

PROMOTING CLEAN TECHNOLOGY FOR COOKING IN SUB-SAHARAN AFRICAN COUNTRIES

LESSONS FROM AFRICAN CLEAN ENERGY

From the African Community of Practice on Managing for Development Results at the African Capacity Building Foundation (ACBF)



Case Study
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SYNOPSIS

In sub-Saharan Africa, 70% of the population is still dependent on the traditional use of solid biomass (wood, animal dung, charcoal, and coal) for cooking. Dependence on these fuels has many adverse impacts on people's health as traditional biomass cookstoves is estimated to have caused almost 600,000 deaths in 2012; and on the environment as the emission of black carbon is contributing to global warming. Acknowledging this problem, African Clean Energy (ACE) has started to provide smokeless and sustainable cookstoves for those who need it the most.

Key findings: ACE's cookstove requires around 70% less fuel to run compared to traditional cooking methods. This leads to huge positive impacts on local economy, environment and population's health and livelihoods. By end 2015, ACE had sold 40,000 cookstoves which provide clean cooking to thousands of households. The case study, however, found that financing is one major challenge that most of the start-up companies face in Africa.

Main lesson: Commercially viable innovations are increasing energy efficiency across Africa but there's need to promote and adopt a business model and market driven approach for promoting the use of clean cookstoves.

Key recommendations: The case study calls for more financial support from governments and financial institutions to African small and medium enterprises which are operating in the energy sector. There's opportunity for capacity building institutions to play a critical role in building African governments capacities on how they can establish public-private partnerships to set up effective financing mechanisms for energy companies. Such institutions can also provide updated information and evidence on the clean energy industry in Africa for financial institutions which would want to develop their portfolio in the sector. The case study further recommends an active role of regional economic communities in the clean energy sector through the harmonization of renewable energy policies and regulations, facilitation of trade in renewable energy services and the promotion of international standards.

Introduction

According to the International Energy Agency (2014), three billion people in the world still rely on open fires and simple stoves for cooking food that burn solid fuels like wood, animal dung, charcoal, and coal. In sub-Saharan Africa, nearly

700 million people make traditional use of solid biomass for cooking, typically with inefficient stoves or simple three-stone fires, in poorly ventilated spaces. Rural households are particularly dependent on traditional biomass for cooking but many urban households also use it in the form of charcoal. According to the World

Health Organization (2016), there is substantial evidence that the use of solid fuels in open fires and traditional stoves for cooking is one of the world's most pressing health and climate issues, directly impacting close to half of the world's population and leading to more than four million premature deaths each year (more than HIV and malaria combined). Inefficient cooking is also a root cause of poverty, gender inequality, air pollution, and climate change (Lim et al. 2012; Lambe et al. 2015).

The statistics on the effects of cooking smoke seem overwhelming, but it's not all bad news. Unlike for many other global problems, the solution to this problem is simple. It can be realized around a desirable, multi-functional clean cookstove with the potential to improve health and environment, and combat poverty on a truly global scale. Creating a solution and making it accessible to those in developing countries who may not currently have access to an alternative, can significantly alleviate the problems resulting from traditional open-fire cooking. African Clean Energy (ACE) has been founded to that end, to provide smokeless and sustainable cookstoves for anyone especially the low-income populations. Clean cooking provides tangible impacts at both the macro and household-levels, and empowers individuals, women in particular, to improve their well-being and the environment around them (Lambe et al. 2015).

This case study aims at documenting the success of this clean technology for cooking that improves health, protects environment and reduces poverty. The remainder of this case study is organized in two sections. The first presents the initiative and the second section discussed lessons learnt and formulated appropriate policy recommendations.

Presentation of the case study: The ACE Ultra-Clean Biomass Cookstove

The problem

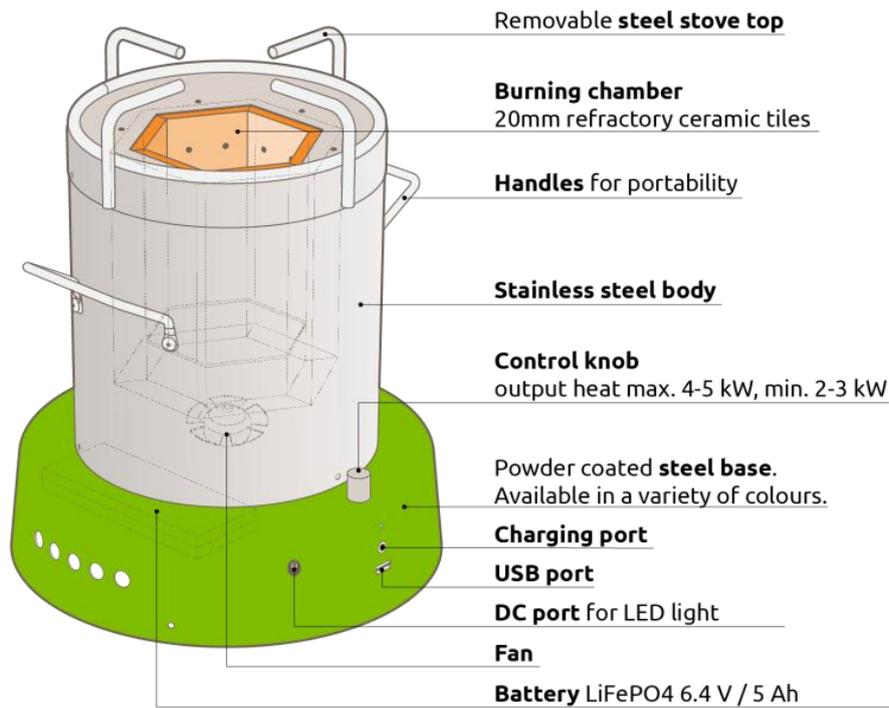
Woodfuels are the primary cooking and heating fuels for nearly half of the world population with the highest proportion of biomass dependent users living in Sub-Saharan Africa (IEA, 2014). This long standing energy challenge seems to be a neglected subject, yet it kills every year more people than HIV and Malaria put together (WHO, 2016). Besides the health sector, the utilization of massive biomass for cooking is very harmful to the environment and traps millions of households in the poverty cycle (Lambe et al. 2015). Solid biomass for cooking is responsible of 18% of global greenhouse gas emissions notably the black carbon which results from incomplete combustion that occurs during burning of coal, charcoal and wood (Bond, 2007). Moreover, Rysankova et al. (2014) confirm that the adverse effects of traditional cooking methods overwhelmingly affect livelihoods of households especially women and children; in some countries, they spend as many as five hours every day sourcing fuel. This reduces possibilities for further education, business opportunities and family time. Therefore, biomass dependent families are trapped in a poverty cycle and must continually prioritize the pursuit of energy over other activities. At the same time, the International Energy Agency (IEA) estimates that by 2030 one billion people in sub-Saharan Africa will still depend on wood-based biomass as a primary energy source. Therefore, the energy challenge in sub-Saharan Africa needs to be addressed if the region is to realize its development objectives.

The ACE solution

To address the aforementioned problem that mainly affects the poorest, African Clean Energy, a Lesotho-based company established in 2011, is committed to helping eradicate deadly cooksmoke from kitchens in sub-Saharan Africa. The company developed an innovative and

affordable solution that combines technology and local materials to propose a solution. This solution is materialized and disseminated

through a smokeless and sustainable cookstove called ACE 1 (Figure 1).



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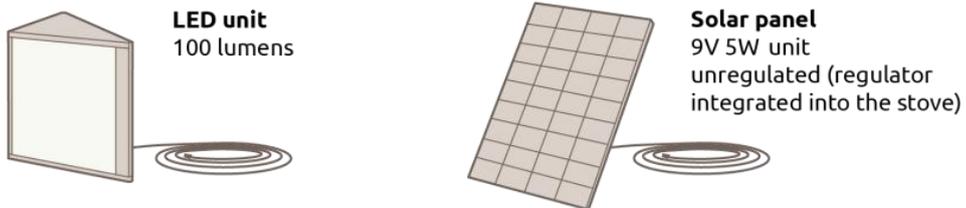


Figure 1: The ACE 1 Solar Biomass Cookstove

Source: <http://www.africancleanenergy.com/>

The ACE 1 Solar Biomass Cookstove is composed of a ceramic burning chamber placed into a stainless steel body, on a colourful, powder-coated steel base. It uses a fan to create gasification, a process that burns biomass without smoke, making the ACE 1 so clean and efficient that it requires around 70% less fuel to

run compared to traditional cooking methods. Its high-tech Lithium Ferrophosphate (LiFePO4 6.4 V/5 Ah) battery drives the fan and is charged by a portable solar panel. It also features USB and DC ports, to power a LED light and act as a device charger.

How does it work?

Figure 2 synthesized the way the ACE cookstove works.

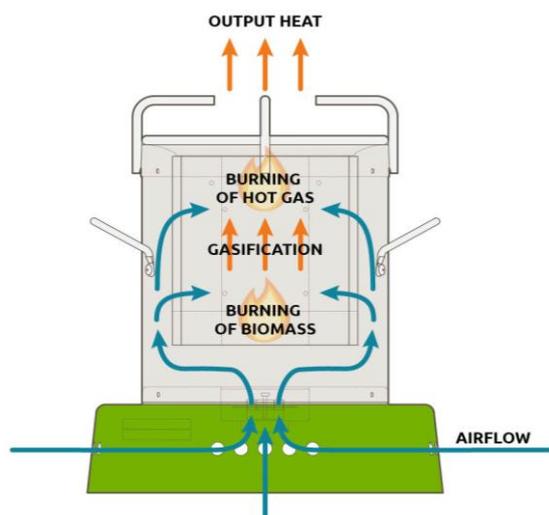


Figure 2: How the ACE works

Source: <http://www.africancleanenergy.com/>

ACE's Ultra-Clean Biomass Cookstove is an innovative technology that provides a smoke-free convenience. A fan blows oxygen into the chamber through holes at both the bottom and the top. This drives the fire to increase in temperature until it reaches approximately 1000°C. These conditions cause the biomass to gasify. Then the hot gas floats up to the top, meeting more oxygen and combusting completely. The stove will produce as much as 5 kW worth of energy, and the outside temperature, though warm after continued use, does not become hot enough to cause injury. When fully charged, the battery will power the fan for over 20 hours of cooking. The battery can also be used to charge a mobile device or run LED lighting, and can be boosted using a solar panel. This makes the ACE's innovation a unique of its kind that provides both clean energy for cooking and solar energy for lighting and recharging phones or radios.

Box 1: Some instructions in using the ACE cookstove

Take extra care when cooking

- The room should be well ventilated.
- Place the stove on a flat surface.
- Keep the stove out of reach of small children.

Charging the stove

- Before using the stove for the first time, be sure the battery is fully charged.
- Put the solar panel outside in the sun, or in as much light as possible, and connect the cable to the stove.
- The stove can be used while the battery is charging.
- When the blue light is on, the stove is charging.
- When the green light flashes, the stove battery is low on power and it is time to recharge.
- A low battery will need charging for a day or two at least to be fully charged.
- 3 hours of cooking \approx 1 hour of charging
- Solar panel charging time may vary according to exposure to sunlight.

Source: <http://www.africancleanenergy.com/>

The marketing strategy

To be commercially viable, a company should establish an engaging and responsive marketing strategy to ensure that its product is sold at a desirable price. In the early days of the company, the marketing strategy was quite simple. As the company evolves, its marketing strategy is being diversified to leverage more market sales. For households which cannot afford the ACE's cookstove in a single payment, the company offers micro-credit possibilities to make them pay in instalments (ACE, 2016). This allows many rural women to purchase the cookstove and pay over time. Moreover, a smarter distribution is being scaled in Lesotho and South Africa, including the use of mobile payment micro-financing and fuel loyalty programmes (ACE, 2015). This will allow

ACE to expand rapidly in a 'copy, paste, scale' method that can move the products into new regions and markets rapidly and efficiently. For large-scale distributors the company offers a flatpack shipping option, saving substantially on logistics costs. Upon request, the first shipment can come with the tools necessary to finish assembly, supporting the setup of local production lines. This is an attractive benefit for distributors and organizations around the world to make the ACE's cookstove available to an increasing number of customers. There is also a webshop¹ that has been set up to make the product available globally (ACE, 2016).

Challenges

As a company that aims at creating disruption in how communities cook in sub-Saharan Africa, ACE faced a number of challenges. The first one was relating to the product design. African communities have different cultures and practices in cooking. Therefore, designing a cookstove that meet this diversity is not easy. The product should be built on local conditions to enhance its chance to get accepted by customers. This is a challenge for ACE who succeeded in developing a product that offer an innovative solution to the cooksmoke problem described above and still, use locally available solid biomass as fuel. The first results of the company showed that the product responded to local conditions, but there is still room for improving the design.

Financing is also a challenge for the company. Most of the funding for initial designs, prototypes and machinery was provided by founders themselves which may be a limitation in starting up a company. Founders later considered other sources of financing like debt financing from a Dutch charity, and support from the Hillary Clinton-founded Global Alliance for Clean Cookstoves. The company is also looking for

support through crowdfunding campaigns (e.g. Kickstarter). Furthermore, ACE is diversifying revenues by exploring how to mainstream sales of fuel in its activity and trade the reduced carbon emissions permitted by ACE's cookstoves. Finally, competition is also a challenge ACE is facing as similar products are offered by other organization such as Practical Action and SNV. It is clear that ACE's product met a success and is expanding, but as recognized by Judith Walker, Co-founder, it is important for the company to effectively manage the growth and most importantly adapt the product to African culture to enhance its positioning on the market.

Outcomes and overall assessment

African Clean Energy has sold 40,000 clean cookstoves as of December 2015. That means the company has generated an income of about USD 3.2 million as one cookstove is sold on an average price of USD 80. Though this is not a huge amount, it is an important creation of wealth in developing countries like Lesotho. Moreover, it is essential to recognize that generation of income as a good performance because the business mostly targeted low-income people from whom it is not easy to make huge profit. Notwithstanding this financial profit, the outcomes of the ACE's initiative are more relating to the co-benefits it provides in local communities. First, **ACE is creating more jobs in the areas it operates.** The company has set up a factory in Lesotho employing 60 people full-time; and more people are employed to manage the marketing and distribution of the products. Besides creating wealth in the region, the employment of staff will drive the local economy and improve the livelihoods of local populations. Furthermore, the use of the ACE's cookstove is saving money for households. Total annual spending on biomass cooking fuels (wood and

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<http://www.africancleanenergy.com/product/ace-1-cookstove/>

charcoal) in sub-Saharan Africa was estimated to be USD 12 billion in 2010 (Rysankova et al. 2014). Evidence from the World Bank and the World Health Organization based on cost-benefit analysis also shows that there are significant opportunities for cost-saving from a shift to modern cooking, even after accounting for potential costs associated with the new stoves and fuels. This confirms that **the use of ACE's cookstove is saving more money for households and gives them the opportunity to invest and improve their livelihoods.**

On another hand, 40,000 clean cookstoves sold will **provide access to basic electricity for thousands of households across the region.** Indeed, as mentioned earlier, ACE's cookstoves have a USB and DC outlet that can be used to either charge a phone or light up the house at night with a LED lamp. This is an important co-benefit in the African context where the majority of the 1 billion people do not have access to affordable power especially for lighting their houses. ACE is also creating huge environmental benefits as its cookstoves use 70% less fuel to run compared to traditional cooking methods. It is broadly estimated that the amount of biomass cooking fuel required each year can reach up to 2 tons per family (World Bank, 2011). Therefore if one family uses the ACE's cookstove, it may be assumed that 1.4 ton of biomass is saved per family. At the community level, this is an important effort of **saving natural resources from degradation since collecting biomass for cooking is equivalent to destroying large quantity of trees.** At the global level, since incomplete biomass combustion is responsible for massive emission of greenhouse gas (GHG), the use of 40,000 ACE's cookstove is also reducing the amount of GHG emitted in the atmosphere.

Lessons learnt and policy implications

A key challenge that is common to all start-up is financing. At the early stages of businesses it's not easy to mobilize the necessary funding.

Though financing is not the panacea for successful business, it is quite an essential asset. The case of ACE showed that business founders often have to rely on their own funds, but it also points out **innovative funding mechanisms like the crowdfunding which is a method to get investors online** through popular platforms such as Kickstarter, Gofundme and Indiegogo. Funding challenge for start-ups also calls for policies to establish mechanisms that will provide initial funding to the most promising business ideas in Africa. Some examples already exist on the continent but they need to be strengthened and scaled up. **Governments, local authorities, banks and microfinance institutions should also get involved and support both companies and customers in the uptake of clean cooking stoves.** This is an area in which capacity building institutions like ACBF can play a critical role in building African governments' capacities on how they can establish public-private partnerships to set up effective financing mechanisms for companies. Such institutions can also provide updated information and evidence on the clean energy industry in Africa for financial institutions which would want to develop their portfolio in the sector.

The study of the ACE case also reveals that partnership is essential for companies to expand their geographical coverage and reach more customers. ACE established partnerships throughout East Africa in order to strengthen the long term viability of an East African scale-Up. No company can emerge without collaborating with other stakeholders. Partnership should also encompass the public sector. **A public-private partnership is important to address the different challenges faced in promoting and scaling up the use of clean cookstoves.** Furthermore, partnerships can go beyond geographical expansion and encompass technological improvement to make the product more efficient. This is an important point to be raised as many starting companies across Africa tend to work in a vacuum.

Furthermore, it is possible to offer a commercially viable solution to tackle the energy challenge faced by millions of people in developing countries. Unlike the majority of development programmes that address the energy challenge in a charity way (distribution of clean cookstoves), **business models have the potential to increase ownership among the communities, thus enhancing sustainability.** GIZ² has acknowledged that a fully commercial approach – as opposed to simply distributing clean stoves through development programmes – is the most important factor in achieving long-term sustainability in cookstove initiatives (GIZ 2011). But, for the market-driven approach to sustain, it is essential to establish the appropriate mechanisms to make the cookstove affordable for communities as most of them have low incomes. Micro-financing as used by ACE offers great potential to that end.

Furthermore, sub-Saharan African governments have an important role to play in promoting on the continent a vibrant clean cookstove sector by **removing taxes and duties to exempt technologies that are imported and by reducing the number of licenses required by cookstove manufacturers and distributors.**

Some countries have established specialized agencies that deal with energy efficiency, which is a good practice to promote. The countries that do not have such agencies should consider establishing them. These agencies will promote clean cookstoves, coordinate technology standards and testing and manage national funds to promote clean energy initiatives.

Finally, it is important to acknowledge that **technologies like the ACE need support from African regional economic communities.** Those regional organizations are aware of the challenges and opportunities related to renewable energy, yet they often lack efficient technologies at the household level to promote and advance the usage of renewable energy at that level especially for cooking. ACE can be instrumental to that end; and a public-private partnership can be formed in that sense. Overall, companies like ACE also need the support from RECs in terms of improving the business environment for the renewable energy industry. This includes the harmonization of renewable energy policies and regulations, facilitation of trade in renewable energy services and the promotion of international standards.

² The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH or GIZ in short, is a

company that specializes in international development. GIZ is owned by the German Federal Government and operates in more than 130 countries.

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This knowledge series intends to summarize good practices and key policy findings on managing for development results (MfDR). African Community of Practice (AfCoP) knowledge products are widely disseminated and are available on the website of the Africa for Results initiative, at: www.afrik4r.org/page/resources.

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