industry and then used the sector mapping output to develop the intervention options and relative roadmap

Sector Mapping



Intervention Options And Relative Roadmap



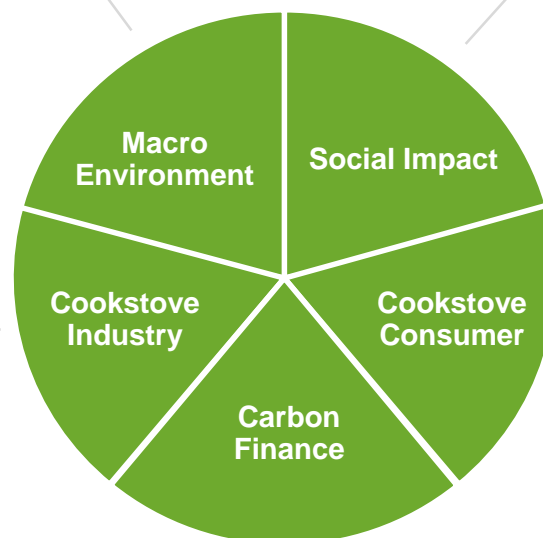
Sector Map

Sector Mapping Approach

Sector Mapping of the cookstove sector was conducted across five dimensions:

- *Social:* What are the country demographics & population distribution across regions?
- *Political:* How stable is government & what political risks will programs face?
- *Economic:* How much money do potential customers have & what is the economic cycle?
- *Technological:* How sophisticated is the infrastructure & what is the plan for progress?
- *Environmental:* How do ecological conditions impact the success of cookstove programs?
- *Gender:* How does gender play a role in use and purchase of clean cookstove?

- What cooking devices are currently used within the region?
- Who are the main players active in the cookstove sector?
- What are the opportunities / challenges for current & future cookstove programmes?
- How commercially attractive is the sector & what are likely to be some of the industry challenges?



- What carbon financing options exist for the country?
- What structures exist which can be leveraged for future carbon financing components?
- Which entities are likely to fill the required roles in the carbon finance operating model?

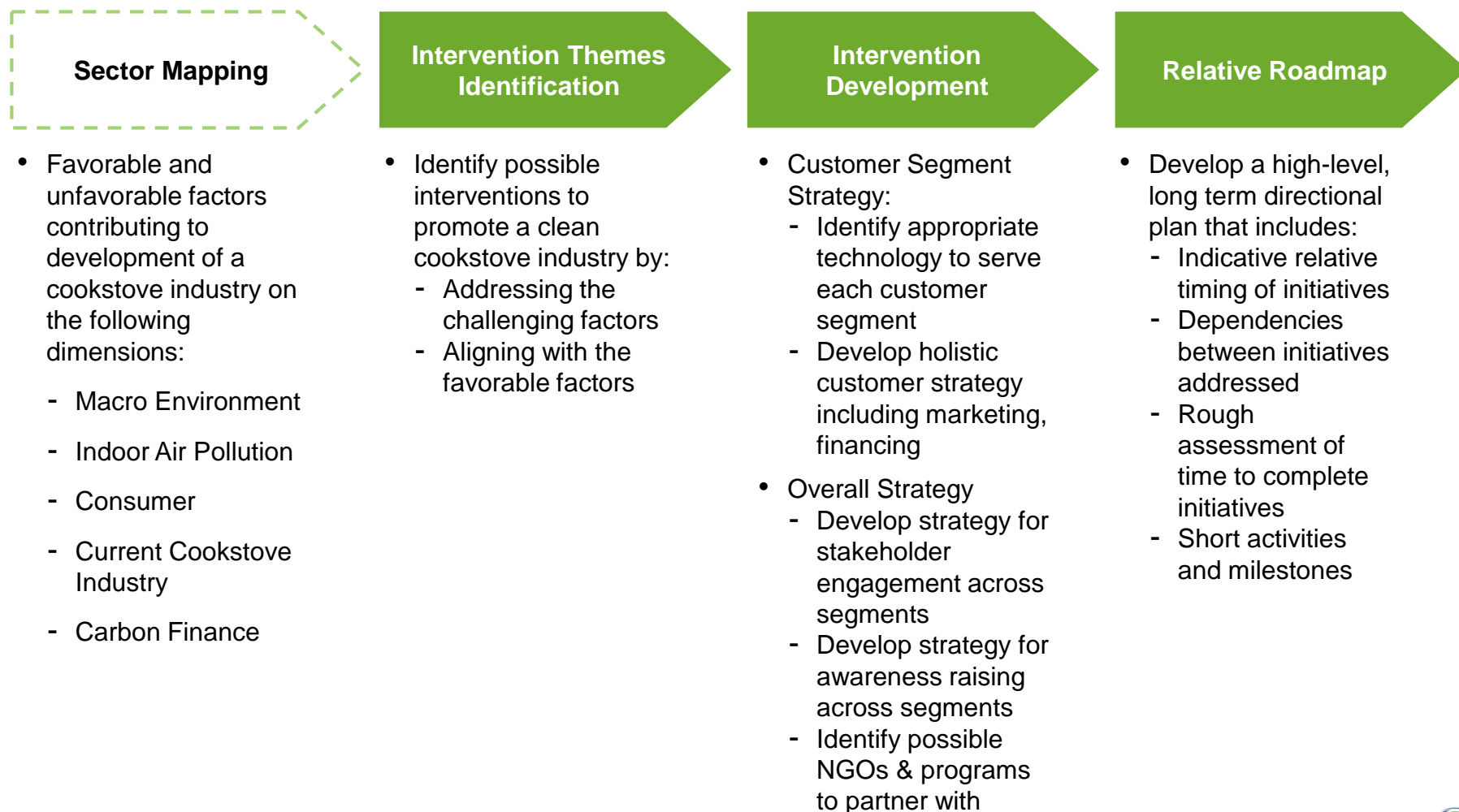
- How do people cook and what fuels are used in the region?
- What is the current IAP exposure profile of our target market? (Primary cause of IAP and size of problem)
- What are the other impacts of traditional cooking?
- How does the impact of cookstoves compare to other health & social priorities?

- What is the profile of the target population?
- How can the customer population be segmented / categorized?
- How big is each customer segment and what are its characteristics?
- What are the specific needs of each customer segment?

Intervention Options Approach

Project Approach

Intervention development was conducted by using sector mapping as input to identify intervention areas, develop recommendations and develop a high level roadmap



Acknowledgements

Project Approach

Many organizations made valuable contributions to this study with their knowledge of Colombia and/or experience in cookstove initiatives.



Almacen
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Content

Executive Summary

Project Approach

Sector Mapping

Macro Environment Assessment

Social Impact & Environment

Consumer Assessment

Cookstove Industry Assessment

Carbon Financing

Sector Mapping Summary

Social Environment

Macro Environment

The 4th most populous country in Latin America with 45 million people, Colombia is very urbanized with 75% of people living in cities yet almost half of the country living below the national poverty line

Context

- Colombia became independent from Spain in 1819
- In the mid-20th century, a bloody political conflict erupted. After resolution, various guerrilla groups arose that later mixed with drug cartels that emerged in the late 1970s. Increased military pressure since 2002 improved safety, but various rural and jungle areas remain dangerous and an estimated 3.9 mln people have been displaced
- Approximately 90% of Colombians are Roman Catholic
- Ethnic groups: Mestizo 58%, White 20%, Mulatto 14%, Black 4%, mixed Black-Amerindian 3%. Approximately 85 indigenous cultural groups remain, but they only make up 1% of the population
- Official Language: Spanish (spoken almost universally)



- Implications -

The relatively small rural population is hard to reach as it is very spread out over the large country and poverty rates are high

Population Demographic	Colombia
Total Population (2012)	45,239,079
Population Growth Rate (2012 est.)	1.13%
Rural/Urban Split (%)	25% / 75%
Rural Population	11,309,770
Total Households	≈11,599,764
Rural Households	≈2,899,940
Average Household Size	3.9
Literacy – Total (%)	90%
Literacy – Female (%)	91%
Life Expectancy (years)	74.8
Population below national poverty line (2010)	45.5%
Population below international poverty line (2009)	18.5%

This has improved from 32.7% in 2002

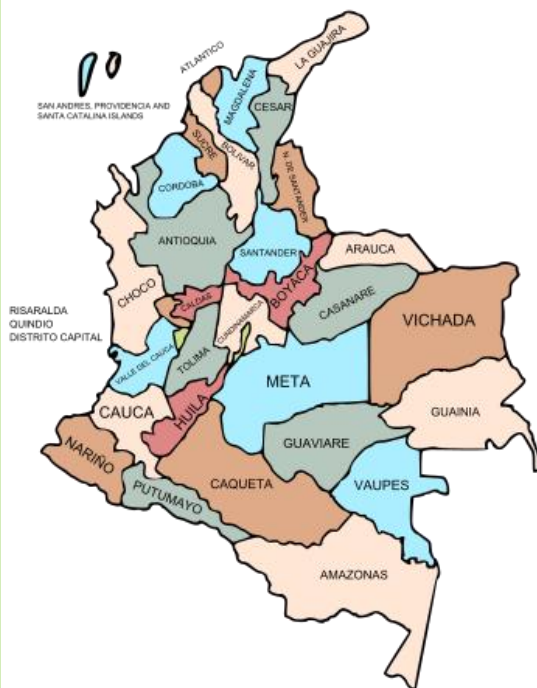
Political Environment

Macro Environment

Colombia's governance is relatively decentralized and is expected to be stable as President Santos is backed by a large majority in Congress

Administrative Map

- Colombia is divided into thirty-two departments that are sub-divided into municipalities. There is also one capital district
- Regional differences are large in social, economic and geographical terms
- Although most political power lies in Bogotá, Colombia is one of the most decentralized states of Latin America with departments and municipalities controlling large parts of the budget
- Population density is relatively low at 41 persons per km²



Political Structure

- Unitary presidential constitutional republic
- President and vice president elected by popular vote for a 4-year term; last elections in Aug 2010
- The President is both the head of the state and the head of the government and picks the cabinet

Current Government

- The Social Party of National Unity is a liberal conservative party uniting supporters of the hugely popular Alvaro Uribe. New leader J.M. Santos achieved a landslide victory in the 2010 vote and is backed by a big majority in Congress
- The Santos government announced a four-year National Development Plan with large scale mining and oil production at its center

Working with the Government

- Colombia ranks at 80 out of 182 in the Corruption Perception Index, above all its neighbors

- Implications -

For a successful cookstove program, it is key to take into account large regional differences and to have the local governments on board

Economic Environment (1/2)

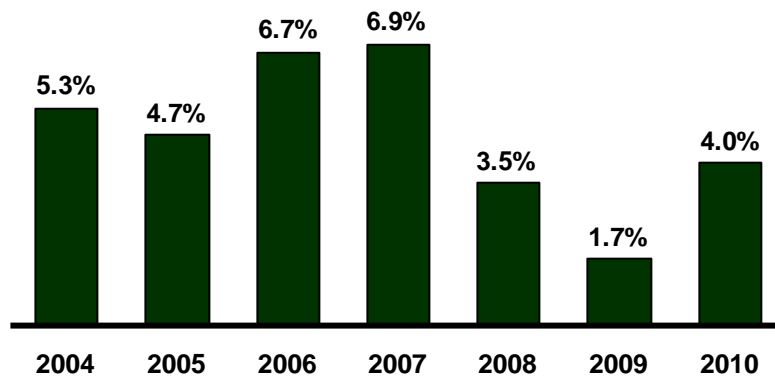
Macro Environment

Colombia is a higher middle income country and remains growing, as increased stability and economic freedom attracts business; it is increasingly dependent on export of primary products

Colombia's economy is growing quickly

The high interdependence of the Colombian economy with the US means the 2008-2009 crisis also hit Colombia, but growth increased again in 2010

GDP growth (annual %)



It became a better place for business

Colombia greatly increased stability and safety during the last decade and increased economic freedom. However, corruption remains a major issue

Ease of Doing Business Rankings

Metric	2005	2010	% Change
Corruption Perception Index	4.0	3.5	-13%
Failed States Index	95.0	88.2	+7%
Index of Economic Freedom	59.6	65.5	+10%
Human Development Index	0.675	0.707	+5%
Global Competitiveness Index	3.90	4.14	+6%

Key Economic Indicators (2010 unless noted)	GDP	GDP/ capita	Economic Growth Rate	Unemployment (2011)	Exports/ Imports (2011)
	\$288.9 billion	\$6240 (\$9453 PPP)	4.0%	10.8%	Export and import are both ~17% of GDP; heavy and increasing dependence on primary products export causes vulnerability to changes in world market and trade conditions

Economic Environment (2/2)

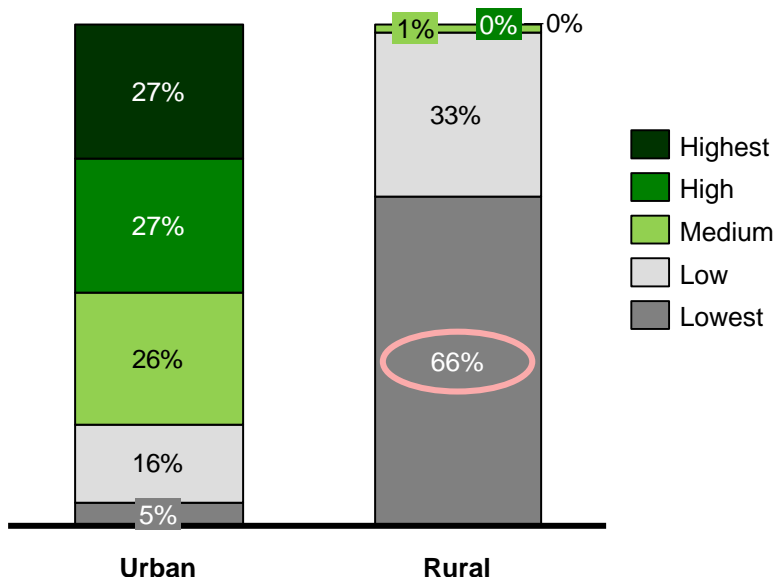
Macro Environment

The rural population is much poorer than the urban population, with 99% of people having below average wealth and a widening gap

Poverty is concentrated in rural areas

Outside of the cities, 66% of people are in the lowest wealth quintile with the rest being in the 'low' quintile

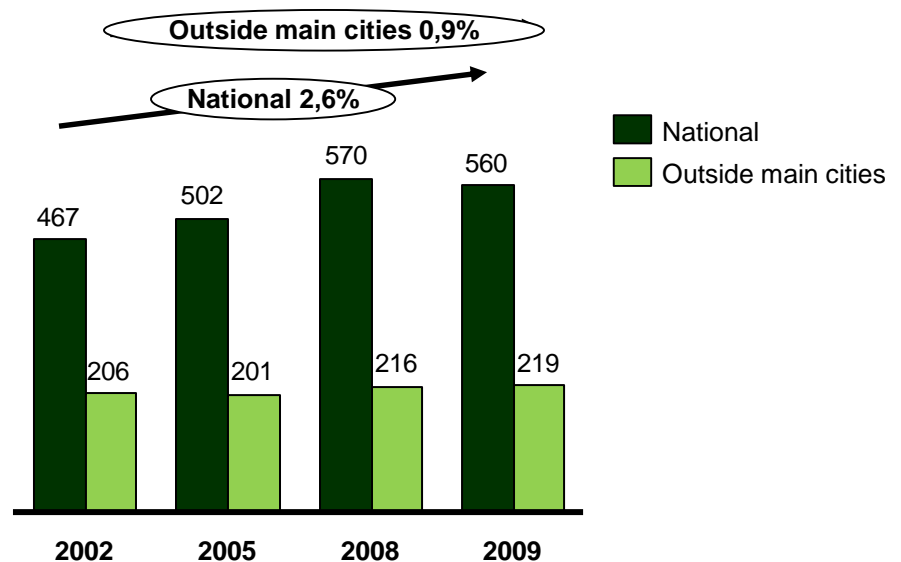
Distribution of population over wealth quintiles (%)



The gap is widening

As income growth is concentrated in cities, the economic gap between urban and rural areas is widening

Real Income Per Capita (thousand pesos)



- Implications -

Cookstove programs in Colombia should take into account the relatively high poverty in rural areas and address it where possible

In recent decades a feminist revolution has taken place which greatly improved the position of women in households and in the labor market, but inequalities in unemployment and wages remain

Policy & Employment

- The feminist revolution is seen as one of the most important changes in society in recent decades
- Unemployment amongst women is significantly higher than amongst men; however, the number of women in (top) management positions is relatively very high
- There are various companies that specifically hire (vulnerable) women, e.g. the successful Crepes & Waffles chain

Cultural Background

- The feminist revolution that changed the social dynamics in the country was the result of mutual reinforcement between the renewed aspirations of women and their increasing level of education and labor market participation
- Family-based violence has decreased significantly (11% of women had to do with it in 2005, down from 20% in 2000) but is still a major issue, disproportionately more so for the ~2 million women that are internally displaced due to the on-going conflict



"In the past to talk about gender was to talk about going to the moon. Now it is included in every project"

Roberto, IADB

Gender Equality Statistics

	Male	Female
Primary school attendance	93%	93%
Secondary school attendance (net)	71%	77%
Representation in Senate / Congress	82% / 92%	18% / 8%
% of top management positions	62%	38%
Literacy	90.1%	90.7%
Unemployment	9.9%	16.7%
Gender Inequality Index Rating	90 th /138 (Medium)	
Income Ratio	0.71 (rank 77/182)	

- Implications -

Cookstove programs should not assume the presence of gender inequality, but nevertheless should pay close attention to the gender aspect

Ecological Environment

Macro Environment

Colombia's is increasingly focused on protecting its significant natural resources, however deforestation continues due to demand for land for agriculture

Climate

- The climate is tropical along the coast and in the eastern plains, but cooler in the highlands
- Colombia is the second most biologically diverse country on Earth; ~1/3 of plant species are unique
- Environmental protection and the fight against climate change have gained momentum in recent years in both private and public sectors
- Colombia was rated 47/179 in the Climate Risk Index for 1991-2010 of Germanwatch



Deforestation

- 55% of Colombia's surface is covered by forests, which is over 60 million hectares. 14% of this is classified as primary forest
- Due to a steady deforestation rate of approximately 100,000 hectares each year, Colombia lost 3.2% of its forest cover between 1990 and 2010; REDD qualifies Colombia as "High Forest Cover with Low Rates of Deforestation"
- The major reason for deforestation is to make place for agriculture land (and coca cultivation in the highlands)

Flooding

- An unprecedented rainy season in 2010 led to large floods in Colombia, resulting in hundreds of deaths and injured persons, thousand of destroyed homes and over 1.5 million homeless

Other Environmental Issues

1. Periodic droughts
2. Soil and water quality damage from overuse of pesticides
3. Air pollution, especially in Bogota (from vehicle emissions)

- Implications -

Cookstove programs should emphasize the prevention of deforestation and make use of the increased public and private attention to protection of the environment

Infrastructure and Priorities

Macro Environment

Colombia's infrastructure is moving towards that of a developed country, but there are still limitations in rural roads and health care for the poor that are being addressed under 'prosperity for all'

National Development Plan (PNC) 2011-2014: "Prosperity for all"

Government
Priorities

- The key priority is becoming a country that has prosperity for all: with more jobs, less poverty, and more security
- The Plan aims to limit government intervention: *"the market up to the point that is possible and the State up to the point that is necessary"*
- Eight major pillars were defined: convergence and regional development, growth and competitiveness, equal opportunities, innovation, environmental sustainability, good government, and international relevance

Healthcare

- Public healthcare is available for people who cannot afford private insurance (about half of the population) but the systems is heavily indebted
- The government is working to increase access to care for remote areas and improve its quality (often inferior)

Telecommunication

- 93% of urban vs. 83% of rural households has a mobile phone
- Fixed phone penetration is decreasing but still was 40% end 2010
- Internet penetration was 49% in 2009
- Television penetration is higher than radio and is 77% in rural vs. 96% in urban areas

Energy

- Large gas fields discovered in the 1980s, after which a 'gas massification' program was started
- Access to electricity is 99% in urban vs. 91% in rural areas (in rural areas this might not be 24h/day; sometimes served by expensive public diesel generators)

Transportation

- Well-developed air and waterway routes (only means of transport in 60% of the country)
- One of the lowest ratios of paved roads per inhabitant in Latin America
- Means of cargo transport: Road 70%, rail 27%, internal waterways 3%, air 1%

Current Situation

- Implications -

Cookstove programs can build on the government's plan to bring prosperity to all, but will have to deal with limited infrastructure in a large part of the country

Millennium Development Goals

Macro Environment

Colombia has made progress toward meeting the MDGs in all eight areas, but does not seem to be on track in three areas, while continued attention also remains necessary in all other areas



1

Big Challenge

Eradicate Extreme Poverty and Hunger

Although poverty is decreasing (from 54% of the population in 2002 to 46% in 2009), the goal of 28.5% is not in sight and the share of the population in extreme poverty has hardly been decreasing at all



2

Achieve Universal Primary Education

Colombia has made great progress in the enrollment of children in mainly primary and secondary education



5

Big Challenge

Improve Sexual and Reproductive Health

Skilled assistance in child delivery goal has been met and great advances have been made in maternal mortality, but teenage pregnancies have increased and contraception use and cervical cancer prevalence hardly improved



6

Combat HIV/AIDS, Malaria and Dengue

A HIV prevalence of 0.7% is projected for 2015, well under the goal of <1.2%. Deaths due to malaria and dengue are decreasing but more work needs to be done



7

Ensure Environmental Sustainability

Achievements in reforestation, reduction of ozone damaging substances and access to water and basic sanitation are promising but more attention is necessary



8

Develop a Global Partnership for Development

Substantial resources have been mobilized, about half of which contribute directly to the MDGs



3

Big Challenge

Promote Gender Equality and Empower Women

Partner violence against women has been reduced significantly; political participation of women has increased but is still far from the target of 30%



4

Reduce Child Mortality

Infant and child mortality rates have been falling drastically and are well underway towards the target

Content

Executive Summary

Project Approach

Sector Mapping

Macro Environment Assessment

Social Impact & Environment

Consumer Assessment

Cookstove Industry Assessment

Carbon Financing

Sector Mapping Summary

Cooking Habits

Social Impact and Environment

Colombians eat a wide variety of dishes prepared using different methods for each meal, and consider meals as a centerpiece of social interaction



Diverse plates and multiple courses

Type of Food

- **Wide variety** of regional dishes due to diverse geography and richness of food from 83 ethnic groups
- **Multiple courses** using different cooking methodologies and a lot of oil:
 - A single traditional meal such as *bandeja paisa* can include **simmered** beans, **raw** avocado/salad, **fried** plantain and arepas, **grilled** meat, and **boiled** rice and soup
- Meat and carbohydrate heavy due to farmers focusing on one crop: Corn, rice, and meat/fish feature in every meal
- Coffee is a staple drink, as is a warm sugar-water drink called Agua de Panela

Cooking Habits

- Urban households nearly exclusively cook with gas and tend to eat outside of the home for lunch
- A drastic 97% of household cooks are women and children
- 79% of rural houses use the cooking area for another purpose, like sleeping or eating
- Charcoal and wood cooking features prominently to flavor dishes, with people being picky about what kind of wood to use, e.g., on the plains, veal is prepared with a specific type of wood and in Nariño, bread is prepared with oak.
- Cooking is cultural: Wood stoves are preferred to cook for large groups of people on a farm



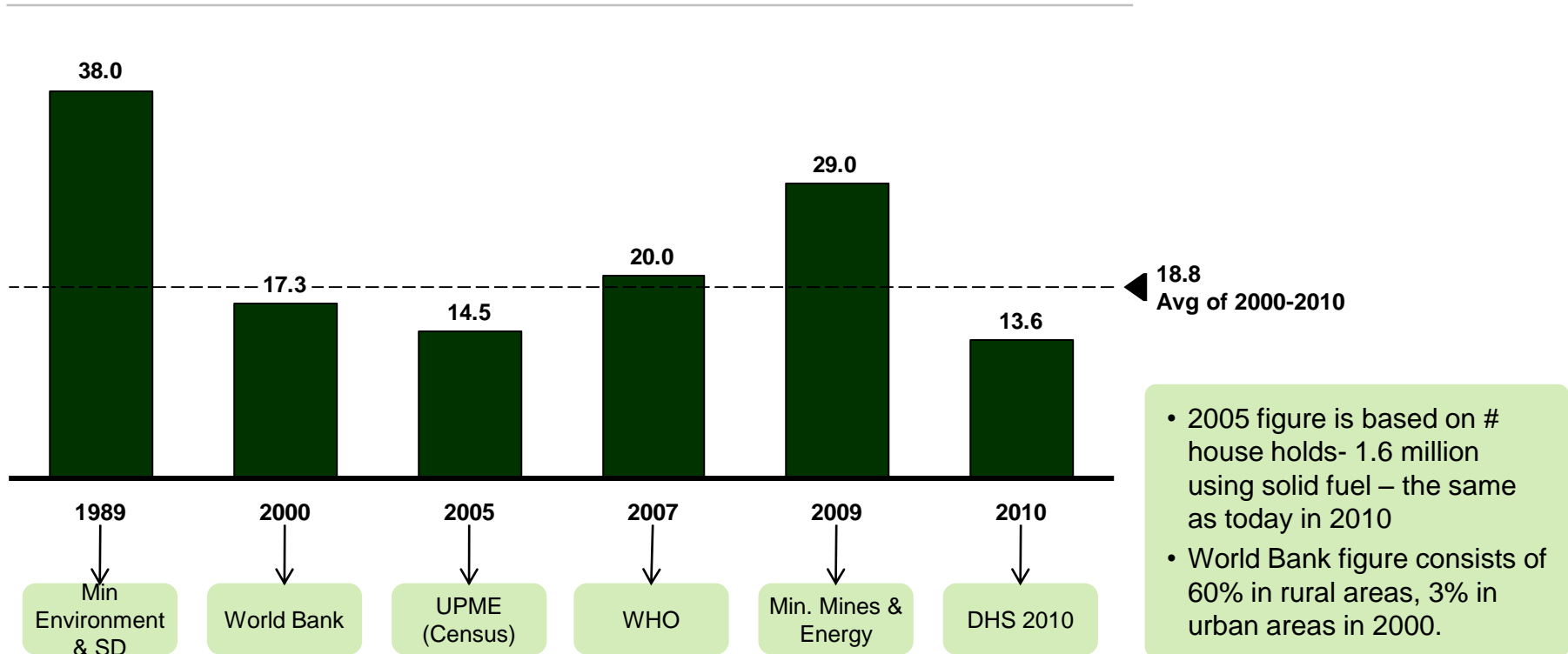
- Implications -

ICS will have to employ multiple burners in order to enable cooking of many dishes, and care will have to be made to not lose the cultural aspects of cooking with the introduction of an ICS

Fuel Usage & Availability (1/3)

There appears to be a lack of consensus on the number of solid fuel users in the country, with differing numbers and sources

% Solid Fuel Users – Total Colombia



- Implications -

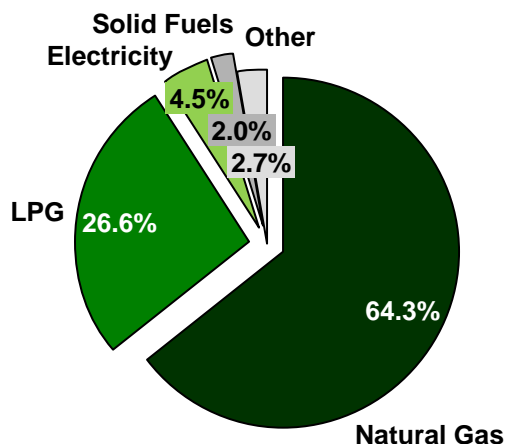
For the purpose of this assessment, fuel consumption will be taken from the most recently available data, with a more comprehensive follow up study advisable

Fuel Usage & Availability (2/3)

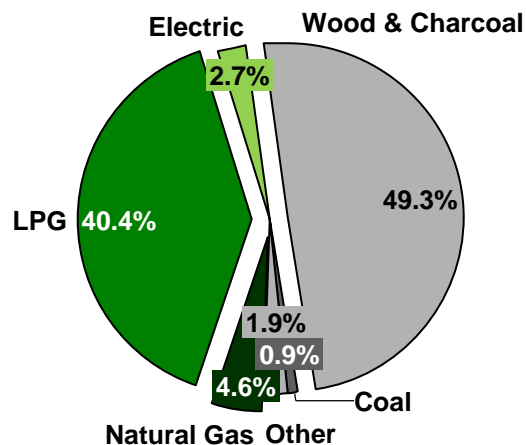
Social Impact and Environment

Though urban solid fuel use has been virtually eradicated, just over half of rural people still cook with solid fuels, mostly wood that they collect for themselves

Dominant Urban Fuel Use



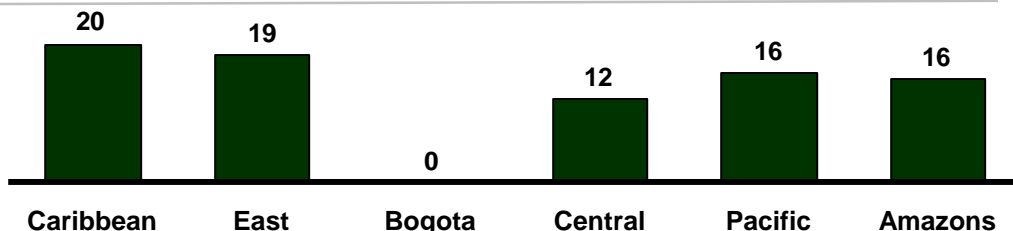
Dominant Rural Fuel Use



Fuel Use and Availability

- Gas is the top fuel in urban areas, with 80% of people using gas.
- A 1990s program replaced 'cocinol' (white gasoline), a highly dangerous gas that causes lots of burn victims, with connected natural gas pipes, focusing on peri-urban areas. This was after large gas deposits were discovered in the 80s.
- Wood is typically collected for free if it is used, as natural gas is cheaper than purchased wood.
- Coal and charcoal penetration is extremely low in Colombia compared to other countries, despite it being a coal mining country
- There are rare cases where alternative fuels are used, such as car batteries

Overall % Using Solid Fuel , by Region



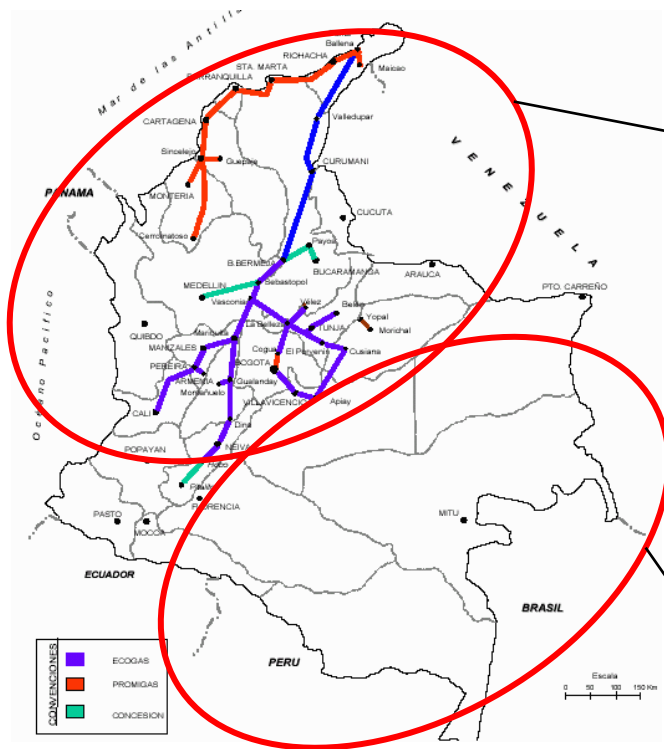
- Implications -

ICS programs should focus on rural areas to expand the reach of LPG and natural gas, as well as providing efficient cooking solutions to populations who have no choice but to cook with wood

Fuel Usage & Availability (3/3)

Gas is being rapidly adopted where available, but cultural implications and cost considerations of cooking with wood means that biomass will not soon go away as secondary fuel type

Natural gas, quickly adopted, is only available in half the country

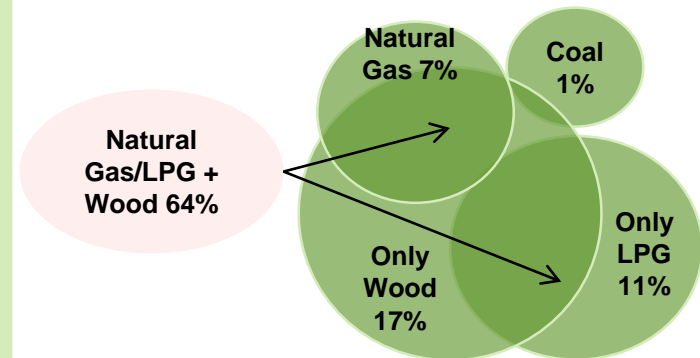


Map of natural gas pipes in Colombia

- Coverage of natural gas pipelines determines usage. Coverage in Bogotá, the Caribbean, and Eastern regions means that natural gas usage is 86%, 59%, and 41% respectively. There are over **600,000 HH still to connect**
- Installations of natural gas grew from 700k in 1994 to over 3.6 million in 2005
- Areas are not covered by gas pipelines because they are very low density. They use a mixture of LPG (40%) and wood.

Rural populations use more than 1 Fuel

Example from the area of USME



- Rural Colombians typically cook with more than one stove, burner, and fuel type to accommodate affordability and diversity of food
- Wood is considered more efficient for cooking big meals for big groups, gas more efficient for quick, short meals

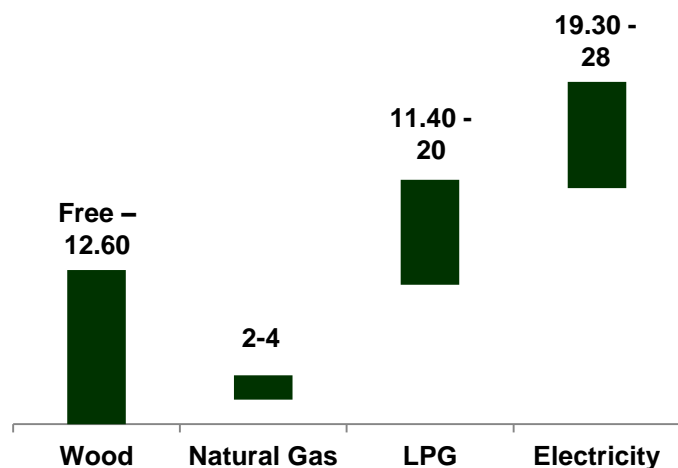
- Implications -

Though the largest programs focus on gas cookstoves, there is still a need for ICS programs in areas unconnected to gas, as well as a household's secondary cookstove in gas-connected areas

Available Fuel Cost

It is cheaper for households purchasing wood to leverage the income subsidy to purchase natural gas instead. LPG and electricity are much more expensive than natural gas

Fuel Cost per Average Month, USD



Assumptions

- LPG price for a 20lb tank
- Wood price would go down 34% on average by using an Improved woodstove
- Electricity is based on WB cost of fuel substitution for unimproved wood stoves. Low range based on UPME quote

Fuel	Unit Price	Fuel	Unit Price
Collected Wood	Free	Natural Gas	\$ 2-4/mth
Purchased Wood	\$1.7/cart (4.2 cart/mth)	LPG	20lb tank
Coal	\$40/ton	Electricity	400/kwh

Prices converted to USD from COP

Pricing and Supply Observations

- Energy subsidies are in place for the lowest income strata. Price ranges listed are for the lowest two strata, if subsidized
- Subsidy applies to fuel only, not the natural gas connection fee (\$494), a barrier to gas
- Two companies started research on pellets, mostly for energy rather than stoves, but no production has started
- It is difficult but possible to acquire LPG refills in the countryside – people just do not like to pay for them
- Coal is only rarely used, and therefore not included

Level 1	50% subsidy
Level 2	40% Subsidy
Level 3/4	Nothing
Level 5	20% Contribution
Level 6	80% Contribution

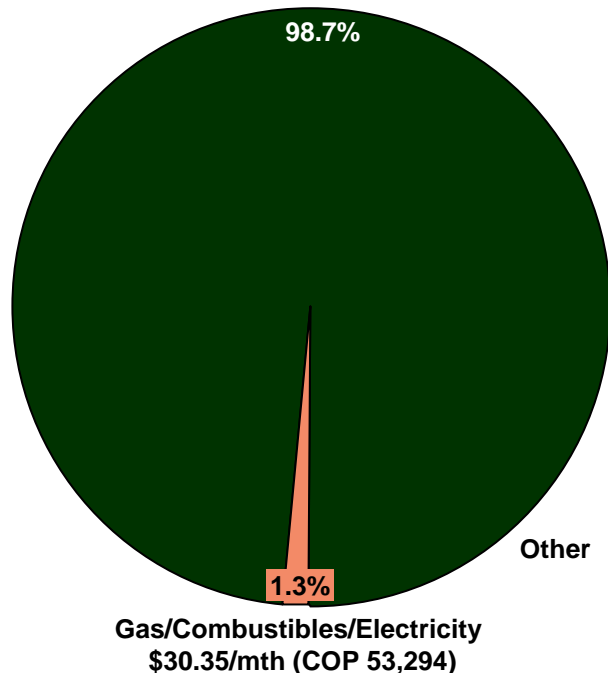
- Implications -

Connecting natural gas to densely populated regions should prove effective, but it will be difficult to transition those collecting wood at no cost to paying for fuel

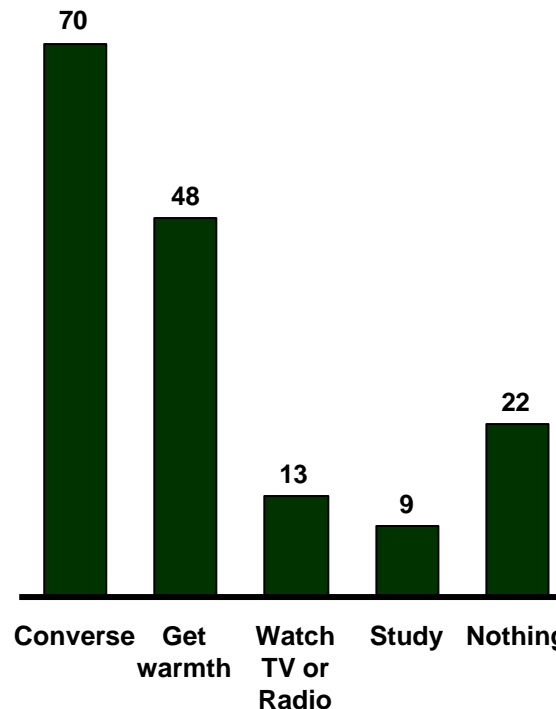
Source: Interviews (Promigas, Tetrattech, Ecopulpa), Promigas project report, Ecopetrol Report, World Bank 2007 Environmental Report, UPME

People tend to purchase clean fuels only when they are a small portion of their income, as cooking with wood is culturally accepted as an enjoyable, socialization opportunity, and not a major burden on time

Fuel as a % of Consumer Expenditure (2006-7)



Other activities done in the room with the wood stove? (%)



Time Consumption

- Woodburning HH consume 3.34 hours every time they go to collect a load of firewood, (14hrs/mth) not including cooking. This is reduced to 8.14hrs/mth if LPG is used part of the time to fuel cooking
- A beneficiary of a stove project noted that she went from 12hrs/day cooking to only 4hrs.

“Time, what am I going to do with the time? Stare at the sky?”

Colombian commenting on convenience of improved stoves

- Implications -

ICS programs must take into account the cultural implications of cooking and customers must be aware of the impacts of IAP

Indoor Air Pollution (IAP) in Colombia

Social Impact and Environment

The impacts of IAP are concentrated almost exclusively in rural areas, where just over 50% of the population is affected

# Households Affected			
	Population (Households)	% Using Biomass	Total exposed to IAP (HH)
Rural (25% of total pop.)	2.9 million →	50.1% →	1.46 million
Urban (75% of total pop.)	8.7 million →	2.1% →	0.17 million
Total →			1.63 million (14% of total households)

“When rural people using wood cookstoves go to the doctor for respiratory issues, he writes one thing on the prescription – buy a cleaner stove. That’s it. Nothing more.”

Cornare

Health Impact

- **1,100 - 1,900** annual deaths attributable to solid fuel use in 2007*
- **35,200 DALYs** attributable to solid fuel use
- **\$193 million annual cost** of health impacts of IAP associated with use of traditional fuels
- Indoor/outdoor air pollution damages represent **1% of Colombia's GDP**, of which acute respiratory illness (ARI) in children and women represents 47%, and women's chronic obstructive pulmonary disease (COPD) accounts for 28%, and respiratory child mortality accounts for 12%.
- In one pilot area, it was found that 53% of users of woodstoves have **inadequate ventilation**, and 69% have no chimney
- University of Antioquia study for Cornare indicated that lung capacity is 45% reduced among those using traditional wood stoves

- Implications -

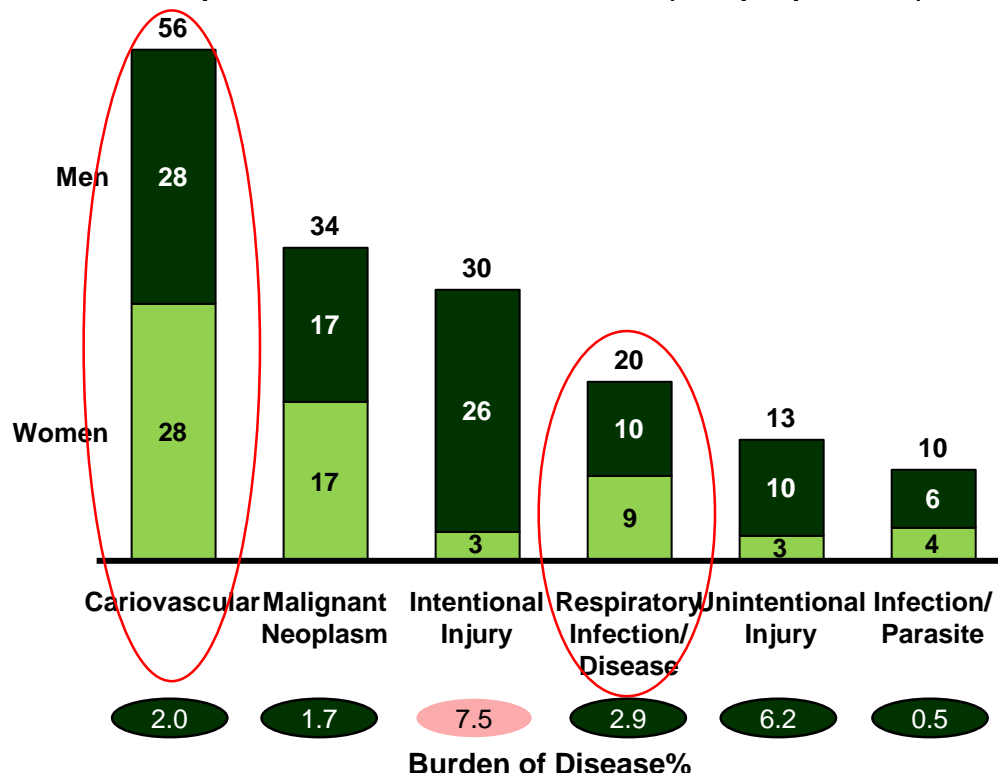
Cookstove programs need to focus on reaching last-mile rural populations, and not on urban communities

Indoor Air Pollution vs Other Priorities

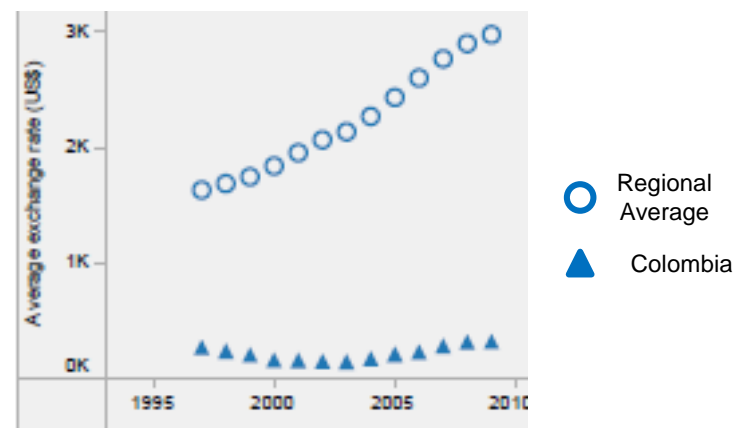
Social Impact and Environment

Though there is some work being done on IAP at the Ministry of Health, it is not a recognized priority for a government contending with other health issues

Top 6 Causes of Death in Colombia ('000 people, 2008)



Per Capita Health Spending



Internal Displacement

- Between 3.9 and 5.3 million people are internally displaced, disproportionately women, minorities, and youth under 25. 89,000 were displaced in the first 6 months of 2011 alone. These people are disproportionately poor, and difficult to reach with healthcare

- Implications -

Improving awareness of IAP among health ministries, associations, and stakeholders is a key component of addressing the issue from a health, not only environmental, perspective

Sources: WHO Colombia Country Profile 2010, WHO Burden of Disease Statistics, 2008, Interviews, internal-displacement.org

Colombia uniquely packages reforestation programs in with cookstoves programs to not only reduce the impact of wood usage and deforestation, but to also sustainably reproduce fuel wood resources

GHG Emissions

- The government is interested in Biomass programs that will reduce slash and burning and thus GHG emissions, Dioxins, and other PoPs.
- Stoves that have been tested vary greatly in the amount of emission reduction they are able to give, with some fixed stoves that look nearly identical claiming up to 85% particle emission reduction, and others only 14%

Best Practice

Reforestation through Cleaner Cookstoves

- Even in rural areas, people are convinced that deforestation is a major issue. A study to rural Usme discovered that a full 91% believe that wood will die out and the majority believe that planting trees is a good way to combat that
- Measures of success for ICS programs typically include wood savings as a metric, though might ignore IAP impacts
- Program actions from the government contain a component of incentivized forest gardening, whereby stove recipients must care for their patch of trees and use them for fuel wood
- There are 5 different ecological forest regions, causing differing uses of wood:
 - Dense wood areas
 - Mountain forest with lower trees, shrubs, branches
 - Savannah plains with scares patches of wood
 - Amazons with lots of wood, but each wood serving different purposes
 - Mangrove – 2500 hectare area is being preserved by locals through economic incentives

- Implications -

While more research is needed to standardize emission reductions from specific cookstoves, ICS programs should include aspects of reforestation and emissions reductions

Sources:

Interviews (MESD, Patrimonio Natural), ENVIRONMENTAL IMPLICATIONS OF THE USE OF WOOD AS DOMESTIC FUEL IN THE RURAL AREA OF USME

Gender Issues in IAP

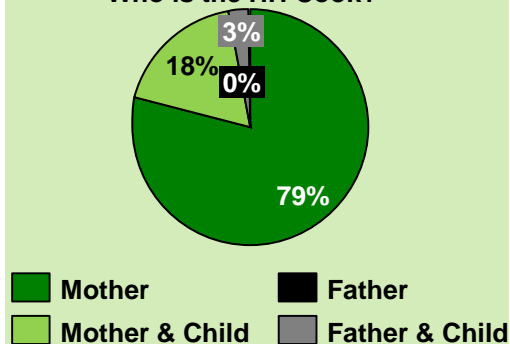
Social Impact and Environment

Women are the main players in rural cooking, giving them more exposure to IAP, but also presenting an opportunity to engage women in cookstove-related business

Role of Gender in the Household

- Women are far more likely to be exposed to IAP in their role as primary cook.
- Women are in charge of the kitchen. Women & children spend a lot of time in the kitchen, with the kitchen also functioning as a dining room or bedroom in 79% of cases

Who is the HH Cook?



Challenges

- Women are not often in control of decisions around the stoves, often leading to disuse of the stove
- Women's needs are often not taken into account in the design of stoves – for example in a project in Santa Marta where women were not consulted
- 80% of wood collector businesses are men aged 15-57, but wood collected for personal use is collected mostly by women. Differs greatly by region

Opportunities

- There is an opportunity for gender to be more effectively integrated into the design of upcoming projects, such with the ministry, IADB, Fundacion Natura, and the continuation of Huellas project.
- Community organizations are often led by women, giving them a position for voicing needs related to cookstoves
- In La Guajira, women make a business out of making charcoal and selling it to restaurants in the city

- Implications -

ICS programs need to include ways to actively engage women in cookstove design and program implementation in order to be successful and sustainable

Content

Executive Summary

Project Approach

Sector Mapping

Macro Environment Assessment

Social Impact & Environment

Consumer Assessment

Cookstove Industry Assessment

Carbon Financing

Sector Mapping Summary

The customer segmentation in this section is an illustrative example of how the Colombia market could be grouped. Segments are based on the following assumptions:

- The customer segmentation is designed to provide a high-level view of the market and strengthen the understanding of the customer base in Colombia.
- The customer segmentation is based on a preliminary market assessment and has used a combination of both primary and secondary research. Further refinement of customer segmentation and customer profiles will be required for specific programmes and regions.
- Customer usage trends is the biggest gap in robust knowledge & research, therefore segment knowledge is sometimes based on consistent anecdotes from stakeholder interviews
- The high-level customer segmentation calculations were derived based on the following mathematical assumptions:
 1. Being well connected to a modern fuel is defined as living in a connected zone that is serviced by an operator (non-IPSE zones)
 2. All non-connected households fall in the lowest income quintile
 3. The number of type 1 and 2 IPSE locations is representative for the share of non-connected households in the Andean region
 4. The national income distribution is representative for the Andean region

Consumer Landscape in Colombia

Consumer Assessment

To understand and derive insight on the consumer landscape in Colombia the population can be segmented based on four key areas

**Market
(Rural / Urban)**

**Well connected to a modern fuel
(Yes/No)**

**Income Quintile
(Lowest 40%/Above)**

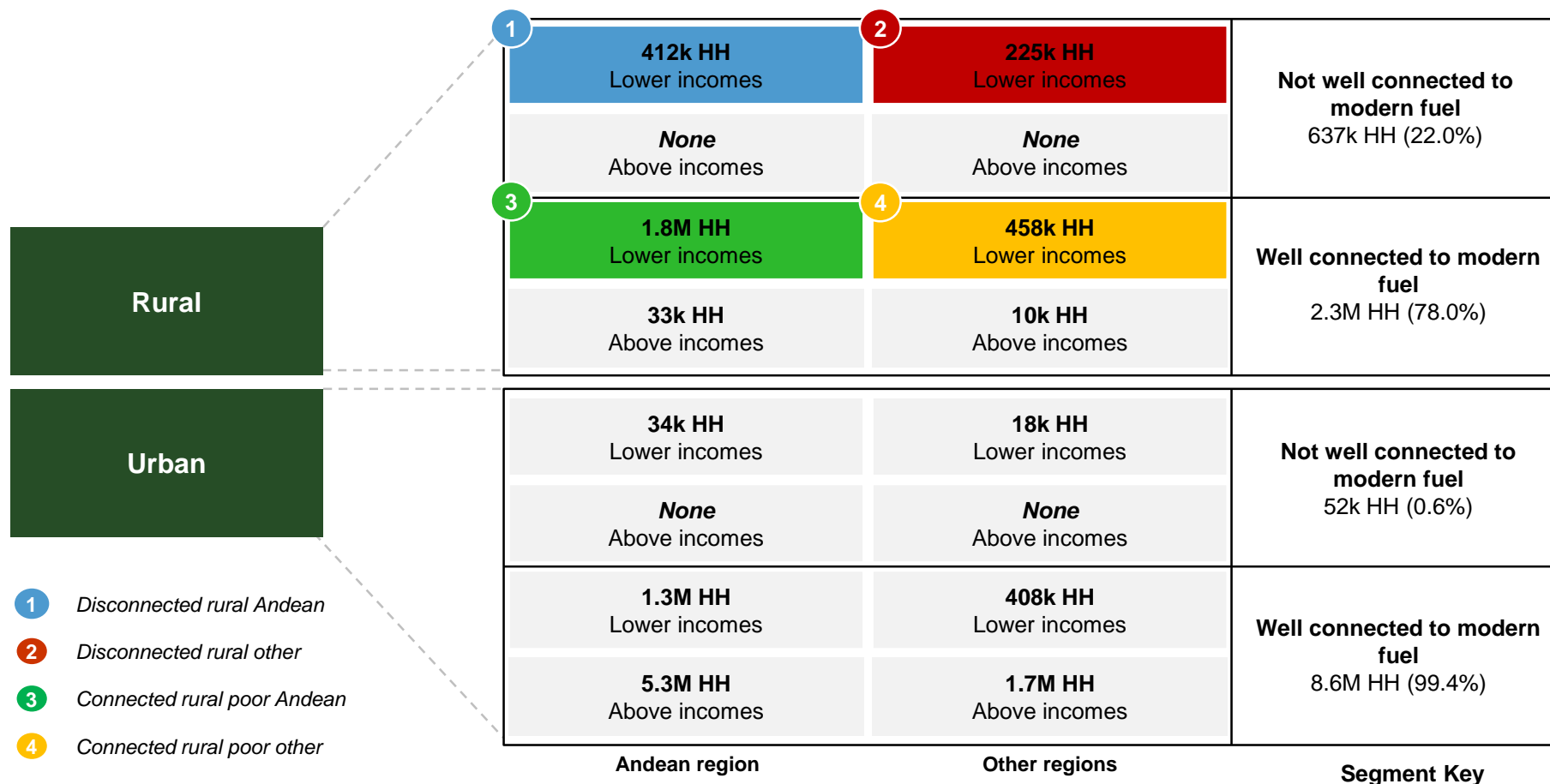
**Geographic location
(Andean region/other)**

Note: The attributes of the segmentation are illustrative based on only initial research

Target Market Identification

Consumer Assessment

The target market is entirely situated in rural areas, but differences in connection to a modern fuel, income and region imply different needs



- Implications -

The potential market for a cookstove intervention in Colombia is approx. 2.9 million households

Segment Profiles

The targeted population can be segmented into four groups: 1) Rural households in the Andean region not well connected to a modern fuel & 2) Not connected rural households in other regions



Not connected rural Andes



Not connected rural other regions

	Not connected rural Andes	Not connected rural other regions
Size in Households	• 412k (4% of population)	• 225k (2% of population)
Profession	• Sustenance farming, work on coffee plantation	• Sustenance farming, animal husbandry
Household Income	• Below National Poverty Line; seasonal	• Below National Poverty Line; seasonal
Cooking Device & Fuel	• 3 brick fire variations, sometimes LPG stove • Fuel: Firewood, sometimes LPG	• 3 brick fire variations, binde, sometimes LPG stove • Fuel: Firewood, sometimes LPG
Cooking Location	• Indoors in the kitchen room (also social center of the room, looking for heat in cold areas of Andes)	• Both indoors and outdoors is common - often hot outside which allows outdoors cooking (preferably below a roof)
Cooking Frequency	• Three meals per day	• Three meals per day
IAP Exposure	• High (cooking indoors on biomass)	• Medium
IAP Awareness	• Low (adults are used to it)	• Low
Environment Impact	• Medium	• High (Deforestation key issue in some areas)
Barriers to Switch	• Availability of alternative stoves and fuels • Affordability	• Availability of alternative stoves and fuels • Affordability
Willingness to Pay	• Minimal; not used to paying for stove/fuel	• Minimal; not used to paying for stove/fuel
Purchase Drivers	• Convenience • Less smoke in kitchen (social gathering place)	• Convenience • Easier availability of fuel (difficult in some areas)

Segment Profiles

The targeted population can be segmented into four groups: 3) Rural households in the Andean region that are well connected to a modern fuel & 4) Connected rural households in other regions



Connected rural poor Andes



Connected rural poor other regions

	Connected rural poor Andes	Connected rural poor other regions
Size in Households	• 1.8M (15% of population)	• 458k (4% of population)
Profession	• Odd jobs, small businesses	• Farmer, small business
Household Income	• \$13-\$16 USD/day (cannot work every day)	• ~\$15/day
Cooking Device & Fuel	<ul style="list-style-type: none"> • 3 brick fire variations, LPG stove, some Lorena, electric stoves • Fuel: Firewood, LPG, sometimes electricity or nat.gas 	<ul style="list-style-type: none"> • 3 brick fire variations, binde, LPG stove, some Lorena, electric stoves • Fuel: Firewood, LPG, sometimes electricity or nat.gas
Cooking Location	• Indoors in the kitchen room (also social center of the room, looking for heat in cold areas of Andes)	• Both indoors and outdoors is common - often hot outside which allows outdoors cooking (preferably below a roof)
Cooking Frequency	• Three meals per day	• Three meals per day
IAP Exposure	• High (often cooking indoors on biomass)	• Medium
IAP Awareness	• Low (adults are used to it)	• Low
Environment Impact	• Medium	• High (Deforestation key issue in some areas)
Barriers to Switch	• Affordability of stove, connection fee, and modern fuels	• Affordability of stove, connection fee, and modern fuels
Willingness to Pay	• Low; may switch to LPG or electricity if fuel cost is affordable	• Low; may switch to LPG or electricity if fuel cost is affordable
Purchase Drivers	<ul style="list-style-type: none"> • Convenience (quick heating, fuel availability) • Less smoke in kitchen (social gathering place) 	<ul style="list-style-type: none"> • Convenience (quick heating, fuel availability) • Status symbol for visitors

Customer Segmentation Summary

Consumer Assessment

There are no easy segments to target. People in the Andean region seem to have the greatest need, particularly those in non-connected areas, however these populations are hard to reach

Customer Segment Characteristics

Segment	Size	IAP Exposure	IAP Awareness	Affordability	Willingness to Pay	Alternative Use	Distribution Access
1) Not connected rural Andes							
2) Not connected rural other regions							
3) Connected rural poor Andes							
4) Connected rural poor other regions							

Key | Minimal | Low | Medium | Medium-High | High

Rural households living in the Andes that are connected to a modern fuel are by far the largest segment

As it is cold in parts of the Andes, people cook and gather inside and have high exposure to IAP

IAP awareness is low overall and both affordability and willingness to pay are low across the board

Secondary uses are important with people using the stove for heating in the Andes and to repel insects in jungle areas

- Implications -

A cookstove solution should be tailored to the needs of each segment on variables such as size, IAP exposure, safety risks, price and consumer messaging

Content

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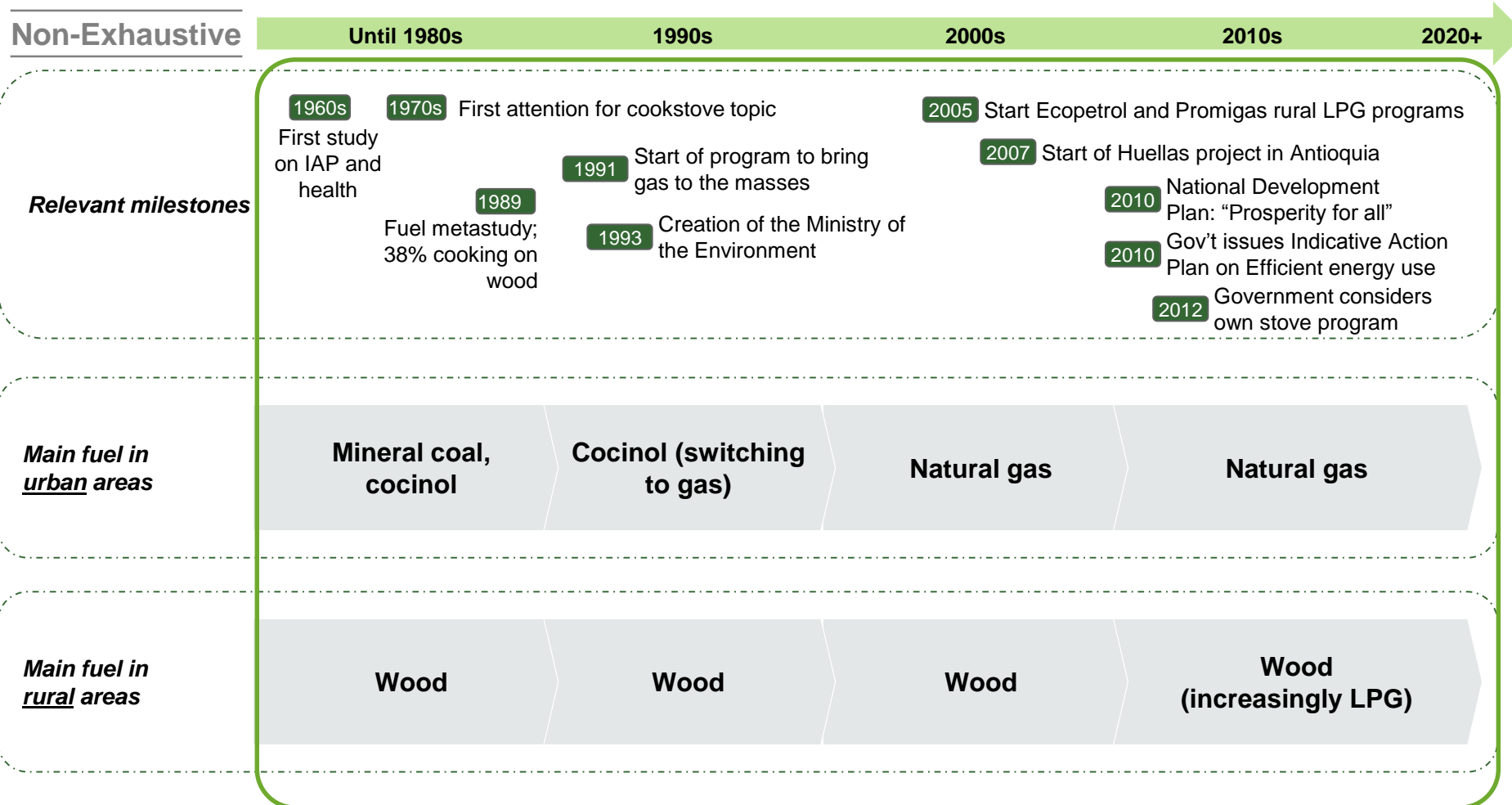
Carbon Financing

Sector Mapping Summary

History of Cookstoves in Colombia

Cookstove Industry

Urban areas switched to clean and safe cooking on gas in the 1990s, but programs to improve rural cooking practices are a more recent phenomenon in Colombia



Government Policy relating to Cookstoves

There are various relevant policies from the ministries responsible for energy and environment issues, but their influence on cookstoves has been limited thus far

Government Policies

Environmental policy

- Colombia is a participant in the Stockholm Convention, seeking to reduce permanent gases (PoPs) such as dioxins
- 1993 - Creation of the Ministry of the Environment through Law 99 of 1993;
- 1992 - The Rio Declaration establishes the concept of sustainable development;
- 1974 - The Natural Resources Code is issued for the purpose of preventing and controlling pollution;
- 1968 - TheINDERENA [National Institute of Renewable Resources and the Environment] is created with the objective of coordinating the management of renewable resources.

Energy Policies

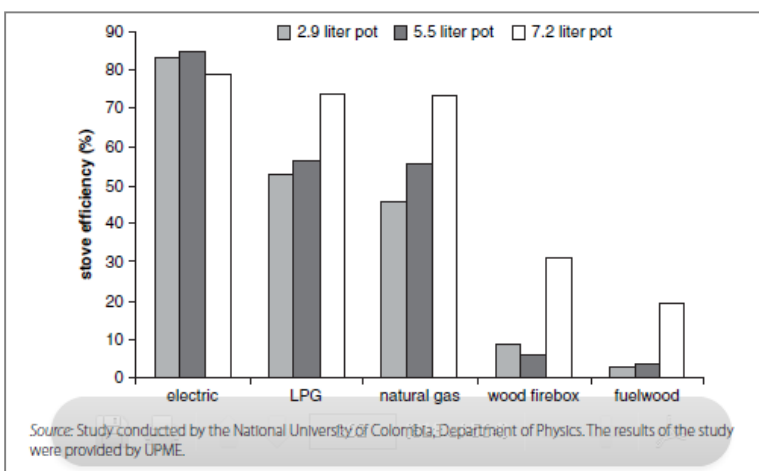
- 2010 - An Indicative Action Plan 2010-2015 develops the Program of Rational and Efficient Use of Energy and Other Forms of Non-Conventional Energy, PROURE – resolution 180919;
- 2001 - Law 697 of 2001 regulates the promotion of Rational and Efficient Use of Energy, besides raising strategies for the use of alternative energies; to foster awareness of energy efficiency in the population, in the government introduced the CONOCE program with a strong emphasis on awareness in cooperation with Icontec;
- During the 1980s new natural gas reserves were found at Colombian west region (Cusiana Field), leading the Government to implement gas massification policies;
- The electricity sector is managed strictly; no electricity can be sold to the grid only if the company is established as an electricity company.

This list was compiled from inputs through various interviews, including those with government stakeholders. It is by no means exhaustive

Although there are standards for gas and electric stoves, there are no established standards for biomass cookstoves. Testing happens on occasional basis, though there is no stoves testing center

No Continuous Testing of Biomass Stoves

- There is no permanent testing center for biomass stoves in Colombia, although stoves were tested for various studies. Projects often have no idea of emissions and efficiency improvements
- Both National University of Colombia (public; see example below) and Andes University (private) in Bogota have the knowledge and equipment to test stove efficiency and emissions after either combustion or gasification, both in- and outside the lab. They also have experience with testing and are seen as the best place for a permanent testing center



No Standards regarding IAP and Biomass Stoves

- Technical norms (Norma Técnica Colombiana or NTC) are set by Icontec – an international PPP institute
- There are standards on safety and efficiency of gas and electric stoves, but not of any other stoves
- There are no plans to set any other stove standards, as there is no industrial production of these stoves
- There are no standards on Indoor Air Pollution; standards for outdoor air pollution have been around for a long time but outside of Bogota measurement of air quality started only recently. This is administered by the CARs

Illustrations of Current Technology Landscape

Cookstove Industry

Traditional cookstoves made using freely available materials are common in rural areas, especially the three brick fire (often on a platform)

3 Brick Fire – on ground/platform



- Basic technique still used in the poorest areas
- Often elevated on a platform, e.g. made of cement; sometimes also using iron bars
- Highly inefficient, but the difference is smaller when larger pots are used to cook for a group

- Use ○
- Availability ●

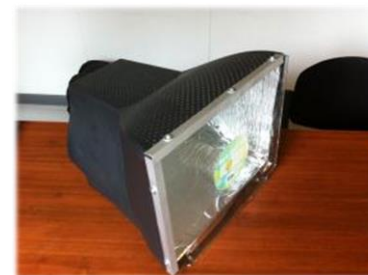
Binde – Termite Mound



- Made from termite mounds and used by some rural populations
- 40-75% more efficient than a 3-stone fire
- Difficulty is that it cracks and breaks easily

- Use ○
- Availability ○

Solar



- No industrially produced designs available, but an organization teaches people to make solar stoves and ovens from widely available old materials (monitors, umbrellas) for about \$10
- High temperatures can be reached (195 °C) if it is not cloudy (often the case in Colombia); constant attention needed

- Use ○
- Availability ○

Key | ○ Minimal | ○ Low | ○ Medium | ○ Medium-High | ● High

Illustrations of Current Technology Landscape

Cookstove Industry

Colombians prefer a kitchen-like stove (often fixed) with multiple burners and often an oven; improved versions significantly reduce smoke but these stoves are very expensive

Traditional Fixed (Lorena)





- Used in rural areas by richer households
- Convenient, any biomass can be used; has a chimney
- Burns approximately 50% more efficiently than three stone fires; significant reduction in IAP
- Prohibitively expensive to create a market at \$500/stove

- Use 
- Availability 

Improved Fixed




- Improved version of traditional design; hard to visually discern, improvements are internal
- Up to 55% more efficient than a traditional fixed stove. Reduction of particle emissions of 86%; very little emissions in the kitchen if used right
- Includes oven, water reservoir and a chimney
- Cost on the market approx. \$500

- Use 
- Availability 

Artisan Traditional Movable



- Made by artisans in larger cities; cheaper versions of lower quality in the countryside
- Efficiency and emissions unknown, but more efficient and clean than traditional methods
- Includes a chimney and options like an oven and a charcoal grill
- Price ranges from ~\$50-\$400 excluding transportation

- Use 
- Availability 

Key |  Minimal  Low  Medium  Medium-High  High

Illustrations of Current Technology Landscape


Cookstove Industry

Various clean-burning stoves that burn biogas or pellets are available, but none are widespread

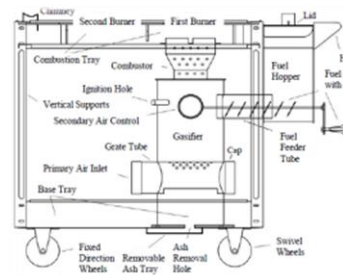
Biogas stove





- Some farmers are using animal and human waste to create biogas
- High energy density and free fuel, but high upfront cost. Cost can be lower by using special plastic instead of concrete, but will not last as long

- Use 
- Availability 

Household Gasifier 1





- Runs on pellets, no IAP fumes
- Should cost around \$100
- Is easy to use – easy to light, load, unload biochar, refill pellets while mid-cooking process from the outside, no electricity required to run it
- Has 2 burners
- Not yet distributed

- Use 
- Availability 

Household Gasifier 2

- Very efficient at boiling water in just over 3min, also produces Biochar for crop fertilizer
- Not yet developed to be customer friendly. Requires electricity, cant last through cooking a meal, difficult to light and change fuel, dangerously hot, difficult to light
- Not sold yet



- Use 
- Availability 

Key |  Minimal  Low  Medium  Medium-High  High

Illustrations of Current Technology Landscape

Cookstove Industry

Most common in Colombia are modern stoves that run on electricity or gas

LPG Stove

GAS PARA EL CAMPO
EQUIPO DE GAS LP



Estufa a gas de dos
puestos



Regulador y
manguera



Cilindro de Gas LP
de 33 libras (15 Kg)

- Clean stove, very common in richer rural areas
- Stoves sometimes distributed for free by gas companies; consumers cannot always afford the LPG afterwards
- Typically buying LPG in containers for up to one month from distribution truck

- Use
- Availability

Electric stove



- Mainly used by richer households that are not connected to natural gas
- Have to comply with national safety and efficiency standards (also if imported)

- Use
- Availability

Modern gas stove



- Most common stove in Colombian cities
- Many brands available on the market
- Have to comply with national safety and efficiency standards (also if imported)

- Use
- Availability

Key



Minimal



Low



Medium



Medium-High

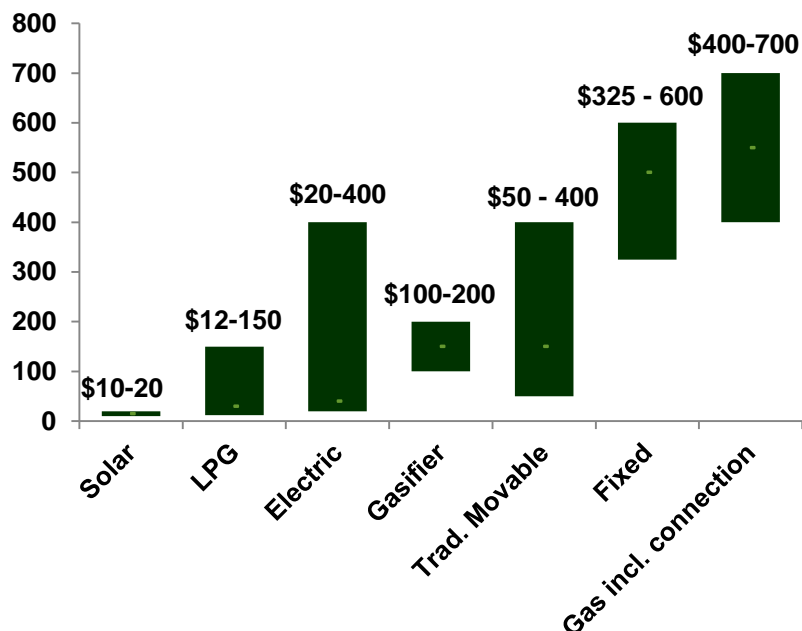


High

Available Cookstove Cost

There are few inexpensive cookstove options in the Colombian market, with the cheapest feasible primary stove starting at \$20 USD. The cheapest wood cookstove is ~\$50 USD and of mediocre quality

Upfront Cost by Product



All prices are in USD equivalent

Observations

- Solar stoves are made from recyclable materials and are not for sale (self-made)
- The price of traditional movable stoves depends on quality and size. We were told a 'good quality' small stove (2 pits) starts at \$80
- The price of fixed stoves includes installation. Large programmes can get the price down to \$325 but for consumers it starts at \$500
- Natural gas is cheap once connected but the connection fee is around \$500. Gas distributors like Promigas have subsidy and/or finance programs for rural households

"Distribution cost can be 3x the materials cost. We once had to carry stove materials 6 hours over a mountain trail"

- Patrimonio Natural

"Most houses are made of clay – the natural gas connection cost more than their house"

- Promigas

- Implications -

There are few inexpensive options that use a fuel source affordable for the poorest, apparently because consumers want large (thus expensive) stoves. This makes it unlikely that rural consumers can pay for the stove themselves, and makes the use of carbon finance more complicated

Overview of Current Cookstove Initiatives in Colombia

Cookstove Industry

Until recently the private sector and autonomous environmental corporations dominated the cookstove sector working alongside universities, but government and NGOs are now getting more involved

Private Sector

CHALLENGER

Unknown # of artisans

Ecopulpa



Promigas



Government



Libertad y Orden

Ministerio de Ambiente
y Desarrollo Sostenible
República de Colombia



Libertad y Orden

Ministerio de Minas y Energía
República de Colombia



Inter-American Development Bank



USAID
FROM THE AMERICAN PEOPLE



Fundación
Natura
COLOMBIA



NGOs



UNIVERSIDAD
NACIONAL
DE COLOMBIA



Universidad de
los Andes



UNIVERSIDAD
DE ANTIOQUIA
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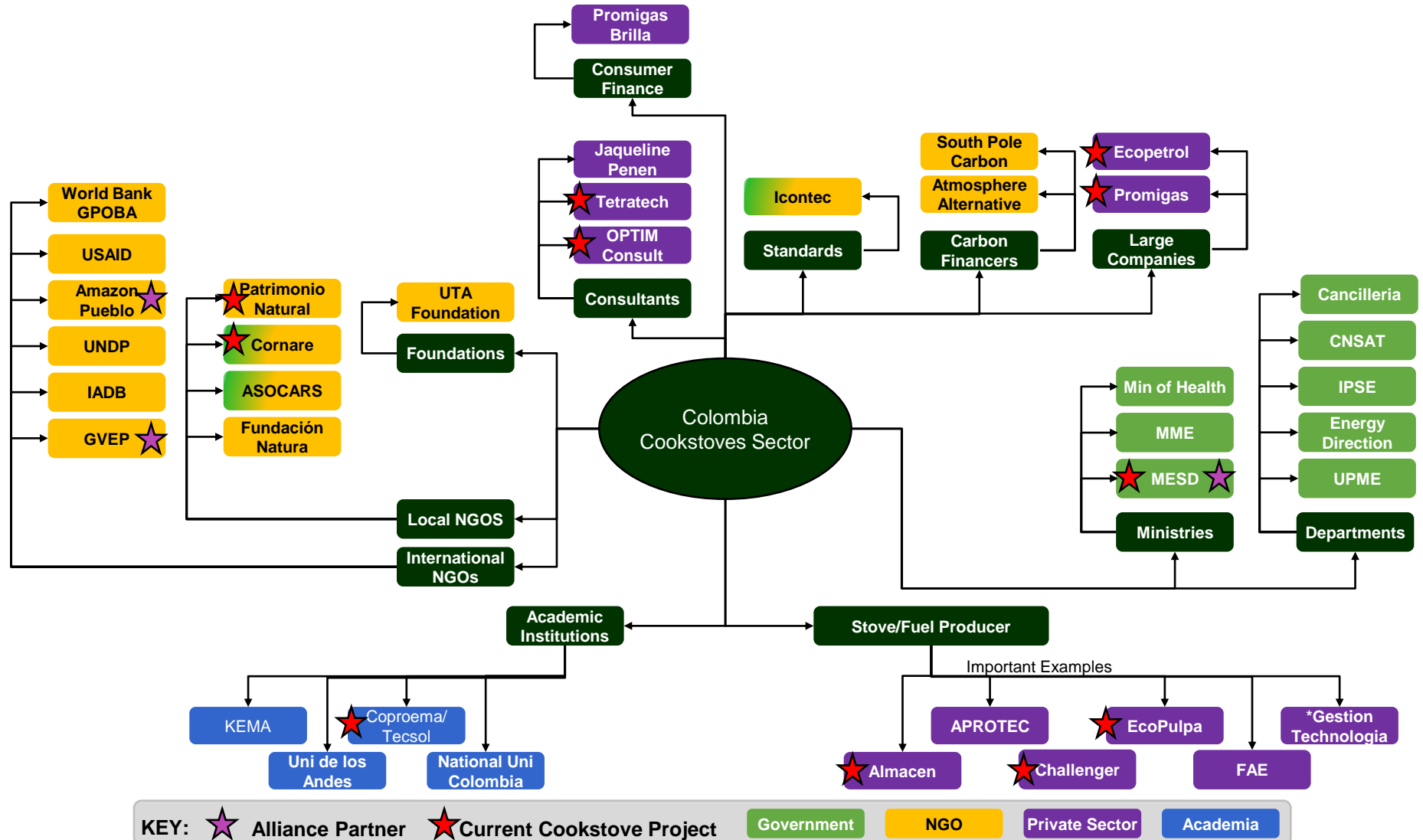
Academia

- Implications -

The increasing involvement of Ministries and NGOs in the cookstove sector presents an opportunity to create a more coordinated sector targeting a broader group of households

Colombia Stakeholder Mind-Map

Cookstove Industry



Note: This is not a comprehensive list of organizations working in cookstoves. It is designed to be a working document that expands over time. Could not speak with Gestion Technologia

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Major Cookstove Initiatives in Colombia

– Government

Cookstove Industry

Government programs are implemented through the regional corporations and generally involve a reforestation component

	Huellas	CAM	Ministerio de Ambiente y Desarrollo Sostenible	PROURE: Indicative Action Plan 2010-2015
Who	Cornare, the government owned environmental 'corporation' responsible for northeast Antioquia	CAM, the government owned environmental 'corporation' responsible for Huila	Ministry of Environment & Sustainable Development (climate change, environment and forestry departments)	Ministry of Mines and Energy (owned by UPME)
What	Started in 2007 and still ongoing. Over 17,000 fixed woodstove kitchens have been installed and every household has also created a firewood plantation of 100-300 trees. High improvements in efficiency and emissions if used right. The families are selected on income level, current fuel source and remoteness and contribute to the installation cost of the stove.	In the 2 nd phase. The goal of this project is installing 800 new fixed wood stoves that use less wood and expel gas more efficiently through a chimney in a design from the 1930s. In return for the free stove, recipients will be obliged to farm their own fuel wood with provided seedlings. 50% improved efficiency expected, stoves last over 10 years.	Want to develop and implement a national strategy to promote the use of eco-efficient stoves and firewood gardens in rural areas. Includes research on what areas are in need and where other energy sources than solid fuels could be used. Part of the plan is the development of pilot projects with eco-efficient stoves and firewood gardens, impacting 20,000 poor rural households.	6 strategic programs, 4 sections and hundreds of actions, one of which in the Residential section is relevant to cookstoves. Estimated \$500k USD would be required to a) Promote the replacement of inefficient burners existing ICS, b) Define a policy framework to standardize stoves and labeling, c) Promote research in efficient burners, d) Promote the installation of efficient burners by gas distribution companies, and e) Promote user education in the best use of stoves.
Challenges	Scalability and funding; mentality towards reforestation; maintenance of stoves	Efficiency found depends on wood used in different areas	Funding and best practice advice for program design are needed	Provides a vision for future energy use but does not assign implementers
Partners	Government of Antioquia, Ministry of Environment & Sustainable Development	Ministry of Environment & Sustainable Development	Ministries (Mining and Energy, Agriculture), Patrimonio Natural, Fundación Natura, regional corporations	Plans to be funded by GEF (World Bank)

Major Cookstove Initiatives in Colombia

– NGOs

Cookstove Industry

There are no NGO programs actively disseminating cookstoves, although various NGOs are considering starting such a project and Fundación Natura has worked on stove designs

	Inter-American Development Bank	USAID w/ OPTIM	USAID w/ TetraTech	Fundación Natura
Who	IADB, looking to cooperate with IPSE and UNIDOS	USAID funded BIOREDD+ program, implemented by OPTIM Consult S.A.S.	USAID funded TetraTech, a US-based development and engineering consulting firm	Fundación Natura, a Colombian NGO working on conserving biodiversity and alternative sustainable use of natural resources
What	Program not designed or funded yet by IPSE, but looking to jump on the back of UNIDOS program for health & food to distribute stoves. Stove to distribute could be fixed model from Brazil, Honduras or portable model from Tanzania	A 3 year \$8 million program that started late 2011. Two objectives: Biodiversity and Climate Change Adaptation/ Mitigation. The goal is to reach 20,000 forest families that are dependent on the forest for food and fuel in the Pacific and Caribbean coast regions.	5 year project started 3 months ago, looking to reach 80 communities with various initiatives to improve their lives and the environment. 3-pronged approach integrating this into policy, implementation bottom up in rural areas and for industry. Stoves could be a potential project within this	Working in Santander to reduce deforestation pressure; as a part of this, in 2009 tested 13 stoves on efficiency and created one prototype that they are now promoting
Challenges	Funding not yet approved or program fully designed. Cannot charge for stoves as they do not sell. Finding reliable in-country producers could be hard	Would like to include stoves as a part of this program, but cannot finance fixed stoves (too expensive) and doesn't know best practice program design or user preferences	Want to only deploy activities that the community wants and ensure ownership and sustainability	Have no funding to further disseminate the stove
Partners	Ministry of Mining and Energy (IPSE), UNIDOS	Local implementers and researchers, power companies (desired)	IPSE, power companies, local communities	Regional corporations; earlier worked with UN, USAID, WWF

Major Cookstove Initiatives in Colombia – Private Sector

Cookstove Industry

Colombian energy companies have been working to get rural consumers to switch to gas and modern stove manufacturer Challenger recently indicated it is interested in producing for the rural market

	Promigas	Ecopetrol	Challenger	Ecopulpa
Who	Promigas, a Colombian gas distribution holding company	Ecopetrol S.A. is the largest company in the country and the principal petroleum company in Colombia	Challenger is a leading international manufacturer of appliances and kitchen furniture with 4 factories and over 300 stores in Colombia	Ecopulpa is a Colombian company producing products from biomass
What	Two initiatives in the period 2005-2008; both were subsidizing and then financing the natural gas connection for rural homes in the Caribbean coast. The cost of gas is very cheap for disadvantaged populations with a 40-50% subsidy, but the connection cost can sometimes be more than their house cost at \$494 and provides a great barrier	This project, also between 2005-2008, aimed to increase demand for LPG in rural areas by giving away stoves with a cylinder and 3 refills to 294,000 households. Distribution was done through local retailers. The investment has been \$28million, with a cost of \$12 per stove	The Challenger Foundation is working to create environmentally friendly, sustainable living solutions for the poor and displaced. As a part of this they are looking to find a clean and efficient cookstove and possibly mass-produce it in their factories. They see this as an opportunity from both business and CSR perspective	Identified a plant that is very suitable to create pellets of paper pulp. Looking to use these pellets to create electricity in remote areas or as a fuel for gasifier stoves
Challenges	Still not everybody can afford the new connection and stove; therefore looking for funding for next program to provide a greater subsidy, but hard to find	People can't pay for refilling the LPG, even though distribution was only to households with a certain minimum income	Do not have a suitable design yet, nor have identified the right partners	Key issue with using pellets for cooking is that rural people cannot pay for the gasifier stove and the pellets. Also have not found an investor for the project yet
Partners	GPOBA, part of World Bank (34,100 houses) and Dutch Government (10,700 houses)	Local retailers	FAE clean energy solutions	IPSE

Cookstove Industry Value Chain

Cookstove Industry

As there is no existing market for cookstoves in rural Colombia and few cookstove programs, the capabilities across the value chain are limited

	Manage Program				Raise Awareness			Provide & Support Stoves										
Key:	Coordinate Program	Provide Funding	Coordinate Project (Region)	Centralize Act. (Mktg, Ops, Fin)	Gender Programs	Educate on IAP	Raise product awareness	Run Promo Activities	Import & retail stoves	Design stoves	Train Stove Manufacturers	Test stoves	Supply Materials	Transport mat. to Manufacturer	Make stoves	Transport stove to customer	Sell and install Stoves	Maintain Stoves
Full capability																		
Partial capability																		
Basic capability																		
No capability																		
Multilaterals/Donors																		
Government																		
Bank/Financial Institution																		
NGOS and iNGOs																		
Local Manufacturers																		
International Manufacturers																		
Local Entrepreneurs																		

- Implications -

Greater involvement by the government in the cookstove sector is necessary to coordinate activities and raise awareness, and gaps in stove design and testing must be addressed

Content

Executive Summary

Project Approach

Sector Mapping

Macro Environment Assessment

Social Impact & Environment

Consumer Assessment

Cookstove Industry Assessment

Carbon Financing

Sector Mapping Summary

Market Attractiveness

Carbon Financing

The new 1991 Constitution has prioritized environmental initiatives and makes it easier to promote carbon financing as a means to achieve new environmental goals. Still, the paperwork is expensive and unclear, and organizations have yet to see benefits

	Designated National Authority (DNA) & Programs of Activities (PoA)	Stove & Program Accreditation	Carbon Baseline	Country Classification	Scale of Program	Monitoring & Evaluation
Best Case	Pre-existing DNA & related PoA	Pre-existing CDM-accredited stove program in country	Previous cookstove projects to leverage for baselining	Least Developed Country	Estimated income will significantly outweigh costs of registration & monitoring	Approved cookstove monitoring methodology in use in country
	Pre-existing DNA; No PoA	Pre-existing GS-accredited stove program in country	Similar projects (e.g. Biomass) to use as proxy for baselining	Advanced developing country	Unclear business case for carbon financing activities	Approved monitoring methodology in use in country
	Clear organizational candidate for role of DNA					Clear monitoring partnership opportunities and capabilities
	No clear candidate or competing agencies	No accredited stoves or stove programs in country	No previous projects to use as reference	Developed Country	Costs of registration & monitoring will likely outweigh income generated by carbon credits	Lack of monitoring capabilities or partnership opportunities
Worst Case						

- Implications -

The mechanisms for carbon financing are available, but it will be a challenge to guarantee that a cookstove program will benefit from them, as the break-even project size is very large

Carbon Finance Programs

Carbon Financing

Colombia has 42 CDM projects and 2 Gold Standard Projects, but only 4 are focused on biomass energy or reforestation. There are no current carbon financing programs on cookstoves

	Biomass project at Caracolito cement plant	Fuel Switch from Coal to Green Harvest Residues	FEDEPALMA Sectoral CDM Umbrella Project
Description	Partial substitution of fossil fuels (coal) with alternative biomass fuels (Rice Husk, Coffee Husk, Palm residues ...) in cement manufacturing at Caracolito cement plant .This will result in significant reductions of anthropogenic CO2 emissions as all the fuels planned in the project are biomass residues.	<ul style="list-style-type: none"> Incauca sugar miller will produce jobs to collect sugar cane residue and replace the use of coal in its mills with this residue collected in the fields. This is instead of burning the residue or letting it lie in the fields. 	<ul style="list-style-type: none"> Palm Oil producer association FEDEPALMA plan to reduce methane capture, fossil fuel displacement and cogeneration of renewable energy Project activities include mitigation of methane from open anaerobic lagoons through biogas and improve waste water effluent quality
Participants	<ul style="list-style-type: none"> Government of Colombia CEMEX Colombia, S.A. 	<ul style="list-style-type: none"> Ingenio de Cauca S.A. Corporacion Andina de Fomento Netherlands Ministry of Housing 	<ul style="list-style-type: none"> Colombia FEDEPALMA Andean Center for Economics in the Environment
Progress	<ul style="list-style-type: none"> Registration Aug 2008 	<ul style="list-style-type: none"> Registration March 2008 	<ul style="list-style-type: none"> Registered May 2009 Crediting period May 2010 – 2017

Benefits still yet to be seen

- Implications -

Though there is a precedent for carbon financing, it has made the market wary of the benefits of carbon financing in the long term, especially as CDM will no longer be an option

Example Colombia Carbon Financing Organizations (1/2)

Carbon Financing

Despite not having carbon financing projects related to cookstoves, Colombia has experienced organizations that can implement carbon projects.



- South Pole Carbon Asset Management Ltd. is an international company that specializes in reducing greenhouse gases and developing carbon strategies. With ten offices around the globe and operations in over 20 countries, the company enables the implementation and operation of emission-reduction projects that address climate change and sustainable development.
- Focused on deforestation projects, they have been involved with research on stoves for Fundacion Natura, establishing a baseline, and have discussed potential CF cooperation with Cornare of the Huellas project



- CARBONO Y BOSQUES (C&B) is a non profit organization whose mission is to generate, to apply and to spread scientific knowledge related to the interactions between the neotropical ecosystems and the global change.
- Since 2002, the Center has carried out seven feasibility studies for the implementation of CDM, in different regions in Colombia. Additionally, they have formulated two project design documents (PDD) for the implantation of afforestation-reforestation projects under CDM.



CLIMATEFOCUS

- Climate Focus is an independent expert in international and national climate law, policies, project design and finance. They have been pioneering carbon markets ever since their inception.
- They do not have offices in Colombia, but have advising Patriomonio Natural and the Ministry of Environment and Sustainable Development regarding carbon financing for the new proposed project of 20,000 stoves.

Example Colombia Carbon Financing Organizations

(2/2)

Carbon Financing

Despite not having carbon financing projects related to cookstoves, Colombia has experienced organizations that can implement carbon projects.



- Founded in 2007, Anthrotect is a private environmental services partnership that works with Afro-descendant and indigenous landowners in rural Colombia to achieve community-based conservation and sustainable development through carbon finance.
- Anthrotect's flagship project, the Chocó-Darién Conservation Corridor, aims to address biodiversity loss and global climate change by strengthening forest governance and territorial identity among collective landholders in the lowland rainforests of Colombia's Pacific coast. This project was recently granted gold certification under the CCB standard



- Atmosphere Alternative aims to support climate change mitigation and the implementation of low GHG technologies by supporting the design and development of GHG emission reduction activities under the project mechanisms of the Kyoto Protocol. The company offers consulting services to CDM and JI project developers and other carbon market participants.
- The company is involved in advising the Ministry of Environment and Sustainable Development on the design of the upcoming strategy involving clean cookstoves.



- OPTIM Consult is a company focused on the identification, development, and commercialization of projects that generate carbon emission reductions in Colombia and other Latin American countries.
- OPTIM Consult provides services in all stages of project cycle. They lead the process of generating carbon assets and guides companies in each of the steps.
- They currently have 15 projects in the registration process, including 4 landfills, 2 hydroelectric plants, and 1 befoul

Overall Carbon Finance Feasibility

Colombia has a precedent for carbon financing, but it is too early for cookstoves since there are no projects of sufficient scale

- Supportive Market Criteria -

Existing Designation National Authority: Ministry of Environment and Sustainable Development

Colombia did not yet have target CO2 emission reductions guidelines, allowing full funding to flow to Colombia

There are multiple, competitive carbon financing organizations to choose to work with

Carbon market is now better known across the country, with people being aware of how to write PDDs

- Potential Risks-

The carbon market is still very new within local and national government

It is difficult to prove additionality for programs that are giving away stoves for free

Poor past experience with carbon financing leads the market to believe that there is a high risk of never seeing returns from the application process

Monitoring of a disconnected population and disconnected projects raises the break-even project size and impacts coordination costs

Opportunities

- The Voluntary Carbon Market (VCM) and Gold Standard is most relevant for cookstoves, since no additional CDM registrations will be accepted after 2012 from non-LDC countries.
- Possibility of having a joint cookstove/REDD program to reduce cookstove program size requirements or to consolidate efforts into a PoA that supports non-government initiatives or finances continued program maintenance
- There is an opportunity to look into the possibility of NAMAs (National Appropriated Mitigation Action) with Colombia and the World Bank

Content

Executive Summary

Project Approach

Sector Mapping

Macro Environment Assessment

Social Impact & Environment

Consumer Assessment

Cookstove Industry Assessment

Carbon Financing

Sector Mapping Summary

Cookstove Industry Summary

Sector Mapping Summary

Colombia has a significant need for the health and environmental benefits of clean cookstoves in rural areas, but the lack of a market in these areas presents a large challenge

Macro	Social Impact	Consumer	Cookstove Industry	Carbon Finance
<ul style="list-style-type: none"> + New government wants to bring 'prosperity to all' + Gender equality is increasing although rural areas are lagging behind + Strong regional governance - Rural population is dispersed over large and inaccessible country - Income equality is high with poverty concentrated in rural areas 	<ul style="list-style-type: none"> + Increased attention to reforestation (which is often combined with stove programs) + Health impacts of IAP in rural areas are large as ~50% cooks on solid fuels - In urban areas everybody cooks on gas and there is no need for ICS - Diverse and elaborate cooking practices present a challenge 	<ul style="list-style-type: none"> - Consumer awareness of ICS benefits is low - Rural households are not used to pay for stoves and often collect fuel for free - Consumers have relatively high expectations of stoves, driving up the stove price - Many consumers prefer cooking on solid fuels for cultural or culinary reasons 	<ul style="list-style-type: none"> + High involvement of private companies and regional environmental corporations - No market for ICS in rural areas - Limited number of designs, little R&D - No standards and limited testing for stoves other than gas and electric - Production only done by hand with varying quality 	<ul style="list-style-type: none"> + CF mechanisms have been established + Many organizations with expertise in the market - No cookstove programs to date; - High price of stoves makes financing completely by CF very hard - Losing ability to apply for CDM in 2012
Moderately Favorable	Moderately Favorable	Unfavorable	Unfavorable	Moderately Favorable

- Implications -

Raising consumer awareness and better understanding the consumer demands are essential to start a market-driven industry that can have significant impact in rural Colombia

Glossary of Terms

Below is a list of commonly used acronyms used throughout the report and presentation:

AIDS	Acquired Immunodeficiency Syndrome	LDC	Least Developed Country
ARI	Acute Respiratory Illness	LPG	Liquid Petroleum Gas
CAR	Autonomous Regional Corporation	M&E	Monitoring and Evaluation
CCB	Climate, Community and Biodiversity	MDG	Millennium Development Goal
CDM	Kyoto Clean Development Mechanism	MESD	Ministry of Environment and Sustainable Development
CF	Carbon Finance	MME	Ministry of Mining and Energy
COP	Colombian Peso	MOH	Ministry of Health
COPD	chronic obstructive pulmonary disease	NGO	Non-Governmental Organization
CSR	Corporate Social Responsibility	PDD	Project Design Documents
DALY	Disability Adjusted Life Year	PNC	National Development Plan
DNA	Designated National Authority	PoA	Programme of Activities
GDP	Gross Domestic Product	PoP	Persistent Organic Pollutant
GEF	Global Environment Facility (World Bank)	PPP	Public Private Partnership
GHG	Green House Gas	PROURE	Program of Rational and Efficient Use of Energy and Other Forms of Non-Conventional Energy
GS	Gold Standard	REDD	Reducing Emissions from Deforestation and Degradation
HH	Household(s)	UN	United Nations
HIV	Human Immunodeficiency Virus	UPME	Mining and energy planning unit
IAP	Indoor Air Pollution	USD	US Dollars
ICS	Improved Cookstove	VCM	Voluntary Contribution Market
INGO	International Non-Governmental Organization	WHO	World Health Organisation
IPSE	Energy Planning & Solution Promotion Institute (focus on non-connected zones, part of the Ministry of Mining and Energy)	WWF	World Wildlife Fund

Glossary of Organizations

- **ASOCARS** - Asociación de Corporaciones Autónomas Regionales y de Desarrollo Sostenible
- **CNSAT** - Centro Nacional Salud Ambiente y Trabajo
- **GVEP** – Global Village Entry Parternship
- **IADB** - Inter-American Development Bank
- **IPSE** - Instituto de Planificación y Promoción de Soluciones Energéticas para las Zonas no Interconectadas
- **MESD** – Ministerio de Ambiente y Desarrollo Sostenible
- **MME** - Ministerio de Minas y Energía
- **UNDP** – United Nations Development Partnerships
- **UPME** - Unidad de Planeación Minero Energética

Case Study A: Negative Carbon Farm

Appendix

- **Organization:** UTA Foundation - TOSOLY Finca Ecológica
- **Region:** Santander - Oiba
- **Stove:** Colombian improved wood, biogas, biomass gasifier from Ankur Scientific Energy Technologies, Pvt Ltd (India)
- **Price:** Biogas Installation: \$200. Biogas plastic replacement (after 3yrs) aprox \$100
- **Funding:**
 - ✓ Formerly SITA (Sweden) funded project here and in Colombia. Now looking for more donors.
- **Stoves Distributed:** Few stoves in immediate area
- **Best Practices:**
 - ✓ The farm is fully integrated, using inputs from the farm as fuel for biomass gasifier, biomass wood, and biogas energy. The outputs of these three stoves, along with solar energy, meet all of the energy needs of the farm.
 - ✓ Cheap UVA resistant plastic Biogas system produces gas for cooking and hot water
 - ✓ Biomass gasifier runs the farm machinery such as sugar cane millers and coffee grinders, takes the input of sugar cane residue
 - ✓ Biochar from gasifier is combined with effluent from biogas to produce extremely effective fertilizer
 - ✓ Testing is also being done for a personal use portable gasifier stove, as per the one in Colombia, using rice husk

Industrial Biomass Gasifier for household farmers



Case Study B: Promigas Rural Natural Gas Program

Appendix

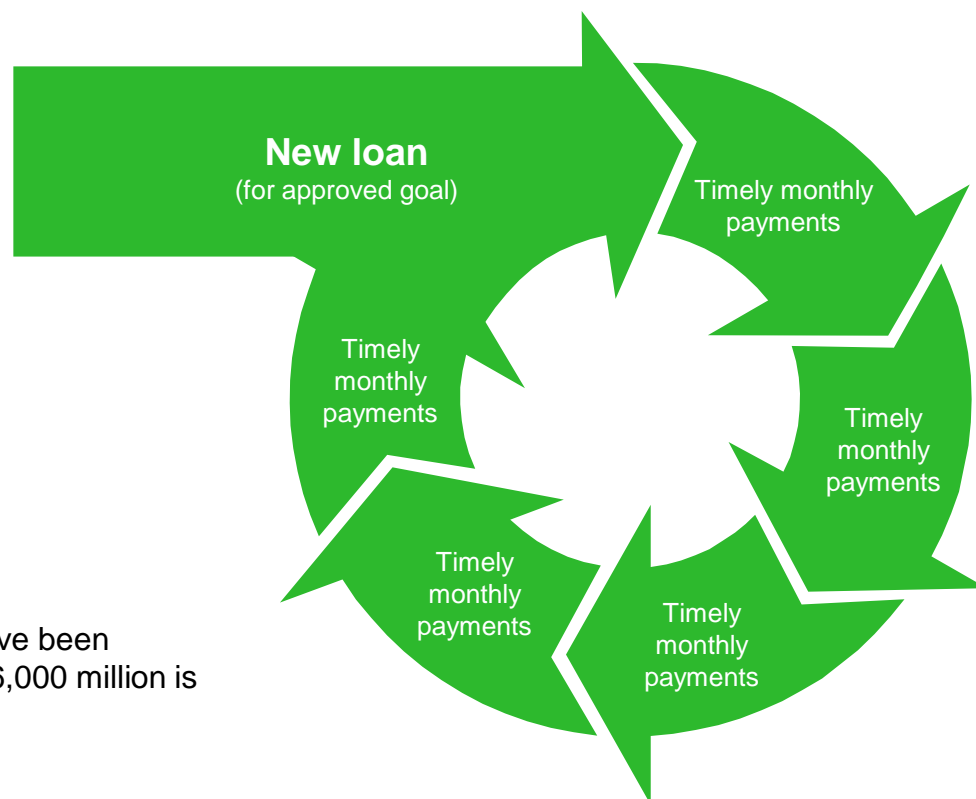
- **Organization:** Fundación Promigas, funded by Colombian gas distribution company Promigas
- **Region:** Caribbean coast toward Pacific coast
- **Stove:** 2-burner natural gas stove
- **Price:** Subsidized 38% of the cost of a natural gas connection , which was \$370 at the time. Financed the rest of the cost against interest
- **Funding:** GPOBA (World Bank) for one project, Dutch government for the other
- **Stoves Distributed:** 34,100 (GPOBA), 10,700 (Dutch Government)
- **Best Practices:**
 - ✓ Created a sustainable market for their fuel and converted more customers, while improving quality of life in rural areas
 - ✓ Used local subsidiaries with relevant knowledge to implement the program
 - ✓ Financing allowed families to begin to establish credit and 'own' their stove
- **Results:**
 - ✓ Frequency of households reporting a household member hospitalized due to respiratory illness fell by 75%
 - ✓ Avoided 64,689 DALYS and 87 deaths through both projects
 - ✓ Firewood consumption reduced, preserving up to 34 hectares of forest or mangrove swamp land
 - ✓ Overall, the economic rate of return of the project over ten years is estimated to be 62%
 - ✓ Economic burden of disease reduced 32% (For every \$1 invested in subsidies, the government saved \$1 in burden of disease treatments; the payback period is 5 years)
 - ✓ 79% of households stated life quality improved, 84% stated community developed

	Before project	After project
Children with respiratory illness	36.5%	12.6%
Adults with respiratory illness	23.1%	9.5%
Fuel expenses vs. HH revenue*	7.6%	2.4%
Expense per meal	\$9.40	\$3.62

Case Study C: Promigas Micro financing: Brilla

Appendix

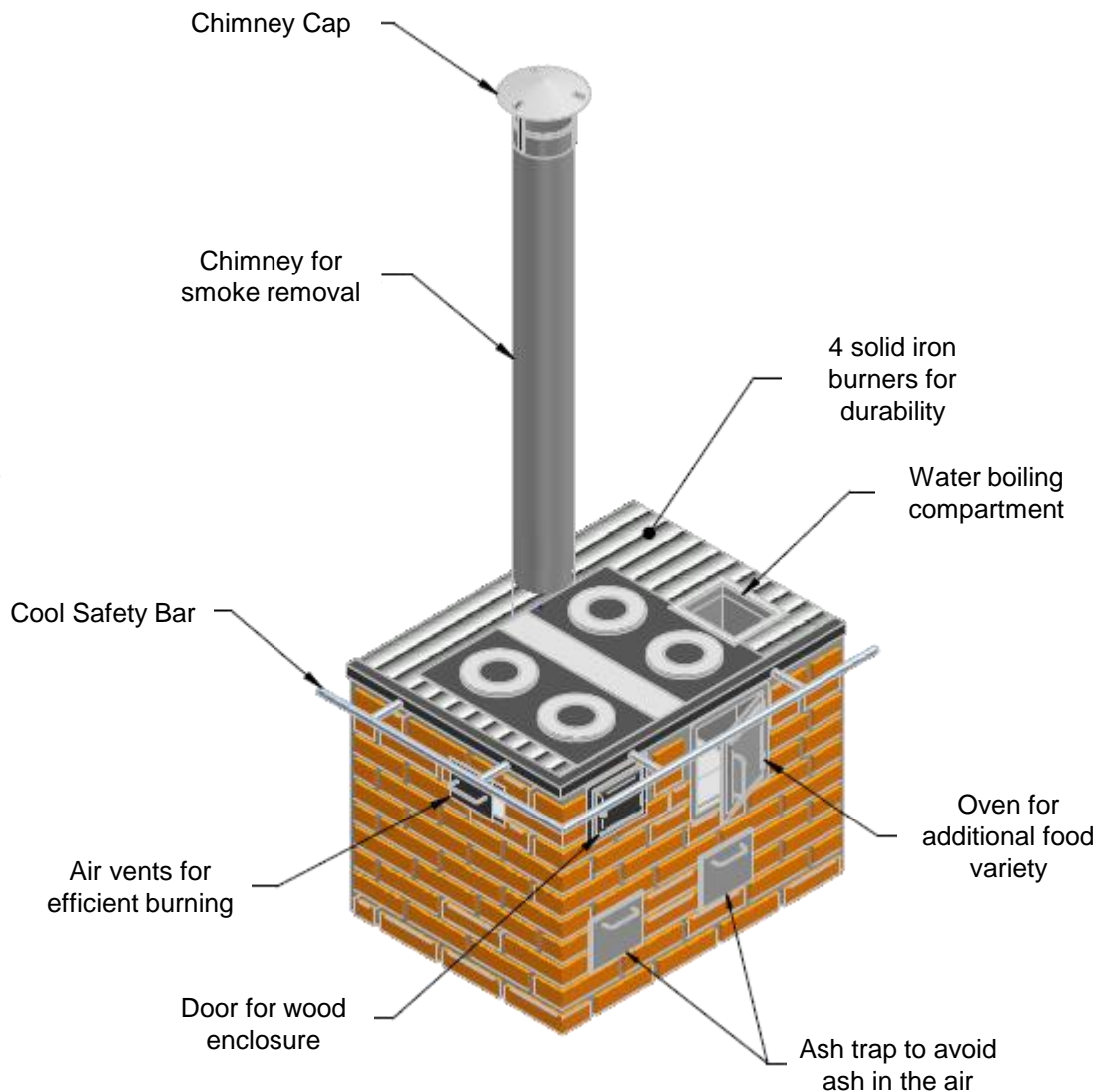
- **Organization:** Promigas Brilla Program
- **Region:** Everywhere that Promigas operates
- **Stove:** No stove: Micro financing credit scheme
- **Price:** Cost of credit is the highest allowable rate in Colombia, approximately 28% interest per year, payable over a maximum of 5yrs (depending on the type of investment)
- **Funding:** No funding required, as the program is self-financing and provides 72% operating margin to Promigas
- **People assisted:** Currently 650,000 households have been reached, alone in 2011 it was 180,000 HH. COP 566,000 million is the total amount of loans given so far



- **Best Practices:**
 - ✓ Promigas uses their existing billing network to provide micro financing to existing disadvantaged customers of natural gas. It is profitable to administer this, because they already have the billing system
 - ✓ Micro finance bills get added to the existing natural gas bill
 - ✓ Only customers who financed their stove installation and made all their payments in time are eligible (this is their 'credit rating'; this provides a serious incentive for people to pay their bill in time)
 - ✓ People can take out a maximum loan \$500 (1mil pesos) and take out a new loan once it is paid back
 - ✓ The program only finances products that make a difference in the quality of life – not just anything. Examples are computers, construction materials, and currently piloting university tuition

Case Study D: Huellas (1/2)

- **Organization:** CORNARE, one environmental 'corporation'
- **Region:** Antioquia
 - ✓ Sonson
 - ✓ Algeria
 - ✓ San Francisco
 - ✓ San Luis
 - ✓ Cocorna
 - ✓ El Carmen de Viboral
 - ✓ San Carlos
 - ✓ San Rafael
- **Stove:** Fixed stove from a company in Bogota
- **Price:** 800,000-2 million pesos per stove, not affordable for poor families, so stoves are given out for free
- **Funding:** Local government and CORNARE, Finlandia, ISAGEN, EPM, Argos, Viva, Municipios y Comunidades
- **People assisted:** 2007-2011 – 14,000 + fixed stoves and as many orchards



Case Study D: Huellas (2/2)

Appendix

- **Best Practices**

Reforestation

Combines more efficient stoves with fuel wood production. Orchards are planted that take 3 years to grow, providing a family with a sustainable and continuous supply of fuel wood



Aptitude Development Strategy

Households are trained on care and **maintenance** prior to the project, during construction, and post-project. Still, people dislike cleaning the chimney

People are also trained on the need to save wood and trees

Local workers are trained in proper stove construction that ensures better emissions

- **Impact:**

- ✓ Reduce fuel consumption by 55% compared to traditional stoves.
- ✓ Reduce particulate emissions to the atmosphere of the home by 92% due to the cooking process.
- ✓ Reduce CO2 emissions generated by households by 86%.
- ✓ Reduce pressure on natural forests with wood consumption savings of 70,200 tons annually
- ✓ Analyze the potential to mitigate global warming in the joint project of reforestation, avoided deforestation and wood energy to establish a larger (national or regional).
- ✓ Improve the situation of women: Cooking hours reduced by 8, less violence in the home due to home being cleaner
- ✓ Hypothesis of improved lung capacity.