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Global Alliance for Clean Cookstoves

Rwanda Market Assessment

Intervention Options

Accenture Development Partnerships

April 2012

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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Project Approach and Background

Intervention Options

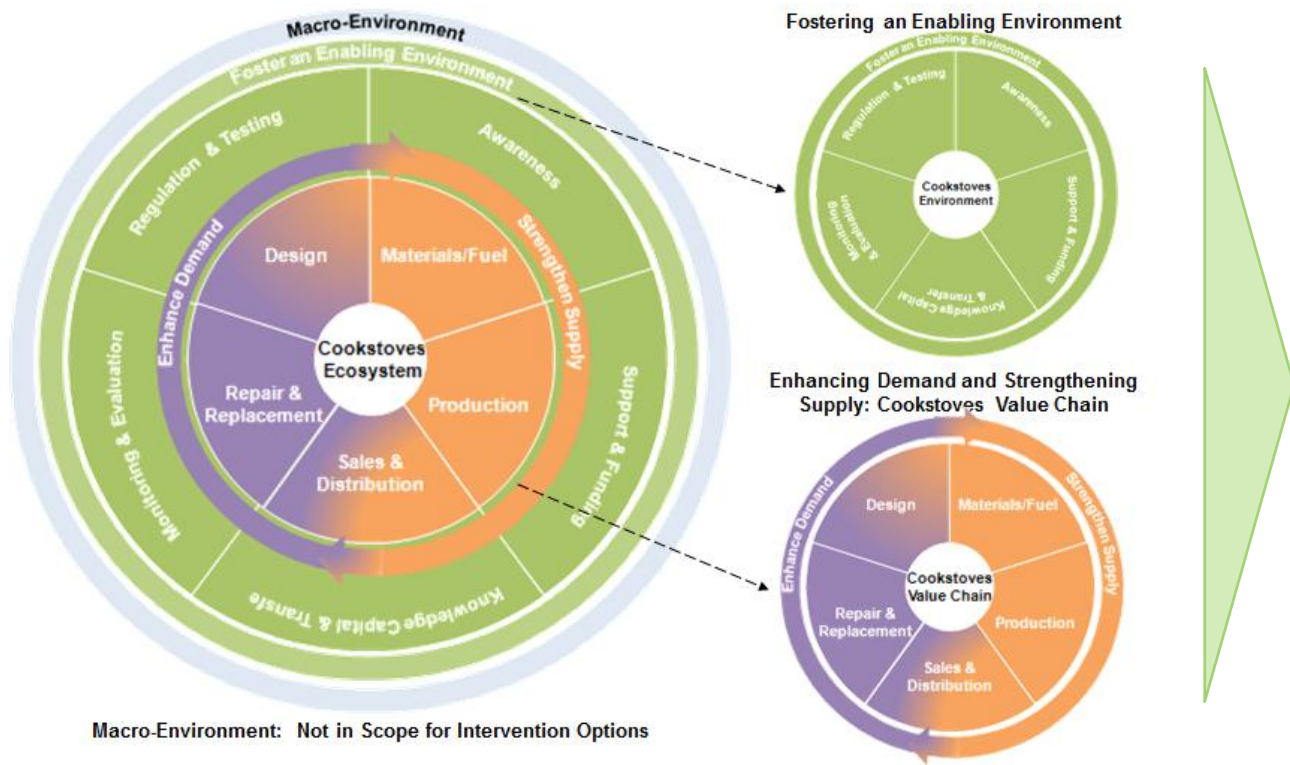
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Executive Summary

As a result of the Rwanda cookstove market assessment, 8 intervention options have been identified through the sections of Fostering an Enabling Environment and 7 intervention options have been identified through the Enhancing Demand and Strengthening Supply



Fostering an Enabling Environment Intervention Options

1. Regulation & Testing
2. Awareness
3. Monitor & Evaluate

Enhancing Demand and Strengthening Supply Intervention Options

1. Materials/Fuels
2. Production
3. Sales & Distribution

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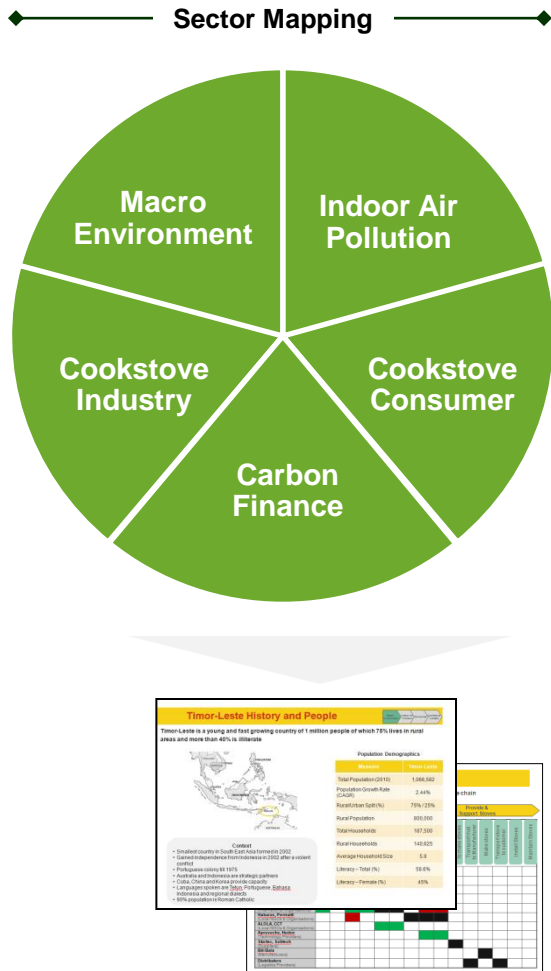
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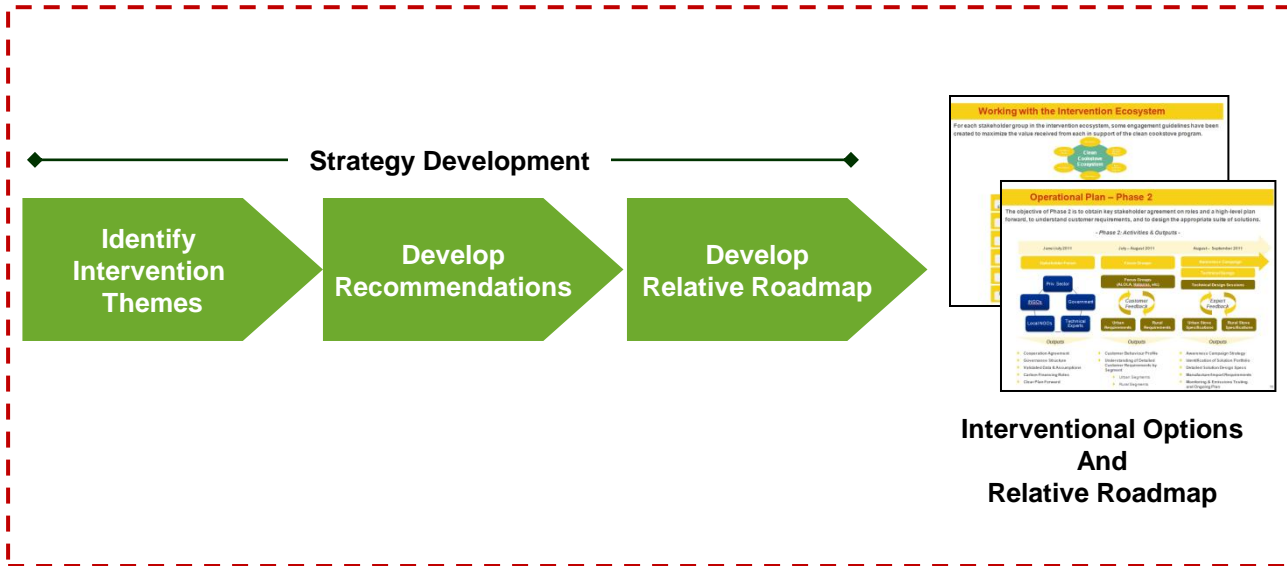
Appendix

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.

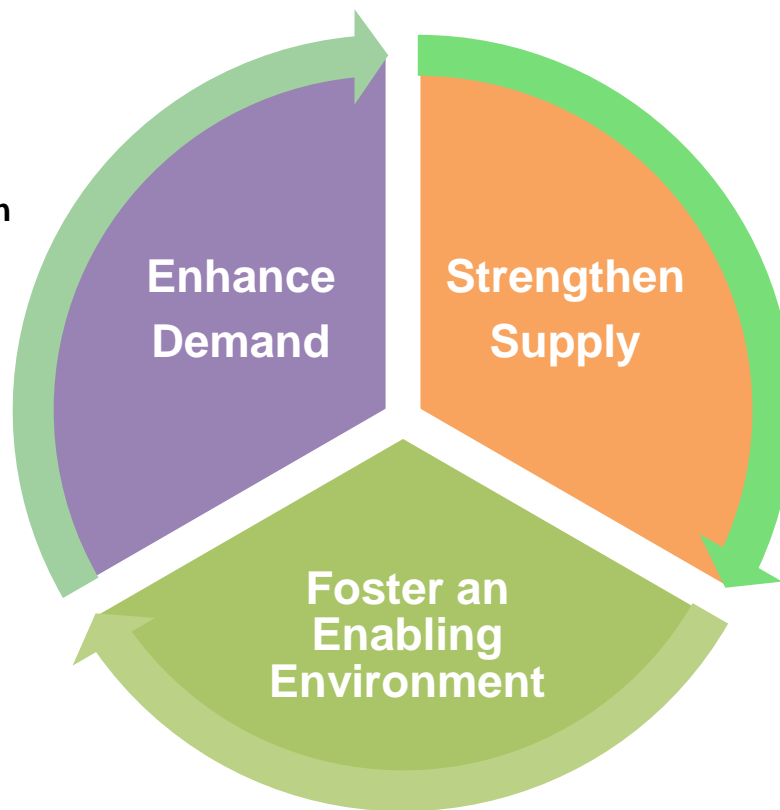


Focus of This Deliverable



A three-pronged strategy has been developed to spur the clean cookstoves market

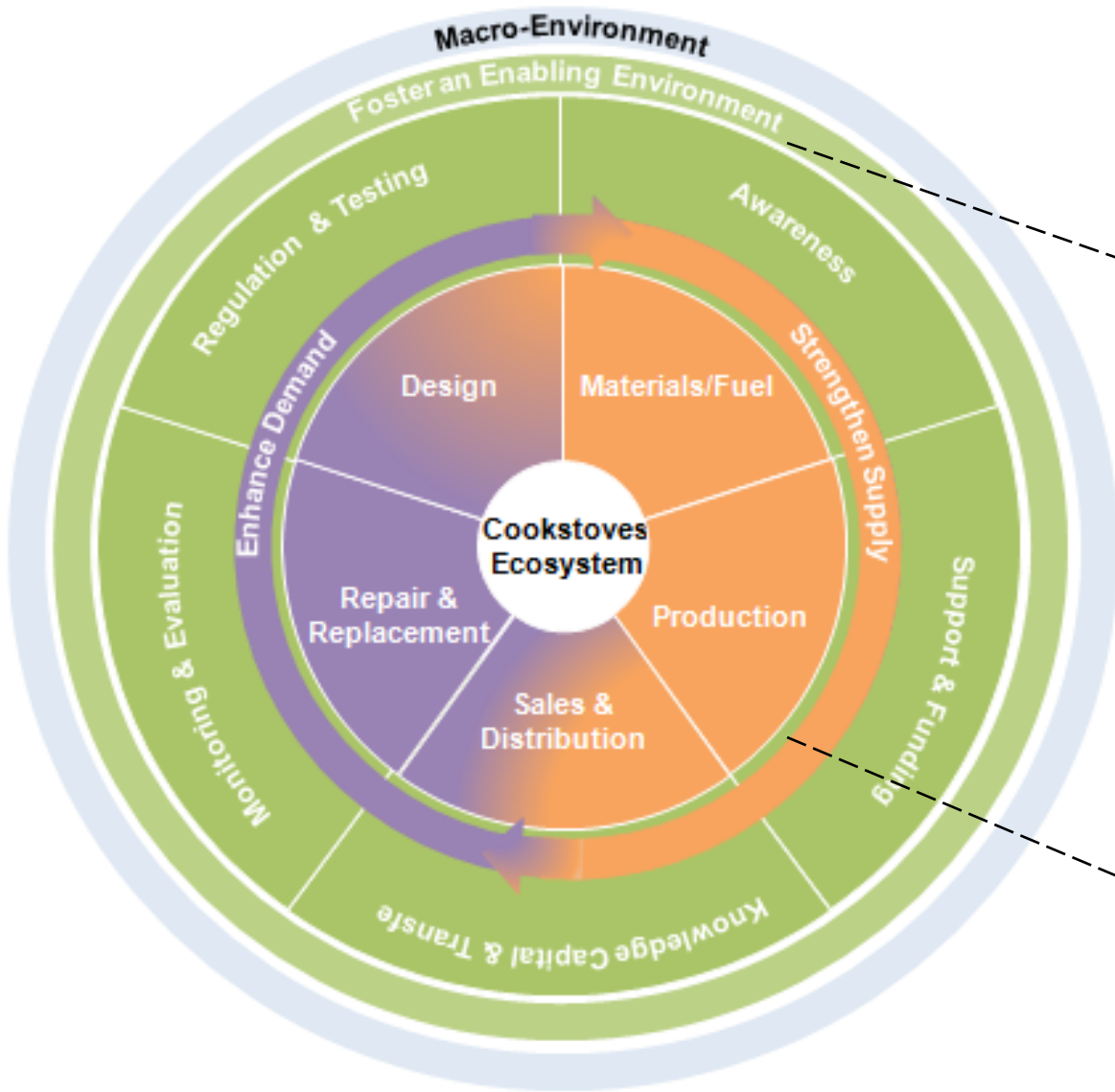
- Understand and motivate the user as a customer
- Reach the last mile
- Finance the purchase of clean cookstoves and fuels
- Develop better cookstove technologies and a broader menu of options



- Finance clean cookstoves and fuels at scale
- Access carbon finance
- Build an inclusive value chain for clean cookstoves and fuels
- Gather better market intelligence
- Ensure access for vulnerable populations (humanitarian)

- Promote international standards and rigorous testing protocols, locally and globally
- Champion the sector to build awareness
- Further document the evidence base (health, climate, and gender)
- Engage national and local stakeholders
- Develop credible monitoring and evaluation systems

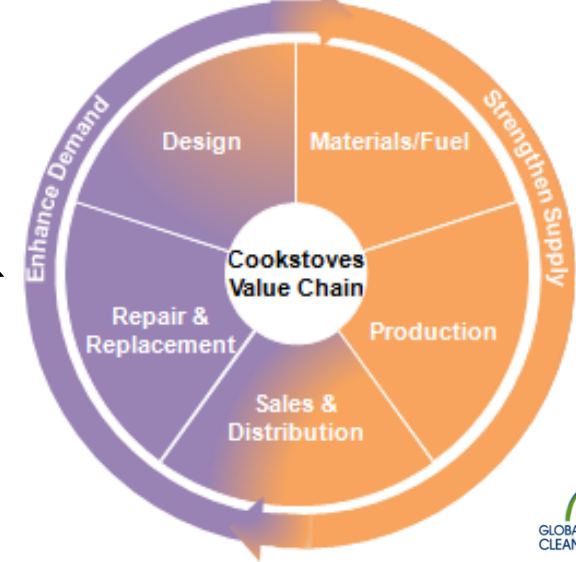
The Interventions are analyzed according to their impact to the three-pronged strategy



Fostering an Enabling Environment



Enhancing Demand and Strengthening Supply: Cookstoves Value Chain



Macro-Environment: Not in Scope for Intervention Options

Sector Mapping (1/2)

Small and landlocked Rwanda is the most densely populated country in Africa and contains ~2.5 million households, of which more than 80% are in rural areas. In both urban and rural areas, the vast majority of households cooks on woodfuels (wood/charcoal), leading to major health issues and deforestation.

The Rwandan government initiated an Improved Cook Stove (ICS) program in the late eighties to combat deforestation. Various programs have been implemented since, leading to a penetration of 'improved' stoves of over 50% by 2009. However, the quality of these stoves varies greatly; often the improvement versus traditional methods is limited. In the last two years, the government has implemented new improved stoves programs for both rural and urban areas. In addition, many private cookstove programs are currently starting up, with the aim of utilizing carbon finance.

The driver for the government's involvement in cookstoves is the country's energy problem. Approximately 85% of Rwanda's energy comes from biomass, which has led to rapid deforestation over the last 20 years and is not sustainable. A large part of this biomass is used for cooking; in rural areas, most families collect wood while those in urban areas typically buy charcoal. Electricity access is limited and clean fuels are expensive.

To combat this issue, the government drafted the Biomass Energy Strategy in 2009. All players within the cookstove market are aware of the strategy and ensure to alignment with it. In general, President Paul Kagame's government has progressive policies and a focus on economic growth. Governance is well organized throughout, from the central government to the grassroots level: There are clear lines of communication down to representatives for every 10 households. Finally, it is significant to note that corruption is practically absent and that gender equality is a high priority at all levels of the government.

A key challenge for any cookstove program in Rwanda will be affordability of stoves and fuels: Although GDP has been growing rapidly in recent years, with \$1,300 per capita GDP PPP Rwanda still ranks amongst the poorest countries in the world.

Sector Mapping (2/2)

	Findings
<i>Social and Environmental Impact</i>	With more than 95% of the total population using biomass fuel for cooking, the health burden of IAP exposure is one of the largest in the world. Deforestation is also a major issue in Rwanda; improved cookstoves could significantly contribute to reducing the wood fuel deficit and thus reduce the problem. Finally, improved cookstoves could decrease fuel expenses for Rwanda's poor population
<i>Consumers</i>	The segment most in need of ICS are biomass collectors in rural areas. Representing 57% of consumers, this segment is most heavily impacted by IAP and deforestation (although the latter differs significantly per region). However, difficulty to distribute to the 'last mile' and very low disposable incomes make these consumers challenging to reach. Another complication is that the free supply of biomass means ICS have no direct economic benefits
<i>Cookstove Industry</i>	There are currently many private sector initiatives emerging in the cookstove sector. However, as the government is very influential in Rwanda, government support is key for any cookstove project. Projects should aim to align with the government vision to capitalize on the strong performance-based governance across all tiers. As the government focuses on economic growth, and Rwanda has no seaports and railroads, in-country manufacturing of stoves is preferable
<i>Carbon Financing</i>	The high fraction of non renewable biomass, strong governance and existing precedents create very favourable carbon market attributes. Various private companies are currently looking to take advantage of this

Implications for Intervention Options

The relatively very high health impact of IAP presents a strong case for cookstove interventions in Rwanda. Rwanda's large energy problem will only get worse if no action is taken and creates strong momentum for a cookstove intervention. The Alliance can contribute by fostering an enabling environment, by enhancing demand and by strengthening supply.

Eight opportunities to create a more enabling environment for the Rwandan cookstove sector were identified. Enabling the country's independent testing center to test for emissions, the creation of standards and certifications for stoves and indoor air pollution and the monitoring of these standards are key to improve the quality of stoves and the confidence of consumers. Another important area of improvement is awareness: awareness of consumers on ICS in general, the certifications that will be created and on ways to reduce the use of fuel by means of behavioral changes, but also awareness across the sector on the health implications of indoor air pollution. Finally, the creation of monitoring & evaluation partnerships with local NGOs and sharing cookstove project experiences across the sector will increase the ability of projects to convince consumers to buy and use ICS.

Looking at the value chain, there are numerous players with competencies that cookstove programs should take advantage of. However, there are some important gaps in the current landscape. The availability of clean fuels is very limited; a short-term solution is improving the distribution and production (possibly from agricultural waste) of charcoal. Promoting the creation of large stove production cooperatives and factories and sharing best practices on production will decrease production cost while increasing quality assurance. Finally, the availability and affordability of ICS needs improvement – setting up savings and micro finance programs, removing relevant taxation and cooperating with local governments and private sector partners to improve last mile distribution can address this.

The Case for Action

The urgent need to address deforestation creates significant momentum for interventions in the cookstove sector that could have a major impact on health and environment

- The Case for Action -

What's Happening?

Rwanda is one of the countries most impacted by IAP: >95% cook on solid fuels, a major cause of disease and mortality

Close to 40% of forest cover was lost in the last 20 years; with most of the wood used for cooking

Government, private sector and NGOs are working to address the problem

So What?

The current use of wood fuels for energy is not sustainable, and improved cookstoves can make a major difference

Current initiatives do not reach the entire population, and could be more successful if key opportunities and barriers in the sector were addressed

There are opportunities to dramatically impact the sector at low cost e.g. re-establishing local academic institutions as independent centres of excellence and raising awareness of the health complications

Why Now?

The government urgently wants to address the deforestation issue, creating a lot of momentum for change

Many private sector initiatives are currently in the critical start up stage and could have a major impact if the environment is supportive

The scope to make a difference in terms of health (especially of children) is immense

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Fostering an Enabling Environment

Background on the sector

With over 95% of the population currently cooking on solid fuels and biomass accounting for 85% of national energy use, the government is acutely aware of the unsustainable dependence on biomass and acknowledges the importance of preventing further deforestation. As such, the government first began distributing cookstoves in the late 80s and early 90s but there are questions about the overall effectiveness with numerous small initiatives reportedly distributing 'improved' cookstoves with limited success primarily due to a lack of sensitization, quality assurance, education and monitoring. Most projects also focused primarily on efficiency; there is a notable gap in emissions data.

The government is very proactive with regard to environmental issues (especially deforestation). Combined with the potential cost savings this led to the implementation of biogas digesters in all 14 of Rwanda's prisons (initiated in 2001). This success was capitalized on by SNV who from 2007 began installing similar technology at the household level, initially supported by the Dutch and subsequently by the Rwandan government.

Primarily led by NGOs and the Rwandan government, the sector started to gather pace in 2008 with CARE's CASE project looking to improve the standard of in-situ artisan stoves by investing in stove/fuel research and

comprehensive training. This was promptly followed by the government publishing the Biomass Energy Strategy and partnering with Practical Action to implement large scale projects in rural and urban Rwanda – both of which have had a major influence on the sector.



The market t

Whilst the gov has been a surge in the private sector in recent years. Various companies are working to distribute household and institutional solutions.

Prisoners cooking on biogas

Fostering an Enabling Environment

The Rwandan government is very supportive of private sector participation in such initiatives and encourages competition to ensure efficiency¹. Combined with the low level of corruption and the favorable carbon finance environment, there are several large players looking to enter the market in the coming years.

From Inyenyeri's free stove and crowd-sourced fuel business model to Enedom's 'cookstove package' which includes a Save80 stove, 2 pots and a 'wonderbox' (used to reduce cooking time) the private sector players are using innovative approaches to address the issue of IAP. Manna Energy have also been capitalizing on the natural resources available in Rwanda to produce efficient stoves from volcanic pumice offering a cost effective and environmentally friendly solution for institutions and households.

A key area to develop for the sector is the capability to build consumer confidence, due in large part to a lack of regulation and in-country, independent testing facilities. Many of the key players highlighted that the lack of a trusted standard undermines awareness campaigns and could be relatively quick to rectify. The Kigali Institute of Science and Technology has experience of working with Aprovecho (US Stove Testing Facility) and is keen to build its expertise in this field, but currently lacks the funding to execute any testing beyond basic stove efficiency.

Upon establishing a testing center, it is critical that suitable monitoring and regulation procedures are implemented so that the standards imposed are not devalued over time. EWSA are making progress in this space, implementing stringent quality assurance controls for the Canamake stove, and as such are pursuing a legal trademark.

There is scope to improve other areas of consumer awareness, in particular the health implications of IAP. The government has been very supportive of ICS programs, but the focus is firmly placed on the energy impact. The Ministry of Health has limited involvement in the current government campaigns and although the population is aware of basic health implications, e.g. discomfort and eye/respiratory complications, there is a lack of knowledge surrounding long term complications and hidden dangers such as emissions from charcoal burning.

Although the carbon market is not fully utilized, there are 3 Program of Activities awaiting validation and at least 2 large implementation organizations from other regions are keen to enter the market. This could be a game changer for the sector due to the vast experience in the areas of, amongst others, financing and implementation – both of which are key areas in which the market is relatively weak.

Fostering an Enabling Environment

Building the market for the future

The intervention options presented with regard to fostering an enabling environment focus on three areas: Regulation & Testing, Awareness and Monitoring & Evaluation.

With regard to Regulation & Testing, the perception of poor quality stoves is debilitating to current initiatives and genuine consumer confidence needs to come from independent research from a trusted party. KIST are ideally placed to take this role, and could act as a 'center of excellence' in country collating best practice, lessons learnt and acting as a focal point for institutions outside Rwanda. This data is also critical if the government is to establish regulations and standards within the sector.

The government is a key ally within Rwanda, with a progressive policy base and well-organized governance down to the local level. It is crucial that NGO and private sector initiatives work with the government and continue the collaborative approach to the cookstove problem. In particular, all parties should ensure their approach is aligned with the Biomass Energy Strategy and Vision 2020.

Raising awareness of basic improvements to current cooking practices could also have a considerable effect on

the health of those cooking using solid fuels. NGOs such as Gardens for Health International are working with local health workers to teach families how to cook healthy meals in 1 pot in under an hour. They use simple techniques such as pre-soaking beans (a staple food in Rwanda). These projects are receiving a lot of traction with the government and in a country where most people with an ICS are also still using a secondary stove they have a lot of potential to reduce fuel use and emissions (at relatively low cost).

Since local NGOs often have a strong community presence, there is also scope to use their grass roots relationships and build partnerships with private sector companies. These partnerships could be used for comprehensive pilot studies or to gain a deeper understanding of the sector.

Although biomass will continue to be a key source of household fuel in the coming years, raising the standard of stoves in the Rwandan market and thus increasing consumer confidence could have a major impact on the level of IAP experienced by those most at risk. In addition to the economic benefits of the stove, increasing the awareness regarding the achievable health benefits is also critical.

Foster an Enabling Environment

Through gaps identified in the Enabling Environment, Intervention options will focus on Regulation & Testing, Awareness and Monitor & Evaluate

Regulation & Testing

- ~ Indoor Air Quality Standards
- ✗ Cookstove Standards
- ✗ Fuel Standards
- ✗ Standard Enforcement

Monitoring & Evaluation

- ~ Monitoring implementations
- ✗ Tracking and Quantifying Success



Awareness

- ~ Consumer Awareness
- ~ Stakeholder Awareness
 - ~ Government
 - ~ Private Sector

Support & Funding

- ✓ Government
- ✓ INGOs and Associations
- ✓ Local NGOs and Associations
- ✓ Private Sector
- ~ Academics

Knowledge Capital & Transfer:

- ~ Health
- ✓ Environment
- ~ Gender
- ~ Cookstove-Specific

KEY: ✓ Advanced/ Favorable ~ Has Potential/ Neutral ✗ None/ Unfavorable □ Focus Area

Regulation and Testing

Currently there are no formal, legally recognized standards for stoves yet in Rwanda, making it difficult to control quality and thus motivate consumers to pay more for better products

Situation

There is no independent testing center in country. Government, private sector and NGOs develop their own requirements and execute/contract out their own testing. Due to lack of available funds, there is no testing facility in Rwanda that can measure emissions – although there is enthusiasm within academic institutions to explore this

Rationale

- Various interviewees, including a local consultant who has been involved with many large stove projects in Rwanda, indicated the that large range of stove quality is a major barrier to greater adoption
- KIST confirmed there is currently no means of testing stove emissions in Rwanda, this is an essential step towards lowering these emissions

Intervention Options

	Involved Parties	Likelihood of Success	Budget	Estimated Time
1. Create standards and certifications	Gov't, Alliance, Authority	Medium	Small	1,5 years
2. Expand the testing capacity of KIST	Gov't, Academic sector	High	Small	6 months
3. Set up quality monitoring mechanisms	Gov't, Private sector	Medium	Medium	2 years

Regulation and Testing

Stove standards, testing and certification ensure that consumers receive the performance, efficiency and durability they expect, thereby boosting demand for improved stoves and fuels

- Intervention Options-

1. Create standards and certifications for stoves and IAP

2. Expand the capacity of KIST e.g. include emissions testing

3. Set up monitoring mechanisms for stove quality and IAP levels in public spaces

- Actions -

- Work with Ministry of Infrastructure and Rwandan Bureau of Standards (RBS) to create standards and certifications for all feasible stoves
- Work with Ministry of Health and RBS for standards on indoor air quality
- Provide international best practices to RBS and organize a meeting on East African standards

- Determine viability of academic cooperation across East Africa
- Organize funding for emission testing equipment at KIST
- Determine whether Aprovecho Research Center can provide training to KIST employees
- Create a centre of excellence documenting stove design etc.

- Work with RBS to set up a method for inspecting stove and IAP standards
- Work with stove producers (/cooperatives) to help them adhere to standards

- Outcomes-

- Improved quality assurance and increased consumer confidence leading to higher demand
- Improved charcoal production and certification, people prepared to pay more for the more efficient, cleaner variety produced more environmentally
- Good quality of indoor air in institutions
- Possibility to test the emissions of existing and new stoves, enabling and stimulating improvement of the stoves' performance
- Presence of a cookstove centre of excellence that can be used to monitor the sector, share best practices, distribute lessons learnt from other geographies, act as an independent non-governmental spokesperson for the industry and focal point for the Alliance
- Produced stoves adhere to standards, improving stove quality and increasing consumer confidence
- Indoor air quality in public places is at acceptable levels

Many people in Rwanda are unaware of the possibilities to save fuel and reduce health problems by using improved cookstoves

Situation

The Ministry of Health is not involved in cookstove initiatives – the Ministry of Infrastructure (responsible for Energy policy) leads all efforts. Many ‘improved’ stoves with very limited efficiency gains have been disseminated. There is limited use of other easy ways to reduce fuel consumption and IAP such as soaking beans (a staple food)

Rationale

- More than half of Rwandans are not aware of the major health problems that cooking on wood can cause; for charcoal this percentage is even greater
- A significant share of people in rural areas associate improved stoves with higher fuel use, lowering demand
- Soaking beans (a staple food) can reduce fuel use by as much as 30%

Intervention Options

	Involved Parties	Likelihood of Success	Budget	Estimated Time
4. Raise awareness on stoves and certifications	Gov't, Local gov'ts, Authority	Medium	Medium	1 year
5. Promote greater involvement of MOH	Gov't	High	Small	6 months
6. Raise awareness on ways to reduce fuel use	Gov't, Local gov'ts, Academic sector	High	Small	1 year

National campaigns, also involving the Ministry of Health, will improve the awareness of the benefits of improved stoves

- Intervention Options-

- Actions -

- Outcomes-

4. Raise awareness of improved stoves and certifications

- Develop materials to use in *umuganda*
- Develop materials for the Community Hygiene Clubs
- Develop radio and TV infomercials
- Raise awareness of the cost saving benefits in the long term (this may be a difficult concept to prove to subsistence farmers)

- Higher demand for improved stoves
- Consumers understand and value stove and fuel certifications

5. Promote greater involvement of the Ministry of Health in the cookstove sector

- Ensure MOH involvement in standards and other regulation on stoves and fuels
- Include health targets in improved cookstove policies
- Incorporate IAP in national health campaigns – ensure the following areas are highlighted: impact on childhood health, long term implications, impact of charcoal smoke

- Sustainable attention to the health aspects of cooking leading to an increased awareness and prioritization of IAP within households

6. Raise awareness of methods to reduce fuel use

- Stimulate research on fuel use reduction through behavioral changes
- Develop materials to use in *umuganda*
- Develop radio and TV infomercials
- Educate local health workers and NGOs with a strong community presence e.g. CARE

- Reduced fuel use/cooking time and associated indoor air pollution for many of the 80% of Rwandans that are unaware of some basic behavior changes which result in reduced fuel use

Monitor & Evaluate

Many past and present cookstove projects struggle with detailed M&E, reducing effectiveness of projects and acting as a deterrent to the use of carbon financing

Situation

Several past subsidized cookstove projects experienced little use or abandonment of the improved stove, while other past and current projects indicate that more elaborate M&E would be desirable. Carbon finance projects indicate that expensive, obligatory M&E is an important barrier

Rationale

- Interviews indicate projects typically have very limited resources and do not have the money, expertise and/or manpower to carry out good M&E
- Households may not take the initiative to fix broken stoves, due to a minimal sense of ownership
- Effective and affordable M&E increases the availability of carbon financing for cookstoves

Intervention Options

	Involved Parties	Likelihood of Success	Budget	Estimated Time
7. Create M&E partnerships	Gov't, local NGOs, Private sector	Medium	Small	1 year
8. Share cookstove project experiences	Gov't, Alliance, INGOs, local NGOs, Private sector	High	Small	5 years

Monitor & Evaluate

Setting up partnerships with local NGOs can result in detailed yet cost-effective monitoring and evaluation

- Intervention Options-

7. Create M&E partnerships with local NGOs to carry out detailed monitoring and evaluation

8. Share cookstove project experiences broadly through the Alliance

- Actions -

- Identify local NGOs with deep grassroots presence built through regular community / household level activities, e.g. Gardens for Health (Ndera), REDO (Nyungwe), CARE
- Collect lessons learned from current cooperative models involving local NGOs, e.g. co2balance's project in Northern Rwanda
- Set up a precedent for cooperation between implementers and local NGOs that supports knowledge sharing

- Set up a national (potentially regional) platform to share experiences with cookstove dissemination in Rwanda
- Confirm whether it is effective to utilise the stove centre of excellence for this

- Outcomes-

- Implementers are better able to match their stove programs to customer needs
 - More favourable carbon finance conditions
 - Level of market intelligence on Rwanda cookstove sector is increased and can be carried out more objectively
 - The buy-in from consumers to buy/utilize improved stoves also increases by involving local NGOs and providing them with a part of the revenues to invest in the local community
-
- Lowering the barriers to enter the Rwandan cookstove sector/reducing risk
 - Implementers are better able to match their stove programs to customer needs

Cookstoves Value Chain

Products in the Market

The Rwandan cookstove market is fairly mature with an improved cookstove penetration of over 50%, and over a third of these stoves coming from local markets¹. Charcoal stoves and wood stoves are widely available in commercial centers, although not all of the rural population can access them.

Although most improved stoves currently in Rwandan homes are fixed (with chimneys being present in about half of the cases), the use of portable stoves is also common². The quality of traditional but also of improved stoves varies significantly: Many 'improved' stoves seem to have no or very limited efficiency and emissions improvements versus traditional methods. As the quality varies considerably, many Rwandans are not prepared to pay more for improved stoves. The recent introduction of a certification for the government-introduced improved Canamake stove is an important first step to address this issue.

Availability of Materials & Fuel

As Rwanda is landlocked and has limited resources of its own, the availability of raw materials for stoves can be an issue. Artisanal producers sometimes struggle to get the metal needed for some improved stoves, and SNV indicated the high price of cement is one of the key drivers for the significant cost of biogas plants. On the other hand, Rwanda has large supplies of good quality clay and

volcanic pumice that can be used for stove production.



Certified Canamake stove

Regarding fuel access for consumers, wood is the dominant fuel in rural areas whereas in urban areas charcoal is the primary fuel by the majority. Despite ongoing government efforts to reduce dependence on biomass, over 95% of Rwandans still cook on wood fuels. Although the well-off in the city have access to modern fuels and, in large part, seem to prefer LPG, the penetration is very limited, even these households often use charcoal for meals that are time consuming.

The current demand for wood is about twice the sustainable supply, and this wood shortage has led to rapidly rising prices for charcoal; the price doubled between 2003 and 2008. The price has continued to raise after 2008, and there is no reason to believe this trend will cease anytime soon. The total value of the charcoal market was over \$50 million in 2008, accounting for more than 2% of GDP. This is comparable to the market for electricity and is larger than the export value of coffee, indicating the significance for the rural economy.

Cookstoves Value Chain

Due to the high dependency on biomass and wood fuels in particular, most current cookstove initiatives are focussing on improving stove efficiency, rather than climbing the energy ladder. As such, it is critical that improved biomass initiatives are incorporated into a cookstove intervention in the Rwandan market.

Current charcoal producing techniques are detrimental to the environment due to the poor efficiency: Production of 1kg of charcoal takes up to 9kg of wood. Furthermore, current charcoal production is linked with the unregulated, charcoal trade (and associated social ills) and often results in poor quality fuel for the households. The charcoal purchasers currently buy charcoal by volume and are hence unaware at the point of purchase as to the weight of the charcoal they've purchased, whether it was sourced legally nor whether the charcoal is of substantial quality.

There is an on-going study into the charcoal supply chain, with the aim of spreading improved production techniques (developed by a Rwandan charcoal expert who trains producers across East Africa), introducing standards/certifications and cleansing the charcoal supply chain to reduce the cost of this improved fuel. This could

have a substantial impact if rolled out alongside the charcoal stove initiatives.

Although still in the research/pilot stage, another interesting approach to address the current dependency on charcoal is the agricultural waste 'briquettes' being investigated by D-Lab (MIT). Whilst the level of emission reduction is unclear, the impact upon deforestation and the potential to create an additional source of income for subsistence farmers could have a major impact on livelihoods of the most vulnerable. If the pilot demonstrates that the fuel can be used with improved charcoal stoves, whilst not a long term solution, it is worth investigating further. The initiative seems to be on the government radar, as His Excellency Paul Kagame met the team when they made a field trip to Rwanda in 2011.



Agricultural charcoal briquette

Production

Whilst standard cookstoves are easily obtainable (via markets/local artisans), the quality of the stoves on offer has proven to be a considerable issue.

The majority of rural households are using in-situ wood burning stoves, built by a local artisan. These stoves often lack quality assurance and the efficiency gains are limited. Many also lack chimneys and hence occasionally, (worst case scenario), stoves are brought inside with minimal improvements to emission reduction, hence causing a net increase in IAP. NGOs have focussed on increasing the expertise of artisans through train-the-trainer models, but not without issue. The train-the-trainer approach allows a large number of artisans to be reached in a relatively quick and cost effective manner, but it became apparent that those trained in the 2nd/3rd generation of the program showed limited improvements in their stove building capabilities. As such there is scope to replicate the models used elsewhere, whereby each region has a team of expert technicians, who can provide regular training 1st hand, but also provide follow up sessions and monitor stove quality going forward.

For the urban market, a large number of charcoal stoves

are available, and although they look similar to the government approved canamake, they are often built of lower quality materials – this is especially an issue for the clay, which often fails to withstand the necessary heat due to poor production techniques. With the exception of the canamake, these are typically produced by small companies with limited training with regard to manufacturing and quality assurance. To avoid stifling the private sector, there is scope to work with these companies to build awareness of best practice with regard to the science of efficient stove design and manufacturing processes to improved production techniques. Cooperatives would also enable standards to be monitored more easily by an independent authority and allow the producers to benefit from economies of scale.

Sales & Distribution

Due to the lack of disposable income within rural communities, most stove producers are competing to produce the cheapest stove possible whilst achieving acceptable gains in stove quality. As such, the low price and associated profit margin makes it difficult for companies to distribute goods to rural areas that are often difficult and thus expensive to reach due to limited infrastructure.

Cookstoves Value Chain

Due to the strong governance in country and the target-led initiatives at the local level, by incorporating stove distribution into regional targets, government distribution networks could be utilized for ICS, potentially creating local hubs in the communities which sell certified stoves.

There is also an opportunity to learn from distributors of similar goods (those which aim to sell to the bottom of the pyramid and hence lack the margin for expensive distribution channels). There are a number of solar product distributors that fall into this category; it may also be possible to set up partnerships with these organizations to lower cookstove distribution costs.

There would be greater incentive to invest in distribution to rural areas if there was confidence in the potential sales within these communities. However, the lack of disposable income of rural households remains an issue. Microfinance and community savings schemes are promising potential solutions, especially since the payback time on stoves could be demonstrated to the lender once certification is implemented. Community savings schemes for national health insurance and a government-led microfinance program for biogas plants have shown the potential of such financing solutions in Rwanda.

Since Rwanda is a landlocked country, there are financial concerns around the viability of importing improved cookstoves. Whilst there are benefits to in-country production, in order to achieve high market penetration in a timely manner (desirable given the high health and environmental impact in country), it would be advantageous to reduce/remove the import tax on clean technology. In addition, to incentive consumers away from inefficient fuels, it is recommended that alternative fuels e.g. pellets, improved charcoal, agricultural charcoal and LPG are subject to the same tax conditions as illegally produced charcoal (currently not subject to VAT).



Equipment for rural entrepreneurs to pay solar lights in installments (pay per charge)

Enhance Demand and Strengthen Supply: Cookstoves Value Chain

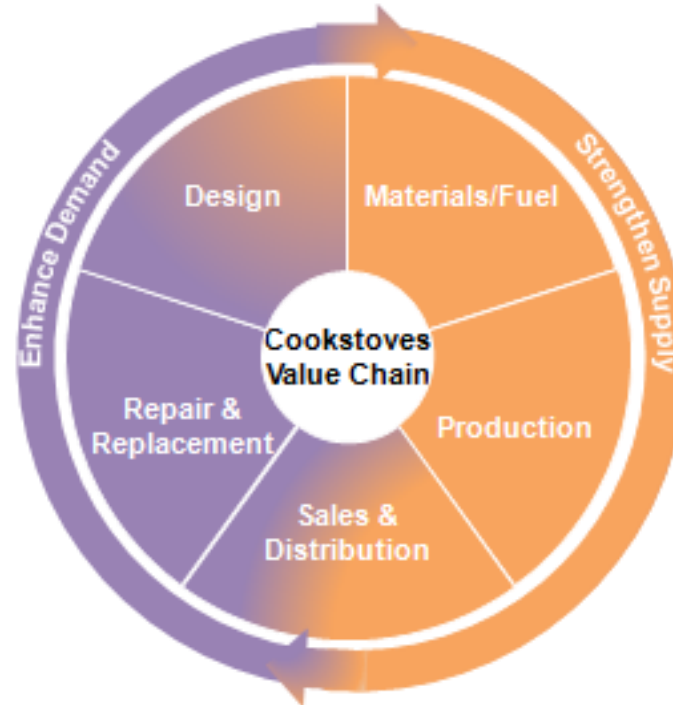
Through gaps identified in the Cookstoves Value Chain, Intervention options will focus on **Materials/Fuel, Production and Sales & Distribution**

Design

- ✓ Stove Type
 - ✓ Fixed
 - ✓ Portable
 - ✓ Biogas Digester
 - ✗ Solar
- ✓ R&D
 - ✓ Private
 - ✓ Gov't/Academics

Repair & Replacement

- ~ Supply of Repair Skills and Parts
- ~ Post-sales Service



Materials/Fuel

- ~ Stove Raw Material Supply
- ~ Stove Raw Materials Cost
- ~ Fuel Value Chain
 - ~ Biomass
 - ~ Clean Coal
 - ✓ Solar/Biogas
 - ✗ Petro based
- ✗ Cost of Clean Fuels

Production

- ✗ Scalability
 - ~ Handmade
 - ~ Masons
 - ✗ Factory
- ✗ Producer Fragmentation
- ~ Producer Financing
 - ~ Access to Capital

Sales & Distribution

- ✗ Financing Purchasing (micro-credit)
- ✓ Carbon Financing
- ~ Customer Segmentation
- ✓ Implementation Pilots
- ~ Last Mile Distribution
- ~ Reach Vulnerable Populations

KEY: ✓ Advanced/ Favorable ~ Has Potential/ Neutral ✗ None/ Unfavorable ■ Focus Area

Many key materials for ICS and modern fuels are expensive in Rwanda, and improved biomass fuels are currently unable to scale to the level required to make a considerable impact

Situation

There is a lack of high quality metal to produce improved cookstoves; imported materials like cement are relatively expensive and can make up a large part of improved stove costs. The various improved / clean charcoal initiatives are still on a small scale. Fossil fuels have to be imported, driving up the costs and electricity is expensive.

Rationale

- 85% of Rwandan energy consumption comes from biomass; half of which is not sustainable
- Using traditional production methods, the use of charcoal is notably less efficient than cooking on wood (7-9 kilos of wood are needed for 1 kilo of charcoal, while efficiency gain is significantly lower)

Intervention Options

	Involved Parties	Likelihood of Success	Budget	Estimated Time
9. Study agricultural charcoal production	Gov't, Academic sector, Alliance	Medium	Small	6 months
10. Improve charcoal production and distribution	Gov't, Authority, Private sector	Medium	Medium	2 years

Improvements in charcoal production provide the greatest opportunity to increase the efficiency and cleanness of the fuel landscape in the short term

- Intervention Options-

- Actions -

- Outcomes-

9. Study the opportunity for large scale agricultural charcoal production

- Work with MIT D-Lab to study possible business models for agricultural charcoal in Rwanda
- Involve KIST to build local expertise
- Involve the Ministry of Infrastructure early in the process as it is a key stakeholder

- Possibility of setting up a market for an affordable fuel that greatly reduces the impact of cooking on health and the environment (deforestation)

10. Improve charcoal production and distribution

- Train communities in improved charcoal production techniques
- Work with the Rwandan Bureau of Standards to create charcoal production standards and certifications (*additional to intervention option 1*)
- Harmonize this policy across the Eastern African Community
- Work to streamline the improved charcoal supply chain

- The fuel that is currently used by over 50% of the urban population (and 11% of Rwanda) becomes cleaner and more efficient, and thus will also become affordable for a wider range of Rwandans – enabling people to move away from fire wood
- Removing unnecessary actors from the improved charcoal supply chain will lower its price to a competitive level

Production of stoves is taking place on small scale, with inconsistent levels of efficiency

Situation

Although almost all stoves are produced in Rwanda, there are no large stove factories. Production predominantly takes place at the local artisan level, who typically create a range of products to make a living. Methods and quality vary considerably.

Rationale

- CARE and Aprovecho indicated in interviews that quality control is essential yet difficult as many artisans were producing the CASE project's stoves on a small scale and training can be third hand (or more)
- IB&C indicated that, although stoves are similar throughout Rwanda, economies of scale are not utilized

Intervention Options

	Involved Parties	Likelihood of Success	Budget	Estimated Time
11. Promote the creation of large cooperatives / factories	Gov't, Private sector	Medium	Medium	2 years
12. Share best practices on efficient production	Gov't, Private sector, Academic sector, Alliance	High	Small	5 years

Creating more cooperatives/factories and sharing best practices will improve the quality and consistency of production while decreasing costs

- Intervention Options-

11. Promote the creation of large cooperatives/factories for stove production

12. Continuously share best practices on efficient production

- Actions -

- Work with local governments at the district level to identify opportunities for the creation of cooperatives and factories
- Inform artisans of the benefits of working in a cooperative and facilitate the formation of cooperatives
- Investigate the feasibility of setting up a factory in Kigali that is utilized by multiple stove programs

- Working with local governments, set up a platform to share best practices nationally (potentially via the centre of excellence)

- Outcomes-

- Greater scale of production will decrease costs of improved stoves, making them affordable for a larger part of the population
- The creation of cooperatives and factories will also lead to higher and more consistent quality, increasing demand for improved stoves

- Production of improved stoves with higher and consistent quality for the lowest possible cost, increasing demand

The fact that many Rwandan households have little to no disposable income and the struggle to reach last mile distribution are important factors preventing widespread adoption of improved cookstoves

Situation

Existing cookstove projects have shown that even a very low purchasing price can be a big barrier for many. Private companies struggle to reach last mile distribution whilst maintaining affordability

Rationale

- The lack of micro financing or savings schemes for the purchase of cookstoves is a great barrier, as over 40% of Rwanda lives under the poverty line
- As 81% of the population lives in rural areas, last mile distribution is key to reach widespread dissemination

Intervention Options

	Involved Parties	Likelihood of Success	Budget	Estimated Time
13. Set up savings and micro finance programs	Gov't, Private sector	Medium	Medium	2 years
14. Remove remaining taxation	Gov't	High	Medium	6 months
15. Improve last mile availability	Gov't, Local gov'ts, Private sector	Medium	High	5 years

Sales & Distribution

Collective finance programs and government incentives will improve availability and affordability of cookstoves for the poor rural population

- Intervention Options-

- Actions -

- Outcomes-

13. Set up community-based savings and micro finance programs

- Set up a microfinance program for improved cookstoves with the national government that draws lessons from MININFRA's biogas program and that local governments can use
- Set up a community savings program for improved cookstoves based on existing national health insurance plans that local governments can use

- Local governments can use the savings program to make improved stoves accessible to populations with little disposable income, or utilize the microfinance program to pre-finance the fuel savings for the poorest

14. Remove remaining taxation on clean stoves and fuels

- Agree on the removal of taxation (import taxes and VAT) within the EAC and guarantee this for a 5 year period for both clean stoves and clean fuels (criteria: emissions below WHO norms when used under normal conditions)

- The private sector has more potential for profit and quicker scalability, along with the certainty that a project will be able to provide clean stoves/fuels at an affordable price for a set period making investments in such initiatives more favorable

15. Improve last mile availability of improved cookstoves throughout Rwanda

- Identify areas that are hardest to reach and lobby for improved roads
- Create incentives for local governments at grassroots level to ensure the availability of adequate improved stoves in their areas
- Gather and share lessons learned on last mile distribution in different sectors, e.g. solar lighting entrepreneur models

- The rural population has easy access to adequate improved stoves
- Increased economic activity in remote rural areas

Executive Summary

Project Approach and Background

Intervention Options

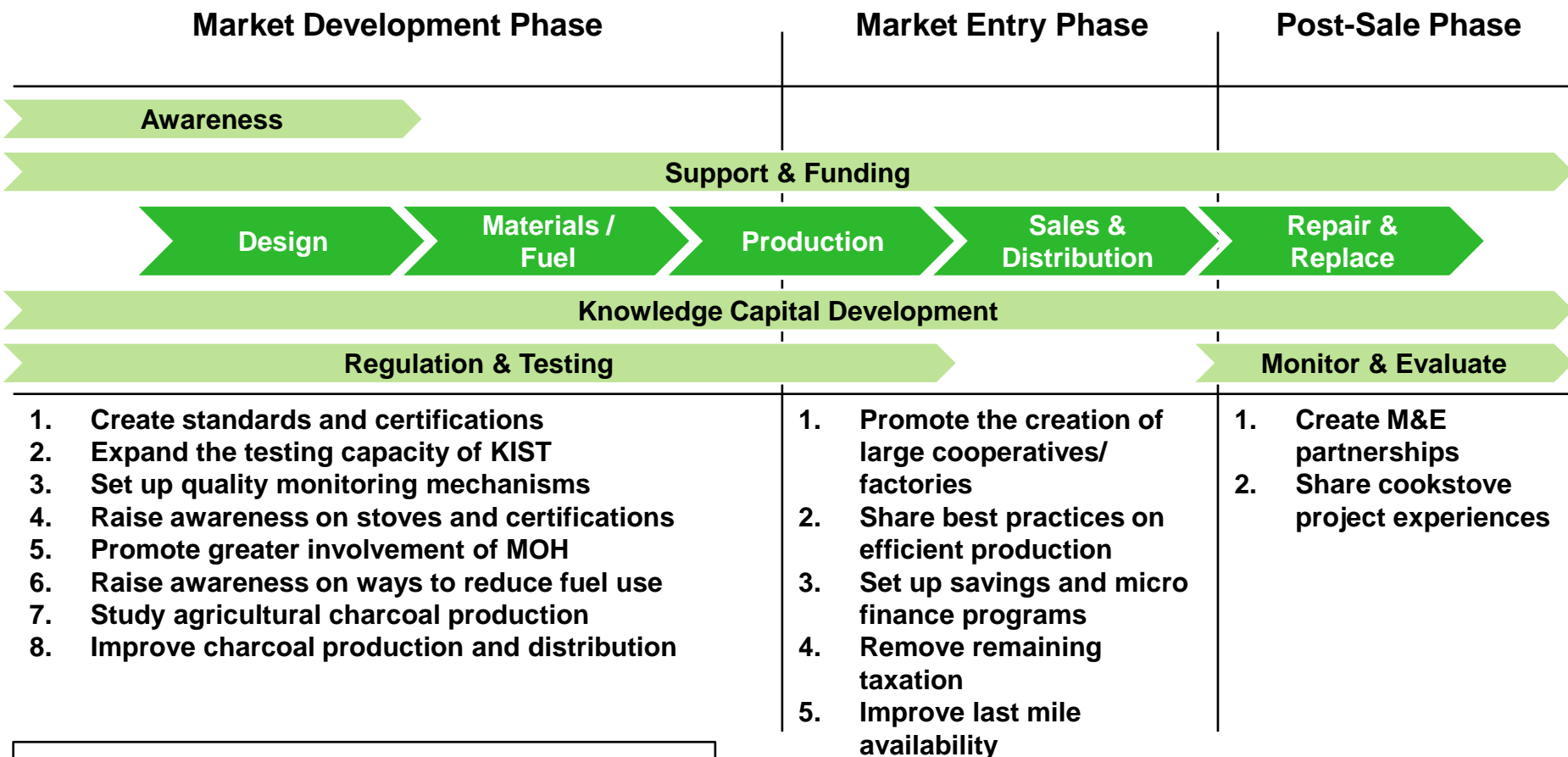
Roadmap

Conclusion

Appendix

Intervention Options Roadmap Overview

The Cookstove Value Chain is a sequential process, and contains interdependencies. Similarly, the Enabling Environment Framework components should be done in lock-step with the value chain



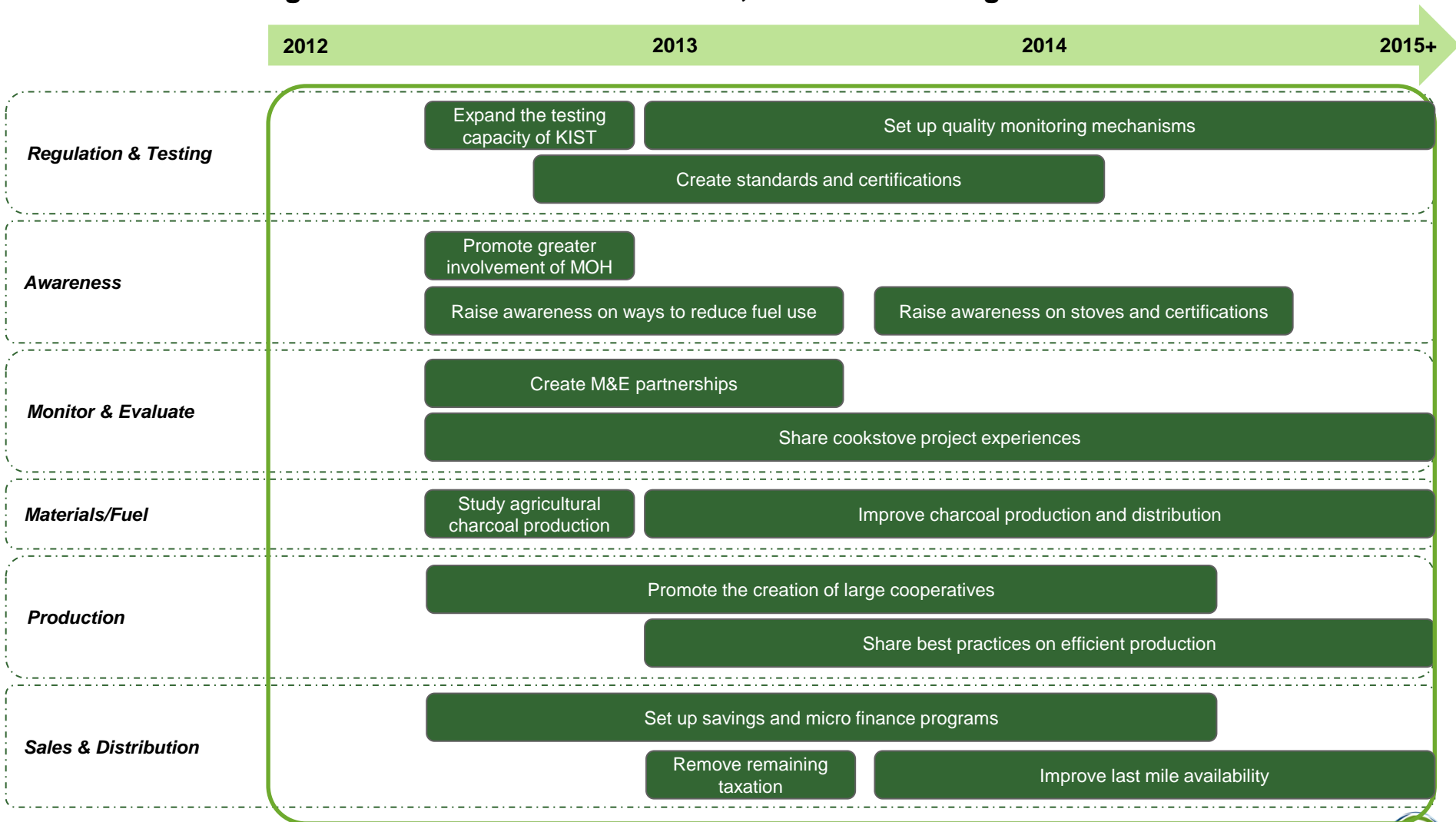
Key

-  Cookstove Value Chain Component
-  Enabling Environment Framework Component



Intervention Options Roadmap

Intervention options will focus on cultivating a market-based environment for cookstoves, supporting manufacturers to get their cookstoves to end users, and on sustaining this market



Executive Summary

Situation

Intervention Options by Customer Segment

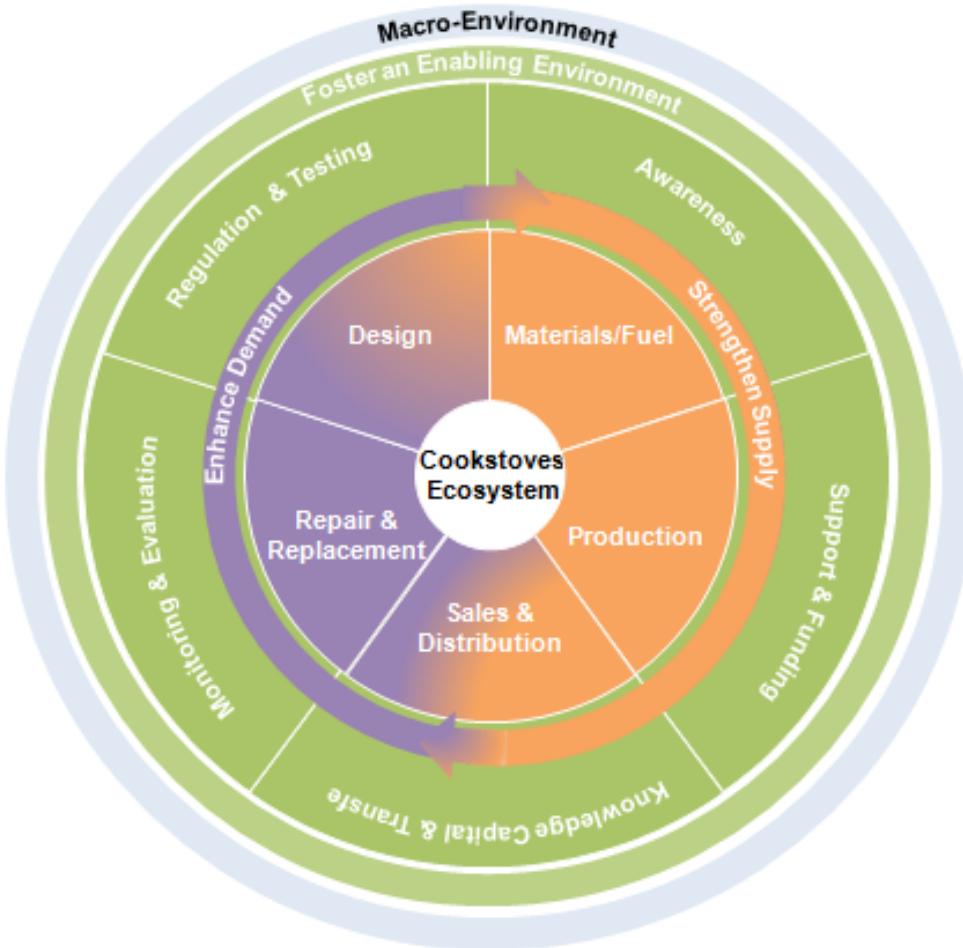
Intervention Options Roadmap

Conclusion

Appendix

Conclusion

In Rwanda, the cookstove sector is fragmented and mostly led by NGOs. There is a need to develop private sector interests so cookstove production can be scaled-up.



Macro Environment

- Rwanda counts 2.5 million households, mostly situated in rural areas
- Strong, directive government
- 85% of energy comes from biomass (95% of Rwanda cooks on it), half of which is unsustainable

Enabling Environment

- Awareness and government support on the fuel efficiency aspect of cookstoves is high, but awareness of the health aspects is much less developed
- There are very limited standards within the cookstove ecosystem and the testing capability is limited

Cookstoves Value Chain

- As modern fuels are expensive and the majority of cooking is done on wood fuels, cleaner charcoal presents an exciting opportunity
- Production is currently fragmented and quality control is lacking
- Last mile distribution and affordability are key challenges to cookstove dissemination in rural areas

Executive Summary

Situation

Intervention Options by Customer Segment

Intervention Options Roadmap

Conclusion

Appendix

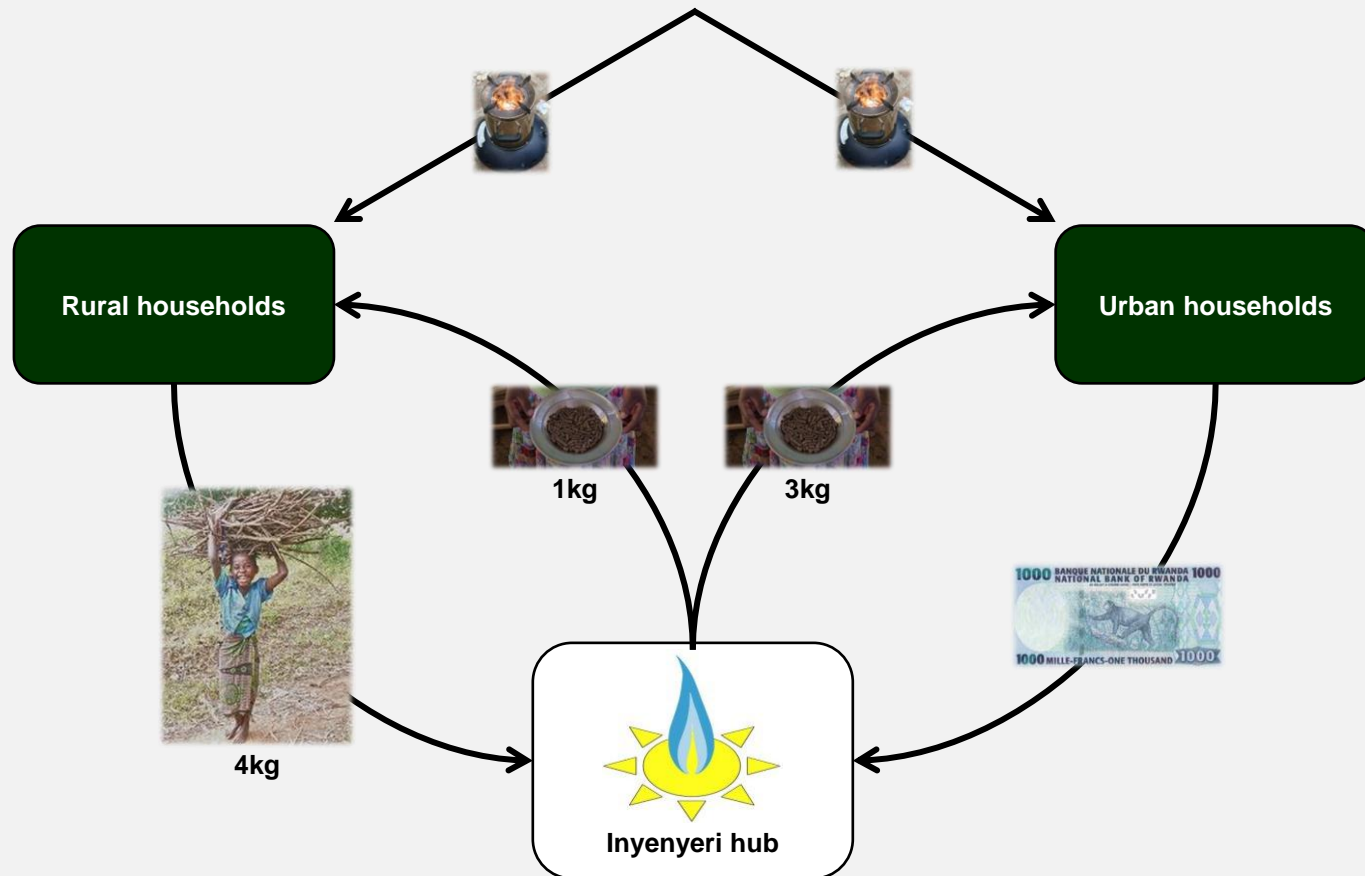
Case Study A: Inyenyeri business model (1/2)

- **Organization:** Inyenyeri
- **Region:** Gisenyi
- **Stove:** Philips Gasified Stove; other stoves to be added
- **Fuel:** Biomass Pellets
- **Price:** Distributed for free; *price is around \$60*
- **Funding:** (see the next slide for a visualisation)
 - ✓ Biomass is crowd sourced by rural communities. The biomass is used to create high density pellets, which are four times as efficient as traditional wood fuels. The pellets are then distributed to the biomass collectors for free and sold to those who would rather pay for fuel (typically those in urban areas). For all customers, the stoves will be distributed for free and the fuel will be sold for a price lower than charcoal
- **Stoves Distributed:**
 - ✓ In pilot, RCT are being used to gather detailed information regarding cooking practice, consumer feedback, Willingness To Pay for fuel etc.
- **Best Practices:**
 - ✓ The stoves are consistently very high quality since they are mass produced by Philips
 - ✓ The efficiency is impressive ($\frac{1}{4}$ of biomass is required)
 - ✓ The carbon and IAP emissions are drastically reduced (meeting European and American standards)
 - ✓ The cooking experience is familiar, with greater control over fuel use/temperature – the stove is hotter than traditional methods



Case Study A: Inyenyeri business model (2/2)

1 Stove of choice (currently only Philips gasifier stove) is provided for free to rural and urban households



2 Households obtain the biomass pellets from the Inyenyeri hub in return for collected biomass (rural areas) or money (predominantly urban areas). The high efficiency of the pellets allows 4 households to cook on the biomass collected by 1 household

Case Study B: Biogas plants

- **Organization:** SNV, MININFRA (Household), *Central Government* (institutions)
- **Region:** Nationwide, although most concentrated in Kigali district
- **Stove:** Ecocina
- **Price:** Cheapest household plant: 650,000 RWF (1,100 USD)
- **Funding:**
 - ✓ Government subsidy: 300,000 RWF (500 USD)
 - ✓ Scheme is not accessible for the bottom of the pyramid; to qualify, the household must have at least 2 cows
- **Stoves Distributed:** 2,000 household biogas plants. 13 prisons use biogas
- **Best Practices:**
 - ✓ The cooking experience is very pleasant – simple to use, clean flame, easy to control, high temperatures easily obtained
 - ✓ Emissions are dramatically reduced
 - ✓ The slurry can be used as a high quality fertiliser
 - ✓ The biogas can also be used to provide lighting
 - ✓ Using biogas in the prisons has resulted in dramatic cost savings (\$1.7 million USD/year) and a reduction in deforestation
 - ✓ The households have readily adopted the new cooking style – raised stoves (less likely to result in back problems when cooking for prolonged periods)



Case Study C: Improved Charcoal Stove: Canamake

- **Organization:** EWSA /Practical Action
- **Region:** Several districts (selection criteria – availability of raw materials/skills), plan to become national.
- **Stove:** Improved charcoal stove - Canamake
- **Price:** 4,000 RWF (6.5 USD)
- **Funding:**
 - ✓ Driven by market forces, stoves aren't subsidised
 - ✓ The stoves are produced by local cooperatives (in-built QA processes)
 - ✓ EWSA/Practical Action help establish the cooperatives, train the staff and provide the kilns/moulds (although these costs are partly recovered once the cooperative is established)
- **Stoves Distributed:** 1,200 canamake stoves distributed
- **Best Practices:**
 - ✓ 35% reduction in IAP, 40% reduction in charcoal
 - ✓ Builds skills of local artisans
 - ✓ The stoves look similar to traditional charcoal stoves, but are Quality Assured. As such, there is a registered trademark in country which is displayed on the stove and in corresponding marketing/training material. The consumers are aware of the benefits regarding emissions and efficiency
 - ✓ Not reliant on subsidies/donors –more sustainable
 - ✓ Demonstrates that a market is available



Pictures taken from:
Dissemination of Improved Cook Stove in Urban Rwanda, Project Progress Brief, 2011.

Case Study D: CARE - artisan woodstoves

- **Organization:** Care
- **Region:** 24/400 sectors of Rwanda (funding limitations)
- **Stove:** Improved wood stove
- **Price:** 3 stove types: 1000-2000 RWF; 3000 RWF; 12,000 RWF (with chimney)
- **Funding:**
 - ✓ The stoves are not subsidised – uses a ‘train the trainer’ model to enable local artisans to produce higher quality stoves
 - ✓ The initial training/monitoring is expensive and funding is no longer available
- **Stoves Distributed:** Trained 1,200 artisans first hand to be able to train 8,000 in total, aims to reach 24,000 households
- **Best Practices:**
 - ✓ Builds skills of local artisans
 - ✓ Worked with several major players in Rwanda and internationally including Aprovecho (who speak highly of the stove improvements) as well as local educational institutions e.g. KIST
 - ✓ Proactively focused on training women and ensuring they were involved with all stages of the project
 - ✓ Utilized a very strong grass roots presence in the poorest communities to understand consumer desires and establish buy-in from the community



Picture taken from:
<http://praktiblog.files.wordpress.com/2011/08/rwanda.jpg>

Case Study E: Enedom – cooking ‘package’

- **Organization:** Enedom
- **Region:** District of Kigali
- **Stove:** Save80 + 2 pots + ‘wonderbox’
- **Price:** Used to be 55,000 RWF (92 USD) but recently lowered to 28,000 RWF (46 USD); it has not been confirmed whether the new price includes the pots and ‘wonderbox’
- **Funding:**
 - ✓ The stoves are sold in the market at a price reduced by carbon credits, no additional subsidies
 - ✓ Atmosfair are the implementing partner. Without carbon credits, the cooking package costs in excess of 100,000 RWF
- **Stoves Distributed:** 270 stoves sold since August 2011
- **Best Practices:**
 - ✓ Split manufacture: the parts are mass produced in Germany (high levels of quality control) and assembled in Rwanda (supporting the local economy)
 - ✓ Provides a holistic cooking package, ensuring the pans are a perfect fit for the skirt
 - ✓ The wonder bags reduce cooking time for all stove types and Enedom stressed that these have been very popular
 - ✓ Innovative distribution model – works with local factories to set up an installation payment scheme



Case Study F: Charcoal supply chain

- **Organization:** CARE/EWSA
- **Region:** Country-wide
- **Stove:** N/a
- **Price:** N/a
- **Funding:**
 - ✓ Project funded by the central government: EWSA/MININFRA – funding has expired
- **Stoves Distributed:** N/a
- **Best Practices:**
 - ✓ EWSA and CARE worked together to perform primary research into the charcoal value chain. Charcoal is currently unregulated, with quality and price differing considerably by region. Low quality charcoal can contain a high proportion of dust, in addition to poorly carbonised charcoal producing additional harmful emissions when burnt
 - ✓ The charcoal is typically produced in an inefficient manner, resulting in an excess of trees being unnecessarily deforested
 - ✓ The project looked into improved carbonisation techniques (halving the quantity of wood needed to produce the charcoal), developed by a local consultant – the technique was awarded the SEED Award
 - ✓ Aimed to cleanse the supply chain, increasing transparency thus lowering cost in urban areas and ensuring a fairer price for the producers
 - ✓ Official trademarks/brands were to be introduced to ensure the end consumer could have confidence in the quality of the charcoal
 - ✓ This project, if re-ignited, could benefit all charcoal stove projects and severely reduce deforestation

Case Study G: Agricultural charcoal

- **Organization:** MIT D-Lab
- **Region:** Based at MIT, US
- **Stove:** N/a
- **Price:** N/a
- **Funding:**
 - ✓ Private
- **Stoves Distributed:** N/a



Fuel from the fields - background.xps

- **Best Practices:**
 - ✓ Developed a technique to produce briquettes from agricultural waste
 - ✓ Can be produced locally and cheaply using readily available materials. Turning waste into a potential income stream for some of the poorest in society
 - ✓ Addresses the issue of deforestation for fuel wood
 - ✓ Considerably reduces household emissions compared with burning wood
 - ✓ Since charcoal stoves are likely to remain popular in the immediate future, this could be an immediate game changer with regard to boosting the income of rural households (currently an issue with regard to ICS) and tackling deforestation
 - ✓ Pilot studies could be executed very cheaply (minimal start up costs) – the guide to manufacture is available [here](#)
 - ✓ 1000 local producers have been trained globally to date – across 20+ countries
 - ✓ One of 22 winners (out of more than 2,000 entries) in the 2007 World Bank Development Marketplace Competition

Case Study H: Del Agua Health Rwanda Program

- **Organization:** Del Agua/Manna Energy
- **Region:** PoA is designed to include rural Rwanda and several other countries (TBC)
- **Stove:** High-efficiency cookstove (TBC)
- **Price:** Yet to be decided
- **Funding:**
 - ✓ Private
 - ✓ Water treatment and improved cookstove project, funded by carbon credits using a CDM PoA and CPA
- **Stoves Distributed:** N/a – project will start in 2013
- **Best Practices:**
 - ✓ Planning to distribute point of use water treatment and high efficiency cookstoves to approximately 2 million residents in Western Rwanda
 - ✓ Utilizing carbon financing
 - ✓ Working in partnership with the Ministry of Health and REMA
 - ✓ Long term strategy looks to expand the PoA into several countries

Glossary of Terms

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

AIDS	Acquired Immunodeficiency Syndrome	MFI	Microfinance Institution
ALRI	Acute Lower Respiratory Infection	MININFRA	Ministry of Infrastructure
BEST	Biomass Energy Strategy	MOH	Ministry of Health
CDM	Kyoto Clean Development Mechanism	NGO	Non-Governmental Organization
CF	Carbon Finance	PoA	Programme of Activities
DALY	Disability Adjusted Life Year	RBESS	Rwanda Biomass Energy and Stoves Survey
DNA	Designated National Authority	RFP	Request for Proposal
EWSA	Energy, Water & Sanitation Authority	Rwf	Rwandan Franc
GDP	Gross Domestic Product	SME	Small to Medium Sized Enterprise
HH	Household(s)	UN	United Nations
HIV	Human Immunodeficiency Virus	UNHCR	United Nations High Commission for Refugees
IAP	Indoor Air Pollution	USD	US Dollars
ICS	Improved Cookstove	VCM	Voluntary Contribution Mechanism
ICT	Information and Communication Technologies	WHO	World Health Organization
iNGO	International Non-Governmental Organization		
KIST	Kigali Institute for Science and Technology		
LPG	Liquid Petroleum Gas		
M&E	Monitoring and Evaluation		