MINISTRY OF ENVIRONMENT
AND FORESTRY

KSG
KENYA SCHOOL OF GOVERNMENT

CASE STUDIES ON CLIMATE CHANGE RESPONSE ACTIONS IN SELECTED DEVOLVED UNITS

COUNTY GOVERNMENT OF KILIFI
PAMOJA TUJENGE

Tapping on Clean Energy Sources

Solar Water Driven Borehole Pump in Mwawesa-Rabai, Kilifi County

Citation

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Background

The inaugural climate change training program, *Climate Change Policy, Planning and Budgeting at National and County Level*[1] was held in June 2017. As a follow-up to the Inaugural Training Program, the USAID – UNDP funded Low Emission and Climate Resilient Development (LECRD) Project in collaboration with the Kenya School of Government developed training case studies for use during future climate change training sessions. The training case studies are designed to complement training programs on climate change to enable trainees tease out and practically relate with concepts, theories and ideas presented in class. The cases document climate change initiatives and response actions in the Counties. Based on county presentations made during the climate change training, two counties namely; Kilifi and Narok were selected to showcase progress made and initiatives implemented in response to climate change in their respective counties. The county representatives (*Climate Change Champions*) who attended and successfully completed the training program were involved in the entire case study development process. The *Champions* planned the data collection visits to and identified exemplary climate change initiatives in their respective counties.

The case study development process entailed; a two week data collection exercise in Kilifi and Narok counties in October 2017 and a one week case study writing workshop in November 2017. The data collection exercise involved; Visits to the respective county offices, Focused Group Discussions with county officers and communities and Key Informant Interviews.

During the data collection visits; the case study team explained the purpose of the visit, interviewed the respective officers to identify and select exemplary climate change adaption and mitigation initiatives in the county to focus on, made field visits, collected relevant information, conducted interviews and

1 The Ministry of Environment and Forestry and relevant stakeholders including Kenya School of Government developed a training program on "***Climate Change Policy, Planning and Budgeting at National and County Level***" to enhance the capacity of the public service to comprehensively address climate change challenges. The program targets middle level managers and technical government officers involved in policy formulation, planning, budgeting and implementation of programs in sectors vulnerable to the effects of climate change

collected secondary data. The main areas of focus included clean energy, climate smart agriculture, forestry and water resources.

During the case study development workshop six (6) training case studies; four (4) in Kilifi County and two (2) in Narok County, and their respective teaching guides were developed namely;

1. Victor's Farm: An oasis of plenty in a dry land, Malomani Village, Kilifi County
2. Greening Kilifi County: The Magical Woodlots, Kilifi County
3. Tapping on Clean Energy Sources: Solar Water Driven Borehole Pump Mwawesa, Kilifi County
4. Waste Becomes an Energy Mine: A Case of Biogas Project at Kombeni Girls Secondary School, Kilifi County
5. Towards Food Sufficiency: Exploring Irrigation Potential – The Case of Maji-Moto, Narok County
6. Breathing Life into Enoosupukia ridges: Re-claiming the Sweet Flow from the Hills, Narok County.

The case studies and teaching guides were then presented to the respective County Governments for validation and case release in February 2018.

Objectives of the Training Case Studies

1) To document practical initiatives undertaken in the counties to adapt and mitigate on climate change;
2) To provide a practical training aid on climate change in Kenya and elsewhere around the world;
3) To publish and publicize lessons learnt, best practice and experiences on climate change initiatives from Kenya's devolved units.

Target Audience

The cases targets global, regional, national and county audiences undertaking assignments involving climate change aspects. The targeted audience should possess prior introductory knowledge, skills and competencies on climate change.

The case is suitable for participants undertaking:

a) Specialized training and sensitization programs on climate change;

b) Educational programs on climate change;

c) Conferences, Workshops, Symposia and other forums discussing the climate change agenda at county, national or global level.

Assumptions

It is assumed that at the time of going through the case, the trainee shall have been introduced to basic concepts on climate change and/or have background information on the climate change agenda, discussions and debates.

Acknowledgements

The financial support from United States Agency for International Development (USAID) and United Nations Development Program (UNDP) through the Low Emission and Climate Resilient Development (LECRD) Project and the technical guidance from the Kenya School of Government (KSG) and the Climate Change Directorate is highly acknowledged.

The teaching case studies and accompanying teaching guides were designed, developed and documented through the dedicated efforts of several people who are highly appreciated for their invaluable input throughout the process. A full list the people involved is given in Annex 1.

CASE STUDY

Tapping on Clean Energy Sources: Solar Water Driven Borehole Pump in Mwawesa-Rabai, Kilifi County

Authors: Rachel Ngesa[1] Patrick Mumo[2] and Sheila Mbiru[3]

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1. Case Synopsis

This case focuses on the adoption of clean energy in running a solar water driven borehole pump in Mwawesa, Kilifi County and outlines Kilifi County's collaboration with members of the community, stakeholders in the energy sector and development partners in exploiting readily available solar energy to pump underground water, enhancing availability and accessibility. It documents the success stories of the initiative, which is based at the County's Mwawesa Ward, which apart from moderating negative impacts of climatic and ecological factors harmful to individuals, has progressively reduced electricity cost, and risks associated with non-renewable energy and created employment opportunities. The case describes the climate change adaptation and mitigation strategies that have contributed to a significant improvement in accessing water among rural households. It also highlights the key achievements of the initiative, challenges, lessons learnt and sustainability measures.

2. Case Methodology

The case has been developed based on primary data collected from the County in November 2017 - February 2018. The data was collected through a focused group discussion with the Member of County Executive Committee and Directors in charge of Agriculture, Water, Environment and Climate Change. A structured interview guide was used for the focus group discussion. Face to face interviews with members of the community also aided in collection of

the primary data Secondary data was also reviewed to inform the case. The case was presented to representatives from the County Government of Kilifi in February 2018 for review and validation. Feedback from the review and validation exercise has been adapted in the finalization of the case. The final draft of the case was presented to the County Executive Committee Member for Water, Forestry, Environment and Natural Resources for approval and case release to allow for publication.

3. Case Introduction and Context

Kilifi County, one of the coastal counties in Kenya is characterised by a high rate of absolute poverty (71.7%) compared to the national rate (47%). The factors contributing to these high levels of poverty include limited access to piped water, (48%) of the population, limited access to electricity for lighting (11.7%) and reliance on expensive sources of energy such as kerosene for lighting (83%). The main sources of water in the county are boreholes, protected and unprotected springs, water pans, rivers, earth dams and shallow and dug out wells. The water quality is not known and access to the sources is not guaranteed with the average distance to the nearest water point being approximately 5 kilometers. The County Government of Kilifi faced the challenge of low water accessibility by residents hence moved its focus from pipeline extension which was inadequate and not accessible to the larger community, to underground water exploitation. The County also engaged in water infrastructure development projects since 2013 and alternative energy sources to guarantee a more reliable water supply.

Kilifi County through the Department of Lands, Energy, Housing and Physical Planning decided to promote the use of renewable energy in households. Kilifi is endowed with solar energy resources from the sun shining more than eight hours a day with tremendous potential to generate energy in a sustainable way. Solar energy has been known to generate income and create employment when utilized in commercial enterprises and households. Solar energy is a clean renewable energy source that emits no greenhouse gases or other pollutants. It reduces electricity bills, has diverse applications and is a low maintenance cost technology development. This contributes to substantial foreign exchange savings by reducing dependency on imported fuels and mitigates climate

change effects. However it is weather dependent and its storage is expensive. Harnessing renewable green energy from solar power reduces greenhouse gas emissions and provides a more reliable and cheaper production option that lowers human health risks. Renewable energy is crucial in managing the uncertain future climate variability.

In November 2015 the County Government of Kilifi undertook an energy audit survey with support from the United States Agency for International Development (USAID Power) and published the "Energy Audit Report" as per requirements of the Energy Regulation Commission (County Energy Policy, June 2017). The main objective was to determine potential renewable energy sources in order to reduce reliance on the electricity grid connection. The Report informed decision making and planning processes. Kenya's Ministry of Energy and Petroleum (MoEP), County Government of Kilifi and development partners formed the legal and institutional framework that contributed to the success of the initiative. The key policy documents relevant to energy initiatives included the Sessional Paper No. 4 of 2004, the Energy Act No.12 of 2006 and the County Government Act, 2012. The case focuses on the solar water driven borehole pump renewable energy initiative at Mwawesa Ward in Kilifi County which was attributed to the ineffectiveness of the available pipelines to supply water to Mwawesa Village.

4. The Solar Water Driven Borehole Pump Initiative

The initiative at Mwawesa Ward in Rabai Sub County is a community water project funded by the County Government of Kilifi. It emerged from failure by existing water pipelines to supply water to Mwawesa village, following effects of droughts to Mzima Springs; one of the major water sources of Kilifi and Mombasa Counties. The project focused on the construction of a dual-purpose system, consisting of a solar-driven pump, a reservoir tank and a convenient 4 tap watering point for drawing water by the community. Solar panels were installed to power the pumping required to fill a standby water tank. In addition to the funding, the County Government provided engineering oversight and technical assistance equivalent of USD 100,000 to ensure quality in the construction of the reservoir, installation of 24 solar panels of voltage, pump and accessories

and laying of main and lateral pipelines. The community co funded the initiative by providing a piece of land and constructed a chain link fence around the project largely to keep off loitering livestock especially goats. The community also provided security and unskilled labor equivalent of USD 3 per day.

Four villages were targeted to benefit from this project to serve a population of 10,000. However, the project has benefited 5,000 persons as the water pipeline was yet to be reticulated to Bwagamoyo Village. The solar driven pump has a capacity to pump 0.5m^3 of water per minute. Due to lack of a battery to store energy, water can only be pumped during the day for a maximum of 8 hours when the solar is able to produce energy. The borehole supplies approximately 240m^3 of water daily.

The tax exemptions on solar imported products and the willingness of most development partners to venture in solar energy technology and local capacity development has contributed to the success of Mwawesa Borehole Solar Driven Pump initiative.

5. Climate Change Adaptation and Mitigation

The project has exploited the beneficial opportunities arising from the use of clean, cheaper and abundant solar radiance throughout the year to moderate the negative impact of current and future climatic and ecological factors that may harm the population. This has contributed to green economy by reducing environmental risks and ecological scarcities associated with non-renewable energy sources this being critical for sustainable development. Local vandalism and external security threats may compromise the safety of equipment at the site. The manufacturing process for the photovoltaic cells that convert sunlight into electricity involves use of toxic chemicals, solvents, alcohol and strong acids and bases. These substances may pose health risks when released to the environment due to improper handling and unsafe storage.

The project has significantly changed lives of the rural population, especially women who previously covered long distances to access water sources. It is envisaged that the County will realize a significant electricity cost saving annually due to investments made in solar energy. Most of the residents in Mwawesa ward and the neighboring villages now access borehole water which is more reliable than the pipeline.

6. Lessons Learnt and Sustainability Measures

The high initial start up costs for purchasing and installing the solar powered borehole and building local capacity in solar technology transfer is a worthwhile investment that accrued significant long term benefits to the households and the County. Buy in by community members into communal projects is a crucial step in the project's shelf life. However, it is worth noting that some politicians gained political millage by indicating that the water is free which dampens the sustainability effort. In spite of this, sustainability measures were initiated by the stakeholders. The local community established a self-management committee to manage water pricing, maintenance of the borehole and security operations at the borehole. The water users are required to pay an affordable monthly fee of approximately USD 9 per household. This fee contributes to the 'Water Fund', which caters for maintenance, operations and security costs. The solar system proved easy to manage with selected community members trained on how to operate and maintain the system. The "local technicians" were expected to increase the local pool of knowledge by training other members. The County Government in collaboration with the community also devised a strategy for financing the replacement of the solar battery once every 5 years, strengthening security at village level and enhancing environmental management at the borehole site. The County intends to connect the existing water tank to at least four other water points and to the existing water pipeline. The community thought it wise to acquire more tanks using self generated funds. Drilling and connection costs for twenty additional solar powered boreholes were budgeted for in the County Budget for financial year 2016/2017.

7. Conclusion and Recommendation

The project, though without challenges, benefited the residents of the County, proving to be a worthwhile investment. The continued collaboration among the stakeholders; Kilifi County, members of the community and development partners among others elevated the success of the initiative through ownership. However, more needs to be done to maintain and even enhance the benefits of the initiative which would be replicated elsewhere. There is need to collect baseline data and enhance the documentation of project activities for future reference. The availability of solar products at county level is desirable to reduce costs since most products were not readily available in Kilifi and had to be sourced from Nairobi. There is need to train the local population in emergent solar technology transfer and scale up the project to more households having no access to water. The community members need to be sensitized on risks of using photovoltaic cells. Continuous sensitization on the benefits of the initiative to the community should also be enhanced for more ownership which would decrease vandalism. Hotels and hospitals and other institutions with high water consumptions should be connected to solar water boreholes and heating systems in future as per the Energy Regulation Commission guidelines.

Case Synopsis

This case focuses on the adoption of clean energy in running a solar water driven borehole pump in Mwawesa, Kilifi County and outlines Kilifi County's collaboration with members of the community, stakeholders in the energy sector and development partners in exploiting readily available solar energy to pump underground water, enhancing availability and accessibility. It documents the success stories of the initiative, which is based at the County's Mwawesa Ward, which apart from moderating negative impacts of climatic and ecological factors harmful to individuals, has progressively reduced electricity cost, and risks associated with non-renewable energy and created employment opportunities. The case describes the climate change adaptation and mitigation strategies that have contributed to a significant improvement in accessing water among rural households. It also highlights the key achievements of the initiative, challenges, lessons learnt and sustainability measures.

Case Objectives

At the end of the case analysis, the participants should be able to:

a) Explain the benefits of using solar energy evident in the case study;

b) Discuss how the solar water driven borehole pump initiative has contributed to climate change adaptation and mitigation;

c) Describe the enabling factors that contributed to the success of the solar water driven borehole pump initiative; and

d) Suggest additional sustainability measures that be used to enhance the project.

Target Audience

The case targets global, regional, national and county audiences undertaking assignments involving climate change aspects. The targeted audience should possess prior introductory knowledge, skills and competencies on climate change.

The case is suitable for participants undertaking:

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b) Educational programs on climate change;

c) Conferences, Workshops, Symposia and other forums discussing the climate change agenda at county, national or global level.

Case Methodology

The case development exercise was undertaken to document and disseminate best practice in Climate change adaptation and Mitigation initiatives in Kilifi County. Primary data was collected in October 2017 from the County offices and at the project site in Mwawesa Ward, Kilifi County in Kenya. The research team had representation from the Kenya School of government, County Government of Kilifi and Ministry of Environment and Natural Resources Low Emission Climate Resilience Development (LECRD) Project.

Case Teaching Strategies

Case Format

The case can be distributed in printed or multi-media versions that incorporate innovative didactic tools. A "soft copy" template for responding to discussion questions can also be availed to programme participants

Case Discussion Strategy

The case may be presented to trainees as preparatory work given in advance, within a training session or as takeaway assignment after the session. The trainer can organize the trainees into groups of 3 -5 depending on the size of the class.

The suggested duration for each activity is:

i)	Case briefing	-	5 minutes
ii)	Case Reading	-	5 minutes;
iii)	Case discussion	-	15 minutes;
iv)	Individual/Group presentations	-	30 minutes
v)	Comments at Plenary	-	10 minutes, and
vi)	Debrief	-	5 minutes.
			1 hour 10 minutes

Opportunities for Scalability

The trainer is at liberty to scale up the depth and breadth of the exercises depending on the program for which the case is being applied. For instance, in formal academic programs, the trainer can allow the trainees/students to do in depth analysis of the case in relation to the National Determined Contribution (NDC), National Adaptation Plan, National Climate Change Action Plan and the Global Climate Change Agenda.

Suggested Discussion Questions

1. What benefits of using solar energy are evident in the case?
2. Which enabling factors contributed to the success of the solar water driven borehole pump initiative?
3. In what ways has the solar driven borehole pump initiative contributed to climate change adaptation and mitigation?
4. What were the challenges experienced during the project?
5. How would you have addressed the challenges in (d) above?
6. What are the key lessons learnt from the initiative in Kilifi County that can be used to enhance similar projects?
7. What additional sustainability measures can be used to enhance the project and similar initiatives in other regions?

Annex 1

Ministry of Environment and Forestry			
	Name	Designation	Role in Case Development
1.	Sheila Shefo Mbiru	LECRD Project – Knowledge Management and Capacity Development Officer	Concept development, data collection, case writing, editing and documentation
2.	Mr. Adegu	Directorate of Climate Change – GHG Officer	Case Writing
3	Phanice Mokeira	LECRD Project – Research Assistance	Case Writing
Kenya School of Government			
4.	Dr. Rachel Ngesa	Head of Centre for Research and Advisory Services	Concept development, data collection, case writing, editing and documentation
5.	Mr. Humphrey Mokaya	Director, Learning and Development	Concept development, data collection and case writing
6.	Dr. Patrick Mumo	Senior Lecturer	Data Collection, case writing and editing
7.	Mrs. Jane Mwangi	Deputy Director, Academic Affairs	Case writing
8.	Ephline Okoth	Communication Officer	Editing case studies and teaching guides
County Government of Kilifi			
9.	Elizabeth Sidi Jilani *Climate Change Champion*	Assistant Director, Environment, Kilifi County	Data collection, case writing and validation
10.	Mwachitu Karisa Kiringi	CEC Member	Case validation and release
11.	Wilfred Baya, Irine Jumwa Kenga, Mary M. Kabani, Victor M. Tsenga, Adam Kheri, Tsuma J. Tembo	Kilifi County Officers	Case validation
12.	Mr. Banda Were Mr. Victor Ngowa	Kilifi County Citizens	Data Collection
13.	Ms. Pamela Onyachi	Principal -Kombeni Girls Secondary School	Data Collection
14.	Mr. Newton Mwagambo Sadi	Principal – Basi Primary School	Data Collection

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