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MANAGING FOR DEVELOPMENT RESULTS

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

COMPENDIUM OF CASE STUDIES ON

NATURAL RESOURCES & ENERGY IN AFRICA



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LIST OF ACRONYMS

ACBF	The African Capacity Building Foundation
ACE	African Clean Energy
ACP	Africa-Caribbean-Pacific
AfCoP	African Community of Practice
AFD	Agence Française de Développement
AfDB	African Development Bank
AGF	Advisory Group on Climate Change Finance
AIDS/HIV	Acquired Immunodeficiency Syndrome/Human Immunodeficiency Virus
AREI	African Renewable Energy Initiative
AU	African Union
CCD	Climate Compatible Development
CDM	Clean Development Mechanism
CSS	Climate Safeguard System
ESG	Environment Social Governance
EU	European Union
FAO	United Nations Food and Agriculture Organization
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GEF	Global Environment Fund
GHG	Green House Gas
GIZDie	Deutsche Gesellschaft für Internationale Zusammenarbeit (German development agency)
Ibid	Ibidem
IEA	International Energy Agency
ITTO	International Tropical Timber Organization
ITU	International Telecommunications Union
L4L	Light for Life
LED	Light-Emitting Diode

MDGs	Millennium Development Goals
MEM	Ministry of Energy and Minerals
MfDR	Management for Development Results
MTC	Micro-Technique-Ceramique
NGO	Non-Governmental Organization
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation and Development
ProCGRN	Projet de Conservation et de Gestion des Ressources Naturelles
REA	Rural Energy Agency
REC	Regional Economic Community
REDD	Reducing Emissions from Deforestation and Forest Degradation
RETAP	Renewable Energy Technology Assistance Program
SBUR	Solid Biodegradable Urban Residues
SEFA	Sustainable Energy Fund for Africa
SGP	Small Grants Programme
SSA	Sub-Saharan Africa
SSA	Sub-Saharan-Africa
TZS	Tanzanian Shilling
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
URT	United Republic of Tanzania
USD	United States Dollar
WHO	World Health Organization
ZDBP	Zimbabwe Domestic Biogas Energy
ZIMASSET	Zimbabwe Agenda for Socio-Economic Transformation

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SYNOPSIS

Africa is a continent of widespread reserves of natural resources (oil, minerals, forests, water and farmland), which can support its economic transformation. Paradoxically, rather than contributing to shared growth and development, rich deposits of Africa's natural resources have often brought violence and poverty. The situation is worsening with increasing global change that cause depletion of these resources and make African people vulnerable to climate change. Fortunately, some initiatives are being implemented to promote efficient utilization of the natural resources and energy on the continent leading to their increased contribution to socio-economic development. Under coordination of the African Capacity Building Foundation (ACBF), some of these initiatives have been documented as case studies under the African Community of Practice on Managing for Development Results (AfCoP-MfDR). This compendium compiles these products to ensure easier and faster access to the knowledge produced. The case studies are basically related to clean technology and efficient use of energy for entrepreneurship and domestic use.

The compendium takes an additional step to analyze the body of knowledge on natural resources and energy sectors, and formulates some recommendations for African countries to ward off the natural resources curse. These recommendations include a need to set up a larger partnership among stakeholders to improve natural resources governance, build capacity of governments' entities in negotiating better contracts for natural resources exploitation, increase development and use of clean technology, and promote entrepreneurship in the renewable energy sector.

INTRODUCTION

African countries are significantly dependent on natural resources, and their governments face the challenge of transforming their assets into wider inclusive and sustainable socio-economic development. Unfortunately, victims of the “resource curse”, African countries perform badly despite their large quantity of natural resources reserves. Furthermore, these natural resources are facing increasing depletion due to anthropogenic actions, climate change and others environmental problems. This situation leads to an increasing attention on natural resources and energy sectors and urges governments and entrepreneurs to develop innovations for sustainable use of natural resources and energy.

Clean technology refers to a set of technologies, services, and processes that harness renewable materials and energy sources, dramatically reduce the use of natural resources, and cut or eliminate emissions and wastes. Clean technology includes a wide range of environmental, social and economic activities comprising (but not limited to) the fields of Recycling/Reuse of resources, Renewable energy, Green transportation, Energy efficiency technologies, Water technologies, information technology etc.

In a narrow sense, African countries are gearing up their natural resources and energy readiness through clean technology initiatives. Some outstanding and successful ones were selected and developed as case studies by AfCoP-MfDR. The knowledge products were largely disseminated and are expected to promote the initiatives, supporting their upscale while proposing key lessons and policy recommendations. This compendium aims at summarizing and sharing the body of knowledge on African initiatives to tackle natural resources depletion through clean technology. The knowledge products considered in this compendium basically cover one theme: clean technology and efficient use of energy for entrepreneurship and domestic use.

This compendium on natural resources and energy in Africa was developed following four key steps: (i) literature review on natural resources and energy issues in Africa, (ii) collection and development of summaries of relevant case studies on initiatives related to natural resources in Africa and (iii) elaboration of the compendium document (iv) review and finalization of the compendium.

The document is structured into five interconnected sections. The second section elaborates a body of knowledge on the issues of natural resources and energy in Africa and related initiatives. In the section 3, summaries of the case studies are presented. Section 4 contains concluding remarks as well as some key policy recommendations. Annex 1 proposes a matrix of the knowledge products used as case studies.

BACKGROUND

Africa has a large quantity of natural resources, ranging from farmlands and forests to oil reserves, mineral deposits and impressive water resources. It is arguably the continent most endowed with natural resources in the world (Ochola et al. 2010; ACBF 2013). Most of Africa's natural resources are undiscovered and there is increasing expenditures for further exploration all along the African coastline. Only five of Africa's 54 countries are not either producing or looking for oil. Eleven of the top twenty global discoveries in the oil and gas sector in 2015 were made in Africa (PwC 2016). New important oil and gas deposits have been discovered in Ghana, Uganda, Kenya, Somalia, Senegal, Tanzania, and Mozambique.

Beyond its abundance and importance, natural resources are yet to effectively improve the livelihoods of African populations and even become a curse for many countries. The natural resource curse refers to the observation that natural resource revenues have also been linked to slow economic growth rates, inequality, and poverty meaning that countries rich in natural resource perform badly (Jeffrey and Andrew 2001). Indeed, in Africa, rather than contributing to freedom, broadly shared growth, and social peace, the rich natural resources (deposits of oil and minerals, forest, water and farmlands) have often brought tyranny, misery, violence, and conflicts to African counties (Maphosa 2012). However, the ACBF Africa Capacity Report 2013 (ACBF 2013) shows that there is no inherent curse in natural resource endowments. It is rather the capacity implications, especially at the policy and implementation levels, that determine the ability to achieve optimal outcomes from available natural resources exploitation.

With a so large spectrum and abundant natural resources, Africa is incredibly rich in potential power-generation capacity including gas, geothermal coal, hydro, wind and solar energy resources. Potential of power-generation was estimate to 10 terrawatts of potential capacity including 400 gigawatts of gas-generated power, 350 gigawatts of hydro, 300 gigawatts of coal capacity and 109 gigawatts of wind (Castellano et al. 2015). However, the continent remains largely poor in energy supply and consumption. The World Energy Outlook Special Report underlines the acute scarcity of modern energy services in many African countries. In sub-Saharan Africa, only 290 million out of 915 million people have access to electricity and the total number without access is rising (IEA 2014). From an electricity-access point of view, the sub-Saharan Africa's situation is the world's worst as it has 13 percent of the world's population, but 48 percent of the share of the global population without access to electricity. Only seven countries—Cameroon, Côte d'Ivoire, Gabon, Ghana, Namibia, Senegal and South Africa—have electricity access rates exceeding 50 percent. The rest of the region has an average grid access rate of 20 percent. The situation of energy deficit is worse in rural and semi-urban communities where, according to Van der Hoeven (2013), 9 of 10 people have no access to energy. In another way, most of the region's homes still use charcoal and firewood for cooking and heating. Solid biomass, accounts for 70% of final energy use for cooking in sub-Saharan Africa. With population growth, that number is expected to rise to 880 million by 2020 (IEA 2014), with adverse economic and environmental

consequences and health effects from household air pollution. The major reasons are an aging power infrastructure that is incapable of meeting current power demand, inadequate infrastructure financing, and poor planning.

Since the last decade, Africa's natural resources including some important power-generation sources are beginning to face depletion due to deforestation, desertification, land degradation, water shortage and contamination and climate change (Ochola et al. 2010). This situation of increasing scarcity of natural resources and climate change switch in some regions to the development to clean technologies including renewable energy.

CASE STUDIES

In the framework of the "Africa for Results" project implemented through ACBF and AfDB under the African Community of Practice on Managing for Development Results (AfCoP-MfDR) initiative, some successful initiatives on natural resources and energy management in Africa have been documented as case studies. In this compendium, they are categorized into one central theme: clean technology and efficient use of energy for entrepreneurship and domestic use.

CASE STUDY 1

Promoting clean technology for cooking in Sub-Saharan African countries: lessons from African Clean Energy

Background

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. Unfortunately, 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 — (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.

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) was founded to that end in order 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.

Activities and results

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 smokeless and sustainable cookstove called ACE 1. 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 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. The results below can be highlighted.

- As of December 2015, African Clean Energy has sold 40,000 clean cookstoves which generated an income of about USD 3.2 million as one cookstove is sold on an average price of USD 80.
- 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.
- 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.

Moreover, 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 can be assumed that an approximate amount of biomass is saved per family. 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 challenges

Funding challenge for start-up. 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. 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 a critical mass of investors online. 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.

Business instead of charity. 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. GIZ has acknowledged that a fully commercial approach – as opposed to simply distributing clean stoves through development programmes – is more effective in achieving long-term sustainability in cookstove initiatives (GIZ 2011).

Policy recommendations

Improving the business environment for the renewable energy industry. It is important that African governments set up appropriate policies for integrating renewable energy into the national energy policy. This includes the harmonization of renewable energy policies and regulations, facilitation of trade in renewable energy services and the promotion of international standards.

Shift from charity to business. Development programmes should address the energy challenges in a business way rather than charity. Therefore, there is a need to set some measures to support rural population to access and buy the clean technologies.

Building and strengthening capacities. Governments, local authorities, banks and microfinance institutions should get involved and support both companies and customers in the uptake of clean cooking stoves.

Promotion of public-private partnership. A public-private partnership is important to address the different challenges faced in promoting and scaling up the use of clean cookstoves. This is an area in which capacity building institutions 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. Furthermore, partnerships can go beyond geographical expansion and encompass technological improvement to make the product more efficient.

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CASE STUDY 2

Valorization of agricultural and domestic waste: lessons from the initiative of green charcoal in Mali

Background

Fuelwood and charcoal are the main sources of heating and cooking energy in Africa (FAO, 2007). African consumption of charcoal accounts for more than half of world production (AFD & BAD, 2009). This massive use of fuelwood and charcoal in Africa contributes to deforestation and forest degradation. The development of clean technologies is thus increasingly encouraged in order to reduce the pressure on forest resources while guaranteeing users an efficient and sustainable energy source. From clean technologies in energy efficiency sector, green charcoal is one of the best alternatives to fuelwood and charcoal. It is produced from biodegradable, high-carbon residues, mainly from agricultural and domestic waste. Green charcoal is sized as small bricks and could be used in most ovens and cookstoves used in African countries. Mali's experience in the development of this technology is quite interesting. It was based on the country's high potential for agricultural residues, which remain largely untapped and often burnt on the fields. This case study presents the context for the development of this clean technology in Mali, the results achieved, the policy implications and the resulting recommendations.

Activities and results

In 2011, the Yasagu Malian association took an initiative to propose innovative and sustainable solutions that would contribute both to the fight against deforestation and poverty reduction, in particular

in terms of meeting the energy needs of grassroots communities. Yasagu Malian association developed a project to produce organic charcoal based on a recycling technology for Solid Biodegradable Urban Residues (SBUR). The results achieved through the actions developed by the Yasagu Association in Mali in the field of green charcoal production are multidimensional. Among concrete results, there are:

- The creation of two fabrication units of green charcoal;
- The creation of local, decent and sustainable jobs (10 per unit);
- The validation and recognition of the energy efficiency of green charcoal;
- The adoption of green charcoal by local households, which consumed about 20 tons of green coal, saving then 188.15 tons of wood.

Lessons learnt and challenges

Three main lessons can be learned from this experience in order to guide future initiatives:

- The development of strategic partnerships is fundamental to the achievement of the objectives of such initiatives. Indeed, the partners (government, civil society, private sector and academia) associated with this initiative strongly influence the level of achievement of the defined objectives. It is therefore important to involve strategic

partners which can bring significant added value in the planning and implementation.

- Communication and knowledge management have been crucial in the visibility and adoption of the product (green charcoal). The communication strategy is a key tool that facilitates the adoption of innovations. It is important to have both internal and external strategies. The internal strategy should be based on an effective monitoring and evaluation system to inform the various stakeholders of the progress and level of achievement of the objectives. On the external side, it must aim to attract the interest of the beneficiaries and other actors in relation to the actions that are carried out.
- Considering real investments during budget planning is important for such initiatives. In the context of this case study, the assessment of investment needs proved to be constraining. It is therefore important to take account all constraints in order to develop a budget that truly responds to the initiative.

Policy recommendations

With the experience of green charcoal initiative in Mali, some policy recommendations have been formulated.

- African countries need to develop adequate policies to promote clean technology initiatives and their adoption. In a process of promoting green technology in Africa, African countries need to develop relevant public policies to encourage such initiatives on the continent. Public policies must define the normative frameworks that favor multi-stakeholder

partnerships (i.e between scientific research, endogenous knowledge and promoters). This experience has shown that the promotion of similar clean technology must take into account endogenous knowledge, scientific knowledge, contexts, requirements of innovations, etc. All this will require a strong collaboration between several actors.

- Capacity-building institutions in Africa are called upon to assist African States in the development of competencies for the formulation of appropriate energy policies. Indeed, African States have a proven need for competence in the development of appropriate policies and strategies related to clean technologies.

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WEB LINK TO THE FULL KNOWLEDGE PRODUCT

<https://afrik4r.org/wp-content/uploads/2017/01/Charbon-Vert-au-Mali.pdf>

CASE STUDY 3

Clean technology: Lessons from Nansu cookstove in Benin

Background

In Sub-Saharan Africa, more than 700 million people still rely on open fires and traditional stoves for cooking food that burn solid fuels like firewood and charcoal (IEA, 2014). Unfortunately, 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 environmental issues. According to the World Health Organization (2016), toxic fumes from traditional stoves lead to more than four million premature deaths each year mainly for women and children. Beyond the health sector, the utilization of massive biomass for cooking is very harmful to the forest resources and traps millions of households in the poverty cycle (Lambe et al. 2015). The use of traditional stoves also maintains gender gap with women who sometimes use up to 5 hours of their time per day to collect firewood (Rysankova et al., 2014).

Benin is one of the Sub-Saharan African countries where cooking energy needs are essentially satisfied from fuelwood (Akouehou et al., 2012a). The steady growing demand for fuelwood is an important risk factor in forest management and climate change programs. This situation has led to the implementation of initiatives for the efficient management of fuelwood, including improved cookstoves, which have been developed and promoted to reduce wood consumption and, in turn, reduce wood demand. Improved cookstoves are clean technologies with

two major advantages: low fuel consumption and low CO₂ emission. Improved cookstoves are therefore a serious option to simultaneously reduce pressure on forest resources and reduce CO₂ emission.

This study focuses on Nansu, an improved clay cookstove developed in Benin. The study presents its origin, its introduction, and then informs about its technical-economic characteristics. It also outlines the results associated with this technology in the context of Benin and then highlights the lessons learned and policy implications.

Activities and results

Nansu is one of the clean technologies revealed to the world in 2000 in the framework of the project "Improved cookstoves in Benin" of the Program for the Conservation and Management of Natural Resources (ProCGRN), funded by GIZ. It has been disseminated in Benin and West Africa. Nansu is an improved double wall cookstove separated by an attachment belt. It is made of ceramic with a metal envelope. The furnace has a cylindrical combustion chamber which also collects ash from combustion. It uses charcoal as fuel. Five main results emerged from the evaluation of the Nansu cookstove in Benin.

- The technical fabrication process was standardized. The Nansu cookstove fabrication process was standardized to facilitate its replication and adoption in other regions and countries.

- The energy efficiency of the Nansu cookstove was proven. Nansu technology recovers 40 to 70% of the energy produced by burning wood and lead to a save of wood of about 42 to 62% (Akouehou, et al., 2012b).
- The Nansu cookstove has been widely adopted by households in both rural and urban areas. As of December 2010 (four years after its introduction in Benin), 7,200 Nansu cookstoves were produced and distributed (GTZ, 2011). In 2014, an additional 5,000 Nansu cookstoves were introduced at household level.
- The development of the Nansu cookstove has enabled the mobilization of various funds for the benefit of the actors. The MTC company, which specializes in the fabrication of ceramic stuffs obtained in 2013 a fund of about 15,000 euros from the Africa Fund, an initiative of the venture capital firm Garrigue and supported By the Tech-Dev association. In addition, external funds from the African Development Bank, the ACP-EU Energy Facility, BMZ, etc. were mobilized to promote and upscale Nansu cookstove.
- The initiative of Nansu cookstove created jobs in local communities. Important number of formal and informal jobs was created through Nansu initiative.

Lessons learnt and challenges

The issue of improving energy efficiency is increasingly being driven by the development of clean technologies. To successfully mainstream clean technology into Africa transformation process, it is important to consider the following issues.

- The development of clean technologies requires significant investments;
- Clean technologies like cookstoves lead to

significant energy saving;

- Clean technologies offer a business opportunity for various actors along the value chain.
- The entrepreneurial potential of clean technologies is enormous notably in the setting up of medium and large-scale fabrication units but also for scaling up and market targeting.

Policy recommendations

More investment in both energy production and clean and efficient energy technologies. African countries, which for the most part depend on wood energy, must invest in energy production as well as in clean and efficient technologies that guarantee low consumption of wood energy. African countries must therefore set up an incentive and coaching mechanism to facilitate the emergence of these technologies.

Promotion of local innovators. There is need for African countries to celebrate and encourage innovative initiatives like Nansu cookstoves. Innovators in Africa are generally neglected. Many initiatives are being developed in the field of clean technologies but are globally unrecognized and rarely scaled up. African countries need to set up a mechanism for incentives, coaching and encouraging innovation efforts.

Capacity building in energy efficiency promotion. With current and future alarmist statistics on wood energy consumption and its health, economic and environmental consequences in sub-Saharan Africa, pan-African development organizations should develop and implement capacity-building strategies for African states. These institutions must engage African states in energy efficiency programs that improve the production and consumption patterns of cooking energy.

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CASE STUDY 4

Women's Empowerment and Protection of Mangrove Ecosystems: An initiative in Central Africa, Equator Prize 2014

Background

Mangrove is one of the most productive terrestrial ecosystems in the world, providing a wide variety of ecosystem services including fisheries production, timber production, coastal protection, Reduction of pollution and carbon sequestration. Unfortunately, mangrove ecosystems are experiencing sharp declines throughout the world, particularly in Africa.

Cameroon loses annually more than 3,000 ha of mangroves (UNEP 2007). One of the main drivers of the destruction of mangrove forests is fish smoking, due to the inefficient practices and high consumption of mangrove wood. Indeed, smoking 1kg of fish requires 2.5 kg of wood, leading therefore to deforestation and degradation of mangrove ecosystems. This situation is responsible for more than 80% of the destruction of mangroves in Cameroon. In addition, the traditional stoves used expose women to smoke and heat and lead to respiratory disorders.

This study reports a mangrove protection initiative focused on the development of improved low-consumption and efficient fish smokers as well as additional innovation to maintain or improve color, flavor and quality of smoked fishes.

Activities and results

The initiative identified four main factors (attractive color, good taste, quality of smoking, excellent combustion) that determine the preference of

mangrove forests to any other wood for smoking fish. According to women, mangrove wood gives to smoked fish an attractive color and better taste. Additionally, mangrove wood could be used even when wet. It burns slowly and allow a better drying of fish. Based on these evidences, an improved fish smoker, energy efficient was developed based on traditional technology and practices. This technology was supported by additional innovations including the use of moistened fish scales to improve the color of smoked fish, the use of aromatic plants to improve the taste of smoked fish and the use of garbage as alternative combustible for the smokers.

In practice, the initiative has enabled the capacity building of 1,035 women in smoking and environmental education and building of 465 smokers. The impact of the adoption of these new fish smokers was related to:

- Time saving. The fish smokers allow a time saving of about 50 to 63% along the process. This saving of time allows women to develop new income-generating activities.
- Increased profit from the new smoking technology. The new fish smoker leads to an increase of about 6 to 25% in profit, resulting from the reduction in post-smoking losses of fish that are almost zero with the new smokers, but also with the much-appreciated quality of the fish from the new smokers.

- Reducing the pressure on mangrove resources. The initiative led to significant reduction of anthropogenic pressure on mangroves.
- International recognition. The initiative has also received international recognition. Out of 1,234 initiatives from 121 countries around the world, this initiative has been chosen as one of the 35 best innovations in the world and is the recipient of the UNDP Equator 2014 Prize.

Lessons learnt and challenges

A local initiative could substantially contribute to reduce the negative impact of anthropogenic actions on forest resources. The initiative of improve smoking stoves led to the reduction of mangroves degradation.

The main lesson learned is that building women's capacities could lead to their empowerment and improve the global resilience of households. This case study is an example of how women could contribute with greater commitment to the fight against climate change.

The success of the initiative and the engagement of women to protect mangrove ecosystems have served as the basis for the Government to develop the Sustainable Mangrove Management Project funded by the Global Environment Facility (GEF).

Policy recommendations

Promotion of alternative sources of cooking energy. Alternative sources of cooking energy have double economic and ecologic advantages. First, it contributes to alleviate poverty by reducing time devoted to firewood collection. Second, it leads to a signification reduction on forest resources

degradation. African governments and development organizations should support clean technology that promote energy efficiency like improved stoves.

Including gender oriented strategies. It appears that capacity building for women, when well targeted and responsive to real needs, results in better outcomes in conservation, sustainable management and development. Therefore, partners and institutions working in capacity building and development in Africa should include capacity building for vulnerable women as a priority in their strategies and approaches.

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WEB LINK TO THE FULL KNOWLEDGE PRODUCT

<http://afrik4r.org/wp-content/uploads/2017/01/AutonomisationdesfemmesPrixEquateur.pdf>

CASE STUDY 5

Solar energy: an opportunity for affordable and clean energy for all

Background

Energy in Africa is a scarce commodity. About two-thirds of the people in Africa live without electricity (Watkins 2015). The number rises daily due to the increasing costs of electricity and growing poverty in most African countries. Most of the region's homes still use charcoal and firewood for cooking and heating. This trend means that the global target of energy for all by 2030 cannot be reached (Watkins 2015). In Sub-Saharan Africa, only 290 million of 915 million people (31.7 percent) have access to electricity, and the total number without access has been rising (IEA 2014). The situation is worse in rural and semi-urban communities where 9 of 10 people have no access to energy. In the same time, Africa is home to a vast quantity of solar power with the potential to meet its electricity demand. Solar power is a hugely promising source of energy that can increase access to domestic electricity to the hundreds of millions now lacking it. With the price of solar panels declining, there are opportunities for both the private and public sectors to connect millions of poor households to affordable small-scale, off-grid systems. The Africa Progress Panel report (2014) estimates that 138 million households living on less than USD 2.50 a day spend USD 10 billion annually on energy-related products, including charcoal, candles, and kerosene—per unit cost, 60–80 times more than people living in London or Manhattan. Off-grid solar power can greatly reduce these costs; promote productive investment, health, and education; raise life expectancy; and reduce poverty.

This case study presents a success story from Tanzania on the use of solar power to improve lives in rural and semi-urban communities. It shows the efforts of Off-Grid Electric in combining information and communication technologies with solar energy to provide affordable and smart energy services in African communities.

Activities and Results

In 2011, Xavier Helgesen, Erica Mackey and Joshua Pierce created an off-grid power company, Off-Grid Electric, in Tanzania with the vision of making solar energy accessible and affordable in a mass market rather than as a niche product. Pooling their knowledge, they developed a business idea to make use of the growing penetration of mobile phones and mobile money services in East Africa to sell solar-powered electricity as a daily service. They use a tailored smartphone application linked to a database to integrate information on customers, systems operations, and payments. The entry-level service is two bright lights and a phone charger for eight hours a day. Customers can add more appliances at additional cost. The second level has up to six lights, two phone chargers, and a radio. A third level, which powers a television set, is being field-tested. In 2014, each customer paid a deposit of TZS 10,000–15,000 (USD 6–9) and a daily fee of between TZS 300 and TZS 1,000 (USD 0.18–0.63), depending on the level of service.

Off-Grid Electric was so successful that, by end-March 2015, its systems were in use in over 10,000 households in rural Arusha, bringing benefits such as access to high-quality light for study and relaxation, increased safety and security, and direct and indirect (often part-time) jobs for more than 45,000 people. The company also created direct and indirect employment for more than 15,000 young people in rural areas. It delivers solar power at a price customers can afford without sacrificing quality. For the same amount of money their customers already spend on kerosene or candles, Off-Grid Electric provides clean energy with 25 times more light and additional energy for appliances such as televisions and radios. The company also offers financing for appliances such as radios and television sets so that customers can enjoy the additional benefits of modern energy at a low cost. Customers can make these payments, too, through mobile money.

Key lessons learnt and challenges

- The case study demonstrates the value of solar light in improving the lives of people in Tanzania through tapping into abundant solar energy, and using mobile phones and mobile money services.
 - Although solar power is the most affordable clean energy in the continent, such affordability varies by market segment. Solar projects must recognize that most rural communities are socially and economically constrained. African states must subsidize some of the costs related to the delivery of solar power so that all citizens have equal access to clean energy by 2030.
- Quality is an essential element of solar lighting and cannot be compromised. Systems quality and the ability to access spare parts and repair services must be an integral part of any solar power program. Performance standards should be in place and monitored for all solar power companies. A strong inspectorate should be built to ensure that high-quality products and services are delivered. With the mushrooming of counterfeit products in African markets, this aspect requires scrutiny.
 - Partnerships and close involvement of the private sector in addressing challenges of access to clean energy are necessary. African countries need to ensure that long-term, sustainable solutions to its power supply problems are implemented.
 - Well-designed programs can enhance rural communities' contributions to national economies, improve business opportunities and job creation, and enhance the revenue and livelihoods of low-income populations—all contributing more generally to raising the quality of people's lives as more people access clean energy.

Achieving the United Nations Sustainable Development Goals, the African Union Agenda 2063, and the AfDB agenda related to energy is feasible as far as efforts to light up Africa and provide clean energy are concerned. However, there is a need for the right mix of policies, incentives, and multi-stakeholder collaboration at country and regional levels; and viable business plans to ensure accelerated solar power deployment.

Policy recommendations

The following policy recommendations are put forward:

- Governments in the region should recognize and support social enterprises delivering clean energy to the poorest households.
- African leaders should show greater leadership in mobilizing domestic resources to finance access to clean energy and focus on providing light to rural communities. They should also develop short- and long-term strategies to implement the globally agreed targets on universal access to energy by 2030. National programs for agricultural, climate change, and energy transformation should be aligned for coherence. African capacity building organizations can provide the necessary knowledge and support to governments in designing, financing and implementing the appropriate programs and strategies.
- Governments in Sub-Saharan Africa should encourage the uptake of solar lights and their components by removing taxes and duties on imported technologies and by reducing the number of licenses required by solar light manufacturers and distributors. A special agency should be set up to plan and promote solar light, coordinate technology standards and testing, and manage national and subnational data on the supply and demand of solar light and energy.

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CASE STUDY 6

Patrick Ngowi: a successful Tanzanian young entrepreneur in solar energy solutions

Background

With a population of 51.9 million and a Gross Domestic Product (GDP) estimated at US\$27.3 billion in 2016, Tanzania is the second largest economy in East Africa . Like in other African countries, mobile phone use has rocketed in Tanzania in the past decade putting the mobile phone penetration rate at 67 percent . Like all sub-Saharan African (SSA) countries, Tanzania faces tremendous challenges to ensure access to energy. In the country, the spread of mobile phones has far outstripped that of grid electricity, as 85 percent of the population were still living off-grid in 2011 . This included most households in rural areas, but also those on the outskirts of cities like Arusha where the grid is available but the connection cost of around US\$700 is prohibitive for most people. In this country, there are some solar-home systems which can provide the needed power to run lights, mobile phones and other small appliances but the initial connection cost and after sales service prevent widespread adoption of these systems. As such, most of the citizens do not have access to electricity. As an alternative, they rely on kerosene to light up their houses. If Tanzania is to realize its development objectives, access to clean and affordable energy should be increased by involving private sectors in the energy sector and developing innovative mechanisms. This case study features Patrick Ngowi, a successful young Tanzanian entrepreneur who built a multi-million-dollar business from solar energy – one of Africa’s most lucrative but unexplored business opportunities. This case study aims to share the story of this successful young multi-

million entrepreneur Patrick Ngowi who started from a simple business idea to become one of Africa’s Best Young Entrepreneurs.

Activities and Results

At age of only 15, and still a student in secondary school, Patrick Ngowi ventured into the mobile phone business by selling call cards (recharge vouchers) which he noticed were scarce in the area. By the time he turned 18, he was fully into the mobile phone trade selling cheap handsets which he bought from Hong Kong. Patrick sold more than 5,000 handsets (at an average price of \$20) in one year alone. During his short stint in the mobile phone business, Patrick noticed that many of his customers did not have access to electricity and getting their phone batteries charged was a serious problem. It was during his frequent trips to Hong Kong and China that he discovered solar panels and learned about renewable energy for the first time. By then, Tanzania had critical energy infrastructural challenges. This problem provided the inspiration into the potential of solar power and the lucrative opportunities it holds in Tanzania and Africa’s future. To prepare himself for this future, Patrick enrolled in Dezhou University in China, where he studied renewable and alternative energies (with emphasis on solar power). While at Dezhou, Ngowi started an informal exporting business. He had previously built relationships with a few friends in the construction industry so he had a lot of orders from them.

By the time he had finished with his studies, Ngowi had built up enough capital and was able to load his own consignment of solar and thermal equipment. He headed back to Arusha, Tanzania to set up his own business. It was in 2007 that he started Helvetic Solar Contractors. His company was the only one based in Arusha offering solar products. His other competitors were in Dar es Salaam, but a distance away, giving him the market.

Through his company and leadership, Patrick achieved the following results:

- Lighting the rural communities in East Africa: Patrick's company has installed more than 6,000 small rooftop solar systems in Tanzania and four other East African countries – Kenya, Uganda, Rwanda, and Burundi – by end of 2013
- Wealth and job creation: In 2011, the company made \$2.8 million in revenues, then \$6.8 million in 2012. The success of Ngowi's company proves that Africa's market and demand for solar energy is indeed lucrative. Also, the enterprise creates and sustains decent jobs especially to young people through its distribution operations and sales centers.
- Philanthropy - Investing in others: Helvetic Group supports the Light for Life (L4L) Foundation, an initiative that aims to offer basic lightning facilities to the rural households, by providing renewable energy sources.
- International recognition: The experience of Patrick Ngowi impressed the international community for the valuable impact his work had on the poor households of rural Africa and on young people's self-employment, job creation as well as wealth creation. Helvetic

Group of Companies Founder and Group Chairman Mr. Patrick Ngowi received many awards for his achievements (Forbes list of 30 under 30 Africa's Best Young Entrepreneurs, Forbes' list of Young African Millionaires to Watch in 2013, East Africa's Young Business Leader of the Year 2014 by Forbes and CNBC, etc.).

Lessons learnt and policy recommendations

The successful venture of Patrick Ngowi provided Africans with key lessons and policy implications as follows:

- Investment in solar energy has huge returns and can be a profitable venture. Solar energy stands a good chance to succeed in African contexts, hence the necessity to support local entrepreneurs through appropriate policies.
- Tax reduction policies are necessary to promote innovative business models that target populations with low purchase power.
- Local entrepreneurs and business men and women can become local philanthropists and reduce dependence on external donors.
- An integrated business model can have a positive impact in building the capacities of Africans, resulting in the structural transformation of Africa.

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CASE STUDY 7

Combining mobile phone and solar power to provide affordable domestic electricity: the M-Kopa success story in East Africa

Background

In sub-Saharan Africa (SSA), only 290 million out of 915 million people (31.69%) have access to electricity and the total number without access is rising (IEA, 2014). In rural areas, the odds are worse, with nine out of ten people lacking access to energy (Van der Hoeven, 2013). Empirical evidence confirms that good access to energy is critical to sustainable development growth (Wolde-Rufael, 2005). Countries with better access to energy tend to have a more vibrant industrial sector and faster economic growth rather than others. Thus, lack of electricity in SSA remains one of the biggest barriers to the region's development and prosperity (Bhattacharyya, 2012), and continues to trap millions of people in extreme poverty. Access to basic domestic electricity to light up houses at night and access to power remain a key challenge that if properly addressed, would boost key sectors like education, manufacturing and services. At the same time, Africa is home to an extremely vast quantity of solar power which has the potential to meet the electricity demand of the continent. It is estimated that Africa's solar power is sufficient to provide enough energy for the continent (Trieb, 2009). Solar power is a promising source of energy that can result in increased access to domestic electricity for the hundreds of millions people who lack basic access to it.

On the other hand, there is a steady growth in Information and Communication Technologies (ICT) penetration in Africa including an increasing rate of mobile cellular subscriptions on the continent. Indeed, this has gone from approximately 87 million in 2005 to 582 million in 2013 and keeps increasing (ITU, 2014). This rapid mobile penetration has brought several innovations and opportunities, especially for remote rural communities, and offers new and promising opportunities for Africa in different sectors including energy value chain (e.g. smarter systems and grids) and customer payment (e.g. mobile payment).

Combining mobile phone and solar power, an enterprise called M-Kopa is providing the financing and distribution for a pay-as-you-go, mobile phone-enabled home solar panel system for off-grid rural villagers in Kenya, Tanzania and Uganda. The mobile payment service used is M-Pesa, one of the most successful in the world. This initiative is one of the rare on the continent to simultaneously address the low access of African communities to electricity and the challenges they face to pay for it.

This case study analyzes this initiative and disseminate its approach and outcomes, to leverage further support and promote its replication in other regions of Africa.

Activities and results

M-Kopa was founded in 2011 and headquartered in Nairobi, Kenya. M-Kopa primarily develops its activities in Kenya and is now expanding in other East African countries such as Tanzania and Uganda. The company developed an innovative approach to offer solar home systems to off-grid customers. The system is unique of its kind as it provides access to electricity through the combination of solar power with a pay-as-you-go mobile solution. The solar power kit offered by M-Kopa includes a solar panel, two light-emitting diode (LED) bulbs, a LED flashlight, a rechargeable radio and adaptors for charging a phone. A central element of the M-KOPA technology is M-Pesa, a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 by Vodafone for Safaricom and Vodacom (CCK, 2012). M-Pesa allows users to deposit, withdraw, transfer money and pay for goods and services easily with a mobile device. Users are charged a small fee for sending and withdrawing money using the service. M-Kopa uses the mobile payment service of M-Pesa to make its customers pay for the solar kit. The payment is made on a pay-as-you go base. The solar kit costs USD 200. Clients pay USD 35 upfront and agree to make a daily payment of USD 45¢ for a year through M-Pesa. When clients paid off, the kit belongs to them. To ensure payment by the client, a mobile-based system is installed in the kit and sends a signal to activate the battery when the customer made a payment. After four years of operations, the outcomes of M-Kopa can be presented as below.

- More people have access to electricity. As of January 2016, M-Kopa had connected over 300,000 homes to affordable solar power in Kenya, Tanzania and Uganda (M-Kopa, 2016). Thanks to the equipment provided by M-Kopa,

these homes have LED lamps to light up their houses at night; rechargeable radio to have access to information and finally the possibility to charge their phones without walking miles to reach a charging point.

- Revenue are generated and more jobs are created. According to Bloomberg (2015), as of December 2015, M-Kopa has 700 full time workers along with about 1,500 sales agents. Revenue generated by the business is rising rapidly from about USD 15 million in 2014 to an estimated USD 30 million in 2015. Every day, the company has about 600 new customers, meaning it is extending loans of almost USD 100,000 a day.
- Livelihoods of low-income population are improved. By replacing the kerosene that was used to light up houses, M-Kopa is improving the health of thousands of poor people. In addition, having access to electricity opens up new possibilities for families. Furthermore, the solution offered by M-Kopa helps families to save about USD 750 over the first four years following the installation of its solar kit.
- Investments in M-Kopa solution are rising. M-Kopa completed a USD 19 million investment round in 2015. M-Kopa has also been recognized for its pioneering business model and scale, notably winning the 2015 Zayed Future Energy Prize, being selected as the top New Energy Pioneer at the 2014 Bloomberg New Energy Finance awards and earning the 2013 FT/IFC Excellence in Sustainable Finance Award.

Lessons learnt and challenges

The power sector in Africa offers business opportunities. M-Kopa is an example of the business

opportunities offered by power sector in Africa. Yet, there are conditions to unleash the full business potential of the sector. Those conditions include among others sustaining a stable investment climate for private sector participation in the sector, enforce cost-reflective tariffs and reducing inefficiency in the sector to support more affordable end-user tariffs.

Poor people can make up a highly lucrative clientele. M-Kopa estimates that 80 percent of its customers live on less than USD 2 a day. M-Kopa initiative provided evidence on the market potential that exists among poor people.

The integration of technology in the power sector can add value. ICTs offer much possibilities to add value to how the power sector is managed on the continent.

Policy recommendations

Shift view of low-population from beneficiaries to customers. The initiative of M-KOPA shows how lucrative clientele the rural population could be. This population could support the economic development of African countries if public policies and development organizations stop to consider rural population as everlasting beneficiaries of gift and start considering them as customers of innovations.

Need for capacity building of African states. Initiatives like M-Kopa show promises but African countries need to go beyond. There is a need to first build the capacities of African states in the domestication and application of regional policies and second assist states in creating the necessary conditions to boost private investments like M-Kopa in the renewable energy sector.

Design policies to integrate modern technologies into the energy sector. New affordable technologies offer the best bets for disruption to the sector. Capacity building organizations can intervene by developing programmes that will assist the government and the private sector to integrate modern technologies into the energy sector.

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http://afrik4r.org/wp-content/uploads/2017/01/Case-Study_M-KOPA.pdf

CASE STUDY 8

Access to clean domestic energy in Africa: Lessons from SolarAid

Background

Sub-Saharan Africa is rich in energy resources but very poor in energy supply. For most Africans, electric power is inaccessible, unaffordable, or unreliable. Only 35 percent of the population have access, compared with 96 and 78 percent in East Asia and the Pacific and South Asia, respectively (World Bank 2015). More than 589 million people in Sub-Saharan Africa in 2012 lived without access to electricity. These people rely on toxic kerosene, paraffin, or candles for lighting. The lack of quality energy services and access to modern sources of fuel such as natural gas, liquefied petroleum gas, diesel, and biofuels traps many families in the region in extreme poverty (World Bank 2015) and prevent from economic development. Indeed, that good access to energy and economic development go hand in hand (World Bank 2015). Improved electricity supply and distribution boosts economic growth, creates jobs, and expands the reach of educational and health services. It can also empower women, providing income-generating opportunities and enabling them to spend their time and finances more productively. Therefore, making reliable and affordable energy widely available is critical to developing a region.

The comforting news is that reports such as World Bank (2015) show that Africa is well endowed with

energy resources. Ensuring that they are available at the exact time, place, and form in which they are needed remains a major challenge, and will be for years to come. Helping countries chart low-carbon growth paths will reduce future dependence on fossil fuels. Most recent research reports strongly advise that off-grid renewable technologies, such as small hydro, solar, or sustainable biomass, represent the least-cost power supply for site-specific needs. New technology, ranging from low-cost electrification techniques to improved cookstoves and solar photovoltaic technologies, can provide solutions for clean and efficient delivery of traditional and modern fuels.

This case study aims to showcase the approach and impact of initiatives by SolarAid—a United Kingdom-based international charity combating poverty and addressing climate change, set up in 2006—and by SunnyMoney—a social enterprise owned by SolarAid and also launched in 2006—in Kenya, Malawi, Tanzania, Uganda, and Zambia. The case study also seeks to present to other African countries' policy makers and development partners a glimpse into the importance and possible returns on solar energy to Africans' lives, especially in rural communities.

Activities and Results

SolarAid provides access to solar lamps that are safe, clean, and affordable, in some of the most remote regions of Africa (Kenya, Malawi, Tanzania, Uganda, and Zambia), and is building a movement to eradicate the kerosene lamp from Africa by 2020. They give off hours of light in the evening so families can earn, learn, and feel safe after dark. When people cannot afford solar lamps, the initiative thinks of innovative ways to help them get on the energy ladder, such as “pay as you go solar.” This approach has helped people to gain access to safer light, but it costs the charity: On March 5, 2016, it reported a loss of around £3 (roughly \$4) on each solar light sold—one reason so few private companies are involved (SolarAid 2016).

In 2015, SolarAid and SunnyMoney sold over 10 million solar lights, which meant that:

- 60 million people had better access to clean, safe light.
- More than 2 billion dollars were saved by households.
- Children had 12.5 billion extra study hours.
- 35.5 million people experienced improved health.
- 5.3 million tonnes of carbon dioxide was avoided.

SolarAid was also recognized for its work, becoming a finalist in the Zayed Future Energy Prize; it was highly commended in the Unilever Global Development Award; and it received a platinum rating from GIIRS. Solar energy has the capacity to empower rural communities with off-grid lights. It can bring opportunities for local entrepreneurs, improve health, well-being, and safety; boost the economy; raise education and knowledge attainment; improve equity

for women and children; and enhance the livelihoods of many people.

Challenges and Lessons learnt

- Funding: The SunnyMoney model is working, and is ensuring that millions of people can access clean light for the first time. However, it requires donations and grants to sustain its efforts.
- Quality: Poor consumers mulling a \$100 investment need to be sure that their purchase will be robust. The International Finance Corporation (the World Bank’s private-sector investment arm) and other aid bodies are running a program to verify manufacturers’ claims.
- Inapplicability: Most electronics goods are not made to work well on low-voltage direct current produced by renewable energy sources and batteries, and makers of mass-market appliances that use grid power have been slow to rejig their products to run on it.
- Inadequate working capital: It takes five months from paying the manufacturer to getting paid by the customer. Some companies are coming up with ingenious hire-purchase schemes for bigger systems to spread the cost. Others offer “solar as a service,” where the customer pays monthly for the power, with maintenance thrown in.
- Counterfeit lights: New market entrants have put their operations under pressure and, in Tanzania especially, low-quality counterfeit lights are damaging consumer confidence. Despite that, SolarAid is determined to adjust

its model while maintaining its affordable, quality products backed up by solid customer service.

Policy recommendations

The following recommendations are made based on the findings in this case study:

- Solar energy and light is of significant value to African states, and is the single cleanest and most easily available energy source for most households. There is an urgent need for governments in the region to support social entrepreneurship in solar energy and light to improve lives, especially in rural areas.
- African leaders should show greater leadership in mobilizing domestic resources to finance access to clean energy, prioritizing light to rural communities. They should also craft short- and long-term strategies to implement the globally agreed targets on universal access to energy by 2030. National agricultural, climate change, and energy transformation should be aligned for coherence and coordination.
- Governments in the region should encourage the uptake of solar lights and their components by removing taxes and duties on imported technologies and by reducing the number of licenses required by solar-light manufacturers and distributors. A specialized agency should be established to plan and promote clean solar light, coordinate technology standards and testing, and manage national and subnational data on the supply and demand of solar energy and light.

- There is a need to tap into and promote local and regional innovations. Research and development in the local solar sector should be promoted to match the financial and policy support that larger, international solar partners can access. Institutions in research and development should be strengthened, and governments should invest in special innovation funds.
- African countries and their partners should adopt, promote, and learn from innovations such as SolarAid and SunnyMoney by seizing the opportunity, as the ground is already set.
- The impact research initiative should be taken up by African regional bodies and they should aim to support countries in this area. They should also help African states by means of capacity building to combat counterfeit lights flooding markets, especially the national bureau of standards, food, and safety institutions.
- Private investors and multinational companies should adopt and promote the SolarAid model and support scale-up efforts.

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CASE STUDY 9

Upscaling the uptake of domestic biogas technology: lessons from Zimbabwe

Background

In Africa, access to clean energy is a problem and people spend a-lot-of time and resources trying to access energy. Africa, however, has a large potential for biogas technology. It is estimated that 24% of households in Africa can own a biodigester (Heegde and Sonder 2007). Biogas has been used for ages for the purposes of lighting, heating and cooling. Biogas is produced from the anaerobic digestion of organic materials. It can occur naturally or through human controlled production like farm and household wastes in biodigesters (Norin 1998). Using biogas as an energy source has several advantages. It is a clean energy source and thus does not contribute any net greenhouse gasses (SNV 2015, Persson, 2003 and Vagdhal 1999). Biogas adoption encourages a green economy, including the creation of green jobs and greening agricultural activities like livestock production (Abaza, 2012). Biogas is gender friendly, especially for women as they spend less time cooking and looking for firewood (Matsvaire et al. 2016). While biogas alone cannot be the panacea to Africa's energy crisis, it can go a long way in alleviating the energy crisis.

In Southern Africa, Heegde and Sonder (2007) noted that Zimbabwe is one of the countries together with Madagascar and South Africa that have the highest potential for large scale biogas dissemination programs. Using the case of Zimbabwe's pilot National Domestic Biogas Program, the paper discusses the achievements and lessons from the

first two years of implementation and draws several lessons and pitfalls for Africa and the developing world on alternative sources of energy.

Activities and results

The Zimbabwe Domestic Biogas Project (ZDBP) is an initiative developed and implemented as a partnership between the Government of Zimbabwe, the Netherlands Development Organization (SNV) and the Humanist Institute for Cooperation with Developing Countries (HIVOS). The project aims to promote the use of biogas as an alternative energy source for domestic use. After two years of implementation, the following results could be noted:

- Awareness raising and promotion of the biogas technology. The project was largely successful in raising awareness about the biogas technology in the country. Three regional full-time promotions officers were hired and more than 60 promoters were trained. The project's promotional activities reached the intended end-users, the project constructed digesters in all the rural provinces of Zimbabwe.
- Capacity building of local masons. One of the main outcomes of the ZDBP is that it built local capacity for siting, sizing and construction of domestic-size biogas digesters by individual builders and construction companies in the country. A total of 31 masons were trained and are actively constructing digesters. A couple

have metamorphosed into small and medium enterprises for example some two trained masons (Tendenedzai and Pedzisai) have formed a construction company called Masons Partnership. A further 11 quality controllers were also trained and equipped.

- Digester construction and supply of construction materials. A total of 122 biogas digesters were constructed and completed in the 24 months under study. A further 27 were still under construction and several more had been sited and sized. An average of 4 digesters per month were built in the first year and this increased to 5 digesters per month in the second year. If this incremental rate is maintained the project might achieve around 70% of the set targets by the fifth year. None of the digesters completed under the project had stopped functioning during the period under study.
- Economic subsectors like dairy seized the opportunity and promoted the technology among their own members. The project introduced biogas fridges. Twelve digesters have been completed for dairy farmers. About 28 dairy farmers had started excavation works and are gathering building materials and a further 30 digesters have been sited and sized. SNV and HIVOS (2012) estimated that the appetite among dairy farmers is 100 household digesters. These have almost been achieved in the twenty-four months of the project (70 digesters including digesters that have been sited and sized).

Lessons learnt and challenges

National biogas programmes can be implemented across Africa. Using the Zimbabwean experience, other country programmes would have to consider their varying climatic, economic drivers and cultural conditions. However, to be successful:

- There is need for a basic building blocks which include: (i) a relatively sufficient national herd and farmer base; (ii) access to water; (iii) economic subsectors that can nest the new technology; a technology adoption funding mechanism like an energy fund.
- There is need for a broad-based implementation matrix. Interest and roles need to be clearly spelt out avoiding duplication of mandates. It is suggested that the consortia be composed of the following: (i) a government imperative (to align to the country policy framework and national priorities); (ii) technical partners well versed in the technology; (iii) funding partners both civil society and private sector and (iv) research partners.
- There is need for a market-based approach which ensures sustainability and optimal utilization of the technology.
- The program should be nested in particular economic sectors. For example, the potential for nesting biogas programs in the dairy subsector is huge in Sudan, Egypt, Kenya, South Africa, Tanzania and Algeria.
- Support of the policy environment. The ZDBP was nested in a broader policy framework. For example, the Zimbabwe energy policy as

well as the economic blue print Zimbabwe Agenda for Socio-economic Transformation (ZIMASSET) recognized the importance of biogas (GoZ, 2013).

- The digester construction materials value chain needs to be managed. In Zimbabwe, the project engaged cement and other building material manufactures to link with rural shops on consignment arrangement. Masons were linked to fabricators who could supply them with dome pipes, and biogas stoves.
- A balance has to be struck between support to the biogas demand and supply side. On the supply side of the market, the project partners should ensure that necessary skills are available locally. On the demand side, the program should ensure that households understand the operation and maintenance of their plants sufficiently.

Policy recommendations

Despite the Zimbabwean program falls short in some instances on its theory of change and targets, it has demonstrated that biogas uptake can be up-scaled in Africa. The study has shown that neither a natural resources crisis nor regulations stimulate a green economy. National governments should forge broad-based partnerships with civil society, private sector companies and research institutions to promote their ideals.

Nesting new technologies in relevant subsector economies is effective for upscaling uptake. Dairy, piggery and poultry are value chains that have potential in many African countries.

While free inputs are generally discouraged, national governments should craft limited subsidies when introducing new technologies. Equally important are learning sites like early adopters in the ZDBP as well as incorporating the technology in national education curriculum. Upscaling the uptake of biogas is also important for achieving green economies and mitigating climate change problems.

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WEB LINK TO THE FULL KNOWLEDGE PRODUCT

https://afrik4r.org/wp-content/uploads/2017/01_Upscaling_the_UptakeofBiogastechnologylessonsfromZimbabwe.pdf

CASE STUDY 10

Equity in access to energy: Assessment of Gender Mainstreaming in Rural Electrification Programs in Tanzania

Background

The world faces a sharp energy divide between rich and poor countries, with more than 95 percent of the world's population without access to electricity and clean cooking facilities living in Sub-Saharan Africa and developing Asia. The wealthiest benefit from the bulk of energy resources: 84 percent of the estimated 1.3 billion people that do not have electricity in their homes live in rural areas (IEA 2011). For those with access to electricity in rural areas, lighting and television account for at least 80 percent of electricity consumption, while only 2 percent of the rural population use electricity for cooking (WHO and UNDP 2009). Thus 2.7 billion people still rely on open fires and traditional use of biomass for cooking and almost half the world's population depends on solid fuels such as wood, dung, crop waste, coal, and charcoal (IEA 2011). The energy divide is also gendered, with women in most developing countries experiencing energy poverty differently and more severely than men. In Africa, women are often associated with household activities and are responsible for the bulk of household and community energy provision. Without access to modern energy services, women and girls spend most of their days performing basic subsistence tasks, including time-consuming and physically draining tasks of collecting biomass fuels, constraining them from accessing decent wage employment, educational opportunities, and livelihood-enhancing options, and limiting their

options for social and political interaction outside the household (Danielsen 2012).

Programs and policies that address the gender – energy nexus have a greater chance of yielding better results and outcomes for sustainable energy services and for human development opportunities available to women and men (WHO and UNDP 2009, Ekouevi and Tuntivate, 2011).

The paper showcases how commitments to equity and gender mainstreaming are put into practice in rural electrification programs in Tanzania. It also explores the extent to which rural electrification resolves the gender-energy challenge among rural women in that country. The study is expected to benefit policymakers and practitioners across the continent in an effort to ensure access to energy for men and women, especially in rural settings.

Activities and results

The government has tried to mainstream gender in the design and implementation of energy projects and strategies. It aims to increase power production sevenfold, from 1,400 MW to 10,000 MW by 2025. Under the Tanzania Electricity Supply Industry Reform Strategy and Roadmap 2014–2025, the financing of power projects is to be left to the private sector, to encourage investors to generate electricity from coal, gas, hydro, solar, wind, and thermal sources in an

energy mix that delivers reliable and cheap power (Muhongo 2013; TANESCO 2016). The national energy policy (2003 and 2015) captures the centrality of gender in all energy programs and projects, as a means of eradicating challenges faced by women due to unreliable energy sources (URT 2003). Further, the MEM Strategic Plan 2011/12–2015/16 stresses the need for ensuring adequate supply of energy to increase social and economic welfare”. These efforts indicate how the government is committed to making gender an integral part of all energy development strategies.

The government established the REA to coordinate and distribute electricity in rural areas. Although the REA has partnered with the World Bank to mainstream gender in the organizational structure, design, implementation, and monitoring and evaluation of energy projects, it does not explicitly state how and to what extent it considers gender issues in its energy distribution. It appears that the main preoccupation of the agency is to increase the number of people in rural areas who have access to energy. Moreover, the question of whether rural electrification is gender sensitive and can help reduce women’s health risks associated with unreliable energy sources remains less researched.

Lessons learnt and challenges

Despite efforts to provide an enabling international-level framework as well as gender policies at national level, gender mainstreaming was a low priority in the energy sector in practice. Results from this case study reveal that the energy-specific needs of women have not been satisfactorily tackled. Gendered energy needs were not prioritized in the design and execution of rural electrification. The focus was to increase the number of people accessing energy in

rural areas rather than addressing gendered energy needs. All women interviewed claimed not to have participated in the program in any way. Some informants attribute this to patriarchy and limited women’s participation and presence in politics and decision-making organs. To successfully mainstream gender into energy-related decision making, there is need to tackle some key challenges:

- Capacity challenges. In fact, gender mainstreaming requires capacity building of staff and incorporation of gender management systems at institutional level to provide guidance to gender-responsive leadership and energy-related decision making. It follows that the success of any energy project depends on how it integrates women’s and men’s concerns and aspirations. In most cases, translating energy and gender policy statements into practice has been a challenge to authorities and functionaries tasked with responding to rural women’s energy needs and priorities.
- Participation and decision-making challenge. Indeed, the lack of inclusive participatory design and implementation processes, high costs, and lack of knowledge on use of rural electrification were the main challenges identified. Interviewees claimed that women are regarded as takers of what has been decided by men.

Policy recommendations

The following measures are recommended to make rural electrification gender sensitive and responsive to rural development and transformation.

- Consulting with and involving rural people, especially women, to learn of their energy needs, challenges, and expectations, and to mainstream these in all energy policies, and so on. The government should not try to think on behalf of rural women and men about what is good for them.
- Conducting training and support for practitioners and policymakers (for example through guides on developing and implementing gendered energy programs).
- Building awareness among rural women and men about the use of different sources of energy, the costs involved, and the likely benefits of sustainable and modern energy sources vis-à-vis traditional energy sources.
- Finally, in designing and implementing energy programs, considering the types of energy required by women, appropriate costs, and adequate distribution systems aligned with women's needs and situations.

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CONCLUSION

The natural resource and energy sectors have great potential in contributing to Africa's economic development. Unfortunately, Africans fail to take advantages from their abundant natural resources deposits to tackle their socio-economic and development problems. This compendium brings insights on issues of natural resources and energy in Africa and highlights some outstanding initiatives developed as case studies. Rather than a fate, the ongoing natural resources curse in Africa and the alarming situation of energy root on a lack of development vision and capacity to transform assets into development drivers. The situation calls therefore for urgent capacity building in fields related to natural resources and energy in Africa. In addition to the recommendations proposed through the case studies, the following concrete steps are recommended to African countries, Pan-African institutions and development organizations to help break the ongoing curse.

- Investing on research and technical capacities of actors for strategic planning of natural resources deposits. For better planning, there is a need for credible information on the diversity, state, evolution and values of natural resources. African governments should encourage and support universities and natural resources related institutions for developing large programmes of forest inventory, mining and mineral exploration, valuation and monitoring. Capacities of researchers and practitioners in natural resources should be

strengthened in order to produce credible and timely information on natural resources.

- Ensure active participation of civil society for more accountability and transparency. Capacity of civil society organizations should be strengthened on how to better follow and monitor extraction and logging contracts in one way, and their implementation as well as related revenues in another way. For more transparency, funding of these civil society organizations should come from independent partners (and not from governments and extractions companies).
- Improving capacities of negotiation of African governments. It is important for African countries to force extractive and logging companies to pay what is due and do what is right as they need the tax revenues to invest in infrastructure and to provide public services for their citizens. It is important to ensure that the extractive companies align their investments with host countries development agenda, add value rather than simply extracting and shipping out raw commodities. Here is a call for Pan African institutions to develop appropriate programmes to assist national governments during mining and logging contracts negotiations.
- Promoting regional integration for natural

resources and energy management. The issues of natural resources and energy are above the borders of countries. As some natural resources are shared among countries, there is need for regional integration for the resolution of related problems. Regional policies should be formulated and translated into national programmes.

- Promote alternate energy power generation and encourage clean technologies. Africa is incredibly rich in potential power-generation capacity including gas, geothermal coal, hydro, wind and solar energy resources. This potential is not yet fully exploited. African governments should encourage the development of clean technologies for efficient use of energy. This could be done through different mechanisms including tax reduction, simplification of administrative procedures, loans or establishment of clean technology fund to support research-development or to help investors cope with risk; setting adequate policy like greening government operations and creating conducive environment for attracting clean technology companies.
- Developing public-private partnership to improve investment in natural resources and energy sector. The Public-Private Partnership (PPP) is a robust investment tool. Through this mechanism, African governments could mobilize funds from private actors (banks, funds, enterprises etc.). Such partnerships should also include the promotion of entrepreneurship, especially in the energy sector, to increase supply of clean energy to populations including those living in rural areas. The promotion of private sector investments in the natural resources and energy sectors also requires the improvement of the business environment at national and regional levels.

ANNEX 1

CASE STUDIES MATRIX

Title	Geographical coverage	MfDR pillars addressed	Page #	Web link to the full case study
Promoting clean technology for cooking in Sub-Saharan African countries: lessons from African clean energy	Lesotho	Lesotho	4	http://afrik4r.org/wp-content/uploads/2017/01/African-Clean-Energy.pdf
Valorization of agricultural and domestic waste: lessons from the initiative of green charcoal in Mali	Mali	Leadership	7	https://afrik4r.org/wp-content/uploads/2017/01/Charbon-Vert-au-Mali.pdf
Clean technology: Lessons from Nansu cookstove in Benin	Benin	Leadership	9	http://afrik4r.org/wp-content/uploads/2017/01/CS36Technologiepropre_FoyerAmelioreNansu_Benin.pdf
Women's Empowerment and Protection of Mangrove Ecosystems: An initiative in Central Africa, Equator Prize 2014	Cameroon	Result based planning Monitoring & Evaluation	12	http://afrik4r.org/wp-content/uploads/2017/01/AutonomisationdesfemmesPrixEquateur.pdf
Solar energy: an opportunity for affordable and clean energy for all	Tanzania	Leadership	14	http://afrik4r.org/wp-content/uploads/2017/01/Solar-energy.pdf
Patrick Ngowi: a successful Tanzanian young entrepreneur in solar energy solutions	Tanzania	Leadership	17	http://afrik4r.org/wp-content/uploads/2017/01/Young-entrepreneur-Clean-Energy-Tanzania-AfCoP.pdf
Combining mobile phone and solar power to provide affordable domestic electricity the M-Kopa success story in East Africa	East Africa	Leadership Statistic capacity	20	http://afrik4r.org/wp-content/uploads/2017/01/Case-Study_M-KOPA.pdf
Access to clean domestic energy in Africa: Lessons from SolarAid	East Africa		23	http://afrik4r.org/wp-content/uploads/2017/01/Affordable-and-clean-domestic-energy-in-Africa-AfCoP.pdf
Upscaling the uptake of domestic biogas technology: lessons from Zimbabwe	Zimbabwe	Result based planning Monitoring & Evaluation	26	https://afrik4r.org/wp-content/uploads/2017/01/UpscalingtheUptakeofBiogastechnologylessonsfromZimbabwe.pdf
Equity in access to energy: Assessment of Gender Mainstreaming in Rural Electrification Programs in Tanzania	Tanzania	Result based planning Monitoring & Evaluation	29	http://afrik4r.org/wp-content/uploads/2017/01/Equity-in-Energy-Access-AfCoP.pdf

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