Business Plan

Rwanda Rocket Stoves

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Executive Summary

Amongst the treeless rolling hills in the landlocked nation of Rwanda, the burdening price of firewood continues to oppress the local community. As the most densely populated country in Africa, the alarming rate of deforestation in Rwanda has led to the outlaw of cutting down trees for firewood. Currently, firewood is still used by over 90% of the population for cooking and heating. The kitchens in most Rwandan homes and institutions can be described as indoor campfires. Aside from deforestation and other environmental concerns, these campfires cause permanent adverse health effects from the continuous exposure to smoke. Additionally, the decreasing resource and escalating demand of firewood results in rising costs and consume the majority of a household's budget. This tension is more pronounced in institutions such as schools, orphanages and hospitals, which provide food for large groups of people.

In response to this problem, Rwanda Rocket Stoves (RRS) designed a high-efficiency, institutional-scale cooking stove that reduces firewood usage by up to 75% in comparison to traditional cooking styles. The increased cooking efficiency keeps more money in the users' pocket to reallocate to other essentials such as schooling, nutrition, and health care. The stove also eliminates smoke in the kitchen because of a more efficient combustion process.

After the successful implementation of 22 stoves, RRS partnered with a local Rwandan entrepreneur, Innocent Nsekeyukunze, to form Makoro Stoves. This social enterprise will be used as a vehicle for the technology to reach the masses. RRS has already raised $31K in funding, which have been allocated to cover capital costs and R&D. The US based non-profit, RRS, is aiming to raise $66K by August 1, 2010 to fund the social enterprise and US non-profit during Year 1. In Year 2, RRS plans to raise an additional $54K. By year 3 the business will run profitably without subsidies from RRS, although it will still support Makoro Stoves with R&D and technical support.

The Makoro Stove's high-efficiency combustion process is the catalyst for positive effects in Rwanda. The hospitals, orphanages, and schools using Makoro Stoves will save a combined $874K over five years. These stoves result in saving 1.2 million trees or roughly 2,900 acres of forest in five years. The use of these stoves allows for people in the kitchen to breathe clean air and live longer.

The RRS management team is comprised of active members of the University of Colorado's Engineers Without Borders chapter (CU-EWB). The team is comprised of three current graduate students and one undergraduate student. Christina Barstow, is the president of RRS, and will work full time after her graduation in August 2010 to fundraise and support the Rwandan Enterprise.

*Social Enterprise is a social mission-driven organization that applies market-based strategies to achieve a social purpose. The aim is to accomplish goals that are social as well as financial – often referred to as the triple bottom line (people, planet, profit). Rather than maximizing shareholder value, the main aim of social enterprises is to generate profit to further their social goals.

The Company

Mission

We aim to empower the people of Rwanda by providing cleaner, more efficient cook-stoves. These stoves offer a cleaner indoor air climate, a reduced expenditure on firewood, a reduced rate of deforestation, and a decrease in atmospheric emissions. Additionally, using all local materials, we aim to create jobs along the supply chain and boost the economy.

We provide an innovative structure which couples a local social entrepreneurship, Makoro Stoves, with a US based non-profit, Rwandan Rocket Stoves (RRS). Makoro Stoves is used as a vehicle to responsibly distribute these institutional sized stoves at scale. RRS aims to incubate the local based entrepreneurship providing innovative technologies, management expertise, and start-up funding.

History

RRS grew out of Engineers without Borders (EWB) at the University of Colorado. Over the past three years, the EWB Rwanda team at CU has developed an optimal institutional *Rocket Stove* of which 22 have been installed in Rwanda. EWB saw the potential for a social enterprise to distribute these stoves at scale. As a result, RRS and Makoro Stoves were developed. Innocent Nsekeyukunze has been a local partner through many EWB projects and is acting the manager of Makoro Stoves. EWB has transferred this knowledge and personnel to RRS in order to incubate Makoro Stoves and has already covered some of the capital costs for Makoro Stoves.

Structure

RRS will be run by the current project manager of the EWB Rwanda team, Christina Barstow. She will be assisted by volunteers from the current EWB Rwanda team. The majority of her responsibilities are fundraising to provide the year 1 and 2 subsidies for Makoro Stoves. RRS will obtain this money from social investments, meaning that there are no monetary returns, only social. By year 3 Makoro Stoves will be profitable and separate financially from RRS.

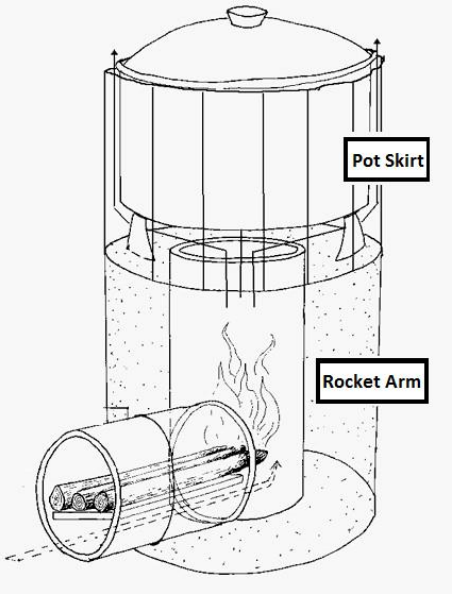
Christina has three years experience in project management and will continue to provide management mentorship to Innocent Nsekeyukunze for the inaugural three years. RRS will use customer feedback for guidance of future research and development. Additionally, other technologies will be explored. For these new markets, RRS will analyze the Rwandan market to determine the potential.

Makoro Stoves will be run by Innocent Nsekeyukunze, the local social entrepreneur. The stoves will be sold in the Northern Province of Rwanda. In addition to Innocent, the enterprise will employ a full-time salesman, a full-time foreman, Alfred, and many contract masons.

The Product

Rocket Stoves

Rocket Stoves can be made from various materials and come in all shapes and sizes. They are known for high efficiency, simplicity, and ease of construction. The geometry of the *rocket arm*or the combustion chamber, which can be seen in the diagram below[1], forces a near complete combustion of the firewood. In order to maximize efficiency the pot must be exposed to the heat as long as possible. In order to maximize this exposure, a pot skirt, shown below, is often used to compress the hot air against the pot as it escapes the stove.



Our Product

The Makoro Stoves' institutional sized stove is built on site to the exact pot size specification to maximize efficiency. It is constructed of all local materials, most importantly pumice rock, which is locally abundant. The tiny air pockets in the pumice make it an excellent insulator, which is ideal for the *Rocket Stove*. Quite simply, the less heat the materials absorb, the more can be transferred to the food. Pumice is used on the inside of the *rocket arm* and pot skirt to maintain high combustion temperatures. The image at the bottom of the page shows a unit installed in 2009 at L'Esperance Orphanage with six stoves constructed together to form a counter.

We will provide a three-year warranty, however these robust units do not require frequent maintenance. We will provide a monitoring service during yearly checkup to ensure proper use of the stove and maintain quality standards. Since *Rocket Stoves* are not abundantly used in Rwanda, they require behavior change and misusing the technology can reduce the benefits.

The Design

During the design process we tapped into the local resources. In order to design a stove that Rwandans will enjoy using, we have relied on continuous community participation and feedback during product design. We have received rave reviews from our most recent installation, which was updated with another round of feedback.

The Price

The stoves are sold for $325, which based on potential customer surveys results in an average payback period of 7.3 months.

[1] Modified from EchoTech.org

Social Return on Investment

As a social enterprise, Rwanda Rocket Stoves aims to bring a positive impact to many facets of human life. Investors should not support RRS for personal monetary gain. Instead, the returns from an investment in RRS manifest as social returns for Rwanda and the larger world community. As a result, instead of the typical 'Return on Investment' figure, RRS provides 'Social Return on Investment', or SROI, for those who offer financial support.

Economic Returns

The Makoro Stove will save money for schools, hospitals, and orphanages by using up to 75% less wood. After just the first five years of Makoro Stoves' operations Rwandan schools, hospitals, and orphanages will save a combined **$874K** as a result of buying and using the Makoro Stove. The money saved can be spent on each institution's specific and critical needs, such as lighting for hospitals, paying teacher's salaries, or food and beds for orphans. The Makoro Stove also decreases cooking time in half, so workers at a school or an orphanage will be able to spend less time cooking and more time helping out the institution.

Before expansion Makoro Stoves will directly employ 10 Rwandan workers and create many more jobs along the supply chain. Additionally, the increase in an institution's disposable income from the Makoro Stove will increase spending in Rwanda, to further create jobs and stimulate the economy.

It is absolutely critical to also consider the negative economic impact of demographics in Rwanda resulting from the stoves, before Makoro Stoves is launched. The wood vending industry will be impacted, as some of its main customers are institutions, which will need 75% less wood. In some locations, skilled labor, particularly masons, will be hired away by Makoro Stoves.

Environmental Returns

One of the major issues facing Rwanda is environmental degradation caused by an extremely high rate of deforestation. The endangered mountain gorillas have lost their native habitat as a result of extensive forest loss in Rwanda. Makoro Stoves will save a total of **1.2 million trees** after five years, roughly the equivalent of **2,900 acres** of forest. Makoro Stoves will help curb heavy erosion in Rwanda by reducing the rate of deforestation.

The impacts will be seen globally as CO_2 emissions into the atmosphere are reduced by the reduction of wood consumption. Over five years of operations **29,000 tons of CO_2** emissions will be saved from the atmosphere. This is roughly equivalent to the CO_2 annual emissions of over 6,000 midsize cars (averaging 12,000 miles driven per year). Because of the great CO_2 reductions investors should consider selling carbon credits if they seek monetary returns on an investment in RRS and Makoro Stoves. By selling carbon credits an investor will receive roughly $15/ton with potential earnings of $434K over the first 5 years.

Public Health Returns

The current smoky and uncomfortable kitchens in Rwanda are a result of cooking over a three-stone fire, which can simply be described as an indoor campfire. As a result of this nationwide practice, lower respiratory diseases are responsible for 13% of all deaths in Rwanda, and are the greatest cause of death behind HIV/AIDS[2]. The Makoro Stove produces almost no smoke. The World Health Organization

[2] www.who.int/whosis/mort/profiles/mort_afro_rwa_rwanda.pdf

estimates that on average the life of someone who dies from lower respiratory diseases is shortened by 15 years. The Makoro Stove can prevent hundreds of Rwandan's from dying young from lower respiratory diseases, and allow the next generation to live longer than the current 46-year life expectancy.

Continuous Development Returns

The most unique return is the model of RRS, or an international non-profit, incubating a locally run social enterprise. The framework of this symbiotic relationship will be an example to build on. From its success, RRS will propagate a model for sustainable development in other undeveloped countries.

Market Analysis

Opportunity

RRS will look to capitalize on the currently weak institutional stoves market in Rwanda. For the majority of schools and orphanages, cooking indoors on an open campfire is just a fact of life. There are 2072 primary schools and 504 secondary schools in Rwanda[3], nearly all are considered target customers who would benefit from a Makoro Stove. Few competitors reach rural institutions with their products. The institutions surveyed said they were unaware of where to purchase a better stove.

Size and Economy

Rwanda has an estimated population of 10.5 million people with a median age of 19. Rwanda is the most densely populated country in Africa, with a landlocked area of approximately 26,338 sq km (slightly smaller than Maryland). The 1994 Genocide decimated Rwanda's already fragile economic base. Slowly Rwanda has started to rebuild its economy and curb inflation, yet it is still highly dependent on aid money and International Monetary Fund relief.

Wood in Demand

Approximately 95% of the total national energy requirement is from biomass, with firewood accounting for 92.8%, and charcoal and agricultural residues accounting for 2.2%. This has contributed to the destruction of 50.2% of the forest and woodland habitat between 1990 and 2005.[4]90% of households depend on wood for cooking, and additionally wood fuel also represents 40% of the energy needs of commerce and industry.

Competition

There is a market vacuum in institutional stoves in Rwanda. Currently in Rwanda, there are only two clear competitors, the "military stoves" and the metal institutional stoves (Appendix A). The military stoves are free, but in addition to being difficult to obtain, they do not offer much of an advantage over a traditional three-stone fire. The metal stoves are $1,600 per stove and significantly less efficient than the Makoro Stove.

Consumer Market

To better understand potential customers, EWB conducted a customer survey in Ruhengeri, a town of about 72,000 people near the Congo border. The survey was completed by Innocent Nsekeyukunze and covered 13 schools (Appendix D). The schools were both public and private and cooked for 180 to 736

[3] http://www.rwandagateway.org/education/article.php3?id_article=93
[4] http://www.undp.org.rw/UNDPannualreport2007.pdf

people daily. In short, the survey pointed out how people don't like the smoke from their current stoves, but don't know how to get a better stove.

Marketing Plan

The Target Customers

The Makoro Stove was designed to meet the needs of large institutions cooking for several hundred people. When cooking on such a large scale, the wood savings from the stove are magnified, and the overall social, economic, and environmental impact is far greater than cooking on a small scale. Therefore, the target customers will be large institutions such as schools, hospitals, and orphanages in Rwanda. From the survey data, it is clear that nearly all institutions are interested in saving money, reducing smoke, and curbing deforestation, all of which are results of buying a Makoro Stove.

Initially, schools, hospitals, and orphanages in Rwanda's Northern Province will be targeted because it is the most populous province, and is where the pumice source is located. This will cut down on transportation costs for the first year.

Sales Strategy

The main avenue for distributing the stoves will be through the full time salesperson employed by Makoro Stoves. The vendor will travel around to target institutions and explain the benefits of the stove to those in charge.

Additionally, in Ruhengeri, a publicly displayed stove will be built at a discount to a customer. The stove will showcase the Makoro Stove technology and have information about how to contact Makoro Stoves to purchase one. This stove will also be a tool for demonstrating that the stove produces no smoke and uses less wood. This model will be scaled up in future years to meet the needs of an increasing demand. Showcase stoves will be built in other major population centers such as Gisenyi, Butare, Gitarama, Kibuye, and the capital of Kigali.

Once the business has become reputable, Makoro Stoves will establish an office or store in Kigali to reach other parts of the country. This will increase product visibility and provide a location to meet with potential customers. The high cost of real estate in the city will limit the immediacy of which this will be done.

Product Positioning

The Makoro Stove meets the needs of every school, hospital, and orphanage because it:

- Reduces firewood usage by up to 75%
- Eliminates smoke in the kitchen
- Costs up to 4 times less than other high efficiency stoves
- Cuts cooking time in half
- Uses an efficient and locally abundant pumice resource

Warranty

In the customer survey, institutions reported that their stoves only last three years on average. The Makoro Stove is under warranty for the first three years after installation. Any damage that hinders the effectiveness of the product will be fixed to meet quality standards. Also, all stoves will be inspected yearly by Makoro employees to ensure quality and functionality.

Pricing Strategy

To meet the aims of the RRS mission, the product needs to be affordable for institutions in Rwanda. The average surveyed institution stated they were willing to pay approximately $153 USD. This unreasonably low price may be partly explained by the fact that Rwanda is a bartering society where price negotiation is a key feature of every transaction. The range stoves in the institutions surveyed carried from $35 to $530 USD (Appendix C). However, these stoves are not nearly comparable to the Makoro Stove. Stoves of comparable efficiency can cost up to $1,500 in Rwanda (Appendix B).

Though priced well below comparable competitor's prices, the Makoro Stove is priced at $325 and will remain constant for the foreseeable future. The main reason for pricing the stove at $325 is to have the shortest possible payback period while still covering stove manufacturing costs ($300 in year 1 and $216 after year 1) and creating a profit. The price results in a payback period of fewer than 8 months assuming an average stove usage. The short payback time will convince potential buyers to make an investment in the Makoro Stove.

Buying Process

Makoro Stoves will give institutions the option of paying $325 for the stove upfront or with a $150 initial payment and eight $25 monthly installments. This will allow institutions the option to circumvent getting bank loans if they cannot cover the entire amount upfront. The customer will not have difficulty paying the $25 monthly installments because they will save an average of $44.50 each month on wood costs. Innocent Nsekeyukunze will be responsible for coordinating payments.

The Operations Plan

In order to maintain a competitive advantage, operations will be streamlined to minimize costs. Makoro Stoves will be based in Ruhengeri, a city in northwest Rwanda that is located close to the pumice source in order to reduce transportation costs.

Supply Chain & Operations

Makoro Stoves will use pumice sourced from local quarries located at the base of Mt. Virunga, which is on the northern border of Rwanda and the Democratic Republic of the Congo. Pumice will be harvested on the Rwandan side of the border and trucked to the warehouse in Ruhengeri. Once the pumice arrives at the warehouse, masons will cut the stone into blocks. The foreman, Alfred, will inspect the blocks to ensure that they meet the quality standards required to achieve the desired insulative properties. Quality pumice blocks will be inventoried and stored at the warehouse, while the rest will be recycled for later use in the construction process.

In addition to pumice, other building materials are available locally, such as stone masonry, concrete, and a metal grate used to suspend wood in the loading channel. These materials will also be transported to the warehouse in Ruhengeri, where they will be inventoried.

The salesperson based in Ruhengeri will receive the purchase orders from the institutions. Once the order is placed, Alfred, along with the masons, will load the truck and transport the materials to the site. The construction of a unit with 5 stoves (average) takes about 3 days to be completed. Alfred will

monitor the construction process and inspect the final stove to ensure that it meets the quality standards.

The clients can contact the manager Innocent Nsekeyukunze any time they have requests or need technical support. Innocent will evaluate the situation and decide if it requires Makoro Stoves to send the foreman to the institution.

Human Resources

All labor requirements will be filled locally. Specific personnel positions will be masons, truck driver, pumice block cutters, general facilities workers, and managers. The number of masons will scale with the number of concurrent building projects. Unskilled labor costs in Rwanda are typically $0.50 per worker per day. Skilled labor for installing stoves and cutting pumice blocks is more expensive. Makoro Stoves expects to pay a daily wage of $5.00 for skilled labor and $15.00 for managers. Training for skilled laborers and business management will be initially provided by RRS and incorporated into regular business operations.

Financial Plan

RRS needs to raise $30K for support of Makoro Stoves beginning in September 2010. RRS has the following budget and therefore needs to raise $66K, $54K, and $41K in Years 1 to 3:

RRS Budget	**Year 1**	**Year 2**	**Year 3**
Subsidy to the Rwandan Enterprise	$30,000	$15,000	$0
Managers salary for funding raising, management, and technical support	$30,000	$33,000	$35,000
Travel	$6,000	$6,000	$6,000
Total	**$66,000**	**$54,000**	**$41,000**

The Income Statement for the first 5 years of Makoro Stoves is shown below. Makoro Stoves becomes financially independent after Year 2, when it stops requiring subsidy from RRS. Sales increase every year. After Year 1, Makoro Stoves will have gained expertise in the use of materials, reducing the amount of materials wasted by 40%. In addition, Alfred and the masons will become more skilled in the construction of stoves after Years 1 and 2, leading to a reduction in the time spent building each stove and reducing the cost of labor. In Year 4, Makoro Stoves will establish an office in Kigali, increasing the number of projects per month to 6 in Year 4 and 8 in Year 5.

Income Statement

Revenue	Year 1	Year 2	Year 3	Year 4	Year 5
Number of stoves (3,4,5,6 and 8 projects per month)	180	240	300	360	480
Sales at $325 each	$58,500	$78,000	$97,500	$117,000	$156,000
Subsidy from RRS - US Nonprofit	$30,000	$15,000	$0	$0	$0
Total	**$88,500**	**$93,000**	**$97,500**	**$117,000**	**$156,000**
Cost of Goods ($300 in Year 1 and $222 in Years 2 and 3)					
$180 to $108 of Materials (Assuming 40% waste reduction after Year 1)	$32,400	$25,920	$32,400	$38,880	$51,840
$90 to $73 of Labor (Assuming 10% efficiency gain in Years 2 and 3)	$16,200	$19,440	$21,870	$26,244	$34,992
$30 to $33 of Transportation (Assuming 5% per year increase)	$5,400	$7,560	$9,900	$10,395	$10,915
Total	**$54,000**	**$52,920**	**$64,170**	**$75,519**	**$97,747**
Expenses					
Legal & Professional Fees	$200	$200	$200	$200	$200
Meals and Entertainment at office	$100	$100	$100	$100	$100
Office Expenses	$50	$50	$50	$200	$200
Payroll Expenses - Two employees - President and Sales Person	$12,000	$12,000	$12,000	$12,000	$12,000
Promotional	$50	$50	$50	$50	$50
Rent or Lease - rent $200/month for office and mfg, office in Kigali added in Year 4	$2,098	$2,098	$2,098	$7,343	$7,343
Research and Development	$1,000	$1,000	$0	$0	$0
Taxes & Licenses (12%)	$7,020	$9,360	$11,700	$14,040	$18,720
Travel	$100	$100	$100	$100	$100
Utilities	$1,154	$1,154	$1,154	$2,308	$2,308
Total Expenses	**$23,772**	**$26,112**	**$27,452**	**$36,341**	**$41,021**
Gross Profit	**$34,500**	**$40,080**	**$33,330**	**$41,481**	**$58,253**
Net Income	**$10,728**	**$13,968**	**$5,878**	**$5,140**	**$17,232**

The balance sheet and year 1 cash flow model are presented in Appendix D.

Funding

Fund raising is one of RRS's central responsibilities. RRS is looking for 66k of social investment to support the total efforts in Year 1. Most of this will be allocated to capital costs such as a truck, grinder, and generator. Some assets have already been purchased, notably an 8k concrete saw. In Year 2, RRS aims to raise 54k, which assists in scaling-up operations. After Year 2, Makoro Stoves will be profitable without any form of subsidies. Following Year 2, RRS will continue to fundraise for R&D and incubation of another Rwandan based social enterprise.

To date RRS has raised over 30k mostly from the National Collegiate Inventors and Innovators Alliance and the Engineering Excellence Fund. During the first week of March, 2010 the enterprise will be participating in the Sustainable Opportunities Summit in Denver to get exposure to investors. In March RRS is participating in the Global Giving Challenge, in which the most recent winner raised nearly 30k.

Challenges & Opportunities

Building Relationships

In Rwanda, Westerners are seen as an opportunity to make money. To address this issue, the customers will not be aware of Makoro Stove's relationship with RRS or any other international backing. Even given this invisible support from RRS, it will be a challenge to form trustworthy relationships along the supply chain. Even though Makoro Stoves has already built business relationships, as the business expands there will be a need to find more partners and develop trusting relationships.

Quality of the Product

To ensure the stove's quality, the employees are trained twice a year, in addition to yearly checkups on each stove. As we preserve the quality of the stoves, we also aim to increase the efficiency of manufacturing by 30%. The efficiency increase is particularly relevant to pumice because of the strict density requirements, which yield substantial waste. We will either recycle this resource into a concrete alternative or sell it to construction companies who build with pumice.

Funding

Getting funding may be a challenge since RRS does not provide any monetary return on investments. Social return on investments is uncommon and to some is unattractive. This is why RRS needs a full time employee, Christina Barstow, to fundraise.

Potential for Expansion

In Rwanda there is potential for Makoro Stoves to expand into tangential markets, something which RRS will continue to research. As firewood becomes an increasingly scarce resource, other fuels are gaining momentum. Fuel briquettes and charcoal are establishing themselves especially in the capital city, Kigali. There is promise for manufacturing briquettes from agricultural and organic wastes. We can either adjust the Makoro Stove to accommodate for this alternative fuel, or simply just sell briquettes to be burned in others. For over a year, EWB has been developing a smaller Makoro Stove to reach the household market. There is a huge potential, however significant international and domestic competition, will make competing in the market difficult.

Selling carbon offsets is another area that we have considered. This could drive down the cost of each stove, allowing for institutions with less fluid cash to purchase.

Social Return on Investment

The results of people using Makoro Stoves throughout Rwanda manifest in several different forms. The more efficient combustion process is the main catalyst for positive effects in Rwanda. The hospitals, orphanages, and schools using Makoro Stoves will save a combined $873K over five years. These stoves result in saving 1.2 million trees or roughly 2,900 acres of forest in five years. The use of these stoves allows for people in the kitchen to breathe clean air and live longer.

The Development Model

We will continue to use our US based non-profit to incubate the locally-run social entrepreneurship as a vehicle for change. The non-profit provides start up funding, mentorship, market analysis, and R&D. Once, the social enterprise is profitable and sustainable it separates from the non-profit. After we have shown that this is a successful model, it can be transformed for other beneficial appropriate technologies around the world.

Appendix A

Makoro Stove Calculations

Per Month Basis:		
Average wood budget per month	318	$
One cubic meter wood	17.45	$/m^3
Mass of one cubic meter	301	kg/m^3
Kg firewood per tree	25	kg/tree
Average number of stoves per institution	5	stoves
Wood budget per traditional stove	64	$
Wood budget per Makoro stove	19	$
Wood used per traditional stove	1,096	kg
Wood used per Makoro stove	329	kg
Wood savings per stove (mass)	768	kg
CO_2 released by traditional stove*	1,284	kg
CO_2 released by Makoro stove	482	kg
CO_2 Not Released into Atmosphere per Stove	800	kg CO_2
Money Saved per Stove	45	dollars
Trees Saved by Makoro Stove^	31	trees
*accounts for 80% combustion --all calculations assume all customers previously had a 3-stone fire set up		

Per Year Basis		
Average Savings Makoro Stove	430	dollars
Average Institutional Savings[a]	2,170	dollars
Stove Pay Back Period	7	months
Trees Saved by Each Makoro Stove	372	trees
Net CO_2 Emissions Saved by Each Makoro Stove	9.6	tons of CO_2
[a]assumes 75% of customers are schools and that each institution has 5 stoves		

Economic and Environmental Returns					
Year	Stoves Sold	Total Trees Saved in Year	Forest Area (acres)^	Total Net Emissions Saved Each Year (kg CO_2)	Total Combined Yearly Savings Institutions with a Makoro Stove
1	180	33,100	80	866,800	-$19,400
2	240	110,000	280	2,889,000	$52,200
3	300	209,000	520	5,490,000	$150,000
4	360	331,000	830	8,668,000	$274,000
5	450	485,000	1,200	12,710,000	$417,000
Total	1,530	1,170,000	2,910	30,620,000	$873,800
^assumes 400 trees per acre of forest					

Carbon Market projections	
Share Price per Metric Ton of CO_2	15 $/ton
1st Year Carbon Credit Revenue	$13,000
2nd Year Carbon Credit Revenue	$43,000
3rd Year Carbon Credit Revenue	$82,000
4th Year Carbon Credit Revenue	$130,000
5th Year Carbon Credit Revenue	$190,000

Appendix B

Local Competition in Commercial Stoves

Pictures	Stove Basics	Fuel Source	Disadvantages compared to Rocket Stove	Advantages over Rocket Stove	Approx. Cost USD
Military Stove – No Photo Available	Military Stove: Stove built by Rwandan military. Similar to a three stone fire but with a small amount of ceramic.	Wood	• Less efficient • Not durable • Longer cooking time • Produces lots of smoke	• Free • Installed by government	Free
	Three Stone Fire: Commonly used cooking method. Essentially a campfire.	Wood	• Less efficient • Shorter lifetime • Longer cooking time • Produces lots of smoke	• Free • Most common method of cooking	Free
	Metal Industrial Stove: Industrial stoves made from high quality metal. Currently the leading manufacturer of quality industrial size stoves.	Wood	• More expensive • Shorter lifetime • Less efficient • Longer cooking time • Produces more smoke than Rocket Stove	• Movable	$1,600/ stove
	The Ceramic Jiko Stove: Requires 50% less fuel	Wood	• More expensive • Less efficient • Lasts only approximately 30 months • Not designed specifically for an industrial setting	• About 700,000 stoves sold in Kenya and DRC • All parts can be made locally • World Challenge Finalist	Institutional $1,000; Residential $3-4
	EnviroFit: Reduces emissions up to 80%; Reduces fuel consumption up to 60%; Reduces cooking time by up to 50%.	Wood	• Not made of local materials • Slightly less efficient • Not designed specifically for an industrial setting	• Already sold thousands	$15-$60 depending on model
Various Rocket Stoves in the Market	Other Rocket Stoves: All vary in size and efficiency.	Wood	• Various	• Various	Various

Appendix C

Customer Surveys

Institution Basics	
Number of Surveys	13
Types of Institutions	All schools (public and private)
Average number of people cooked for	Average 450 people; Ranges from 180-736 people
Number of hours a day spent cooking	Average 10.5 hours; Ranges from 7-15 hours

Current Stove	
How much did you pay for your current stove?	Average $210 USD (12,000 frw) Ranges from $35 to $530
How long do your stoves currently last?	Median 36 months/3 years; Ranges from 1 to 20 years
What do you like about your stoves?	• Use less fuel wood than previous model • Cook faster than previous model
What do you dislike about your stoves?	• Spend a lot of money and time fixing stoves • Destroyed easily • Still use lots of fuel • Produces lots of smoke

Health Issues	
Are the walls in the kitchen black from smoke?	Everyone said yes
Are you aware of the health problems associated with regular stoves?	Everyone said yes
Would you be interested in buying a stove that was better for your health (almost no smoke)?	Everyone said yes
Environmental Issue/Deforestation	
Would you be interested in buying a stove that is better for the environment?	Everyone said yes
Are you aware that there is a shortage of fuel wood in Rwanda?	Everyone said yes
Are you aware of the problems with deforestation?	Everyone said yes

Fuel Source	
What Fuel Source do you use?	Everyone said wood
Where do they get their wood?	Everyone said the people's forest
Average amount of time spent buying or collecting cooking fuel?	Average 32 days per year (9 months); Ranges from 3 days to 90 days
Average amount of costs per month	Average $318 USD (181,000 frw); Ranges from $94 to $1,050 USD
Average amount of costs per year (which is 9 months for school)	Average $2,943 USD (1,674,600 frw); Ranges from $845 to $6,170 USD

Interest in Rocket Stove	
Would you be interested in a stove that saved you 50% of your fuel costs?	Everyone said yes; one person mentioned needing to see if it worked better than current stoves before purchasing
How much would you expect to pay for one 50% more efficient stove?	Average $153 USD (102,700 frw); Range $88 to $400 USD
How would you pay?	Everyone said pay by themselves
Where would you expect to find/buy a stove that uses less fuel?	No one knew where to find one
Prefer a permanent vs. temporary stove?	Everyone preferred permanent stoves
What would you prefer to use for fuel usage?	Everyone stated they prefer to use normal fuel wood because it is inexpensive compared to other fuel

Appendix D

Balance Sheet - As of Aug 31, 2010

ASSETS	Total
Cash	$ 5,000
Total Bank Accounts	$ 5,000
Materials	$ 2,500
Grinder	$ 500
Generator	$ 5,000
Pumice Cutting Saw	$ 8,000
Stove Transport Truck	$ 8,000
Misc. Equipment (Saw Blades, Goggles, Masks, etc.)	$ 2,500
Total Other Current Assets	**$ 26,500**
Total Current Assets	**$ 31,500**
Accounts Receivable Entry	$ 4,875
TOTAL ASSETS	**$ 36,375**
TOTAL LIABILITIES	**$ -**
TOTAL EQUITY	**$ 36,375**

Cash Flow – Year 1

	Start	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	ONE YEAR
REVENUE														
CASH AT BEGINNING OF MO.	**5,000**	**5,000**	**15,346**	**14,341**	**13,337**	**12,333**	**8,985**	**7,930**	**6,926**	**5,922**	**4,917**	**3,913**	**2,909**	
Cash Sales		4,875	4,875	4,875	4,875	4,875	4,875	4,875	4,875	4,875	4,875	4,875	4,875	58,500
Subsidy from RRS - US Nonprofit		30,000												30,000
TOTAL REVENUE (+ cash)	**5,000**	**39,875**	**20,221**	**19,216**	**18,212**	**17,208**	**13,860**	**12,805**	**11,801**	**10,797**	**9,792**	**8,788**	**7,784**	**88,500**
EXPENSE														
COGS		4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	
Equipment		18,500												18,500
Legal & Professional Fees		150					50							200
Meals and Entertainment at office		8	8	8	8	8	8	8	8	8	8	8	8	100
Office Expenses		4	4	4	4	4	4	4	4	4	4	4	4	50
Payroll Expenses - Two employees - President and Sales Person		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	12,000
Promotional		4	4	4	4	4	4	4	4	4	4	4	4	50
Rent or Lease - rent $200/month for office and mfg		175	175	175	175	175	175	175	175	175	175	175	175	2,098
Research and Development		83	83	83	83	83	83	83	83	83	83	83	83	1,000
Taxes & Licenses (12%)		0	0	0	0	2,344	0	0	0	0	0	0	0	2,344
Travel		8	8	8	8	8	8	8	8	8	8	8	8	100
Utilities		96	96	96	96	96	96	96	96	96	96	96	96	1,154
														0
TOTAL EXPENSES		**24,529**	**5,879**	**5,879**	**5,879**	**8,223**	**5,929**	**5,879**	**5,879**	**5,879**	**5,879**	**5,879**	**5,879**	**19,096**
	-												-	**Net Cash**
CASH REMAINING END OF MO. Amount carries up to top of next column	**5,000**	**15,346**	**14,341**	**13,337**	**12,333**	**8,985**	**7,930**	**6,926**	**5,922**	**4,917**	**3,913**	**2,909**	**1,904**	**69,404**

Appendix E

About the Manager of Makoro Stoves

Innocent Nsekeyukunze is a local social entrepreneur in Rwanda, and head of Makoro Stoves. RRS first met Innocent through their work with him on EWB projects. During this time, Innocent proved to be a great resource with knowledge of local construction practices and a tremendous amount of motivation. This is hard to believe with the difficult life that Innocent has endured. Innocent grew up at the L'Esperance Children's Aid Orphanage. His mother died when he was very young, while his father died during conflicts related to the genocide that occurred in the early 1990s. Since then he has dedicated himself to his studies, focusing on business during secondary school. Additionally, he has spent many hours perfecting his English skills because he believes it is an important tool for working in any business environment in Rwanda. The idea for the business was partially Innocent's idea. Innocent has shown continued commitment to the business in his belief that Rwanda is "turning into a desert". He firmly believes in the importance of the Makoro Stove in helping to solve this problem.