



WWF
KENYA

ENERGY

2017

Clean Energy Solutions Powering Communities



WWF-KENYA

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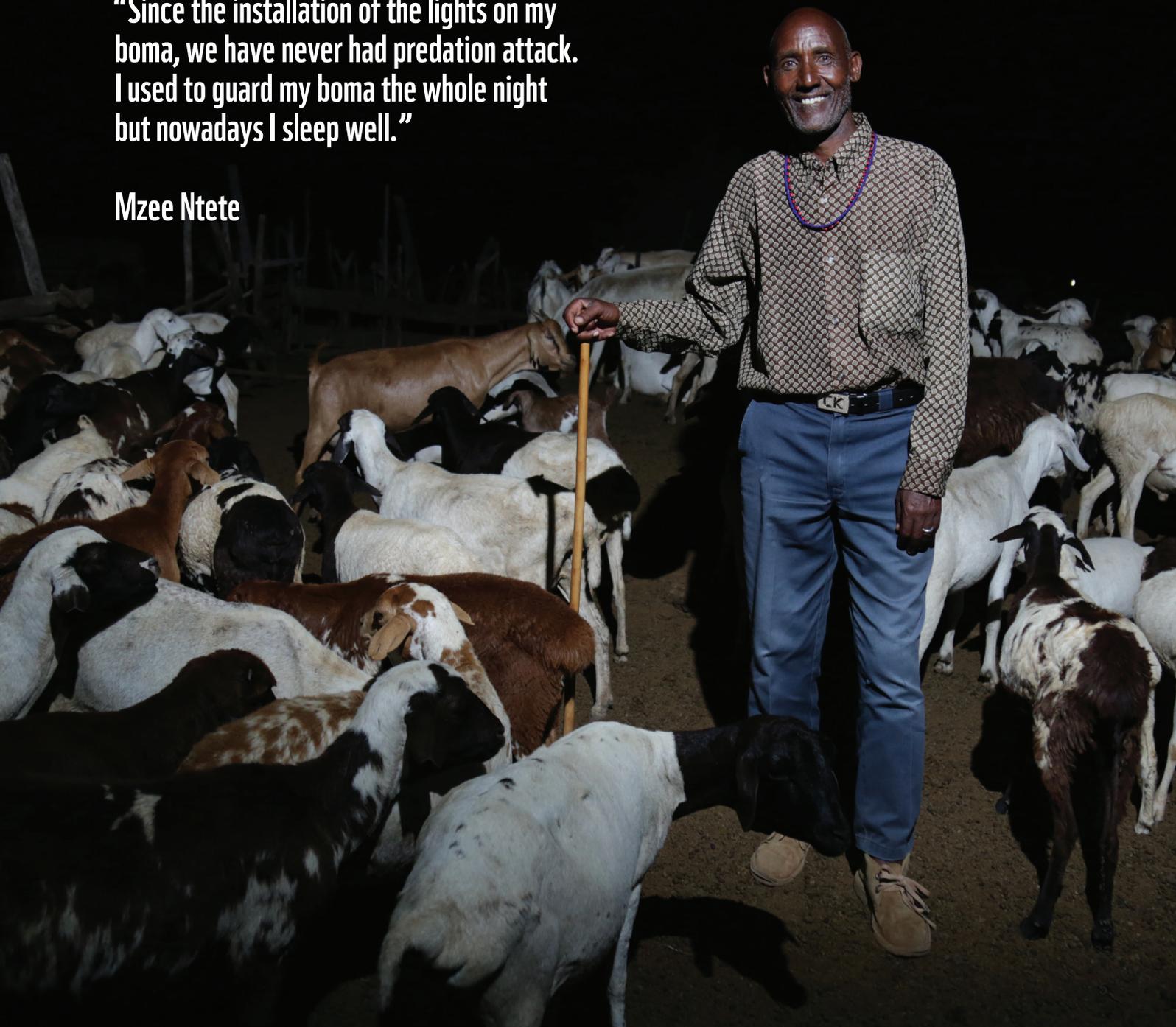


Maasai Lion Lights: Keeping the Peace



“Since the installation of the lights on my boma, we have never had predation attack. I used to guard my boma the whole night but nowadays I sleep well.”

Mzee Ntete



Problem

Every sunset brings a new set of challenges for the Maasai pastoralists in Kenya. This is the time when their main source of livelihood, livestock, is at risk from predation by lions, leopards, hyenas, cheetahs or Jackals. Mzee Michael Ole Ntete, a resident of Oletipis village in Kajiado County is a victim of the predators, and in his own words, narrates his personal experience: *“In the dead of the night, especially when it is raining, they (predators) attack and kill livestock. Personally, I have lost more than 128 goats to lions.”* With more than 70% of wildlife in Kenya living outside protected areas, many community members like Michael often find themselves at the mercy of predators. Predation is rampant in the livestock enclosures (bomas) at night causing significant damage in terms of numbers of stock killed, estimated at 5-15 heads of cattle per household annually resulting in annual loss in the range of US\$500 – 7,500. Predation also has a profound effect on the productivity of the men as they spend nights protecting livestock and still have to work during the day.

The stress of night predation also wears off all tolerance to predators and leads to retaliatory killings of large carnivores, mainly lions. This vicious cyclic phenomenon is what has led to Human Wildlife Conflict (HWC). This is the situation in Kajiado County, a home to the Maasai and their unique pastoralist way of life in an open land where they coexist with the wildlife. The County ecosystem is mainly composed of open grasslands with patches of open bush and acacia riverine woodlands, and is a corridor to wildlife migration. Increased population and need for development has led to encroachment into wildlife corridors and a reduction of the land available to wildlife and livestock in Kajiado. This has inevitably led to competition for resources and HWC. The community retaliatory attacks have overtime become the major source of loss of large predators than from any other cause. By end of 2014, this led to a significant decline in lion population from the Nairobi National Park to just about 25 lions.

“In the dead of the night, especially when it is raining, they (predators) attack and kill livestock. Personally, I have lost more than 128 goats to lions.”





“The Maasai have co-existed peacefully with wildlife for many years but the wildlife doesn’t always reciprocate that same peace.” He adds that “We go at a loss and the lions go back to their dens and nobody cares.”

Left on their Own

According to Mzee Michael, *“The Maasai have co-existed peacefully with wildlife for many years but the wildlife doesn’t always reciprocate that same peace.”* He adds that *“We go at a loss and the lions go back to their dens and nobody cares.”* For a long time, Maasai pastoralists in Kajiado felt that their plight was not adequately addressed. From Mzee Michael’s sentiments, they had challenges with wildlife, but also suffered from what they perceived as neglect from institutions and organisations responsible for wildlife management. The community did not only retaliate in killing lions but also became intolerant to Conservation personnel and Kenya Wildlife Service (KWS) staff whom they perceived to care more for wildlife than their own livestock. Consequently, the community often resisted efforts aimed at minimizing retaliatory attacks, and occasionally assaulted those leading such efforts.

At the same time, due to the lack of grid power and the remoteness of this area, energy for house lighting is sourced is mainly paraffin. This has a profound effect especially on the women and school-going children who have to do their house chores and school studies respectively by use of paraffin lamps. The paraffin lamps have a poor spectrum of light that affects the users’ eyesight, irritates eyes and emit smoke that leads to respiratory infections and add to the global greenhouse emissions.

Interventions/Lights out for predators/lions

Towards the end of 2014, WWF-Kenya in partnership with The Wildlife Foundation (TWF) started dissemination of solar-powered Predator Deterrent Lights (PDL), popularly referred to as the Lion Lights, to mitigate HWC, as well as household lighting systems. The major intervention revolved around the protection of wildlife by securing community livelihoods, through protection of livestock, using sustainable energy solutions. Key interventions included:

1. Community sensitization with participation from different stakeholders including KWS and County government to

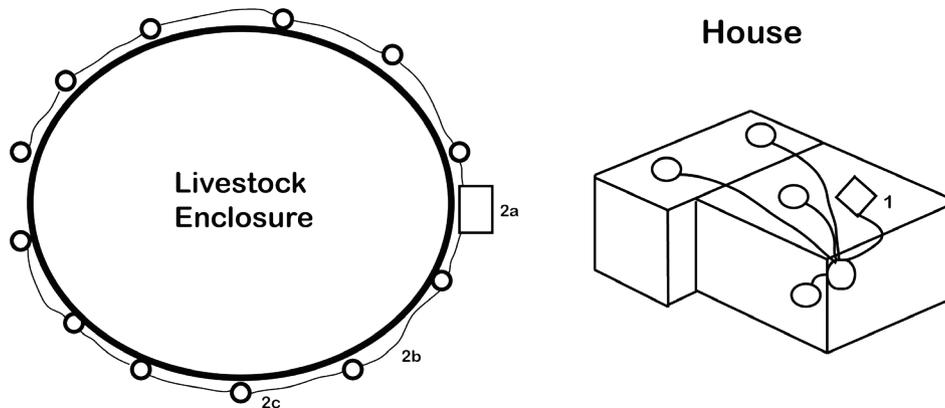


enhance understanding and ownership of the problem, highlight intended pilot solution, achieve community buy-in and agree on implementation approach including selection criteria of beneficiaries for the pilot interventions.

2. Use of solar Predator Deterrent Lights (PDL) technology for bomas, consisting of flashing LED lights which mimic movement of people and interfere with night vision of predators. Accompanying the PDL is solar systems for lighting houses and charging mobile phones.
3. Cost-sharing: Community members contributed Kshs 10,000 for the house lighting system upon which they received a complimentary boma PDL worth Kshs 24,000 from WWF-Kenya.
4. Strategic partnership: TWF responsible for community awareness and relations, beneficiary identification, and technology dissemination including warranty and maintenance; KWS responsible for sensitization on relevant wildlife policy and identification and inventory of predation hotspots; County government responsible for political buy-in and support to the initiative.

The interventions have since brought about significant outcomes, the main one, according to Mzee Ntete, is zero predation in bomas with PDL installations. *“Since the installation of the lights on my boma, we have never had predation attack. I used to guard my boma the whole night but nowadays I sleep well.”* In addition, there’s now greater tolerance toward lions as the community now reports incidences of stray lions to authorities as opposed to killing them. A lion migratory route between Amboseli Park and Athi Kaputiei ecosystem has since been opened, leading to increased lion numbers in the Nairobi National Park from 25 before the project inception to 42 by end of 2016.

House Lighting and Predator Deterrent Diagram



KEY

Sun king home 60 house lighting unit. -6 watt solar, 6AH battery, intergrated contorller, 3LEd lights and a phone charger

LEDS- Predator Light System

2a - 15Watt Solar panel
- power box with 5amp charge contoller, 7AH battery, auto-switch and flasher unit.

2b - Underground boma supply line

2c - 12- 1 watt LED SMD lights

The household lighting systems have also proved to be more effective for lighting homes and enabling families make savings on paraffin and mobile phone charging. Mzee Ntete's wife, Mary Ntete, made this observation: *"Before the solar lights were installed, we had been using paraffin for lighting but it is not effective. The solar light is much brighter. I can see every corner of the house. We have also saved a lot of money which we now use to buy books for children besides saving some for the future."* Solar lights have also enabled school-going children to effectively study at night, and some children have reported improved academic performance.

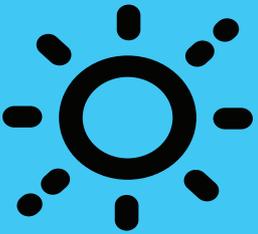
The impact of the project has also attracted additional support from other investors keen on supporting a business case pilot, in an attempt to shift from pure donor funding towards income generating approach, and hence long-term sustainability. This support has made it possible to technically improve on the technology, from a bulb-and-wire system to stand-alone plug-and-play system, and have it readily available to meet the growing demand.



Lessons Learnt

- Communities must be involved in critical decision-making from the onset of the project to enhance ownership.
- Increased community ownership and participation in conservation of natural resources cannot be realised at the expense of community livelihoods. To secure the natural resources in the long-term, the community impacted by the resources must have their livelihoods secured as well.
- Sustainable energy solutions succeed well where they stimulate local demand and have strong links to poverty alleviation
- In conservation of natural resources, even the most hostile community can become receptive and even be a partner; they just need to know that you care.
- Renewable energy technologies, specifically solar systems, offer a variety of socio-economic solutions for off-grid communities. What is lacking is effective sensitization together with a proper distribution network for quality products.

Bright Futures





Problem statement/Universal good start in life

A fundamental fact that rings true is this one ~ No one chooses where and to whom they are born to. Now, consider a child born in a remote island in the Indian Ocean. A region that is already marginalized by virtue of its geographical location. It is cut off from the grid, no running taps and as much as there are basic social amenities, to get one that is up to scratch, one has to cross the ocean to access them. That is one case.



Consider this second one. A child is born in a family whose generation has lived in abject poverty in a slum area within an urban set up. The good start is not lost as much, but the child will definitely be confronted by some fundamental challenges that he/she never really anticipated.

Of the two scenarios, the common challenge will be the educational facilities the two children will both attend. They will be lacking in one-way or the other. On one hand, there will be challenge of inability to study for extended hours to cover up for homework due to unavailability of adequate and quality lighting system for the remote islander. On the other hand, the child from the underprivileged background of a slum will be faced with the challenge of nutrition.

Below, read how WWF's intervention in two different landscapes of Wasini Island in Kwale County and in Nakuru County an urban town has sought to level the education playing field for the marginalized pupils in the two areas through clean energy initiatives.

There is nothing that beats a good start in life for each and every child. Don't we all agree? Over and above a good start in terms of availability of the basic needs of food shelter and clothing, the one critical starter pack that levels the playing field for all is one - quality education. Education establishes a solid foundation for any child. Regardless of his or her background, the opportunities quality education unlocks are limitless, and as they say only the sky will be the limit.

Interventions/The Expensive Meal

The one single reason that contributed to this dismal number according to Flamingo Primary School Head teacher is the fact that food preparation costs were so high due to expensive wood fuel that translated to the expensive meal that only a handful of parents could afford for their children. Secondly is because the cook stoves used then were very slow in cooking and very smoky that discouraged most pupils to sign up for the lunch programme as they would perpetually get late for the afternoon classes.

The situation now is a completely different story. Immediately the lunch bell is rung at 12:45 a huge troop of pupils run in droves to the kitchen area. This is what the pupils' president had to say when probed.

'We always look forward to lunchtime these days. The kitchen is now smoke-less. Our food is always ready on time. This is as opposed to previously when the smoky and lateness made our parents not sign us up for the lunch programme. We have more time to study and we hope to excel in our studies.' Margaret Wambui.

The 15-year old hopes of pulling her family out of poverty have been revitalized and she hopes to become a journalist someday. Head teacher Karanja qualifies further the main reason the lunch programme was resuscitated.

'The tide changed when SIDO installed the efficient and clean cook stoves in our kitchen. Previously we would utilize wood fuel worth Ksh. 500 a day. This was unsustainable financially. Now we use only Ksh. 100 to buy wood fuel. And as you can see we are carrying out this interview in the kitchen; simply because it is smokeless and clean as opposed to the previous times.'
The benefit of the clean cook stove translated to the parents who now pay less for their children to have lunch at school.

'My daughter is now able to concentrate in school without worrying whether she will have to come all the way home to have lunch or not.' Say Mr. Wycliffe Akumonyo Opiyo, one of the

parents of the pupils at Flamingo Primary school.
Quote and photo of the cook. Lady

"I am healthier now and happily go around preparing meals for the pupils because the smoke is gone and this new efficient stove cooks way faster!"

"Imagine if all the public primary schools in Kenya installed these efficient cookstoves, how much wood fuel would be reduced that contributing to climate change mitigation and adaptation as few forests will be cut down? Of course there will be more rain and communities will thrive. Indeed the Government of Kenya should partners with development partners to institutionalize these clean cook stoves in all public schools to save our planet," says the head teacher in his parting shot.

For flamingo primary school, the future for its pupils is bright. The pupils have adequate time to do their home work on full stomachs.

The true impact of the transformative project of installation of the clean cook stoves, a collaboration of WWF-Kenya and THE civil society organization, SIDO is the improvement in the mean score of pupils during the National Examinations.

"Back in 2014, out of a pupil population of over 1,000 here at Flamingo Primary School, only a paltry 20 had signed up to the school-feeding programme. The programme had actually died a natural death. The situation was pathetic."

Karanja Mwangi Head teacher at Flamingo Primary School in Nakuru.

'Before, my work was very difficult and stressful. Too much smoke. Too much heat. I actually got burnt a few times because the handling of the huge cooking boilers was a problem. Now my work is easy!'

KCPE mean score
2015 - 210
2016 - 224



Remote Wasini Island

Nightfall for pupils of Wasini Island for decades meant retreating back into their smoky homesteads and snap their books closed until the sun shines again the following day. And of course the sun will always shine! For a few determined souls though, they would snuggle next to the tin lights after dinner to try and catch up with the days' lessons and probably do their homework.



“The tin lights we used at home were smoky and unhealthy. But now our teachers encourage us to come and study at school at night and this has really boosted our study morale. Our future is indeed bright.”

But since the intervention of WWF to install solar lights at Wasini Primary School two years ago, you would be mistaken to imagine that nightfall is the new dawn. By the time the sun sets, tens of pupils who have already had dinner at home troop back to school for their night study since it is the only solar powered institution.

The intervention has actually added 3 more hours of quality study time in to the previously marginalized pupils who can now compete effectively with their peers in urban areas who have proper lighting

For 13-year old Fatuma Kibwana, who loves mathematics and wants to become a teacher when she grows up, the solar lights have brightened her future.

Deputy Head Teacher at Wasini Island Primary School Mr. Dossa Mohamed is full of praise to WWF for leveling the education playing field for the previously marginalized pupils of Wasini Island.

“Quality education is a human right for every child regardless of his/her geographical location. The solar lights were installed for the best interest of Wasini Island child. We are forever grateful to WWF.” He further adds that since the installation, the mean score for the national examination has continuously improved. The Government of Kenya’s solar lights have equally contributed to enabling a large number of pupils get added study time.



④ Fatima runs 200m in 30 seconds. What was her speed in Km/h.

⑤ The figure below represents Musyaka's plot.

3.37m
13m
30m
40m
53m
30m
He decided to fence his plot using 50 yards of a barbed wire. What was the length of the wire he required?

2x20
40
21
=

Arrow +
2A
6h
2x
4

KCPE mean score.
2015 - 207
2016 - 243



LESSONS LEARNT

1. Slight but deliberate interventions in marginalized institutions of learning have the potential of creating a lasting impact to the community through education empowerment.
2. Installation of efficient cook stoves in public schools both primary and secondary has the huge potential of mitigating wanton destruction of forests for wood fuel with a net effect of mitigating climate change.

Clean Cookstoves: Taming the smoke in Kuresoi Kitchens to Save Mau Forest





“The cook stoves have really helped us; it really has made our work easier. So the time I spent going to the forest is now spent attending to my businesses.”
She adds that, “It took me four to five hours collecting firewood from the forest. Nowadays I use less firewood and no longer go to the forest that often.”

The Problem/Unsustainable Smoky Cook Stoves

Located along the iconic Rift Valley of Kenya is the Mau Forest, the largest indigenous montane forest in East Africa. The forest is a critical water catchment area providing water to more than 6 million people in Kenya. Over a period of the last 20 years, more than one-quarter of the scenic Mau Forest has been destroyed mainly through human activities such as clearing of forest for settlement and agriculture, charcoal burning and firewood.

Residents of Kuresoi in Nakuru County rely heavily on wood fuel (firewood and charcoal) sourced from the Mau Forest, and form part of the eighty-four percent (84%) of Kenya's population relying on solid fuel for their household cooking needs. This over-reliance on biomass for cooking and heating has contributed to loss of forest cover, climate change and negatively impacted on livelihoods, as witnessed by Celina Siele, a resident of Kuresoi, and among the many women who have depended on Mau Forest for firewood: *"There's no water, there's hunger, and we are experiencing drought."*

The degradation of the forest has also forced women and children in Kuresoi to spend many hours each week collecting wood for cooking, which translates into lost opportunities for increasing income, gaining education, and makes them subject to safety and security hazards. The firewood so collected is often used in inefficient three-stone fire stoves which adversely impacts human health, pollutes the environment, and slows socio-economic development. These stoves are largely responsible for in-door air pollution and have low thermal efficiency estimated to be as low as 10% to 15%.

Exposure to smoke from traditional cook stoves and open fires – the primary means of cooking and heating for nearly three billion people in the developing world – causes more than 4 million premature deaths, including 20,000 deaths in Kenya, every year, according to World Health Organisation (WHO). Cooking smoke also contributes to a range of chronic illnesses and acute health impacts such as early childhood pneumonia, emphysema, cataracts, lung cancer, bronchitis, cardiovascular disease, and low birth weight. According to Global Alliance for Clean Cookstoves, women and young children are the most affected, with more than 5,000 children in Kenya dying every year as a result of acute lower respiratory infections caused by the smoke from the use of solid fuels. Inefficient cooking also contributes to climate change through emissions of greenhouse gases such as carbon dioxide and methane, and aerosols such as black carbon.

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Interventions/Transformative partnership

Under its Civil Society capacity strengthening energy project, WWF-Kenya partnered with the Sustainable Integrated Landscape Development Organization (SIDO), based in Nakuru County, to sensitise 25 women groups within Kuresoi area to propagate energy solutions that reduce pressure on Mau Forest and provide access to clean and cheaper energy alternatives. The women were specifically targeted as they bear the primary responsibility of cooking, and the collection of firewood is a burden that is shouldered disproportionately by women and girls. Specific intervention involved the promotion of improved cook stoves which are both affordable and easy to use; cutting the amount of risky trips for firewood and allowing more trees the opportunity to grow. Celina's own experience with the improved stove testifies to this reality: *"The cook stoves have really helped us; it really has made our work easier. So the time I spent going to the forest is now spent attending to my businesses."* She adds that, *"It took me four to five hours collecting firewood from the forest. Nowadays I use less firewood and no longer go to the forest that often."*

The stoves are not only reducing pressure on Mau Forest but also securing better health care and livelihoods for households in Kuresoi by reducing the amount of toxic smoke produced and minimizing health risks to the family. To date, more than 1,000 cook stoves have been deployed in Kuresoi. With each household having an average of 8 people, about 8000 people are already been directly impacted for life through this project.

Other interventions deployed include:

- Educating the women groups on environmental conservation and on the need to establish woodlots and cut down on deforestation. Establishment of local seedlings nurseries and planting of trees is ensuring access to sustainable wood fuel and is slowly reducing pressure on Mau Forest. To date, more than 7 women groups have established woodlots on their farms in Kuresoi.
- Training the women on making of cook stove liners and installation of the cook stoves. Consequently, 150 women have acquired knowledge and skills on the technology behind the clay-made energy saving stoves and are now able to produce the energy saving liners and install the improved energy saving cook stoves at a fee, further improving their livelihoods. The liners cost about Kshs 350 and installation is done at an agreed fee.
- Establishment of a revolving fund to provide small credits for purchasing liners and tree seedlings. The growth of this fund will present the women groups with opportunities for income generation activities.

The impacts of these interventions resonates well with the ultimate outcome of the project, which is to ensure that *"peoples in programme areas are effectively controlling decisions and receiving full benefits from natural resources and exercising their responsibility for ensuring that key ecosystems and habitats are sustainably managed."* Widespread use of clean cookstoves in Kuresoi is therefore working to reduce effects of climate change and pressure on Mau forest, thus helping to create a future where humans live in harmony with nature.

Lessons Learnt

- Successful conservation of natural resources calls for participation and partnership with the communities living and deriving their livelihoods from those same resources.
- There's a great untapped potential of women and women's groups that can help fill the "last mile" gap in the energy value chain so as to reach areas lacking energy access. In other words, without empowering women to participate in the sustainable energy value chain, the realization of total energy access in most rural households will remain only a dream.
- Energy access challenge is both socio-economic as well as environmental. Energy is a social challenge due to disproportionate access and consumption levels; energy is an economic challenge because energy supply challenges can hinder economic growth; and energy is also an environmental challenge because excessive and unsustainable energy use can aggravate climate change.



Maa Briquettes





“For a long time I observed hundreds of donkeys carrying huge loads of charcoal from the forest to the market in Narok town. I therefore made a decision to embark on researching, mainly on the Internet the possible alternatives to charcoal in order to save our forests and put food on the table.”

Joblessness as a catalyst of conservation enterprise

They say necessity is the mother of invention. And for a country like Kenya, a leading economic powerhouse in the continent of Africa but with an undeniably leading unemployment rate standing at 39.1% according to United Nation's Human Development Index (HDI) 2017 report, fresh graduates are confronted with impossible choices in their quest to break from their guardians' dependency.

Confronted with this challenge back in 2013 and driven by the desire to leave a lasting impact on our planet, 28 year-old George Mochu Karaya took the bold step to abandon his white-collar job search and embrace the dirty but profitable briquettes manufacturing route.

Turning the tide on charcoal burning

Narok County, home to world-renown Maasai Mara Game reserve where George Mochu has grown up is one of the biggest charcoal producers in the country. All this thanks to the wanton destruction of the all-important Mau Forest Complex by illegal charcoal burners. This situation created a double-edged problem. One is the risk of desertification of the entire region, a situation that gives birth to a cocktail of socio-economic and environmental problems. Secondly, the charcoal production at the unsustainable rate of 17 million bags annually from the Mau Complex continued, then there was a possibility of snuffing life out of the Maasai Mara game reserve since its is the main source of water for the Mara ecosystem and essentially making it a desert in 10 years.

'For a long time I observed hundreds of donkeys carrying huge loads of charcoal from the forest to the market in Narok town. I therefore made a decision to embark on researching, mainly on the Internet the possible alternatives to charcoal in order to save our forests and put food on the table.'

This was in 2013.

Armed with the scanty internet-sourced knowledge and minimal budget, the Bachelor of Economics graduate bought his first briquette-making machine in December of 2013. What followed was a trial-and-error until Mochu got his big break in 2014 when he officially launched Maa Briquette the business.

In his initial business process, Mochu would source for charcoal dust, sort it, grind it manually, mix the substrate with a binder then air the briquettes to dry. He would also carbonate agricultural waste and use it to make the briquettes.



Interventions

Working alone with the assistance of a few volunteers back in 2014, Mochu would produce 0.1 tones of briquettes every day using his manually operated machine.

Mochu's big break came in 2014 when a call by the National Environment Trustfund (NETFund), a government of Kenya agency that supports environmental innovations made a call to all who undertake to provide green solutions in the country to be awarded.

'George Mochu alongside other winners under the Green Innovations Award scheme was identified, recognized, awarded and supported through NETFUND's business incubation programme to establish Maa Briquettes into a successful enterprise.' Chrispine Omondi, Projects Manager, NETFund.

After the incubation Maa Briquettes was awarded Ksh. 5 million (\$50,000) for product development and research.

A good shot in the arm to Maa Briquettes came when WWF supported the promising innovative enterprise with Ksh. 1 million (\$10,000) that was used to purchase electric and more efficient briquette making machines that scaled its output from 0.5 tones a day to an impressive 10 tones a day.

Mochu is now able to supply at least 500 households with the smoke-free and efficient briquettes as well as hotels and camps around Narok and Maasai Mara including the Sarova Group of Hotels. One of its key customers is the 5-Star Sankara hotel in Nairobi, a clear sign that Maa briquettes products are green and competitive.

Krishna Unni is the General Manager of Sankara Hotel. *"Use of Maa briquettes fit in very nicely with our strategic objective of promoting sustainable business practice and operations. That is why we had no problem in using it when we launched Graze, our steak house."*

'The briquettes burn for longer compared to charcoal and improves the flavor of the meat.'



Environmental Benefits of Briquettes

Briquette takes off the pressure from the forest. This is simply because its raw material is considered waste, i.e the charcoal dust. In seeking to buttress the green-nature of Maa briquettes, Mochu is looking into recycling of agricultural waste from the environment. The possible substrates include maize stalks, maize cobs, rice husks, banana leaves, wheat stalks among others.

The future

Mochu is a young man with big dreams. His vision is an expanded business able to generate 40 tones of briquettes a day. An impressive amount that will be a great alternative to charcoal. His hope is that he will able to employ more young people up from his current work force of 6.

His parting shot, *“I urge all the young people to start small wherever they are in impacting our environment positively. It is the small concerted efforts by youths across Kenya that will guarantee our future generations a clean and healthy environment where people and nature thrive in harmony.”*

George Mochu Karaya, MD/Founder - Maa Briquettes



Lessons Learnt

1. Great green innovations especially by young people need to be supported through intense capacity building and adequately resourced in order for them to attain their desired goals.
2. Encouragement to graduates and young people in general to seek and find solutions to the pressing environmental challenges of our time is a sure way of creating employment and leaving a lasting impact on the environment.
3. Transformational partnerships like the one between WWF and NETFUND provides a rich mix of expertise and produce tangible results.



Biogas and Biofuel: Clean Kitchens in Slums for a healthy environment





Extensive use of paraffin, charcoal and firewood mainly for cooking in the urban informal settlements continues to put much pressure on forests and the environment as a whole.

Background/Paraffin affinity

Kenya's annual informal settlements growth rate of 5% in cities such as Nairobi and Kisumu, is the highest in the world and it is likely to double in the next 30 years if positive intervention measures are not put in place (UNDP, 2007). These unprecedented rates of urbanization can be linked to massive migratory movements as well as to natural growth, challenging urban planning and thereby causing massive environmental problems with far reaching effects.

High cost of energy also means heavy dependence on paraffin, charcoal and firewood leading to depletion of forests. Paraffin is the most common fuel among poor urban households who use it for cooking, lighting, and water heating. Unfortunately, the predominant use of paraffin poses a series of challenges.

Firstly, paraffin is a major cause of in-door air pollution, a major contributor to black soot and health-related ailments such as eye irritations and respiratory diseases.

Secondly, there's the problem of storage in homes- a major safety hazard. Most of the residents in informal urban settlements normally purchase and store paraffin in soda bottles. These can easily be mistaken for a beverage and as a result incidences of children accidentally drinking paraffin are not uncommon.

Thirdly, paraffin being a highly flammable liquid, it is normally not advisable to store it in large quantities in the house, especially in the typically crowded settings in such settlements, where entire families commonly share a room.

Finally, the price of paraffin has been on the rise over the last few years. The main cause is the rising cost of crude oil in the world market, and this has a direct impact on the local cost of paraffin, making it more expensive for a majority of the urban poor population. On average, families spend slightly more on cooking fuel (Kshs 348) per month, as compared to electricity for lighting (Kshs 330). Paraffin contributes the largest share of cooking cost, standing at Kshs 280 per month .

Waste to energy

Extensive use of paraffin, charcoal and firewood mainly for cooking in the urban informal settlements continues to put much pressure on forests and the environment as a whole. Such settlements provide a huge market for paraffin use and wood fuel (charcoal and firewood) energy sources. Alternative renewable energy solutions can therefore reduce the demand for paraffin and wood fuel, and go a long way in supporting conservation efforts at the supply end of such natural resources like forests. Conservation of critical natural

The bio-centre initiative by Umande Trust entails an ablation block that produces biogas from human waste and a multifunctional area to provide income generation opportunities through sale of water, rental income, hire of halls and sale of bio-gas.



resources such as forests must therefore go hand-in-hand with demand curtailment by the end-user.

In an effort to address cooking challenges in informal settings, and reduce demand for paraffin and wood fuel, WWF-Kenya has partnered with Umande Trust and the National Environment Trust Fund (NETFUND), to support initiatives aimed at promoting use of biogas and biofuel technologies in cities of Nairobi and Kisumu respectively.

Biogas from unlikely source brings life to kitchens in Nairobi slums

WWF-Kenya is partnering with Umande Trust, a local CSO based in Kibera slums in Nairobi to help communities generate and use biogas, ablation blocks in urban informal settlements, institutions and schools. The biogas is generated inside a facility known as a bio-centre using innovative technologies and is used for cooking, heating and lighting.

The bio-centre initiative by Umande Trust entails an ablation block that produces biogas from human waste and a multifunctional area to provide income generation opportunities through sale of water, rental income, hire of halls and sale of bio-gas. Self-help community groups are supported and facilitated, to construct and manage these centres.

The project promotes renewable energy helping the shift from the usual wood, charcoal, and paraffin to biogas for cooking. This helps in improving energy efficiency, reducing carbon dioxide emissions and alleviating pressure on forests. It is also cheaper and relatively affordable. Bio-centres have helped facilitate community education and sensitization on conservation. Some groups have facilitated activities that further help conserve the environment such as tree planting.

To date, Umande Trust has installed more than 60 bio-centres in different informal settlements with support from several partners. WWF-Kenya's support has further enabled more households and community self-help groups to access biogas for cooking and other bio-centre benefits, according to Fanuel Ongato, a Bio-Technician at Umande Trust: *"The impact of the partnership between Umande Trust and WWF is that a number of households are now able to access biogas upto the household level. So far it has transformed the groups. They are earning Kshs 300 from every household that biogas is connected to."* Mr. Ongato



has also observed reduced demand for paraffin and wood fuel from households using the biogas: “Furthermore, the households benefiting from the project are now able to save from costs that they were incurring in purchasing other modes of fuel like paraffin, charcoal and firewood”.

To increase uptake of the biogas and reduce social stigma associated with cooking near the bio-centre facility in an open kitchen, WWF-Kenya has also supported Umande Trust to successfully pilot the use of a compressor technology to fill the biogas into cylinders and/or bags for use in houses. This initiative has proved effective in pressuring the gas, and the next steps will involve exploring opportunities for large scale biogas packaging.

Turning lemon into lemonade

In 2015, while teaching at Mudhiero Secondary School in Siaya County, Richard led a group of students in carrying out experiments to extract biofuel from water hyacinth, as a way of containing the weed and providing cleaner and cheaper energy for cooking in place of paraffin. Well, the success of the initial experiment earned Richard and his team of students an Award from NETFUND, as the best entry in the schools category under the theme of Energy Management.

The rest, as they say, is history. NETFUND, with support from WWF-Kenya, soon enrolled Richard in its incubation program. The program provides an array of business support services for green start-ups to realize their full market potential. Through this program, NETFUND supports the Government of Kenya’s ideals of green growth in the Kenya Green Economy Strategy and Implementation Plan (GESIP).

WWF-Kenya’s support went towards research, specifically qualitative as well as market acceptability test in informal settlements in Kisumu, as narrated by Richard: *“The support was used for qualitative testing in a government laboratory in Nairobi, and to purchase 100 stoves and generate enough biofuel for market acceptability test. The result we got was overwhelming.”* The overwhelming results that Richard is referring to include findings that biofuel from water hyacinth is a better cooking fuel than wood fuel, briquettes, charcoal and paraffin and has higher calorific value, lower carbon and Sulphur emission. “Paraffin emits 8 times more carbon than the biofuel,” observes Richard, and then continues: *“For now, it (biofuel) is Kshs 5 cheaper than paraffin, and even more cheaper than charcoal. Maybe firewood is the cheapest but accessibility of firewood is increasingly becoming a challenge.”*

As a result of its outstanding qualities and characteristics, the biofuel has proved a good alternative source of clean and affordable energy for the 100 households used for market acceptability test and pilot in Peri-urban settlements in Kisumu City. This development can only mean one thing, a brighter future for bioethanol!

“The business future is brighter for us,” explains Richard. “From here we want to expand our production capacity,” he continues. “Now we produce about 300 litres of biofuel per day, but we want to enhance our production to 3000 litres per day,” he concludes.

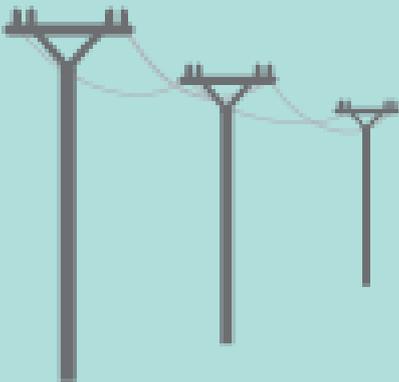


Lessons Learnt

- No “one size fits all.” Overcoming the energy challenge in most parts of the country calls for testing and promotion of a variety of available solutions within the local context, in terms of available energy sources. This underscores the importance of renewable energy as offering a world of possibilities through a variety of available solutions that can address energy access challenge.
- Sustainable bio-energy requires participatory involvement of stakeholders and successful pilots need scale-up.
- Successful bio-energy exploitation requires creation of local capacity in research and development, enabling environment for investments and a focus on full value chains, (market solutions).

Powering Communities

Mihuti village's shining star



Kenya has the potential to generate 3000MW (renewable energy portal) of power from mini-hydros. However, only a small percentage of this potential has been exploited.

Darkness

When he was younger, his village, Mihuti, never had electricity. The community members used paraffin for lighting and in some instances light from burning firewood with the option of staying in darkness until the sun rises the following day. The nearest power line was more than 15 kilometers away. Due to this, he struggled to study, as there was only one source of lighting at their home. And when the light-bulb moment occurred to him at a tender age of 9 years, he began the journey of solving lighting problem not only for his homestead but the community as a whole while he was in class three. His interest developed from the mechanics of how his brother used a dynamo to generate light for his bicycle that he rode after nightfall. His attempts to answer the question yielded what is Magiro Mini Hydroelectric Limited, a private hydroelectricity generation company that is serving 250 households in Mihutu Village.

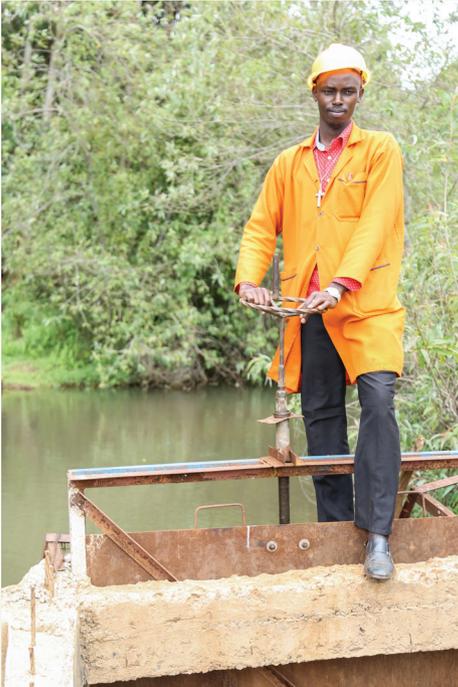
Modern Day Michael Faraday?

Armed with little formal education just like the father of electricity Michael Faraday who came way before him in the early 17 century, Mr. Magiro decided to re-invent the wheel, albeit for the betterment of his community. He took advantage of his self-taught skills in electricity to develop and construct a mini-hydro electricity system. And like any other experiment, it took Magiro a deep sense of discipline and determination before he perfected his idea and successfully generated the first flicker of electricity.

At the beginning, he was using a diesel-run generator to produce electricity. Upon realizing the potential to generate power using the free-flowing water from the Mihuti River with its steep gradient that created the perfect waterfalls, he started fabricating the generator to run on water by putting a turbine, a bicycle rim and a dynamo to regulate the power. He was able to generate 48Kw and connected 30 households by the time he cleared form four. With further modifications, the generation reached 75Kw.

His innovative idea was recognized by the National Environment TrustFund (NETFund) through the Green Innovation Awards. WWF-Kenya financially supported upscaling of the innovation by purchasing poles used to supply the electricity through the power lines. The funding also supported system upgrades to the waterway, generator and turbine powerhouse and transmission lines.

As a result of the improvements, the power generation has increased to 250 Kw and households connected have increased from 30 households to 250 households.



“My desire is to transform my community from within.”

Against all Odds

It has not been smooth sailing for Mr. Magiro. From the onset, he faced financial challenges and this led to delayed upscaling of the initiative, as he was unable to procure proper materials. Due to his education level, some of the concepts taught during the incubation phase by NETFund, especially business development, were a challenge to comprehend.

Lighting the way

Despite these challenges, Mr. Magiro has managed to improve the wellbeing of the community and contribute to water conservation efforts by promoting energy access. The communities understand that insufficient water in the rivers means no power. Thus there is minimal abstraction by upstream users and downstream users ensure the water is not polluted with solids.

In terms of Skills transfer, Magiro has managed to create employment opportunities for the youth that he has personally trained in the tradecraft of electricity generation as well as in the area of wiring of households supplied with electricity.

He has a total of 7 young people as his assistants, out of whom five are male and two female. *“I personally run this business but at the same time impart skills to my peers so that in case I transit to another phase of my life, the electricity supply does not come to an end.”* Magiro

Mr. Magiro’ vision is to transform the community from within through empowerment, provision of affordable electricity and fostering a culture that uses eco-friendly power while increasing opportunities for making productive economic investments and conserving water sources.

“In five years I wish to see my community transformed, especially in alleviating hunger by encouraging irrigation farming using Magiro Powered Electricity. This will be the surest way to alleviate poverty in my community.”

Magiro believes that his company will be able to compete with the national electricity supplier if he gets the much-needed upgrade of 2 transformers, 30km of wires and at least 250 posts. These he says will enable him supply electricity to 2500 households, an increase of 100% in the next one year. This will essentially push down the cost of electricity for the villagers of Mihuti.

WWF-Kenya has already committed to support Magiro's project with a total of \$10,000 towards attainment of this key milestone. Today, Mihuti village stands tall among the few villages whose dirt streets are adequately lit throughout the night. This feat is all courtesy of a great son of the soil who has installed over 200 bulbs in strategic areas to .



Lessons Learnt

1. Great green innovations especially by young people need to be supported through intense capacity building and adequately resourced in order for them to attain their desired goals.
2. Encouragement to graduates and young people in general to seek and find solutions to the pressing environmental challenges of our time is a sure way of creating employment and leaving a lasting impact on the environment.
3. Transformational partnerships like the one between WWF and NETFUND provides a rich mix of expertise and produce tangible results.



Mobile Technology Drives Renewable Energy





Kenya's mobile telephony uptake is arguably one of the highest in Africa. It stands at an impressive 88.1% with 37.8 million subscribers, according to the Communications Authority of Kenya. This scenario presents an opportunity to try and integrate the use of mobile phone technology to accelerate uptake of renewable energy.

Problem

Access to clean and cost effective renewable energy solutions has been a major challenge for many households in Kenya. This has contributed to the slow penetration of renewable energy products, particularly solar technologies. Moreover, proliferation of cheap and counterfeit solar products has been yet another market challenge. This has left consumers at the mercy of unscrupulous traders selling cheap sub-standard solar products.

Furthermore, a field inspection and testing study of installed solar Photovoltaic (PV) systems was undertaken by Kenya Renewable Energy Association (KEREAA) in 2009 and covered 76 randomly selected systems across 7 provinces. It revealed that users of only 48% of the surveyed solar systems did feel that the system had met their expectations. Technical assessment of these systems further revealed that only 36% were properly installed and only 10% were correctly designed. At the same time, Focus Group discussions undertaken by Lighting Africa, IFC World Bank as part of the awareness campaign for off-grid lighting products also revealed that the consumer perception of solar PV is that it was expensive and doesn't work.

The widespread availability of low quality products and services in the Kenyan market has a number of negative effects including reduction of consumer confidence in off grid lighting products due to poor performance, inability to honor warranties and inability to secure repair services. Undercutting of good quality products and services by sub-standard products also creates unfair competition and reduces the comparative benefits of off-grid lighting to consumers including product reliability, quality of lighting and longevity of products.

Although the Kenyan solar market is often considered as a successful commercially driven market, market spoilage due to poor quality of products as well as design, installation and maintenance services has significantly hindered market growth. "People were bringing all sorts of products and the market was not getting value. Anybody would import cheap products and sell into the country," says Cosmas Musyoki, CEO of Powerpoint Systems East Africa Ltd, a major solar distribution company in the country.

Countering Counterfeits

KEREAA is an independent non-profit association dedicated to facilitating the growth and development of renewable energy business in Kenya. Through WWF-Kenya's support, KEREAA and other partners such as Powerpoint EA Ltd, are developing innovative solutions to counter the counterfeit renewable energy products and enhance market penetration and access to the products. "We are doing several events and activities. One of the most prominent ones is a USSD mobile phone tool, which is *860#, and through this tool we are connecting people to get quality solutions," says Kamal Gupta, the Chairman of KEREAA.

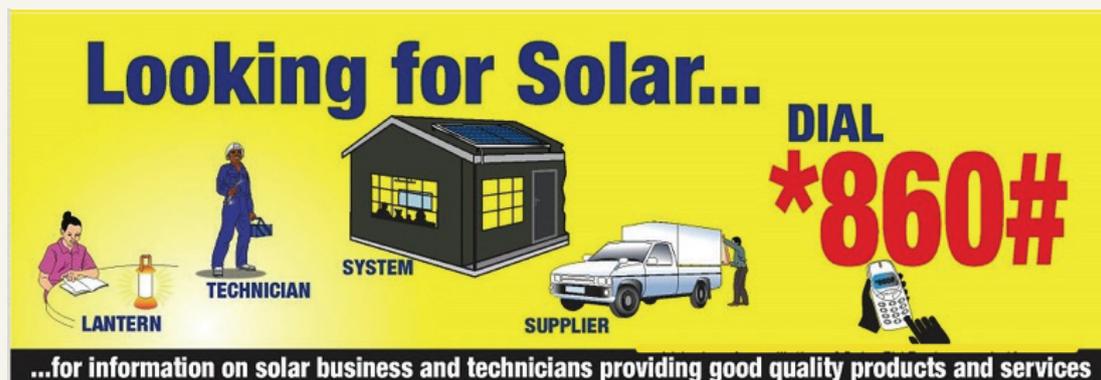


In Africa, Kenya is recognised as a leader in innovative mobile phone technology and this has transformed the lives of millions of people and businesses, through innovations such as the globally acknowledged mobile money transfer MPESA services. The USSD tool is yet another innovation meant for the development of renewable energy sector in the country. In brief, the USSD tool (*860#) is a nationally accessible mobile phone based tool to provide the public with information on where to access good quality solar products and services by providing information on accredited vendors of quality solar products and services.

The initiative began with development of a quality based accreditation criteria for providers of off-grid lighting products and services, mobilized adoption of the criteria by businesses (importers, distributors, vendors and technicians) in the sector before publicly promoting accredited business through the developed USSD and SMS tool.

The development of the voluntary accreditation framework comprised the following key activities:

- Development of criterion for accreditation of providers of off-grid lighting products and services (in consultation with the industry);
- Promoting the accreditation system to product and service providers countrywide and providing guidance for compliance;
- Assessment of interested applicants and the establishment of a database of accredited product and service providers;
- Design and development of a nationally accessible mobile based tool (USSD & SMS i.e.*860#) to enable consumers to query the databased of accredited business and access contact information for accredited product and service providers near them.
- Create nationwide awareness and acceptance of the mobile based tool; the USSD tool was marketed nationally through radio, national TV and billboards



The Magical *860#

Since its launch in 2015, The USSD platform has contributed to numerous benefits for both distributors and consumers, as narrated by Cosmas Musyoki, *“When KEREA came into the market, plus our input, a lot of improvement has been done; things like warranty, and there’s actually policing in the sector through KEREA.”* He adds, *“People are using it and we can start seeing more sales and more enquiries which eventually turn into sales.”*

Many people can now access the tool and are reaping from its benefits, according to Kumal Gupta: *“More than 400,000 people use this tool. Definitely our associates and partners are very happy with this tool and they are seeing the value, and a great prospect in future also.”*

The voluntary accreditation framework and USSD tool have proved to be an effective way of encouraging businesses to commit to providing quality products and services and creating public awareness on where to access good quality off-grid lighting products and services. The high usage of the tool, and feedback from the users indicates that the general public is in need of information on renewable energy. The USSD tool has also been developed with the flexibility to incorporate additional renewable energy and energy efficiency products and services e.g. solar water heating systems, clean cook stoves, biogas, solar water pumping systems and RE/EE loans/consumer financing products. Moving forward, KEREA will update the tool to incorporate these other products.

Following the success of *860# in Kenya, KEREA is also planning for wider role out of this innovation in the entire East African region, as explained by Mr. Gupta: *“With the help of five other regional bodies-we are talking of Tanzania, Uganda, Rwanda, Burundi and Kenya-we are forming one association which is East African Renewable Energy Association. This means great networking, great expansion and great access to the people and we are seeing that there will be a time when all East Africa will benefit.”*

Lessons Learnt

- Mobile phone technology is the most available and accessible means of accelerating adoption of renewable energy technologies.
- Strategic partnership with the private sector is key in the development and growth of renewable energy sector in the country



Banking On Nature's Sweet Returns





Enchanting Kwale County

Kwale County is one of Kenya's hidden jewels boasting of a unique mix of Africa's finest sandy beaches, the exquisite Kisite Mpunguti Marine Park, magnificent indigenous forests and more interestingly iconic wildlife species including the gentle giants – the African elephant.

This dynamic environment also boasts something that doesn't fly or run, has no roots or leaves, but has become an essential part of daily life for the residents of Kwale, and continues to help keep the forest, the wildlife and the marine ecosystem healthy. It's a Village Bank.

The Energy Challenge

With such an impressive natural capital endowment, one would expect a thriving and an empowered population. However, according to a survey conducted by the Kenya National Bureau of Statistics (KNBS) and Society for International Development (SID),(Ref 1) Kwale alongside a host of other Coastal Counties was ranked among the leading counties in the poverty index with the residents experiencing problems of low income, expenditure and immense inequality.

These challenges pushed the community to resort to environmentally destructive options to make ends meet. Key among them was the wanton destruction of the indigenous forests and even mangrove forest in other instances in order to access wood fuel. Due to unavailability and/or unaffordability of off-the-grid electricity, a huge section of the population was equally chocking from the use of kerosene powered tin lamps.

This unhealthy mix of energy and lighting sources in a way boxed the community in an impossible situation exposing them to health risks, a diminishing forest cover that would soon condemn them into a drought stricken population, and a vicious cycle of poverty especially because their children would never have had a level playing ground to pursue their studies and break the cycle in those circumstances.

Despite the abundance of solar energy at their disposal, the cost of solar powered lights were a far cry in terms of affordability for a good chunk of the population. Equally, the burden of putting food on the table prepared wholly by firewood was not a cheap affair as they used very inefficient cook stoves.

The insurmountable challenges at the time notwithstanding, the community basically divided into traditional governance structures called the 'Kayas' had a mission ~ To protect and bequeath to their future generations a pristine traditional heritage, The Kaya Forests which is of great cultural and spiritual importance to the local Digo community.



Interventions

The realization of the fact that a financially empowered population is capable of making environmentally sound decisions was the key that unlocked the key intervention in Kwale – The village bank.

According to 50-year-old mother of six Zainab Ahmed, arguably the pillar of Kaya Kinondo Village Bank who has steered the organization to where it is right now despite not having formal education, their livelihoods would have been put into serious jeopardy had the community not realized what immense economic potential their forest has, and acted on it.

“Kaya Muhaka and Kaya Gogoni and the greater Kinondo has very good trees. We were beginning to use the forest badly, cutting many trees from it to make charcoal. This was badly affecting the forest and slowly destroying it.”

It is at this point that Zainab and her neighbors realized that there is indeed a better way to co-exist with and even benefit from the forest.

“In 2003, we decided to come together and start an eco-tourism project. We sold carvings and introduced our rich culture to tourists along a trail in the Kaya Kinondo forest,” Zainab says.

Through this simple venture, the community in and around Kaya Kinondo began to see the economic value of forest conservation. Money began streaming in, and the community faced a new challenge.

“We were getting all this money, but we had nowhere to take it because at that time, banks were really expensive and inaccessible,” says Zainab

Banking on nature

It was at this point that WWF, supported by the UN Development Programme’s Global Environmental Facility, the Ford Foundation and Critical Ecosystem Partnership Fund, introduced the idea of banking in the village, for the village, by the village. In addition to the bank component, the project worked with people who earned their living by making charcoal or selling firewood with the aim of helping them shift to more forest-friendly enterprises such as growing tree seedlings, eco-tourism and various agricultural projects, such as chicken farming.

“We helped create Kaya Kinondo Financial Services Association in order to help communities in Kwale invest their revenue in environmentally viable businesses that would keep their forests profitable while also conserving them,” says WWF’s Elias Kimaru, who works on the project.

Training was carried out for community members to help them invest wisely and ensure that the bank is sustainable and continues to benefit the community and the environment.

“In every village, WWF trained one person on how to set up and run a village bank. This was an important move because we had previously seen other village banks start and then die because of mismanagement. We did not want our bank to fail. After the training, we started the bank with 153 members who bought shares at \$3 each,” explains Zainab.”

Client numbers were low at first because villagers were not convinced that their money would be safe in a village bank. As Zainab recalled, other banks had been set up and had folded; the families of Kwale can’t afford that kind of financial risk.

Then light came

In 2004, WWF in seeking to integrate use of renewable energy services into the community introduced the solar light loans by injecting a \$10,000 revolving fund into the village bank. It is from this fund that in partnership with barefoot power, a private company that manufactures solar powered lights that members of the village bank would be advanced with the lights and thereby repay in installments of \$1 every month. The loan was also extended to those who sought to construct improved cook stoves.

“In 2004, WWF offered us training on how to manage loans as a bank, and we began providing business loans of up to \$50 to our members,” notes Zainab.

By 2011, more than 130 members had taken loans amounting to \$60,000. From a desire to protect their forest and promote their culture, the members of Kaya Kinondo Financial Services Association have created a strong and growing community institution.

For Mzee Shaban Ndegwa, the chairman of Kaya Mtswakara, one of the key beneficiary groups of the village bank initiative, his community’s transformation both economically and socially is plausible.

“The savings we make now of upto \$40 every month per household from not buying kerosene, purchase of firewood, charging our phones and even hospital bills is all thanks to WWF. Thank you!”

In a bid to ensure the health of the Kaya forests, the elders have helped the community set up woodlots where they provide seedlings for its members to grow fast growing trees from which they can continually be harvesting firewood from. This reduces the pressure on the forest.

'Our biggest win is the fact that our great ancestors will surely be very happy with our generation for protecting the sacred Kaya forests, a place we believe they dwell and watch over our community.'

For businesswoman Umazi who runs a food kiosk in Mtswakara village, the improved cook stoves are helping her reap some good returns.

'I save upto \$2 dollars everyday since I use less firewood. This was essentially my profit previously. Glad to be making double profit!'

Meet Benson Bunju Martin, a student at Jilore High School in Malindi who at the time was preparing to sit for the all-important national examinations later in 2017.

'For my entire primary school education I could not study at night. But with the introduction of the solar lights when I joined high school, my performance has consistently improved and I know I will make my mother proud after I sit for my national examinations.'

Conservation Impact

By all standards, Mama Zainab exudes confidence that the Kaya Kinondo Village bank has lived up to its founder's expectation.

'All our members who made their livelihoods from charcoal burning and wood fuel harvesting have moved from forests and are now running alternative businesses. In addition, the uptake for environmental loans to establish tree nurseries and also establish agribusiness ventures is on the upward trend. I am 100 per cent the project has aided conservation. Actually, forest destruction in our areas of operation has reduced by 80 per cent.'

Mama Zainab opines that Kaya Kinondo Village Bank has its eyes fixed on being transformed into Micro finance institution in order to expand their customer base as well as attract funding from the Government of Kenya in line with WWF's objective of Conservation impact at scale.

With 2081 {996 are women (48%), 919 men (44%) members with a net worth of \$800,000 in 2017, the village bank is indeed a testament to the fact that human beings can live in harmony with nature.

Lessons Learnt

1. Tapping into the indigenous knowledge of the local community while introducing forest conservation concepts is key.
2. In the sensitive matter of finances, allowing the respected community members to be at the center of managing the institution inspires confidence and creates a sense of ownership.
3. Financial empowerment as an intervention for reversing the effects of climate change and igniting the uptake of clean energy initiatives is critical.
4. Adequate capacity building in financial management of leaders of the village bank ensured the effective running of the bank.





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