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## **Global Alliance for Clean Cookstoves**

**Brazil Feasibility Study**

*Intervention Options*



# 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).
- 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 sixteen such assessments 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, 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.*

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- Brazil has a very high penetration of modern fuels – LPG has reached 95% of the country's 60 million households; however 30% of households still rely on solid fuels to a varying degree
- The majority of solid fuel usage is in the economically underdeveloped and highly populated Northeastern states of Brazil and Northern Minas Gerais, and intervention in Minas Gerais has the potential to address 1.1 million households, and an intervention that includes North and Northeastern Brazil has the potential to address 6 million households
- Currently the majority of biomass users collect fuelwood easily, even in urban areas, making fuel switching costs high; however, in certain Northeast states charcoal is purchased sometimes at a higher cost than LPG, but in smaller increments
- Ethanol interventions cannot compete in cost with fuelwood and hence will only result in displacing LPG; ethanol is heavily regulated and there is currently no culture or infrastructure for ethanol cookstoves or cooking fuel
- The next step up from rudimentary woodstoves are the stoves typically assembled from store-bought components, which can get expensive. There are no pre-fabricated efficient woodstove solutions in the market that are cost-effective and target the Base of the Pyramid (BOP) market

- A cookstove program could span three intervention areas – 1) improving efficiency of biomass stoves, 2) increasing usage of modern fuels, and 3) leveraging alternate fuels in niche markets
- An efficient biomass BOP solution could be designed to address the higher income poor; for those within this segment who cannot afford or do not prefer the BOP stove, a lower cost components market could be created to enable incremental stove upgrades
- A cookstove program could explore ways to make LPG more affordable (lowering distribution and retail cost, lowering taxes and making subsidies more effective) and more accessible (introducing installment payment options or smaller canisters and increasing last-mile distribution)
- A cookstove program can explore ways to adopt ethanol as cooking fuel by making it cost-effective and establishing distribution channels to the consumer; however significant regulatory and supply hurdles exist that make ethanol unattractive for the Brazilian market in the immediate future; potential to lead the global ethanol as cooking market exists
- Ethanol as cooking fuel could be feasible if produced at a lower cost in community-owned micro distilleries; a cookstove program should conduct pilot studies to confirm the potential
- A cookstove program could serve niche technologies such as biogas or renewable palm byproduct to targeted markets that have cattle or harvest macauba

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# Brazil - Social Environment

**Brazil is the largest country in South America with a population of 191 million. Although 86% is urban, 29 million people still reside in rural areas**



## Context

- Recognized in 1825 as the largest country in South America
- Most populated urban areas are São Paulo, Rio de Janeiro and Salvador
- Official language is Portuguese
- 75% Roman Catholic, 15% Protestant, 10% Other

## Population Demographics

Measure	Brazil
Total Population (2010)	191 M
Population Growth Rate (2000-2009 CAGR)	1.19%
Rural / Urban Split	14% / 86%
Rural Population	29 M
Total Households	59 M
Rural Households	9.5 M
Average Household Size	3.2
Literacy – Total (%)	90%

• Growing as fast as the world (1.20%) but slightly slower than the rest of Latin American countries (1.23%)

• Lower than Latin America (21% rural population); however, significant number of people still reside in rural areas

## - Implications -

***Brazil has a large and growing population; therefore even if only a small percentage of the population were targeted by a cookstove program, the potential impact could be significant***



# Brazil - Political Environment

**Brazil is governed by a federal government; states are semi autonomous with independent administrative and executive branches**

**Brazil District Map**



**Administrative Map**

- Capital city is Brasilia
- Country is divided into 26 states
- States are subdivided into 5,564 municipalities (municípios) with an average population of about 34,000 each

**Political Environment**

## Structure

- Democratic republic with a President
- Three distinct political entities: the Federal District, the States, and the Municipalities
- Each municipality has an autonomous local Govt. with a Mayor and legislative body
- Relevant ministries: Environment, Health, Social Development, Economic Development, Agrarian Development, Science and Technology

## Current Government and Related Gov. Program

- Current Govt. has been led by President Dilma Rouseff since 2011, when he succeeded President Lula
- Bolsa Familia seeks to reduce poverty through a monthly stipend (R\$ 68 – R\$ 134) to families with per capita income below R\$ 140 per month; includes LPG subsidy of R\$ 15 every two months
- Ministry of Science and Technology has funds and can be potential investor

*"Government is very bureaucratic and decision making is very slow"*

*- Both NGOs and Private Sector*

## - Implications -

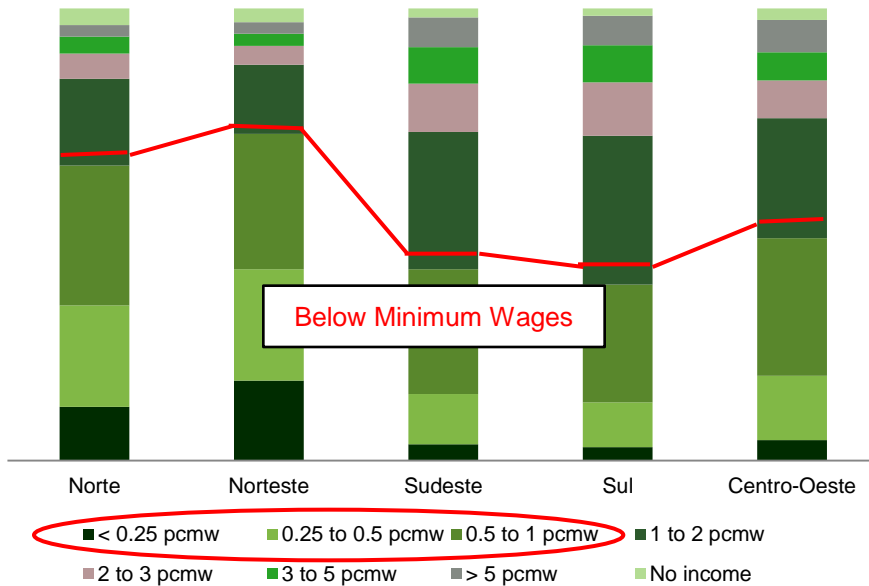
***Any intervention planning for government participation should carefully consider government priorities and their process of slow decision making***

# Brazil - Economic Environment

Sector Mapping

Brazil is a rapidly growing economy, with a free market offering favorable conditions for new businesses; however, 26% of the population remains under the poverty line

Per Capita Monthly Income (2009)



## Context

- Brazil has the seventh largest economy in the world (nominal GDP)
- The southern portion of the country is wealthier than the northern part

Country Economics

Key Indicators	Brazil
GNI Per Capita (2009)	USD 8,070
Economic Growth Rate (2010)	7.5%
Inflation Rate (April 2011)	6.5%
Unemployment (March 2011)	6.5%
Poverty rate	<ul style="list-style-type: none"> <li>• 26% of population (50 M) lives below poverty line</li> </ul>
Occupation (2004)	<ul style="list-style-type: none"> <li>• Services (34%)</li> <li>• Agriculture (21%)</li> <li>• Commerce &amp; Refitting (17%)</li> <li>• Industry (15%)</li> <li>• Construction (6%)</li> </ul>
Trade Restriction	<ul style="list-style-type: none"> <li>• Incentives available for export</li> <li>• Low restrictions on foreign ownership in selected sectors</li> </ul>
Micro finance institution	<ul style="list-style-type: none"> <li>• Various microfinance institutions are available with approx. 821K borrowers (2009)</li> </ul>

## - Implications -

***A development program should include the less developed areas in Northeast of Brazil, which would stand to benefit most from a local industry***

# Why Minas Gerais?

This study focuses on the South Eastern state of Minas Gerais as a potential region to develop a clean cookstove pilot that can be scaled to North East Brazil

- Mimics the economic diversity of Brazil within the state
- Strong cultural attachment to woodstove cooking
- High percentage of population dependent on solid fuels
- Strong manufacturing and distribution capabilities
- Two efficient woodstove companies (Ecofogao and Energer) located in capital city Belo Horizonte
- Borders North and Northeastern states of Brazil which could be high priority areas for cookstove intervention
- Availability of alternate fuels such as ethanol, biogas and palm oil

## - Implications -

***Minas Gerais is a good testing ground for a cookstove sector; any intervention here can be scaled to North Brazil***

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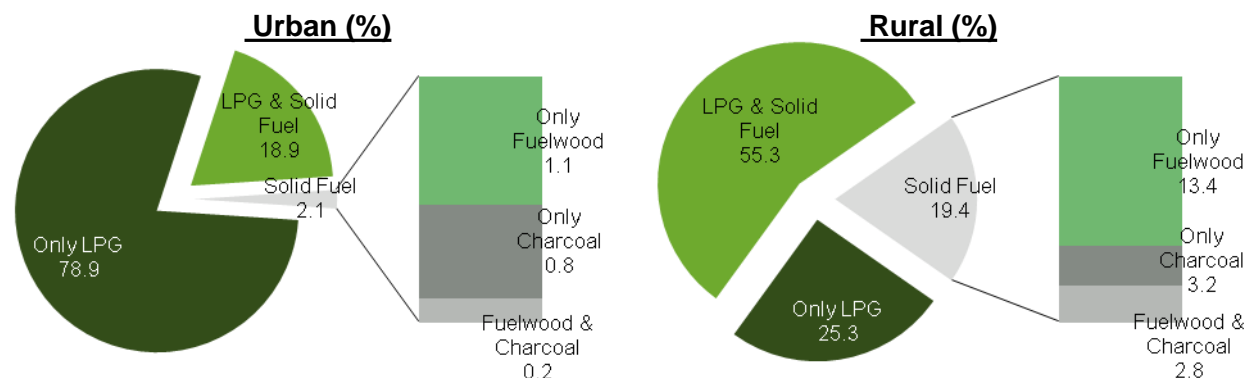
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# Solid Fuel Usage in Brazil

Sector Mapping

While the majority of the population uses LPG for cooking, a significant proportion of the population still uses solid fuels as either a primary or secondary fuel

Household Energy Consumption  
Brazil (2003)



IAP Impact  
Annual Incidence Rate  
Brazil (2003)

## Mortality from Solid Fuel Use

- 1,360 ALRI deaths (age <5)
- 2,640 COPD deaths (age 30+)
- 80 lung cancer deaths (age 30+)

## Morbidity from Solid Fuel Use

- 110K disability adjusted life years

## National Disease Share

- 0.3% of national burden of disease attributed to solid fuel use

Household Energy Consumption	Urban Households	Rural Households	All Households	All % of Total
Only LPG	39,520 K	2,417 K	41,937 K	70%
LPG and Solid Fuel	9,464 K	5,274 K	14,738 K	25%
Only Solid Fuel	1,084 K	1,845 K	2,929 K	5%

Source: IBGE

Primary LPG

Primary Fuelwood

## - Implications -

**Considering the number of households, solid fuel usage is significant in urban as well as rural areas; a cookstove program could be included in both regions**

Sources: 1. Food and Agricultural Association of the United Nations, 2. WHO

# Indoor Air Pollution Awareness Level

Sector Mapping

Both the Government and NGOs (with some exceptions) fail to acknowledge IAP to be an urgent or significant issue in Brazil

	<u>Awareness Level</u>	<u>Awareness Type</u>	<u>Comments from the Field</u>
<b>Federal Government</b>	Low	<ul style="list-style-type: none"> <li>Government does not consider IAP a significant issue in the country because of high LPG penetration</li> </ul>	<p>"It is hard to get the Federal Government's attention on IAP"</p> <p>- Ethanol cookstove program</p>
<b>State / Local Government</b>	Low	<ul style="list-style-type: none"> <li>Some state governments in the Northeast are funding cookstove programs</li> <li>In general very limited participation as not a focus area</li> </ul>	<p>"Government actions are politically motivated, not sure whether they understand the benefits of a clean cookstove"</p> <p>- Cookstove program on State Govt. partner</p>
<b>NGOs</b>	Moderate	<ul style="list-style-type: none"> <li>Several international NGOs are involved in cookstove dissemination</li> <li>No awareness raising or marketing campaigns</li> </ul>	<p>"We have tried to engage &lt;a global NGO&gt; however they have repeatedly declined interest in a cookstove program"</p> <p>- Cookstove program coordinator</p>
<b>Consumer</b>	Moderate	<ul style="list-style-type: none"> <li>As per Winrock survey, 84% of households are aware that smoke from fuelwood combustion can cause respiratory illness and burns</li> <li>No cultural attachment to smoke</li> </ul>	<p>"Though not fully knowledgeable of the risks or consequences of biomass stoves, most respondents feel that smoke has no beneficial side effects"</p> <p>- Winrock International Report</p>



# IAP in Minas Gerais and NE Brazil

Sector Mapping

In Minas Gerais and Northeast Brazil, IAP is caused by use of traditional open fire woodstoves in poorly ventilated rooms

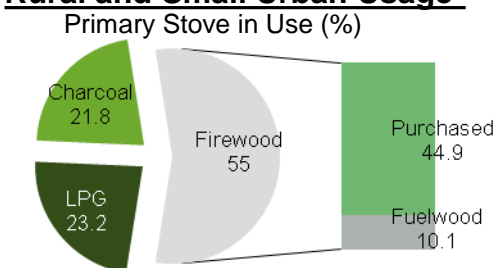
## IAP Cause

## Scenes

## Rural and Small Urban Usage\*

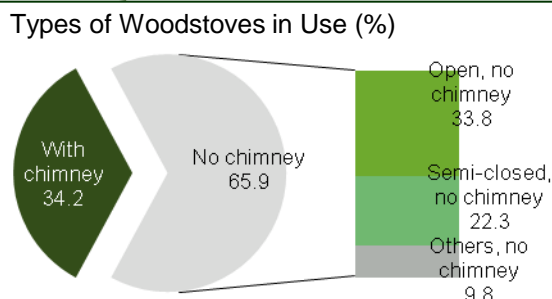
## Comments

### Cooking Fuel



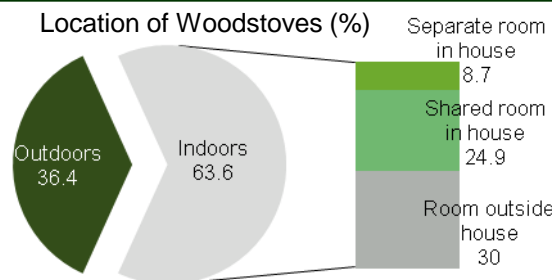
- High emissions from burning large logs
- Fuelwood is often-collected from construction debris - increasing toxicity

### Cooking Device



- Most stoves have chimneys, but these are often poorly maintained
- Open fires provide no protection from smoke

### Cooking Location



- Poor ventilation increases the magnitude of smoke exposure
- Outdoor stoves are often attached to homes

## - Implications -

**Minas Gerais has a need for a cookstove intervention– which can then be scaled for Northeast Brazil**

Sources: Winrock International Study (2007)

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\*Data available only for these segments

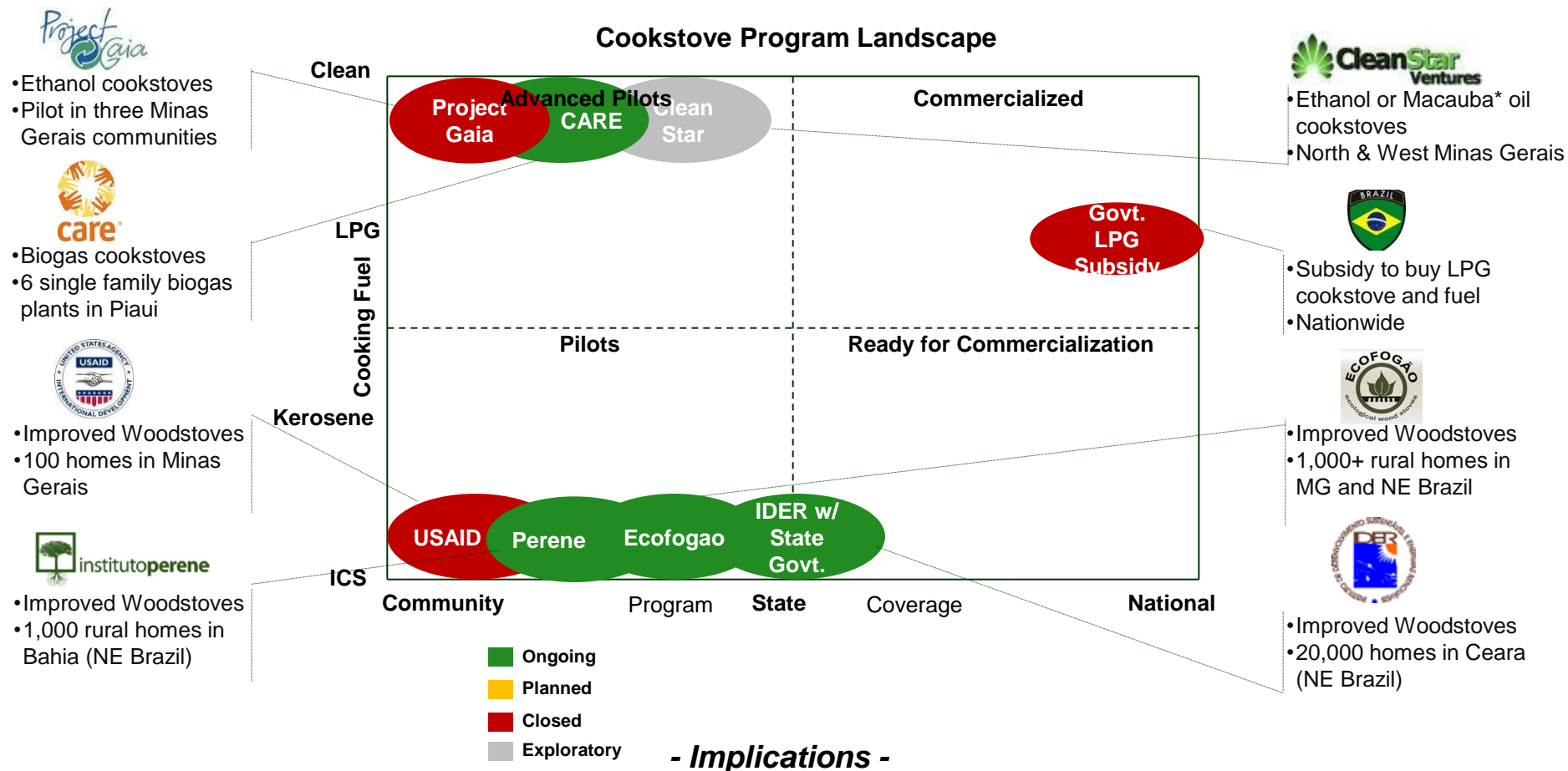
15 Small urban defined as towns with less than 15,000 people



# Cookstove Programs

Sector Mapping

The few ongoing clean cookstove initiatives are focused in the North and Northeast of Brazil and mainly disseminate efficient woodstoves; however, there are recent pilots which focus on alternate fuels



## - Implications -

**No programs currently focus on the state of Minas Gerais. A cookstove program may benefit from coordination or knowledge sharing with existing programs**

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# Consumer Cooking Habits

Sector Mapping

**Minas Gerais' cuisine is famous for being prepared on woodstoves, and consists of a minimum of three dishes which requires the use of large oven stoves**

## Typical Meals in Minas Gerais

- Bread, corn dish and coffee for breakfast
- Beans, rice, vegetables and meat for lunch and dinner
- Traditional baked cheese bread
- Strong preference for slow-cooked and woodstove prepared meals



## Typical Meals in Northeast

- Varies based on states – generally smaller meals because of lower affordability
- Maranhao and Piaui use charcoal

## Cookstove Requirements

- Multiple burners for multiple dishes, hot plate and oven
- Pot holes for high intensity heat
- Table mounted stoves
- LPG for fast preparation – breakfast, reheating, or baking
- Connected water heating system

## Cookstove Requirements

- Smaller two-burner stoves suffice
- Charcoal stoves in some states

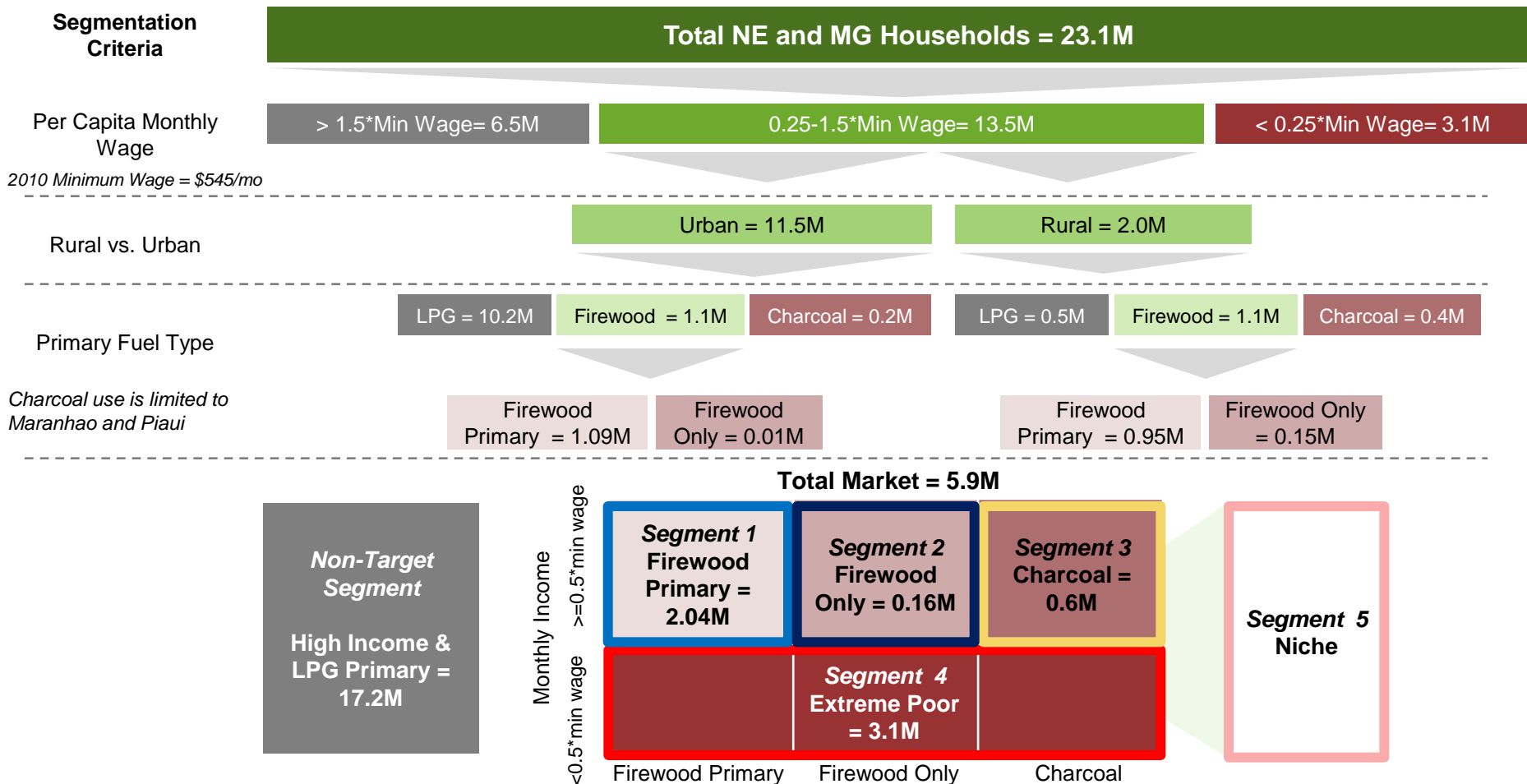
## - Implications -

***While it would be difficult to displace a woodstove from the Minas Gerais culture, its use could be reduced and made more efficient. Any stove design should incorporate local taste and needs***

# Consumer Segmentation

Sector Mapping

Households in Northeast Brazil and Minas Gerais can be segmented into 5 cookstove segments



## - Implications -

**Each segment has distinctive characteristics; differentiated cookstove program designs are required to tailor to the needs of the segments**

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# Available Cookstove Usage and Cost

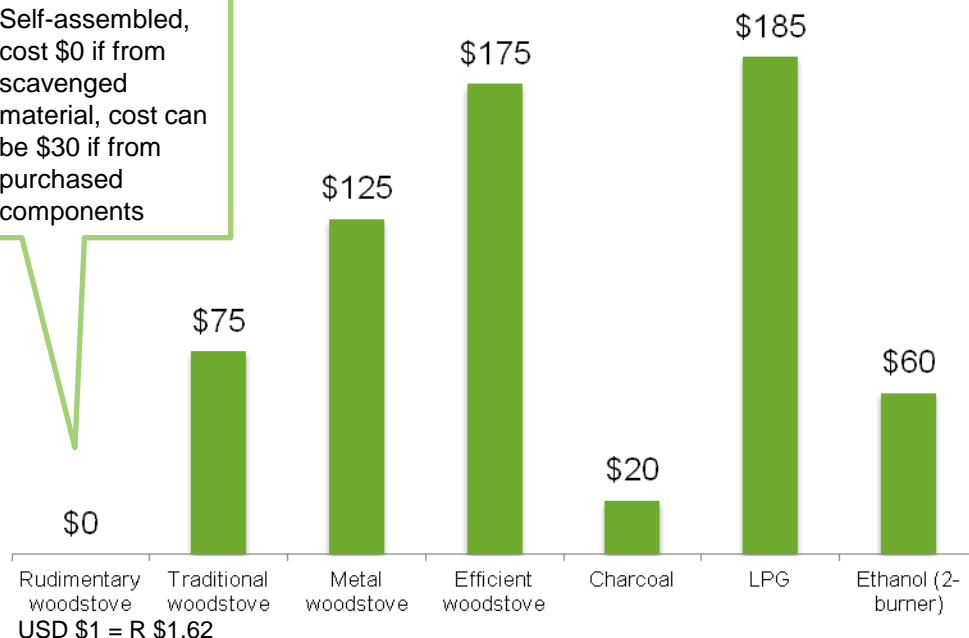
**LPG stoves and locally assembled woodstoves are the prevalent cookstove technology. Clean and efficient stoves are available but penetration is low; prices are high due to multiple burner requirement**

## Cookstove Usage

### Approximate Upfront Cost of Cookstove (in USD)

Three or more burners except for ethanol stove

Self-assembled, cost \$0 if from scavenged material, cost can be \$30 if from purchased components



- A traditional woodstove is purchased in parts and assembled at home; chimneys are optional and no efficiency is built into the design; stove life is 7-8 years
- Traditional stoves sometimes fuel water heating systems
- Metal woodstoves, popular in South Brazil, have not penetrated the North and Northeast due to the strong existing preference for traditional stoves; while cleaner in design, they are inefficient and pose IAP risk if not maintained
- Efficient woodstoves\* are very nascent and expensive, and have not reached critical volume for economies of scale
- Charcoal stoves are smaller (1-burner) and have a life of less than 5 years
- 95% of households have four burner LPG stoves and access to LPG fuel, but usage may be limited in poor and rural homes for economic reasons
- Currently ethanol stoves are not used or manufactured in significant quantities in Brazil

## - Implications -

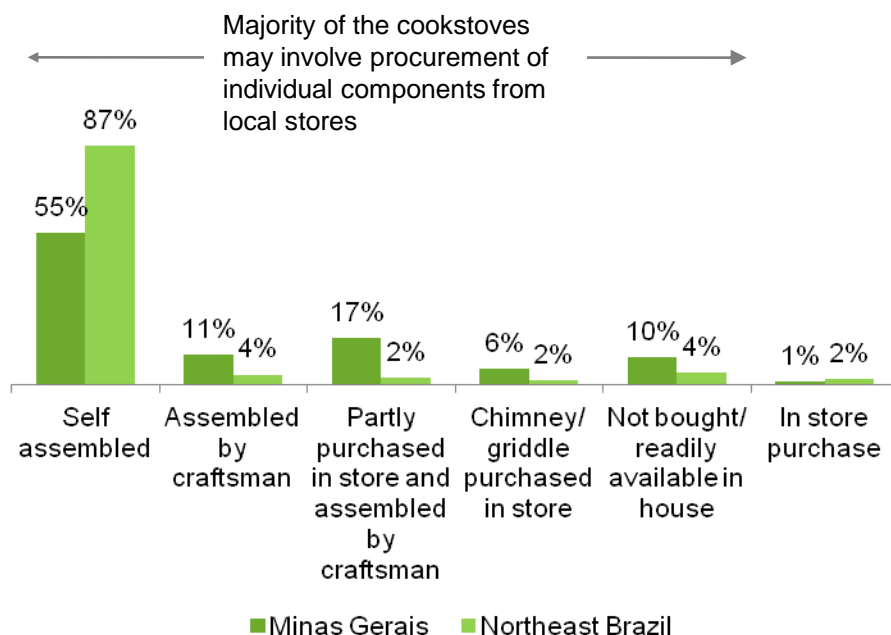
**A cookstove program should explore the option of leveraging existing stove penetration. Cookstoves should be designed to be cheap and long lasting for obvious economic benefits**

# Basic Components of Woodstove and Cost

Sector Mapping

**A large percentage of woodstoves, used by primary woodstove users, are either self assembled or made by local craftsmen**

Sources of Woodstoves among Primary Woodstove Users



\*Figure may not add up to 100% due to rounding error

Basic Components of a Woodstove and Average Prices

 <p><b>Griddle</b> R\$ 40-60</p>	 <p><b>Chimney</b> R\$ 27-37</p>
 <p><b>Rocketstove Chamber</b> Currently unavailable</p>	 <p><b>Bricks and Cement</b> R\$ 10-80</p>
 <p><b>Oven</b> R\$118-160</p>	 <p><b>Water Heater</b> N/A</p>

## - Implications -

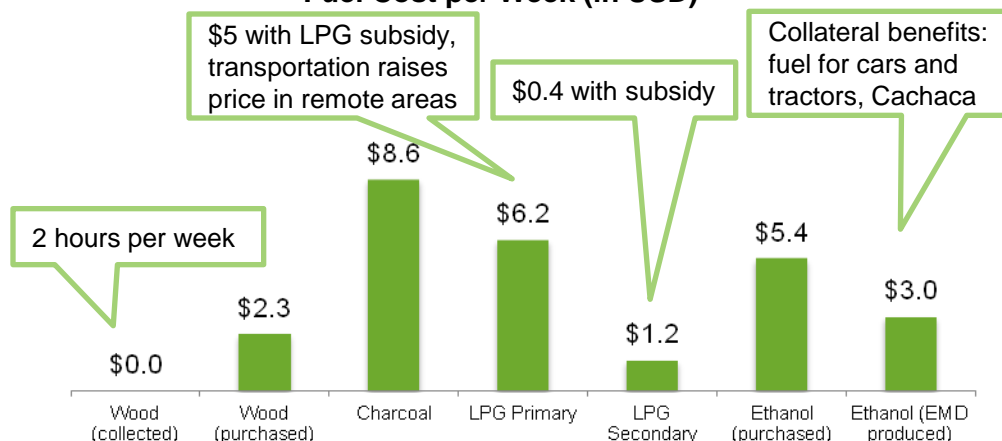
***A cookstove program should explore the opportunity of increasing the accessibility of cookstoves to the lowest income group by reducing the cost of individual parts***



# Available Fuel Cost

The majority of fuelwood is collected and therefore creates little/no costs to consumers; while fuelwood substitution options are available, they remain either high in cost (LPG) or less available (ethanol)

Fuel Cost per Week (in USD)



Assumptions

Fuel	Purchase Unit	Usage	Cost
Wood (purchased)	1 wagon	1 month	R\$15 / \$9
LPG Primary	13 kg bottle	1 month	R\$40 / \$25
LPG Secondary	13 kg bottle	5 months	R\$40 / \$25
Ethanol (purchased)	1 litre	1 day	R\$1.25 / \$0.75
Ethanol (EMD produced)	1 litre	1 day	R\$0.7 / \$ 0.45

USD \$1 = R \$1.62

## - Implications -

**Considering collecting fuelwood is generally free, a cookstove program suggesting alternate fuels should add strong economic value**

Sources: Winrock International Study (2007), field visits, interview with Ministry of Environment

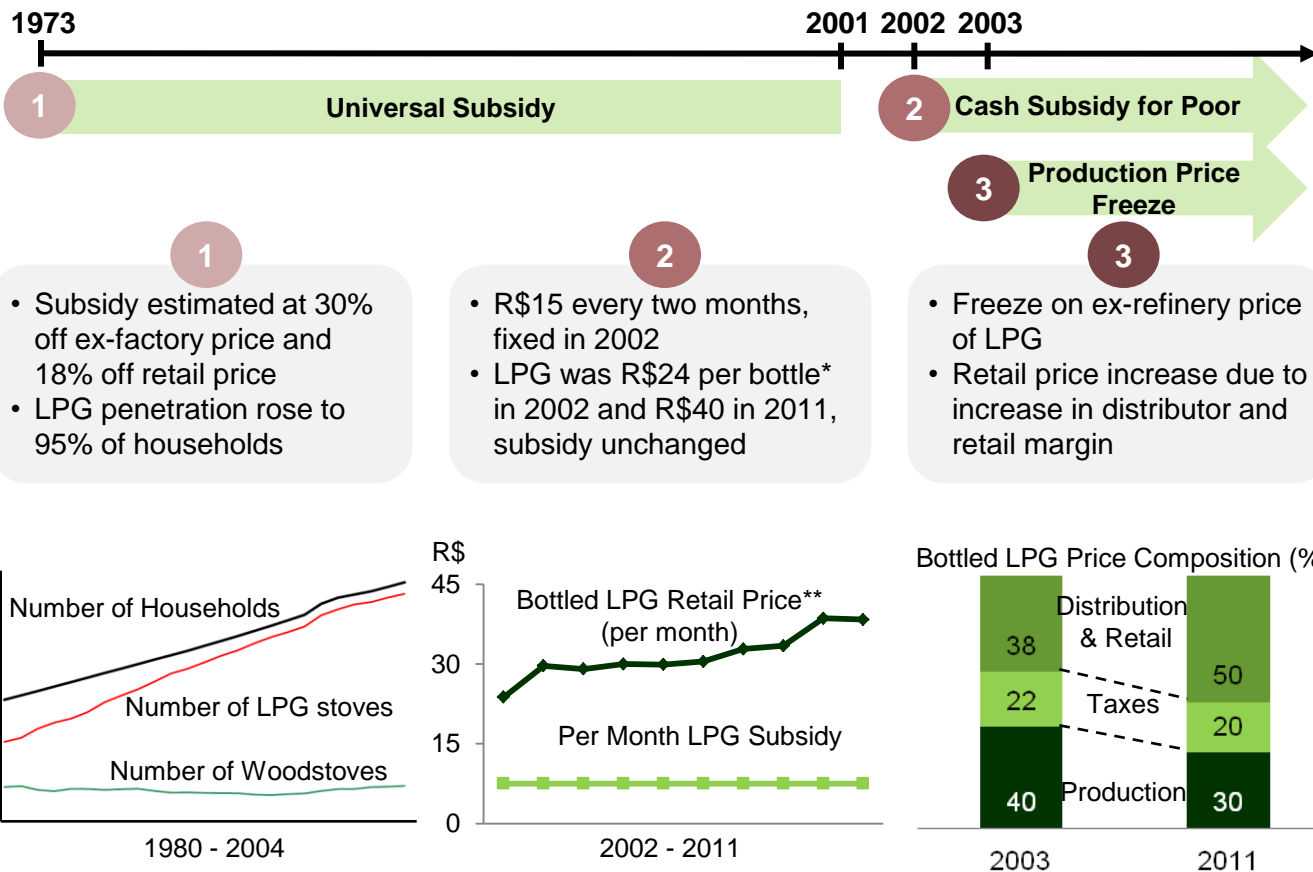
## Fuel Usage

- As per the Winrock survey, 76% households collect while 24% purchase fuelwood; avg. consumption is 10kg per day and avg. time spent collecting is 2 hours per week
- Select states in the Northeast pay R\$60 per month for charcoal, making it more expensive than LPG; barrier to adopt is a high upfront cost for LPG
- LPG cash subsidy of \$7.50 per month for low income families has little impact on cost; in many low income households LPG is stretched to last for 5-6 months
- Ethanol fluctuates in price and may not always be cost effective; ethanol supply depends on price of sugar in international market
- There are collateral benefits to modern fuel:
  - Time saved in collecting fuelwood
  - Ethanol from EMD can be used for personal vehicles (cars, tractors, etc.)
  - EMDs can also be used to produce cachaca, native alcoholic drink

# Brazil LPG Story

Sector Mapping

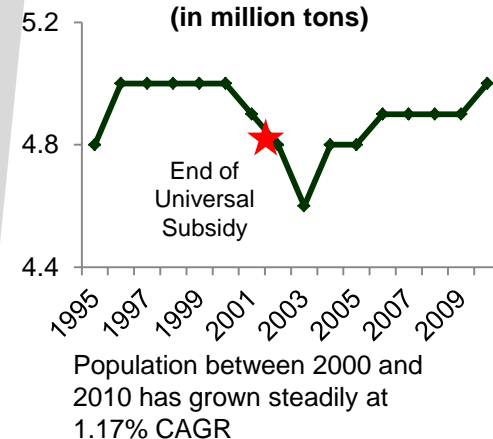
**While the Universal LPG subsidy drove penetration to 95% households, current LPG subsidies have not kept up with LPG's retail prices**



## Resulting Impact

- Poor families in both urban and rural areas switched to fuelwood as their primary cooking fuel
- LPG subsidies collected every two months by poor families but LPG bottle is stretched to last 5-6 months

## Bottled LPG Sales per Year (in million tons)



## - Implications -

**A cookstove program needs to address the segments excluded from LPG usage due to rising LPG retail prices**

Sources: Jannuzi & Sanga (2004), Winrock International, Sindigas, Ministry of Mines and Energy

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\*LPG is sold in 13kg bottles, not verified if cash subsidy is used for LPG

\*\*Assuming consumption is one bottle per month

# Brazil's Ethanol Story

**While ethanol is easily available and cheaper than LPG, price fluctuations and unclear regulation contribute to an unstable supply chain for cooking fuel**

## Production

- Production mainly in Central and Southeast Brazil – Sao Paulo (60%), Parana (8%), Minas Gerais (8%) and Goias (5%)
- Production and price depend on sugarcane harvest and sugar demand
- Producers cannot sell to consumers directly

## Regulation

- ANP is the regulating agency
- In 2002, Govt. prohibited the sale of liquid alcohol in supermarkets and pharmacies\*, law was challenged and retailers continue to sell
- Containers for packaging ethanol must be certified by INMETRO
- Law prohibits transport of liquid fuel on public transport and storage of liquid fuel at home

## Retail

- Retailed in two ways –
  1. Alcohol gel and liquid, in certified containers of 500ml and 1,000 ml, in pharmacies and supermarkets
  2. At gas stations, as transport fuel
- Alcohol sold in supermarkets and pharmacies is twice the price at gas stations
- Available in smaller quantities

## Ethanol Price Composition

- Price at gas station at time of study = USD 0.75 per liter
- Production cost = USD 0.25 per liter
- Taxes = 15% to 30% (USD 0.11 to USD 0.23 per liter), depending on state
- Rest is retail and distribution cost

## Supply

- In early 2011, Brazil had to import ethanol to make up supply shortages caused by a poor sugarcane harvest

## - Implications -

***An ethanol cookstove program could work with the Government and producers to stabilize supply and make ethanol available at a cost-effective price point***

# Ethanol For Cooking

Sector Mapping

**Certain organizations are investigating technology and models that can make ethanol (cooking usage) feasible, if not domestically, then at least internationally**

## Ethanol Micro Distillery (EMD)



- Communities/households can produce up to 30,000 liters per month for local consumption (cooking and transport) without regulation)
- EMDs produce between 400 to 5,000 liters per day at R\$ 0.65 (USD 0.40) per liter
- EMDs cost USD 80K onwards
- Cachaca producers can fit an ethanol processing module and can potentially use corn waste materials

## Last-Mile Distribution



- Current domestic ethanol stoves have fiber lined canisters to store ethanol, minimizing spillage or leakage
- Possibility of creating distribution model similar to LPG – exchange empty canister for a full one
- Project Gaia is working with the Government to further understand and address last-mile distribution constraints

## Ethanol for Domestic Use Initiative (EDUI)



- Project designed by Brazil and Italy, aimed at sustainably increasing the use of ethanol as a cooking fuel in developing countries
- For example, ethanol donations from Brazil and Italy have enabled EDUI to restore Ethiopia's ethanol cookstove program
- Future phases envision building technical capacity for local bio-fuel production and implementing a bio-fuel production chain

## - Implications -

***Community-owned EMD could be a potential solution for sugarcane growing regions; there is potential for ethanol to become a global player in the cooking sector***

# Brazil Macauba Story

**Macauba is a native palm tree that can yield renewable biofuel for diesel and biomass for cooking; several pilot programs are currently exploring its potential commercial value**



## Context

- Native Brazilian palm tree abundant in Minas Gerais
- Sustainable plant oil source for biodiesel - has potential of yielding 6.5 tons of oil per hectare
- Oil from kernels can be used for cosmetics
- Mesocarp/husk from oilseeds can be used as cooking fuel to replace wood/charcoal

## Macauba Investments

- Minas Gerais' State Secretariat for Agriculture has two pilots to test commercial viability
  - Local farmers to harvest Macauba from existing native trees and/or commercial plantations
  - Fruit sent to a processing facility for oil extraction
  - Oil purchased as base for biodiesel
  - Potential to distribute byproduct to plantation workers and surrounding communities for fuel use
- Petrobras granted R\$ 4.7 million to University of Vicosa for Macauba research; committed to purchase oil from Government pilots for biodiesel
- Entaban\* plans to process Macauba oil based biodiesel in Lima Duarte, Minas Gerais; Currently has 1.5 million plant seedlings and plans to cultivate ~12,000 hectares

## **-Implications –**

**A cookstove program could also explore the opportunity of utilizing Macauba oil as an alternative cooking fuel source**



# Cookstove Industry Value Chain

Sector Mapping

**A commercial cookstove supply chain already exists in Brazil; but currently only focuses on LPG and wood-fired cookstoves**

	Manage Program				Raise Awareness			Provide & Support Stoves									
Key:	Coordinate Program	Provide Funding	Coordinate Project (Region)	Centralize Act. (Mktg, Ops, Fin)	Educate on IAP	Raise product awareness	Run promotional activities	Import & retail stoves	Design stoves	Test Stoves (Efficiency, etc)	Train Stove Manufacturers	Supply materials to make stoves	Transport mat. to Manufacturer	Make stoves	Transport stove to customer	Install Stoves	Maintain Stoves
Full capability																	
Partial capability																	
Basic capability or potential																	
No capability																	
<b>Federal/State Govt., USAID, Private Companies (Donor)</b>																	
<b>State/Municipal Govt. (Regional Coordinating Org)</b>																	
<b>Credit Card Companies (Financial Institutions)</b>																	
<b>Banco do Povo, etc. (Micro Finance Institutions)</b>																	
<b>CARE, IDER, Perene Ambiental PV (Cookstove Related NGOs)</b>																	
<b>Ecofogao, Energer (Efficient Stove Mfrs/Technology Provider)</b>																	
<b>Petricosky, Maestro, Venax (Stove Manufacturers)</b>																	
<b>Local Entrepreneurs (Import, Retail &amp; Distribution)</b>																	
<b>Centro Cape (Local NGOs)</b>																	
<b>FIEMG, SIAMIG, SEBRAE (Trade Associations)</b>																	

• Well developed cookstove supply chain for metal woodstoves in the South and for charcoal stoves in Maranhao and Piaui

• High participation from the private sector

## - Implications -

***A clean cookstove program could leverage Brazil's mature cookstove market, strong existing manufacturing sector, distribution network, and retail facilities to shorten the time to market***

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# Major Industry Gaps

Intervention Options

Careful consideration of the sector mapping outputs have led to the identification of a set of notable gaps or needs in the current industry landscape

## *Cost Effective Solutions*

- The cookstove industry in Brazil, while quite advanced, is still in the design & experimentation phase without an appropriate design nor sufficient economies of scale to achieve an affordable solution for low income households

## *Targeted Solutions by Segment Attributes*

- No marketing strategy has been developed to account for the distinct attributes of consumer segments and provide tailored solutions which account for niche factors such as biogas or access to alternate bio-fuels

## *Solution & Product Awareness*

- Despite moderate awareness of IAP and an aspiration for improved solutions, product adoption has been hampered by limited solution knowledge and awareness

## *Government & Agency Support*

- Government and agency support for IAP & cookstove initiatives is limited and the issue does not rank high in the list of priorities for Brazil

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**Executive Summary**

**Sector Mapping**

**Intervention Options**

**Intervention Areas & Priorities**

**Priority 1: Biomass**

**Priority 2: Modern Fuels**

**Priority 3: Niche Strategies**

**Operational Plan**

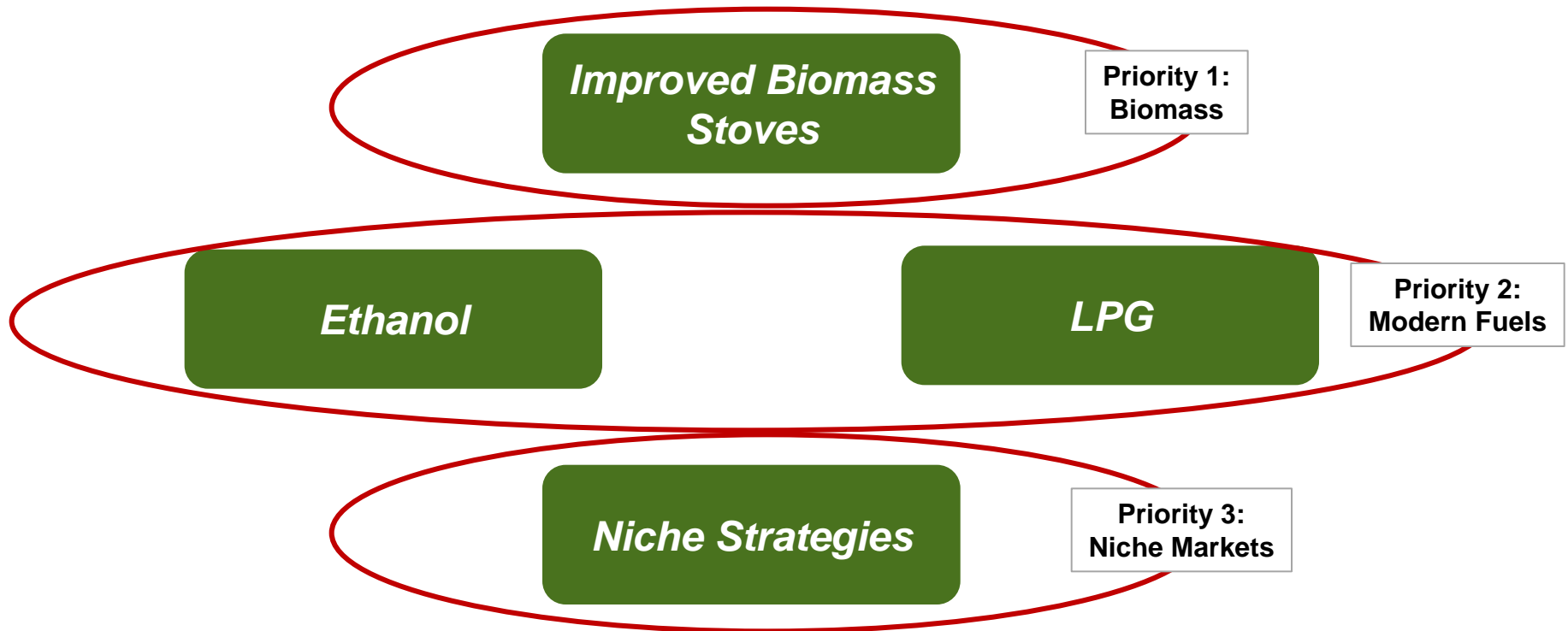
**Appendix**

# Potential Intervention Options – Intervention Areas

Intervention Options

To reduce IAP and deforestation in Brazil, support for the growth of the clean and efficient cookstove industry could be explored in four primary intervention areas:

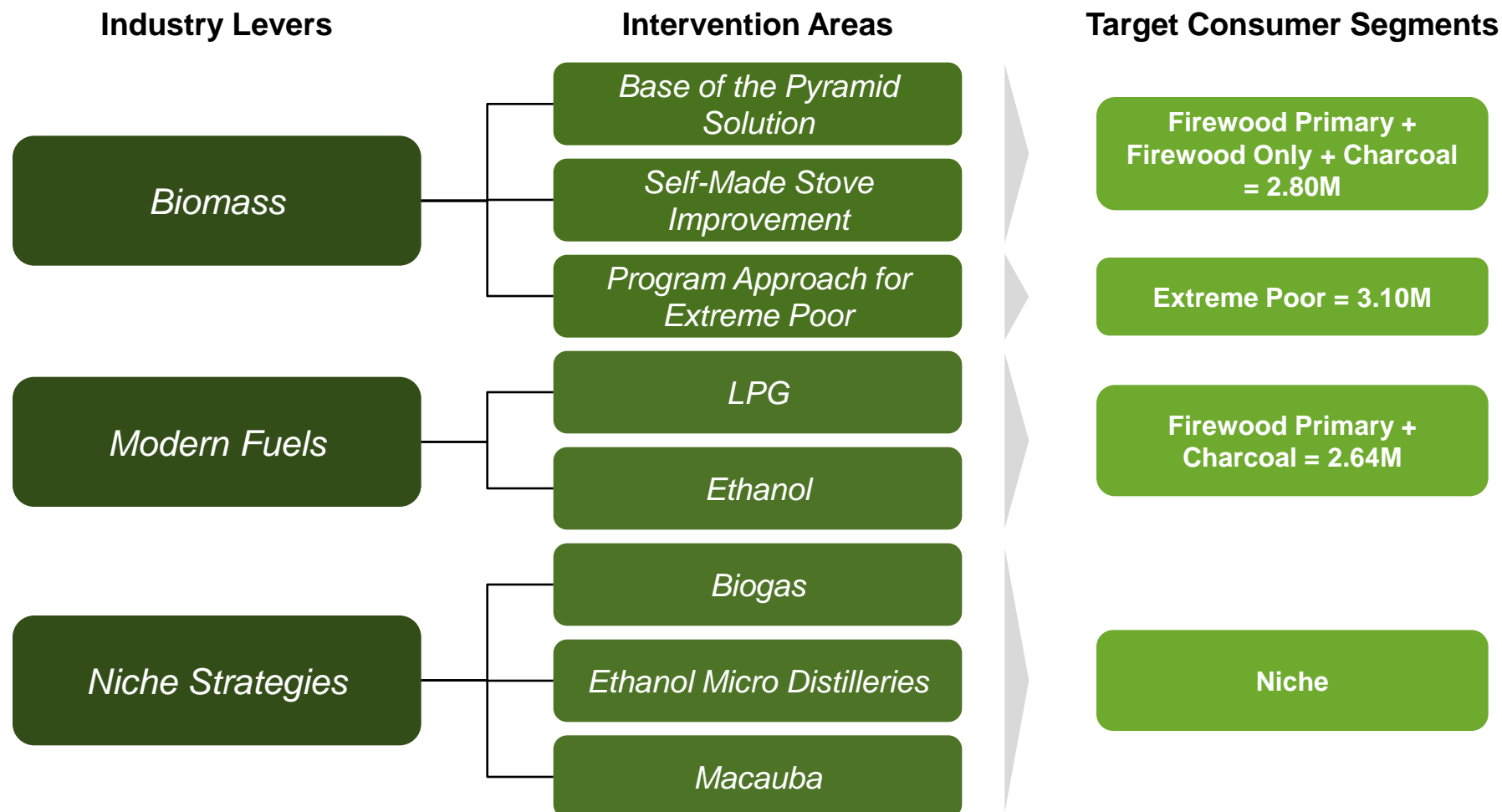
## Possible Intervention Areas



# Intervention Options – Intervention Areas

Intervention Options

Within these levers lie a number of key intervention areas with specific interventions where the clean cookstove industry could enable adoption in targeted consumer segments



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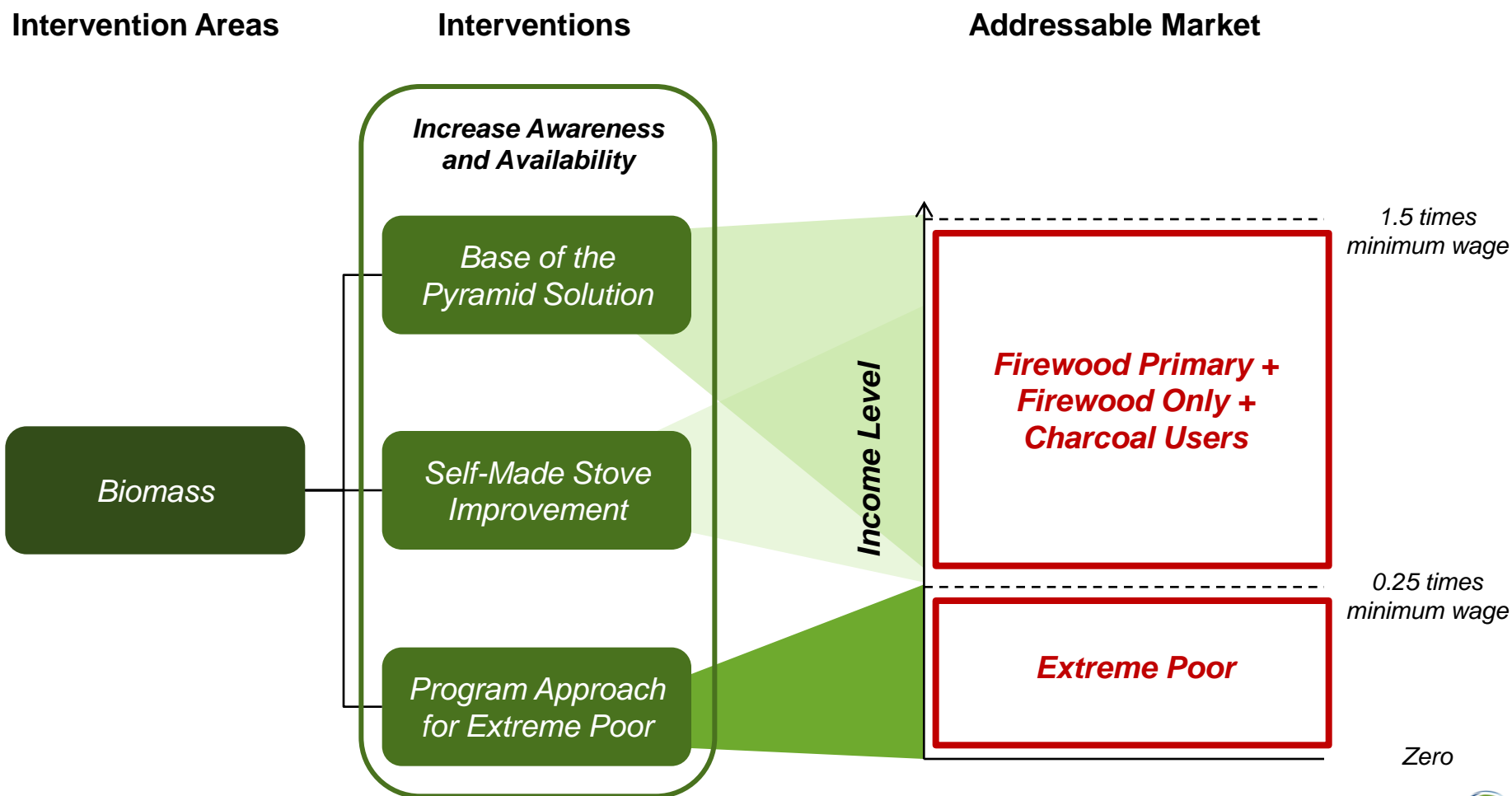
**Operational Plan**

**Appendix**

# The Addressable Market – Biomass

Intervention Options

To reach the entirety of the biomass users, a three-pronged solution approach for all income levels is recommended, complemented by issue and solution awareness raising activities



# Intervention Options – Base of the Pyramid Solution

Intervention Options

The lack of an affordable efficient biomass solution represents the largest opportunity for a potential intervention to promote clean cookstoves and fuels

## Intervention Areas

## Interventions

## Situation

### Biomass

*Base of the Pyramid Solution*

*Self-Made Stove Improvement*

*Program Approach for Extreme Poor*

### Modern Fuels

*LPG*

*Ethanol*

### Niche Strategies

*Biogas*

*Ethanol Micro Distilleries*

*Macauba*

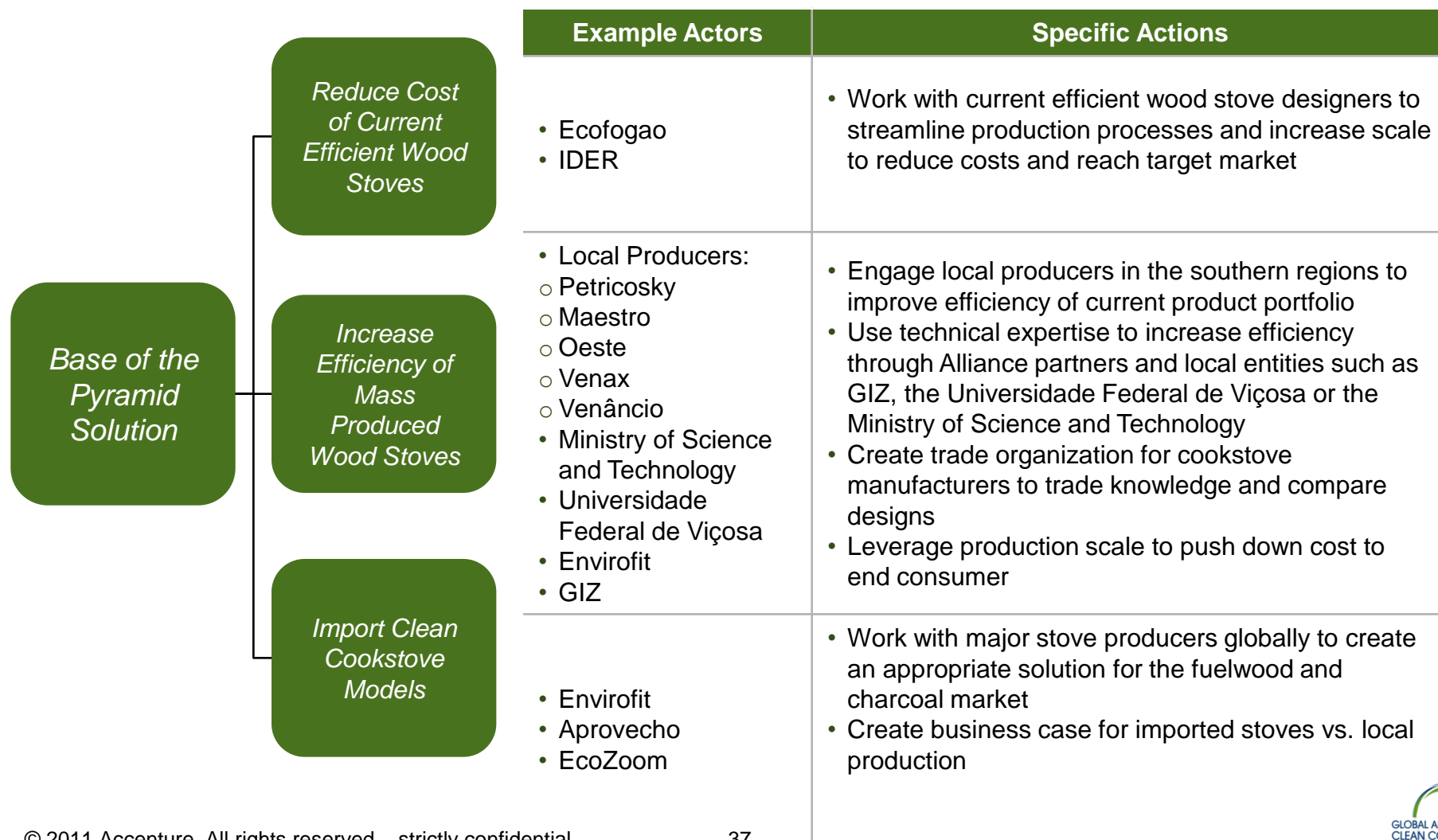
- Majority of wood users collect wood for free, undermining the economic argument to switch to modern fuels
- Charcoal users pay for charcoal
- There is currently no affordable, efficient biomass cookstove solution for low-income families
- Current mass-produced stoves are costly and inefficient but have sufficient scale to potentially achieve low cost
- Low product awareness for efficient woodstoves and limited supply available



# A Solution for the Base of the Pyramid

Intervention Options

An appropriate solution for the base of the pyramid could be achieved by reducing costs of current efficient stoves, increasing the efficiency of local mass-produced stoves, or using an imported model



# Intervention Options – Self-Made Stoves

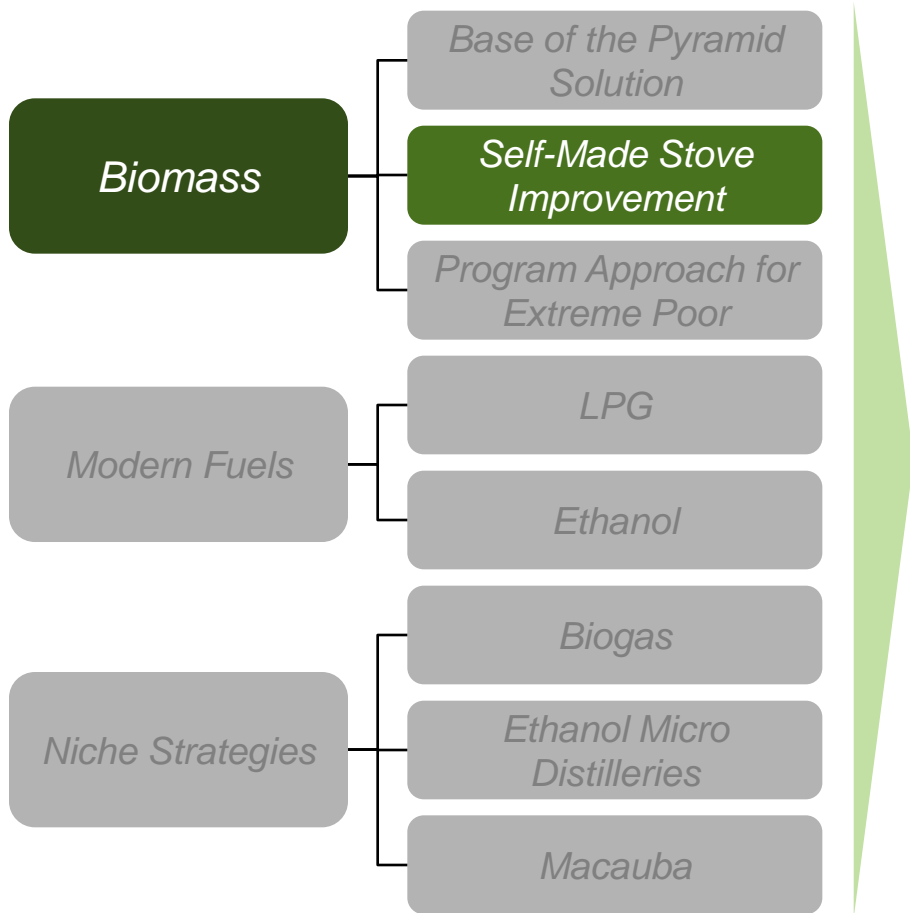
Intervention Options

With many people self-assembling stoves, the Alliance can intervene by helping reduce the cost of stove components and promoting the use of efficient stove designs

## Intervention Areas

## Interventions

## Situation

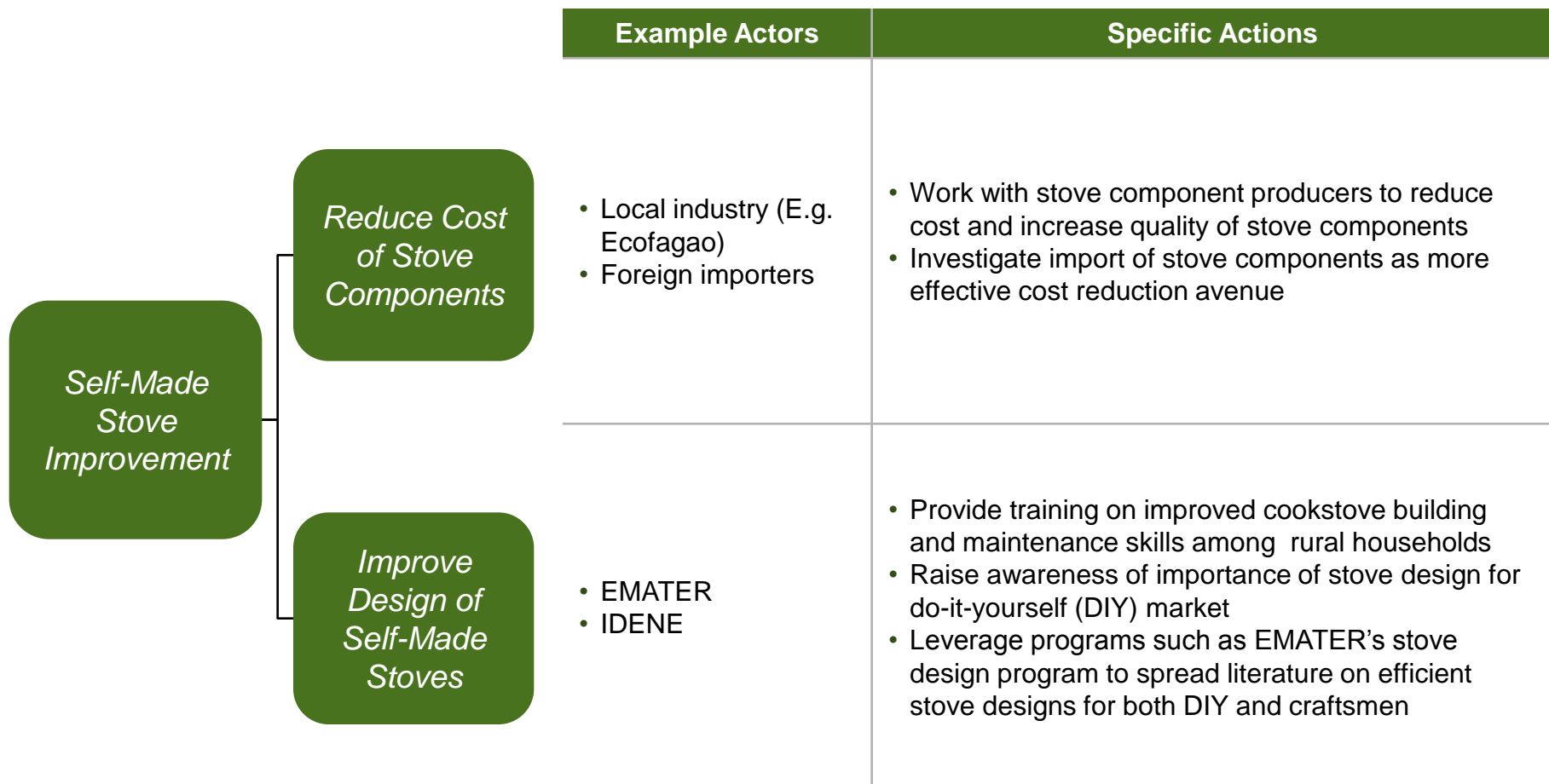


- Many stoves self-assembled with store-bought components or using scrap
- Self-assembled stoves are usually highly inefficient and have high emissions
- Stove components such as the chimney and griddle are often store-bought, but prices remain quite high
- For those with financial means, a craftsman is sometimes brought in to design and construct the stove
- Craftsman assembled stoves are often more efficient than self-made stoves, but still lack the basic design principles to be considered an ICS
- EMATER's program of distributing design pamphlets for self-made traditional stoves has had some success, though adoption volume is unknown

# Improving Self-Made Biomass Stoves

Intervention Options

For those who self-make stoves, efficiency can be enhanced by reducing the costs and improving the quality of stove components, as well as providing individuals and craftsman with efficient designs



# Intervention Options – Addressing the Extreme Poor

Intervention Options

For the poorest consumers with very limited buying power, a programmatic approach is recommended to provide subsidized stoves through government and agency channels

## Intervention Areas

## Interventions

## Situation

### Biomass

*Base of the Pyramid Solution*

*Self-Made Stove Improvement*

*Program Approach for Extreme Poor*

### Modern Fuels

*LPG*

*Ethanol*

### Niche Strategies

*Biogas*

*Ethanol Micro Distilleries*

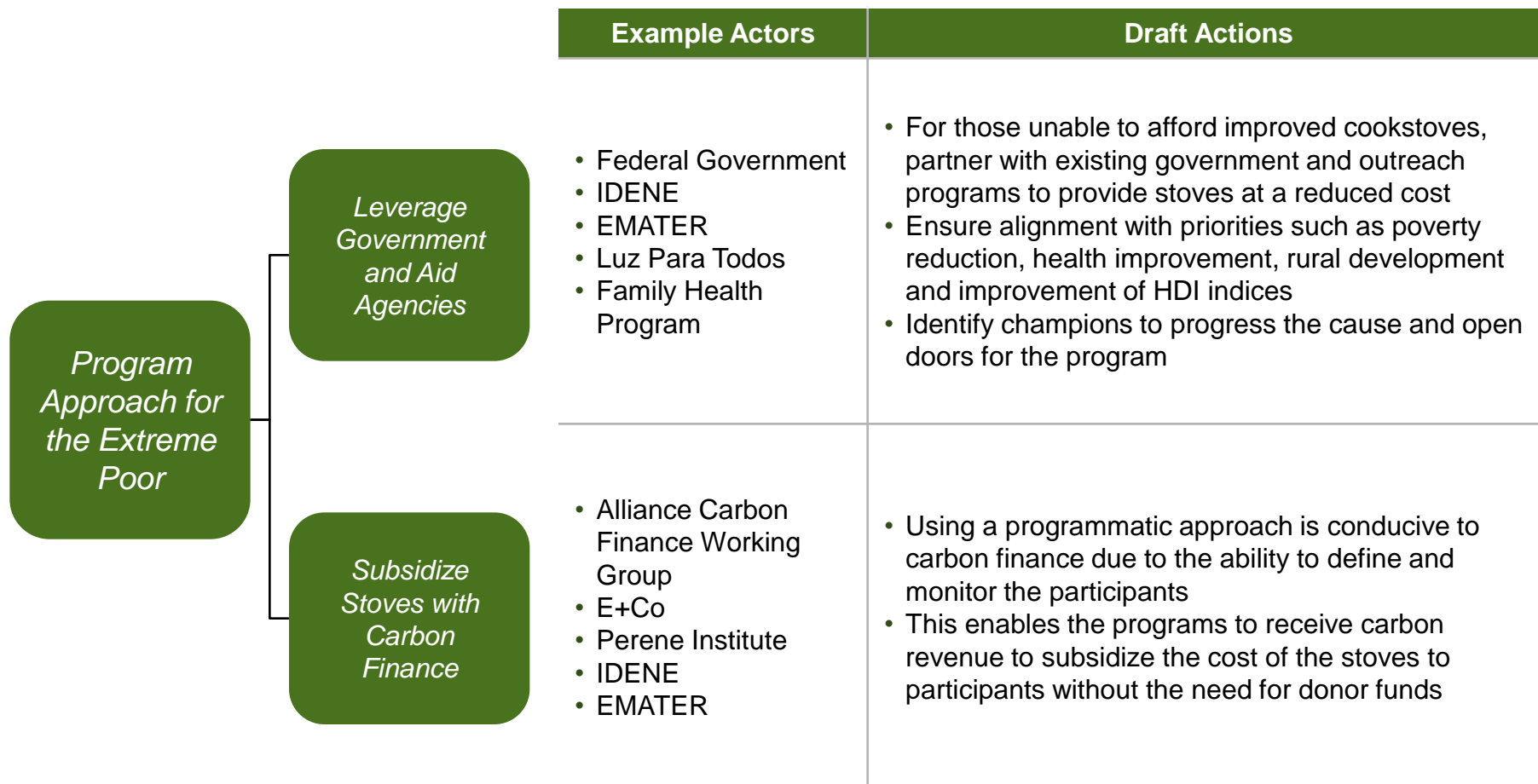
*Macauba*

- Strong culture of wood use in Brazil
- Vast majority of wood users collect, complicating the economic argument to switch to modern fuels
- Many stoves self-assembled with store-bought components
- Current assembled stoves are inefficient but have sufficient scale to achieve low cost
- Efficient stove production is small scale and costs are high
- Low product awareness for efficient woodstoves

# Reaching the Extreme Poor

Intervention Options

To reach the extreme poor, existing government and NGO programs should be leveraged to provide cookstove solutions using carbon finance and donor funds to subsidize costs

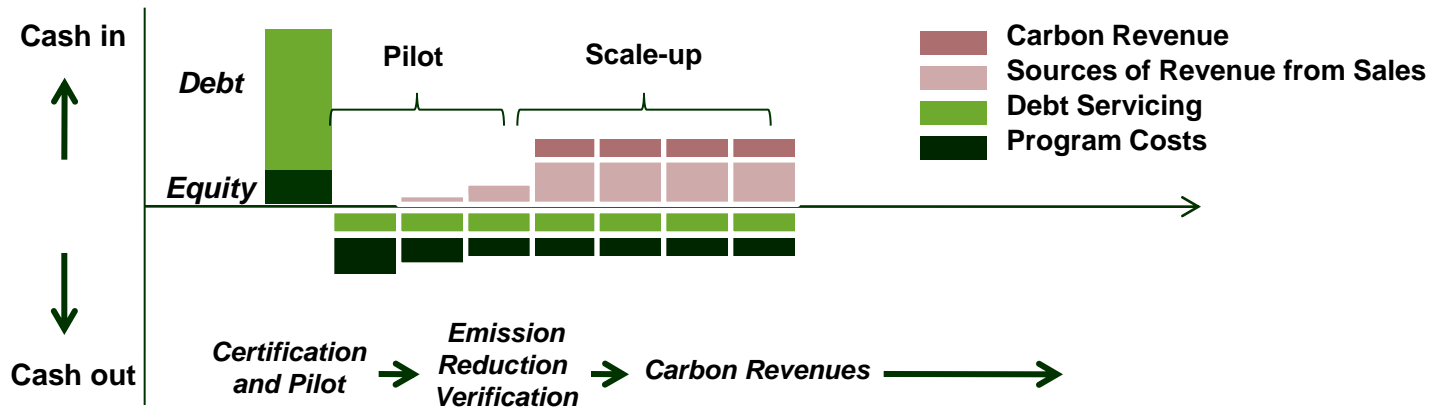


# Carbon Finance to Reduce End Cost

Intervention Options

To support the commercial sustainability of the program, carbon financing can be leveraged to both reduce the upfront expense to consumers and/or help cover ongoing program costs

## Carbon Finance in Support of Ongoing Program Costs



## Carbon Finance in Support of Commercially Sustainable Pricing Strategy

### - Illustrative Stove Subsidization Model-

Illustrative Carbon Revenue per Stove <sup>1</sup>	
€ 12	Lifetime Savings (3 yr lifespan, CER)
€ 20	Lifetime Savings (5 yr lifespan, CER)

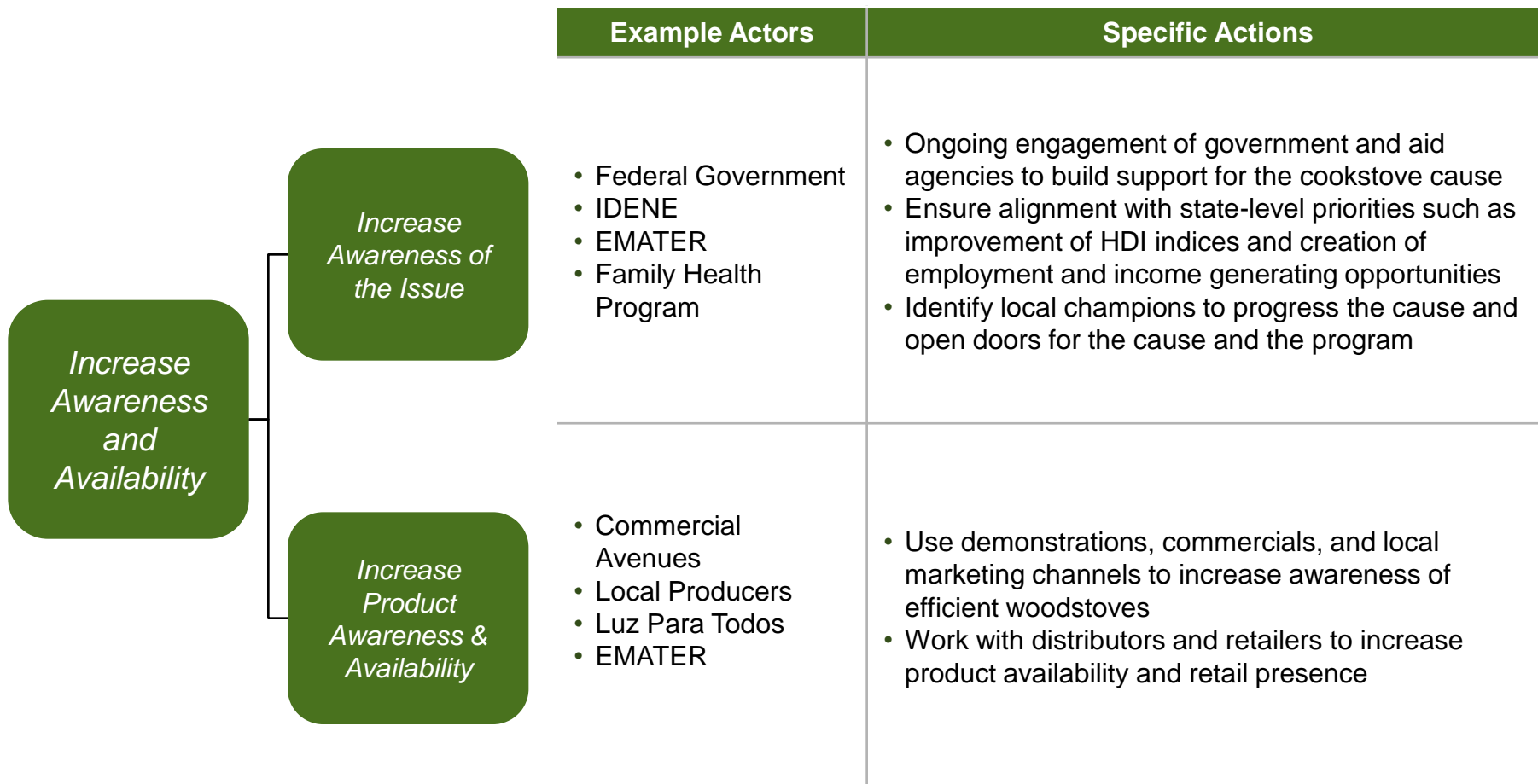
€ 35	Original stove cost
€ 20	Reduced cost from CF revenue
€ 15	Final cost to end consumer

NOTE 1: Calculated using HERA-GIZ's AMS-II.Gv2-Emission-Reduction-Calculation-Tool

# Raising Awareness and Demand

Intervention Options

Once the solutions have been brought within reach of the target segments, efforts must be taken to help make consumers aware of the issue, available clean cooking solutions, and increase availability





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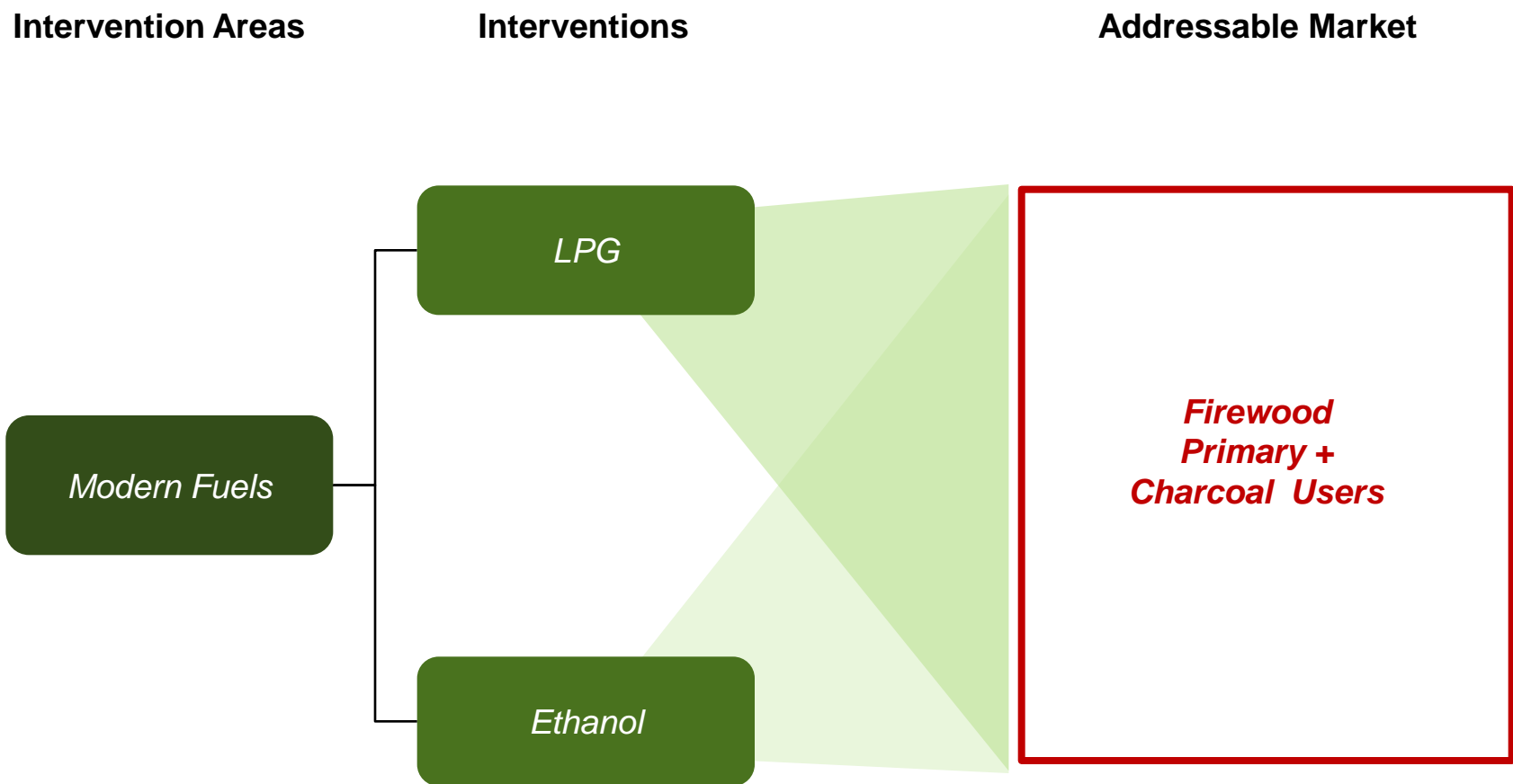
**Operational Plan**

**Appendix**

# The Addressable Market – Modern Fuels

Intervention Options

The target market for the LPG and national ethanol interventions would be the segments currently supplementing their LPG use with biomass stoves, and especially those who purchase biomass



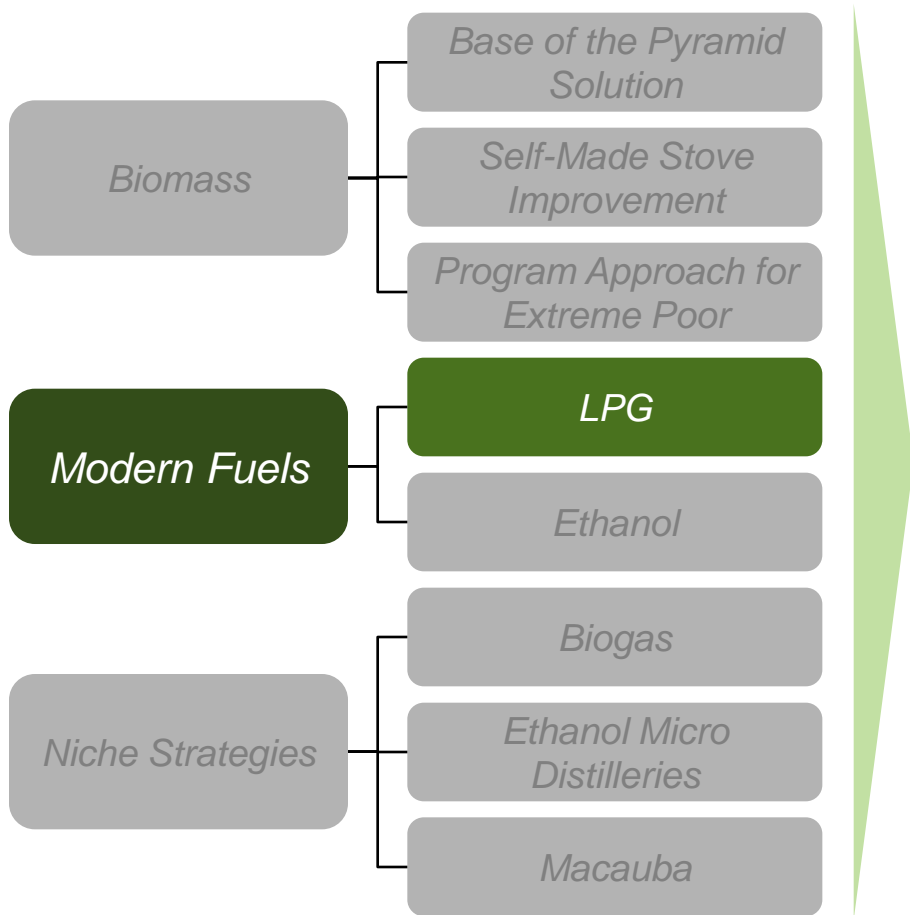
# Intervention Options – LPG

While LPG is considered a ‘social fuel’ and enjoys widespread usage, efforts to bring LPG within reach of the poor have encountered limited success

## Intervention Areas

## Interventions

## Situation

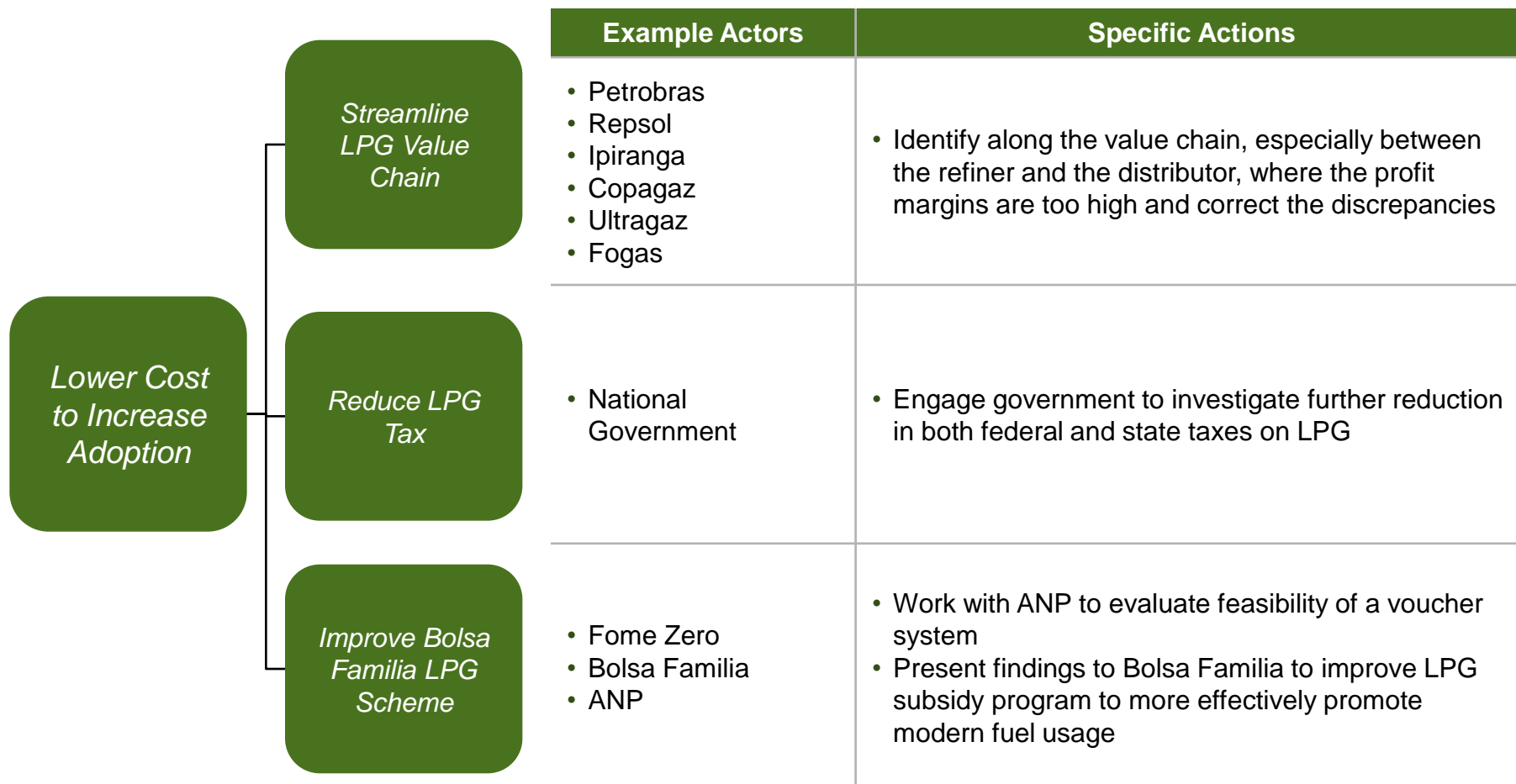


- High presence of LPG across country creates favorable conditions for further adoption
- Primary barrier for low income families is high cost of LPG relative to easily collected fuelwood
- Secondary barriers are limited access in remote areas and high upfront cost of current 13kg LPG bottles
- In charcoal markets, people pay more for charcoal than LPG but find the high upfront cost for LPG a limitation
- Current LPG subsidy scheme for poor via Bolsa Familia is ineffective due to cash payout nature and lack of indexing against rising price of LPG

# Reducing the Cost of LPG

Intervention Options

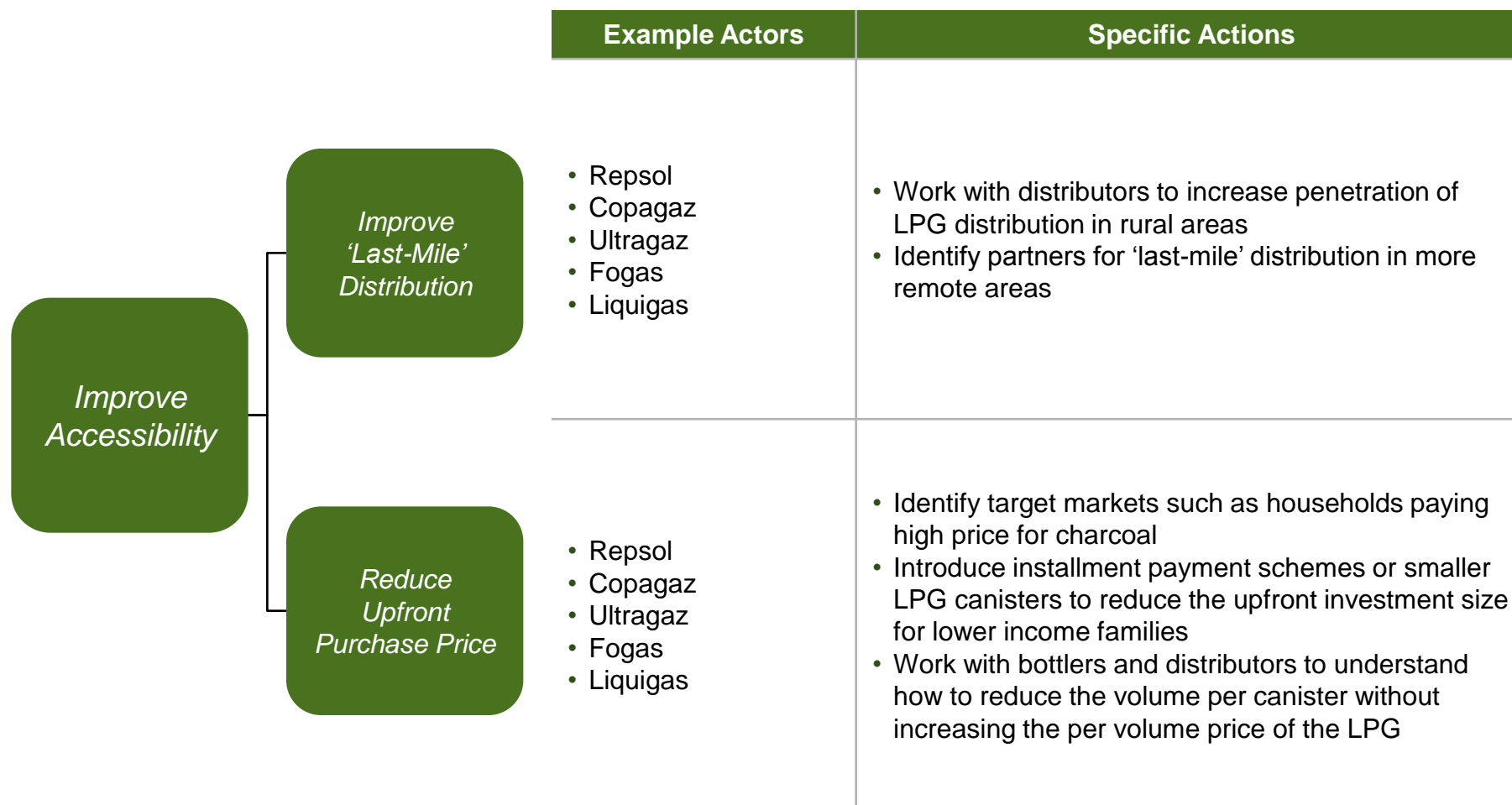
Since the primary barrier to more widespread LPG adoption is cost, prices will need to be reduced through either blanket subsidies, targeted subsidies, or streamlining of the value chain



# Improving LPG Access in Target Markets

Intervention Options

Access and upfront investment are challenges for some consumers and can be remedied by improving 'last-mile' distribution and investigating a cost-efficient reduction in canister size



# Intervention Options – Ethanol

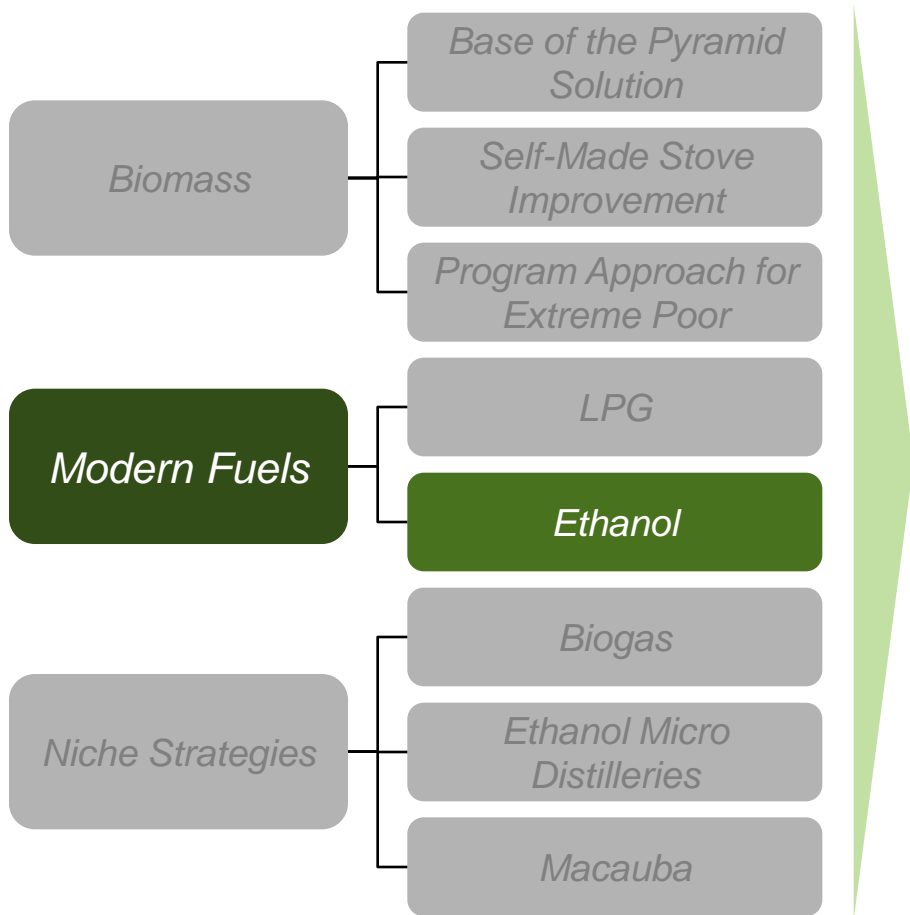
Intervention Options

Brazil's strong domestic production and use of ethanol as a transport fuel creates a unique opportunity for Brazil to pilot an ethanol cooking model with potential for global reach

## Intervention Areas

## Interventions

## Situation

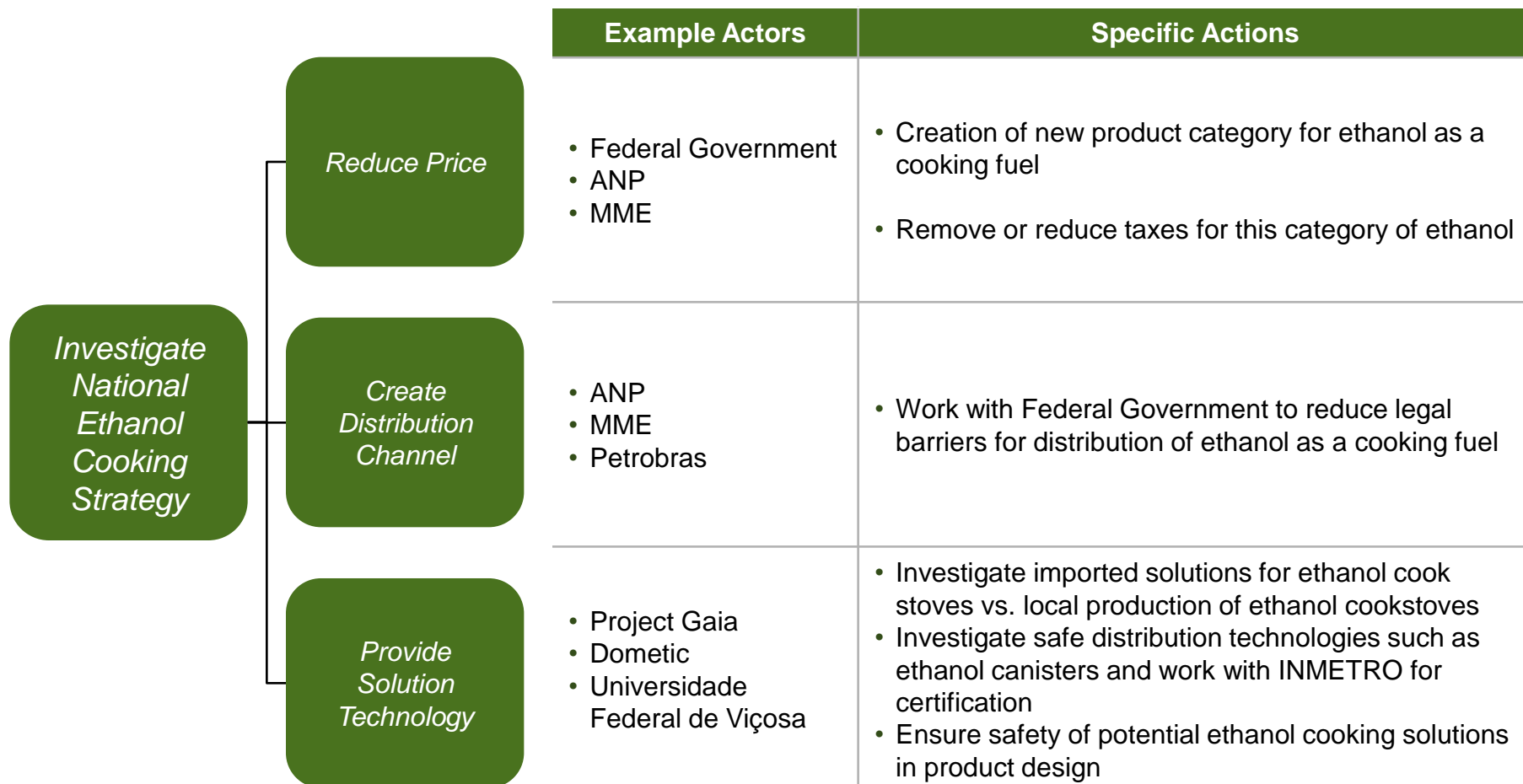


- Brazil is the world leader in ethanol export
- Ethanol can be produced at extremely low cost and would make the most economical modern fuel option without taxes
- Current regulations restrict the ability for ethanol to be used in cooking
- There is no ethanol cookstove market in Brazil

# Interventions for Potential Ethanol Cooking Industry

Intervention Options

In order to create a national ethanol cooking industry in Brazil, taxes would need to be dropped, regulations adapted, and cookstove solutions introduced into the market





# The Reality of Ethanol as a Cooking Fuel

Intervention Options

**While there is potentially a strong argument for the usage of ethanol as a cooking fuel, it faces a number of environmental, economic and regulatory challenges to widespread adoption**

## Potential for Ethanol

- Ethanol has the potential to provide a modern renewable source of cooking fuel for countries around the world
- As a cooking fuel, ethanol would help reduce both IAP and deforestation globally
- Depending on market prices, ethanol can be significantly cheaper than LPG
- In countries without strong LPG subsidies, this economic differential is even more dramatic
- If the model proves effective, Brazil could become a global leader in production of ethanol and in ethanol capacity-building around the world

## Challenges

### Global

- Cooking ethanol would face competition from economic substitutes – Sugar and transport ethanol
- Open questions on ethanol's effect on deforestation and food security

### Brazil

- Ethanol supply is volatile, with Brazil occasionally having to import ethanol from abroad to cover shortages
- Due to safety concerns, currently there are restrictions on storage and transport of ethanol in liquid form
- There are no ethanol cook stoves in Brazil while LPG stoves can be found in 95% of households

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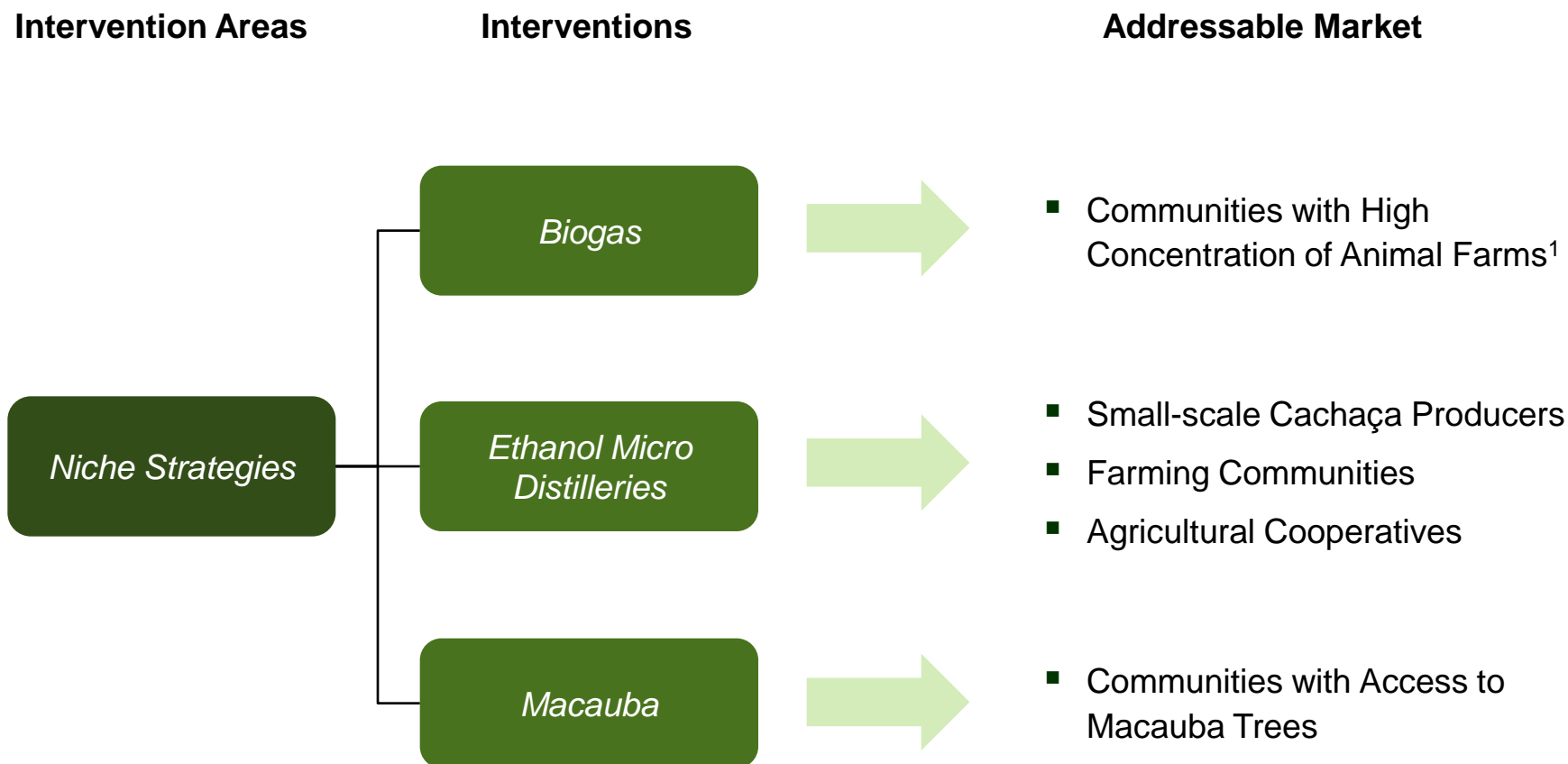
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**Appendix**

# The Addressable Market – Niche Strategies

Intervention Options

While a smaller portion of the overall market, niche strategies are an option for those communities with access to the alternative fuel source and would provide interesting pilot opportunities



NOTE 1: See map on “Biogas for Niche Markets”

# Regional Strategy – Biogas

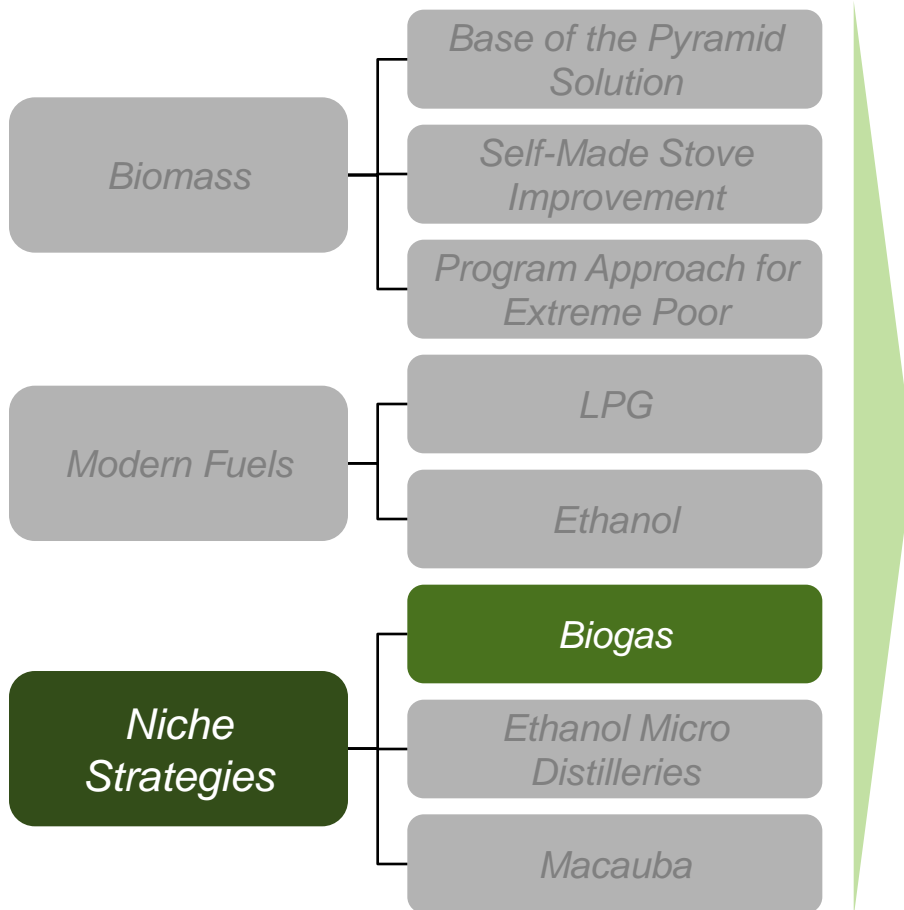
Intervention Options

Heavy concentrations of animal farms across certain regions of Minas Gerais make biogas an attractive solution for the cooking needs of this niche market

## Intervention Areas

## Interventions

## Situation

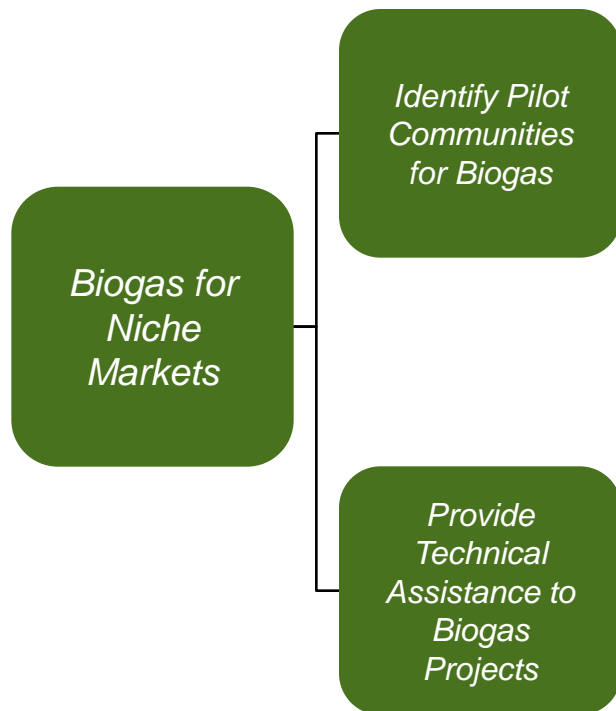


- Minas Gerais has large biogas potential
  - Most dairy farms in Brazil
  - 3rd in number of chicken farms in Brazil
  - 4th in number of pig farms in Brazil
- Animal waste is a big problem in agricultural regions
- Previous biogas projects have experienced technological challenges
- Potential for Biogas to cogenerate electricity for the 200,000 unelectrified properties in Minas Gerais

# Biogas for Niche Markets

Intervention Options

A potential biogas program would first need to more clearly identify the target market and overcome technological challenges encountered by previous pilots



Example Actors	Specific Actions
<ul style="list-style-type: none"> <li>• EMATER</li> <li>• IDENE</li> <li>• INCRA</li> <li>• Universidade Federal de Viçosa</li> <li>• Animal Farms</li> </ul>	<ul style="list-style-type: none"> <li>• Further breakdown potential pilot communities and identify ideal candidates</li> <li>• Build on regional approach as per below:</li> </ul> <p><b>Biogas Potential in Minas Gerais*</b></p>
<ul style="list-style-type: none"> <li>• GIZ</li> <li>• CARE</li> <li>• EMATER</li> </ul>	<ul style="list-style-type: none"> <li>• Extend understanding of key biogas technological challenges through further discussion with project implementers</li> <li>• Bring in technical expertise of global partners to confirm feasibility and overcome challenges</li> </ul>

Source: \*EMATER – Empresa de Assistência Técnica e Extensão Rural do Estado de Minas Gerais

# Regional Strategy – Ethanol Micro Distilleries

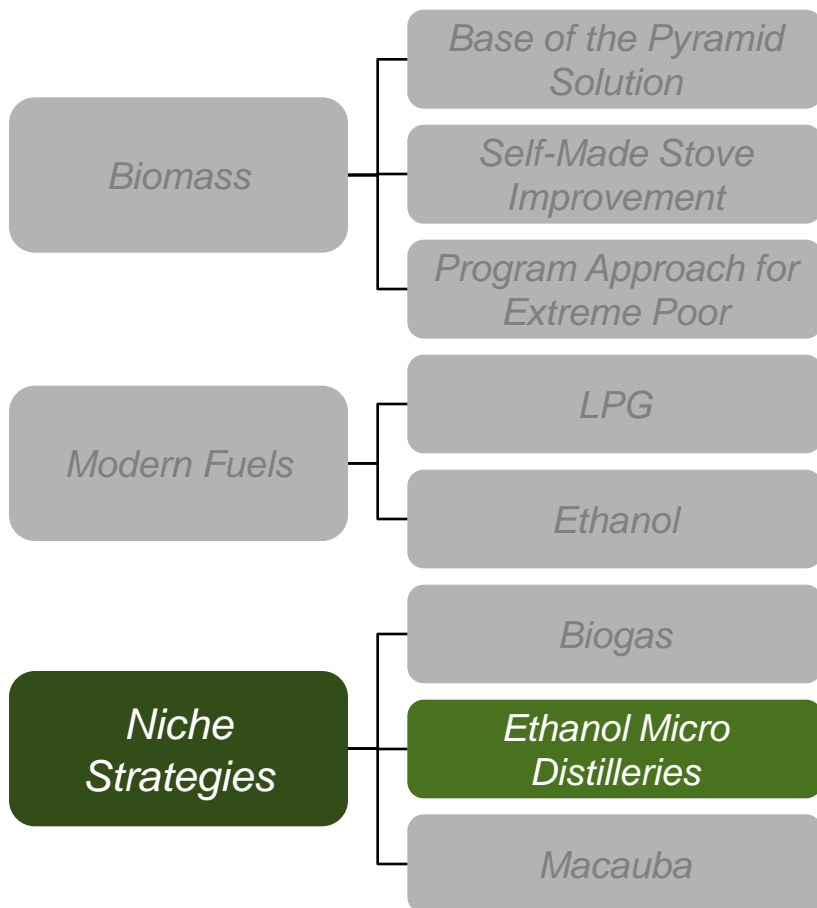
Intervention Options

Separate from a national ethanol strategy, ethanol could be used in the short-term in niche communities which are legally allowed to produce ethanol on a smaller scale for self consumption

## Intervention Areas

## Interventions

## Situation

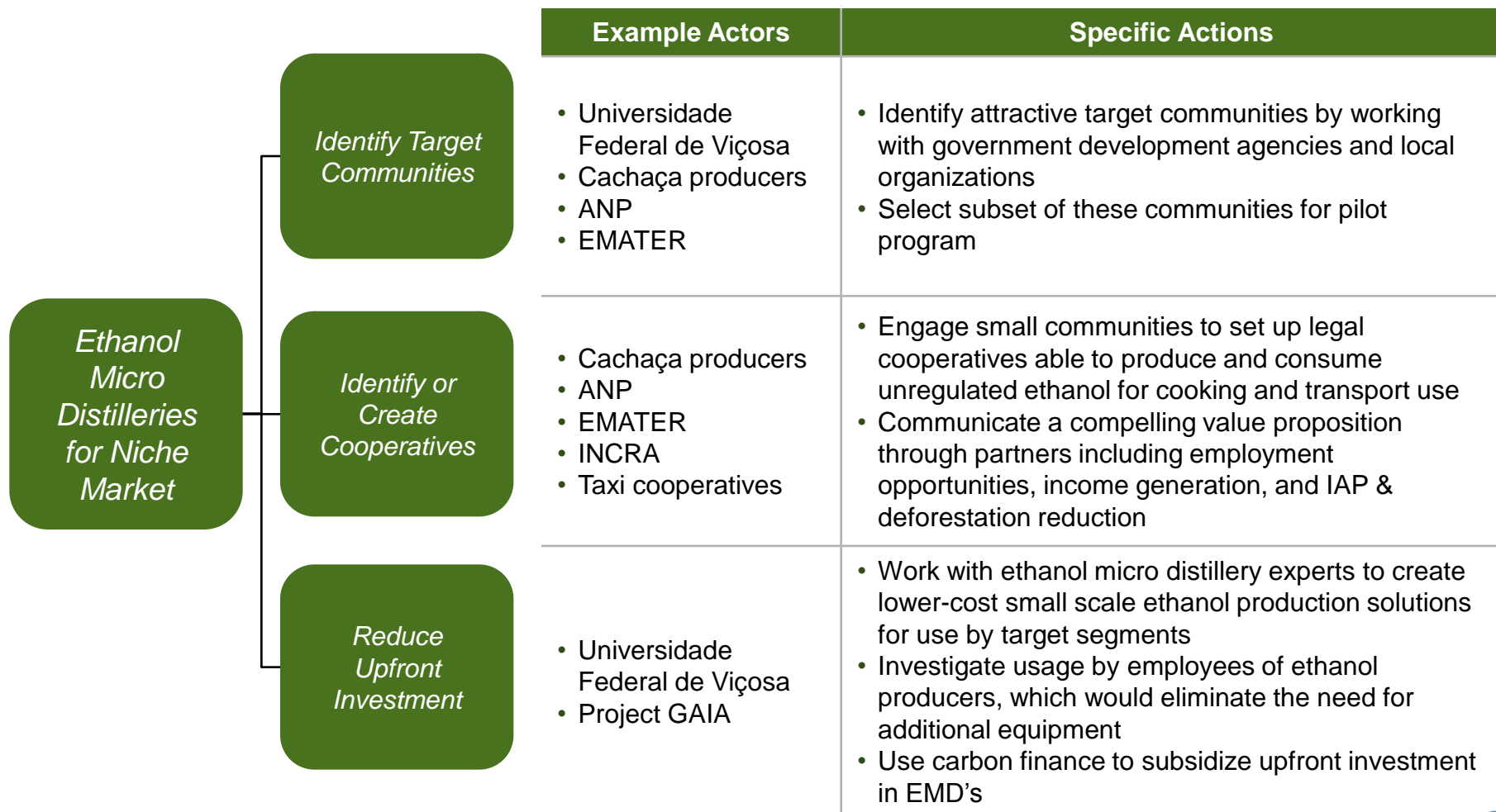


- Current regulations allow for small scale producers of ethanol to produce for self-consumption
- Ethanol micro distilleries are an attractive option to produce a cooking fuel, transport fuel, provide additional income and also potentially generate electricity for remote communities
- Ideal candidates include small-scale cachaça producers, farming communities, agricultural cooperatives, taxi cooperatives, etc
- An ethanol cooking solution would still need to be introduced into Brazilian market

# Ethanol Micro Distilleries for Niche Markets

Intervention Options

To move forward with ethanol micro distilleries for niche markets a pilot approach is recommended in target communities and cooperatives to overcome the large initial investment





# Regional Strategy - Renewable Biomass

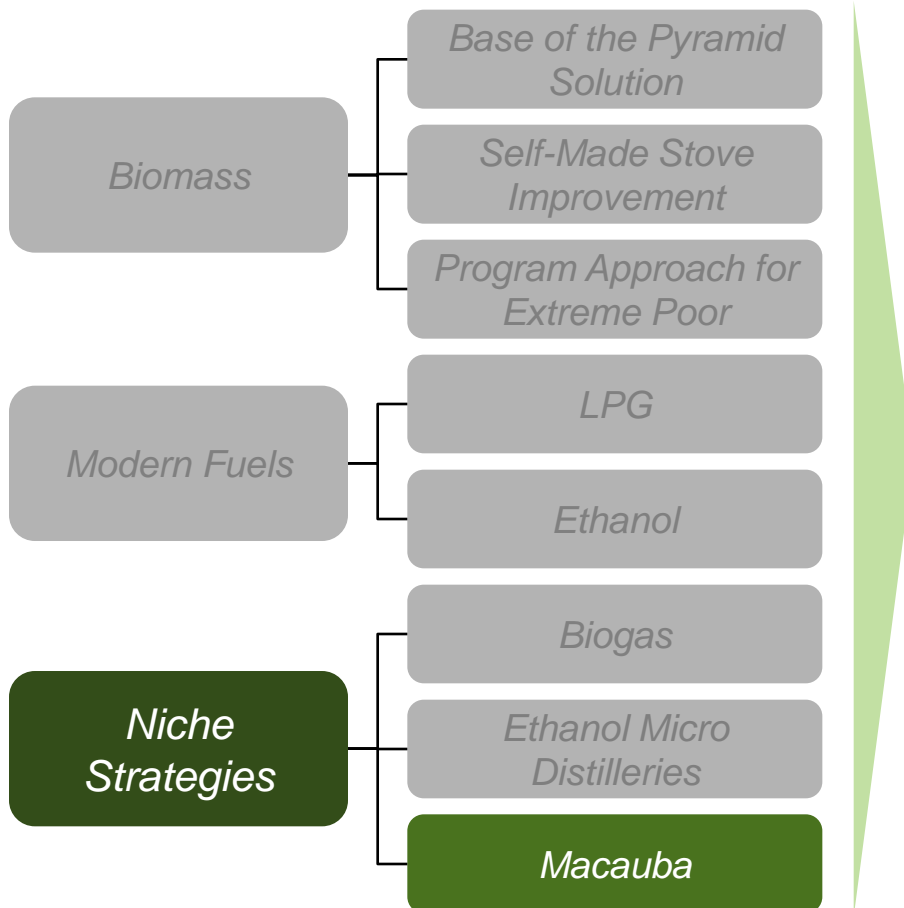
Intervention Options

Certain communities involved in macauba harvesting can switch to renewable biomass waste such as macauba kernels

## Intervention Areas

## Interventions

## Situation

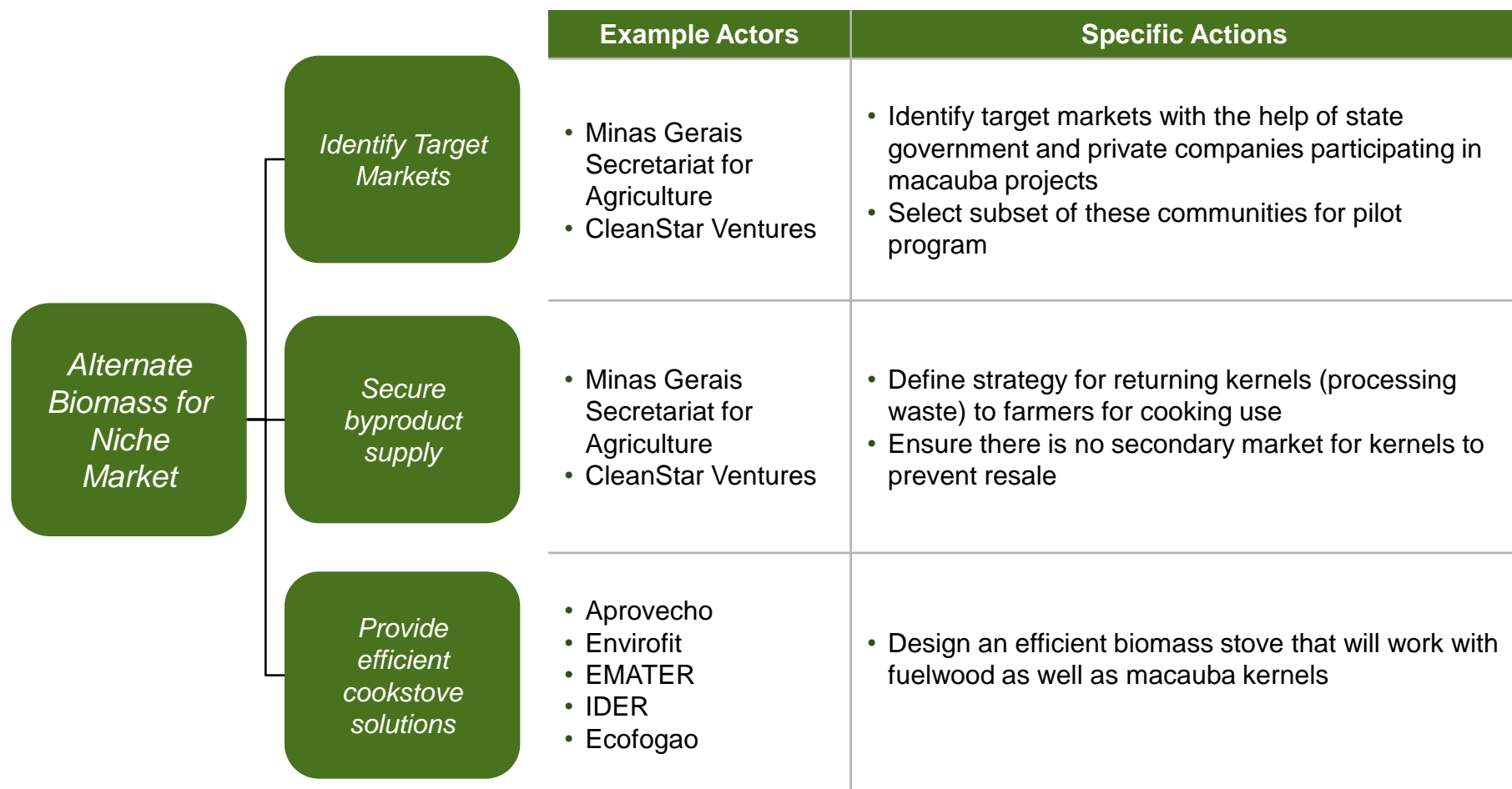


- Brazil has native palm trees such as the macauba that are rich in oil
- The fruits have a kernel that has high calorific value and can be used as biomass
- Macauba grows naturally in the semi-arid climate of North Minas Gerais
- Currently the Minas Gerais State Government has two pilot projects to set up a commercial supply chain for bio-oil from macauba; Petrobras has committed to purchase the bio-oils for their bio-diesel plant

# Renewable Biomass for Niche Markets

Intervention Options

To realize the renewable biomass strategy, work with existing Government pilots to identify communities and secure supply of byproduct for cooking purpose; provide efficient cookstove solutions to reduce dependence on biomass



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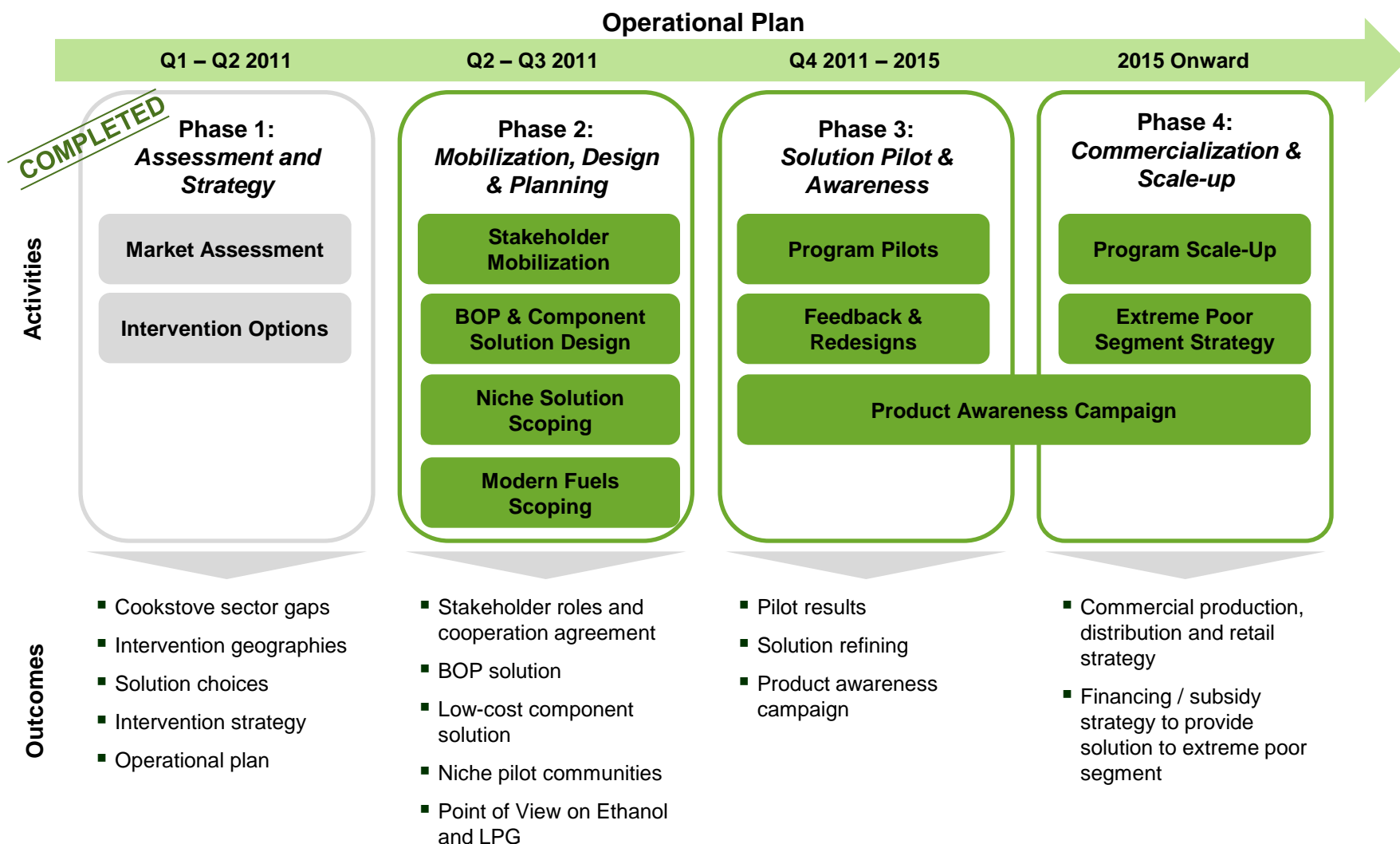
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# Operational Plan

Operational Plan

Next phases of a cookstove initiative in Brazil involve stakeholder mobilization, solution design and scoping, and pilot projects leading to scaled programs



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# Glossary of Terms

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

ALRI – Acute Lower Respiratory Infection

CDM – Kyoto Clean Development Mechanism

CF – Carbon Finance

DNA – Designated National Authority

EU – European Union

GACC – Global Alliance for Clean Cookstoves

GJ – Gigajoule

GIZ – Gesellschaft für Internationale Zusammenarbeit

HH – Household(s)

IAP – Indoor Air Pollution

ICS – Improved Cookstove

iNGO – International Non-Governmental Organization

LPG – Liquid Petroleum Gas

MFI – Microfinance Institution

NGO – Non-Governmental Organization

COPD – Chronic Obstructive Pulmonary Disease

Q# – Quarter

UN – United Nations

UNDP – United Nations Development Program

UNICEF – The United Nations Children's Fund

USAID – United States Agency for International Development

USD – US Dollars

WB – The World Bank

WFP – World Food Program