



**REPUBLIC OF KENYA**

**PROJECT CONCEPTS FOR CLIMATE CHANGE, MITIGATION**

**MARCH, 2013**



Supported by:



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This document is an output of the Technology Needs Assessment project, funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) and the UNEP Risoe Centre (URC) in collaboration with Environmental Development Action in the Third World (ENDA Senegal), for the benefit of the participating countries. The present report is the output of a fully country-led process and the views and information contained herein are a product of the National TNA team, led by the National Environment Management Authority-Kenya (NEMA-Kenya).

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This report has assessed the technology needs for climate change mitigation in Kenya. The report has further prioritized technology needs for mitigation within the energy and waste management sectors using a multi-stakeholder process and a linear additive Multiple Criteria Analysis Framework. A Barrier Analysis and Enabling Framework for the prioritized technologies have been done and measures identified to overcome these barriers. Finally, Technology Action Plans and Project Concepts have been developed. It is my sincere hope that these 4 part report findings will prompt all stakeholders to take timely action in climate change mitigation and that the reports will form an important reference tool to spur all actors to implement the prioritized technologies in order to contribute in addressing climate change in Kenya.



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## **REPORT IV: PROJECT IDEA REPORT**

This report comprises project ideas for solar home systems (SHS) and solar dryers in the energy sector and methane capture in the waste management sector.

### **CHAPTER 1: PROJECT IDEAS FOR ENERGY SECTOR**

#### **1.1 Summary of Project Ideas for the Energy sector**

The following project ideas in the energy sector were identified on basis of their contribution to socio-economic development and climate change mitigation potential. Further they were prioritised among a list of other green technologies with the assistance of Multi-Criteria Analysis using a computer based model. The target group for SHS technology comprises rural households, health and market centres and other institutions based in the rural areas that are not connected to the national electricity grid. For solar dryer technology, the target for the diffusion of the technology comprises small scale and commercial farmers. The objective of concept idea for Solar Home System technology is to widely diffuse solar home systems technology amongst the rural households not connected to the national grid. As for the solar dryer technology project idea, its main objective is to promote its widespread use amongst Kenyan farming communities and other commercial enterprises that hitherto have been using traditional drying in the open or using diesel powered and fuel wood for drying their products.

Diffusion of the two technologies will be done through public awareness campaigns, technical capacity building and financial assistance to the target users of the technologies.

#### **1.2 Specific Project idea: Promotion of Diffusion of Solar Home System Technology in Kenya**

##### **1.2.1 Introduction and Background**

Kenya lies along the Equator. Solar energy resources are available in many areas of the country in quantities that are commercially viable. Solar Home Systems provide households lights, electrical power for televisions, radio cassette players and small appliances.

Although Solar Home System technology is not new in Kenya, there is potential to increase its diffusion rate especially in rural areas where 80% of the population is not connected to the grid. As one of the largest unsubsidized markets for solar home systems (SHS) in Sub-Saharan Africa, Kenya represents a promising model for rural electrification based on private purchases of clean decentralized photovoltaic technologies.

Kenya has put in place an enabling an enabling framework in terms of national policies and legislation for accelerating diffusion of SHS. Additional measures are being recommended for the same.

As a technology in the energy sector, SHS was prioritized with the assistance of Multi-Criteria Analysis (MCA) which is a computer based model. MCA was conducted with involvement of key stakeholders. The project will involve promotion of country-wide diffusion of SHS technology. This is expected to result in wide application of SHS technology by rural household and institutions such as schools, health clinics and markets not connected to the grid. Again, due to high frequency of power blackouts across the

country, households and institutions connected to the grid may wish to install SHS for purpose of secure power supply.

The projects were developed through a participatory process involving the Mitigation Working Groups and key stakeholders (Annex I).

### **1.2.2 Objectives**

The major objective of this project idea is to promote wide application and diffusion of SHS technology, a green energy technology, to replace fossil fuel based technologies associated with emissions of greenhouse gases into the atmosphere. At national level, 165,000 SHS units by 2017 and to reach 3 million SHS household units by 2030. The project will target about 83,000 households annually in 24 counties and is expected to reach an overall target of 332,000 households by 2018. By 2030, an estimated 1.5 million households are expected to access SHS technology. The targeted households solely depend on kerosene lamps and candles for lighting. These lamps/candles are harmful to the environment including human health because they produce black particles and smoke resulting in upper respiratory diseases. Because of poor illumination eyesight is also affected.

Green technologies assist in reduction of the country's reliance on fossil fuels which are imported and making the country spend a lot of hard currency which could otherwise be used for other national development priorities. Adoption and diffusion of SHS technology therefore assists the country save on the foreign currency, improve human health and assist in mitigation of emissions of GHGs into the atmosphere. SHS can replace use of kerosene, and fossil fuel for lighting rural households. The mitigation potential is in the range of 1,000ktCO<sub>2</sub>/year in 2030 (Saidi et.al. 2012).

### **1.2.3 Outputs**

The project is targeting 332,000 households by 2018 in 24 counties in the rural Kenya who are not connected to the electricity grid. A rural household on average consumes 3KWh/day. This would translate into 996,000 KWh/day for the target population. A rural household on average consumes 1 litre of kerosene at Kshs. 84/week. This would translate into Kshs.1, 454,160,000 per year being spent by the country to import kerosene. Adoption of the SHS technology by 332,000 million households by 2030 would mean that the country will save Kshs. 1.45 billion per year that could be used for other economic development activities.

### **1.2.4 Relationship to the Country's sustainable Development Priorities**

At present, Kenya relies heavily on use fossil fuels as sources of energy to meet her increasing energy needs. In order to achieve the goal of low carbon developed society, Kenya is expected to pursue an energy mix that greatly relies on carbon-neutral energy sources such as solar and other renewables. The implementation and use of renewables will increase Kenya's energy security besides mitigating climate change associated with droughts and floods in the country. This is in line with Kenya's vision 2030 and the national energy policy of 2004 and the National Climate Change Response Strategy.

According to Vision 2030, the government intends to make SHS technology accessible to all rural households and public institutions not connected to the grid by 2030.

### 1.2.5 Project Deliverables

The project benefits include the following:

- i) Employment creation. About 480 technicians will be employed on full time basis in the 24 counties to install, repair and maintain SHS.
- ii) Foreign currency savings. 78 million litres of kerosene are imported annually for use by 1.5 million households. Use of SHS technology will avoid importation of the same.

#### **Social and health benefits include:**

- i) Good learning opportunities for students in the evenings. Use of SHS will increase the ability of school children to do their homework effectively at night and thereby improving their academic performance.

#### **ii) Improved health**

Traditionally families in rural areas use paraffin and candle lamps as source of light. These lamps produce fumes which are harmful to human health. Enhanced quality of indoor lighting using SHS will reduce incidences of respiratory diseases.

#### **iii) Mitigation of climate change.**

About 664,000 paraffin lamps would be replaced by SHS in the 24 counties by 2018.

### 1.2.6 Project scope and possible implementation, Feasibility and Linkages to Current or Past Projects

The project will be implemented in 24 out of the 47 counties targeting rural households, market and health centres and other institutions in the rural areas that are not connected to the grid. The project is feasible because solar energy resources are available in many areas of the country in quantities that are commercially viable. Solar Home Systems (SHS) technology is available in the country and its diffusion is being promoted by the private sector, NGOs and the government. Solar electric systems are being sold to end users in Kenya through a competitive and growing free market network.

The government has also put in place an enabling framework aimed at removing barriers related the implementation of green energy technologies in the country. The government has exempted SHS components and parts from import duty and Value Added Tax (VAT), formulated standards for SHS technology, and is in the process of actualising a green energy facility fund to be accessed on concessionary rates by people investing in green energy technologies such as SHS.

This project is linked to current government's efforts to provide green energy based electricity including SHS to all Kenyans by 2030 to ensure sustainable socio-economic development.

### 1.2.7 Project Activities and Budget

The project will be implemented by the Ministry of Energy in collaboration with the private sector and Non-Government Organizations (NGOs), development partners and the beneficiaries.

The following activities will be supported:

- i) Public awareness campaigns through print and electronic media to promote wide diffusion of the technology in the country

- ii) Training of technicians and selected households in installation, repair and maintenance of SHS
- iii) Provision of financial incentives to the consumers of technology in order to remove the barrier of high up-front costs associated with acquisition of the technology
- iv) Marketing campaigns by the industry and other stakeholders
- v) Institutional collaboration mechanism between the government, private sector, NGOs and community groups.
- vi) Quality control of SHS components by the Kenya Bureau of Standards to ensure that only high quality SHS are imported into the country
- vii) Monitoring and Evaluation

The total project budget is US dollars 17,565,882.35. Details of the project budget are indicated in the tables below.

**Table 1.1: Project Activities and Budget**

Activity	Target Group	Main actors	Cost in US Dollars	Justification
i) Public Awareness Campaigns. To educate and sensitize the rural households and other potential users of the technology on its socio-economic and environmental benefits of SHS technology	Rural households and other potential users of the technology	Media, Civil society and private sector and county governments	2,400,000	At US \$ 100,000 for each of the 24 counties
ii) Training of technicians, rural households, and other potential users on installation, repair and maintenance of SHS technology	Technicians; rural households and other potential users of the technology	Ministry of Higher Education, Science and Technology; local universities Private sector; partners in development; and NGOs	6,240,000	At US \$ 2,000 for 20 technicians and 30 rural households in all the 24 counties. Trained households and business men/women will train others i.e. Training of Trainers (TOT). Tot will be allocated US \$ 5,000 per county for four years to train other households in installation, repair and maintenance of solar PV and SHS technology.
iii) Provision of financial incentives to enable poor farmers access affordable credit to buy SHS technology	Poor rural households	Ministry of Finance; financial institutions private sector; development partners; NGOs	2,400,000	At US \$ 10,000,000 per county
iv) Marketing campaigns by private sector and civil society	Rural households; market centres, health centres, schools	Civil Society; and private sector	2,400,000	At US \$ 100,000 per county
v) Institutional collaboration. This is to ensure harmony and avoid conflicts in the project implementation	Government, private sector, rural households, businessmen and women	Ministry of Energy; and Public Private Partnerships	1,200,000	At US\$ 50,000 per County
vi) Quality control of SHS	Importers and retailers of the technology	Kenya Bureau of Standards and Kenya Revenue Authority (immigration section)	2,400,000	At US\$ 100,000 for 24 counties
Monitoring and Evaluation	Project management unit	Ministry of Energy, private sector, NGOs and the project beneficiaries.	\$8,000	At US\$ 2000 per annum per county
<b>Sub-Total in US Dollars</b>			<b>17,088,000</b>	

**Table 1.2: Staffing Budget and Car Purchase**

Item		Time	Salary/Month in Kshs.	Kshs.	US Dollars 1 US \$=85KShs.
1	Project Manager	60 Months	200,000	12,000,000	141,176.47
2	Deputy Project Manager	60 Months	150,000,000	9,000,000	105,882.35
3	Project Secretary	60 Months	80,000	4,800,000	56,470.58
4	Driver	60 Months	50,000	3,000,000	35,294.11
5	Support Staff	60 Months	35,000	2,100,000	24,705.88
6	Field allowances	60 Months	100,000	6,000,000	70,588.24
7	Purchase of Project Vehicle			6,000,000	70,588.24
8	Vehicle Fuel and Maintenance	60 Months	20,000 Per month	1,800,000	21,176.47
	<b>Sub Total</b>			44,700,000	525882.35
	<b>Total in US Dollars</b>				17,613,882.35

The government of Kenya will seek support from bilateral and multi-lateral donor agencies and NGOs to fund the project as part of Nationally Appropriate Mitigation Actions (NAMAs).

### 1.2.8 Timelines

The project will be implemented within a time span of five years as follows:

**Table 1.3: Project Timelines**

	Timeframe in Months	Activity
i	01-03	Hiring of Project Manager and Deputy Manager and other project staff
iii	09-60	Training of technicians as well as selected households and other potential users of solar dryers technology in operations and maintenance of the equipment
iii	06-60	Public Awareness campaigns
iv	12-60	Provision of financial incentives to those who are unable to pay for the technology
v	12-60	Quality control of SHS equipment
vi	01-60	Institutional collaboration
vii		Marketing campaigns

### 1.2.9 Measurement/Evaluation

A monitoring and evaluation system will be put in place to monitor the project achievements on quarterly basis.

The project will have a project steering committee chaired by the Ministry of Energy. Other members will comprise representatives from the relevant government institutions, R&D institutions, academia, financial institutions, media, NGOs and project beneficiaries. The Project Steering Committee will be responsible for monitoring project implementation and will receive project progress reports from the Project Manager on quarterly basis.

Monitoring will be conducted in collaboration with the government, private sector, NGOs and the project beneficiaries.

#### **1.2.10 Possible Complications/Challenges**

The biggest challenge is to get funding for the project. Other challenges include convincing the private sector, NGOs and development partners to support the project

#### **1.2.11 Responsibilities and Coordination**

The project will be coordinated by the Ministry of Energy in collaboration with the interested stakeholders. These include the following:

- i) R&D institutions
- ii) Academia
- iii) Print and electronic media institutions
- iv) The Kenya Bureau of Standards
- v) Immigration Department
- vi) Service providers: financial institutions; NGOs, industry and development partners
- vii) Project beneficiaries

### **1.3 Specific Project ideas: Promotion of Solar Dryers Technology and Capacity Building for Technicians and Farmers in Kenya**

#### **1.3.1 Introduction and Background**

The main economic activity in Kenya is agriculture that includes production of cereals mainly maize, wheat, rice, sorghum, millet and other produce such as beans, peas, vegetable and fruits etc. The export market is dominated by tea, coffee and horticultural products.

Traditionally direct solar drying has been used for processing and preserving food, vegetables, fruits and other crops by laying products out in the sun to dry. However for bulky products, the National Cereals and Produce Board of Kenya has dryers that use diesel in all its stations in the country. These diesel powered dryers contribute to emission of carbon dioxide. However, there is no baseline data on the level of emission.

At the various consultative meetings with relevant stakeholders, it has been suggested that the issue of the use of fuel-wood or fossil fuel in the drying of agricultural products be reviewed with a view to promoting application of green energy technologies such as solar energy as a mitigation option. The results of Multi-Criteria Analysis also placed Solar Dryer technology high in the list of prioritised technologies that can contribute to the socio-economic, environment and climate change mitigation.

In many other countries of the world, the use of solar thermal systems in agriculture to conserve vegetables, fruits, coffee, tea leaves and other crops has shown to be practical, economical and environmental friendly by reducing the use of fuel-wood and fossil fuel.

The development of this technology can be at different levels namely the family units, medium scale systems for groups or cooperative societies, and large scale commercial applications for large commercial farming operations.

### 1.3.2 Objective

The main objective of this project concept is to promote widespread use of Solar Dryers technology amongst Kenyan farming community and other commercial enterprises who hitherto have been using traditional sun drying in the open or using the diesel fuelled dryers and fuel-wood to dry their products. This will not only cut down on the use of fossil fuel and fuel-wood but will also reduce contamination of products and increase climate change mitigation potential.

### 1.3.3 Project Outputs

The project is intended to cover all the communities in the maize, wheat, beans, tea, coffee, vegetables, fruits, flower growing areas in the country, by ensuring that they adapt Solar Dryers for drying their grains and other products.

By the end of five year period, each of the 24 selected counties will have at least one commercial solar dryer to be used by the local community to dry their farm produce such as cereals, legumes, vegetables, legumes and herbs at low costs. All the 65 tea factories in the country will have shifted from using fuel-wood to solar dryers to dry their tea leaves. Again 300 coffee factories and 10500 farmers will be using solar dryers. Awareness on socio-economic and health benefits will have been created in the targeted 24 counties. Every county will have 40 trained technicians and 10 farmers trained to install, repair and maintain solar dryers. All poor farmers interested in the technology will be provided with financial incentives to access the technology.

### 1.3.4 Relationship to the Country's Sustainable Development Priorities

Energy sector is key as a driver to the pillars of Vision 2030

In line with the Vision 2030 to transform Kenya into a newly industrialised country and the desire to achieve low carbon developed society, the Solar Dryer technology will enable the country apply green technology and contribute to climate change mitigation. It will also positively respond to the National Climate Change Response Strategy and the National Climate Change Action Plan.

### 1.3.5 Project Deliverables

The project benefits include:

- **Reduced GHG Emission**

This technology will increase the country's climate change mitigation potential by reducing GHG emissions. However, so far there are no baseline data to rely on.

- **Running Cost Low compared to the use of fossil fuel**

On personal communication with the Kenya Cleaner Production Centre, it was revealed that a tea factory in Kericho that uses solar dryer has been able to reduce its energy cost by fifty percent.

- **Quality and Hygiene ensured**

The use of solar dryers reduces contamination of products and is therefore hygienically clean.

- The use of solar dryers will contribute to forest conservation and enhance carbon sinks
- Increased income to the farmers
- Prevent losses of products after harvesting

### 1.3.6 Project Scope and Possible Implementation Feasibility and Linkages to Current or Past Projects

The project is intended to be implemented in 24 counties amongst the farming communities especially in the areas growing maize, wheat, rice, sorghum, millet, beans, peas, vegetables, fruits, flowers, tea and coffee.

One tea estate in Kericho has installed a withering tea facility that uses solar energy. The government policy on renewable energy favours this project and the necessary enabling framework will encourage the private sector to be involved in promotion of this technology. The role of civil society in awareness promotion is very important.

It is expected that all the 65 tea factories and coffee factories in the targeted 24 counties and majority of farmers will have embraced the technology before end of the project.

### 1.3.7 Project Activities

The implementation of the project will involve many players including the government, the private sector, the civil societies and the individual farmers. The activities will include:

- Public awareness campaigns especially by the civil societies
- Training of technicians as well as farmers and other potential users of solar dryers technology in operations and maintenance of the equipment
- Marketing campaigns through publicity
- Provision of financial incentives to address the issue of initial cost of the technology
- Institutional collaboration amongst government, private sector and the civil society.
- Technology demonstration

### 1.3.8 Timelines

The project will be implemented in a time frame of five years.

**Table 1.4: Timelines**

Activity	Duration
Hiring of Project Manager and Deputy Manager and other project staff	01-3 Months
Institutional collaboration	01-60 Months
Training of technicians as well as farmers and other potential users of solar dryers technology in operations and maintenance of the equipment	09-60 Months
Public Awareness campaigns	06-60 Months
Marketing campaigns	09-60 Months
Provision of financial incentives to those who are unable to pay for the technology	12-60 Months
Technology demonstration	12-60 Months
Monitoring and evaluation	

### 1.3.9 Budget

The budget for the project for five years will be based on the activities mentioned earlier. This budget is proposed to cover the whole country and especially those counties that produce maize, wheat, rice, sorghum, millet, beans, peas, fruits, tea leaves, coffee and vegetables. Out of the 47 counties the initial focus will be in 24 counties. In each of the counties the project will target 500 farmers. Trained farmers will teach other farmers on installation, repair and maintenance of solar dryer technology (Trainers of Trainers-TOT). This number is expected to double every year and reaching 10,500 farmers before end of the project. The total project budget is US dollars 79,200,000. Details of the project budget are indicated in the table below.

**Table 1.5: Project Budget**

Activity	Target Group	Main actors	US Dollars	Justification
1. Public awareness campaigns. to educate and sensitize the farmers, industry and other potential users of the technology	Farmers and other potential users of the technology	Media and civil society	2,400,000	At US \$ 100,000 for each of the 24 counties
2. Training of technicians, farmers, industry and other potential users of the technology	Technicians; farmers and other potential users of the technology	Government; private sector; partners in development; and NGOs	24,000,000	10 technicians and 120 farmers per county for four years
3. Provision of financial incentives to enable poor farmers access credit	Poor farmers, cooperative societies; industry	Government; private sector; development partners; NGOs	24,000,000	500 farmers per county at US \$ 2000 per farmer for 24 counties
4. Marketing campaigns by private sector and civil society	Farmers, cooperative societies and other potential users of the technology	Civil Society; and private sector	2,400,000	At US \$ 100,000 per County
5. Institutional collaboration. This is to ensure harmony and avoid conflicts in the project implementation	Private sector; farmers; industry; civil society; and development partners	Government	1,200,000	At US\$ 50,000 per County
6. Commercial solar dryers for each county to demonstrate effectiveness of the technology	Farmers and business men/women	County government	24,000,000	At US \$ 1 million per county for five commercial solar dryers
7. Monitoring and Evaluation	Farmers	County governments, farmers, civil societies	1,200,000	At US \$ 50,000 per county
<b>Total in US Dollars</b>			<b>79,200,000</b>	

The above budget should cater for staff, consultants partnership etc.

### 1.3.10 Measurement/Evaluation

Monitoring and Evaluation is an important component of the project that should spell out mechanisms and procedures to ensure that activities occur as planned and that they remain directed towards stated objectives and that appropriate corrective actions are taken if

required. The exercise should ensure that resources have been used efficiently and effectively.

The project will have a project steering committee chaired by the Ministry of Energy. Other members will comprise representatives from the relevant government institutions, R&D institutions, academia, financial institutions, media, NGOs and project beneficiaries. The Project Steering Committee will be responsible for monitoring project implementation and will receive project progress reports from the Project Manager on quarterly basis

### **1.3.11 Possible Complications/Challenges**

The main challenges include:

- Soliciting for funding from development partners
- Effective involvement of the private sector and the civil society
- Giving false hope to the farmers that they will get free funding through the government

### **1.3.12 Responsibilities and Coordination**

The project will be coordinated by the Ministry of Energy which will recruit the Project Manager in collaboration with the interested stakeholders. These include the following:

- i) Government of Kenya
- ii) Civil society(NGOs)
- iii) Private sector
- iv) Financial institutions
- v) Development Partners

## **CHAPTER 2: PROJECT IDEA FOR THE WASTE MANAGEMENT SECTOR**

### **2.1 Summary of Project Ideas for the Waste Management Sector**

This project proposal focuses specifically on the management of bio-degradable wastes that are produced by household, institutional and commercial activities. Identification of this project as a priority for Kenya arose as a result of consultations with stakeholders during a workshop held at the Ministry of Works Club on November – 29<sup>th</sup> 2012 during which biogas technology was selected as the most suitable for waste management under the country's circumstances because of its history of deployment in the country, its national and global benefits and its potential for wide diffusion in the country.

### **2.2 Specific Project Idea: Building National Capacity to Increase Utilization of Bio-Gas Technology towards Enhanced Conservation of Forests and Cleaner Environment**

#### **2.2.1 Introduction and Background**

Almost all socio-economic activities in the country generate different types of wastes the quantities of which are dependent on type and level of activities. The problem is that the management of these wastes often leads to emissions of greenhouse gases into the atmosphere and other negative effects on the environment including public health. The aim of the project being proposed here is to deploy and diffuse technologies that will greatly improve waste management not only to reduce emissions of greenhouse gases but also to improve socio-economic conditions of communities and other actions of environmental conservation.

The project was developed through a participatory process involving the Mitigation Working Group and key stakeholders.

#### **2.2.2 Project Rationale**

Wastes are often justifiably regarded as hazards because of their potential negative impacts on human and animal health, plant life and the environment. However bio-degradable wastes can be managed in a way that not only reduces their negative effects but also improves the environmental conservation and socio-economic conditions of communities.

The rural communities are often the most affected by the impacts of climate change and also undertake activities that lead to global warming such as deforestation. They are therefore the main focus of the climate change technologies being proposed.

#### **2.2.3 Why the Need for Financial Assistance**

Response to climate change is now agreed to be at two main levels namely:

- i) Climate change adaptation whose aim is to reduce its impacts.
- ii) Climate change mitigation whose aim is to reduce its magnitude.

Kenya is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and is striving to contribute to global efforts to reduce emissions of greenhouse gases and to enhance Carbon sinks within the country's development plans and programs. However the country does not have the technological and financial capacity to do so, for these reasons in accordance with the Convention there is need to be provided with both technological and financial assistance to enable her to undertake effective measures to respond to climate change.

#### **2.2.4 Project Relationship to National Development Plans and Priorities**

Kenya's Vision 2030 recognizes that energy will be the key driver of the national development programs towards realisation of the Vision. In this regard Energy Policy of 2004 and the Energy Act of 2006 promote development of renewable energy resources that are available in the country.

Rural development that is environmentally sound is one of the top national development priorities. Generation of clean renewable energy from wastes and focusing on rural areas has many national benefits such as conservation of forests, community health, improved farm productivity and poverty reduction.

#### **2.2.5 Project Deliverables**

According to technology action plan for methane capture at least 120,000 households are targeted to have access to biogas by the vision year 2030.

The main aim of this project idea is to drive the diffusion of the technology. It is expected that at least 6000 households in 20 counties will be recruited to participate in the project during the first year with the number increasing until all the 47 counties are covered.

The main benefits will be as follows:

##### **i) Expected Community Benefits**

- Fuel-wood burning increases indoor air pollution leading to increase in respiratory diseases. The use of biogas will reduce the incidences of the diseases and the communities will benefit from avoided medical costs.
- The bio-digester slurry is very rich in crop nutrients and the farmers can use it instead of expensive numeral fertilizer, and hence reducing the cost of crop production leading to enhanced income generation.
- Enhanced quality of indoor lighting at night will increase the ability of school children to do their homework effectively leading to enhanced academic performance.
- Women in rural areas are the ones who search and carry heavy loads of firewood for households. The use of biogas will relieve them of the labour.

##### **ii) Expected National and Global Benefits**

- Forests are some of the critical national resources in the country because of their contribution to social and economic development and conservation of the environment. This project will lead to reduced deforestation.
- Forests enhance some of the rain producing processes and forested areas receive more rainfall than non-forested ones. They therefore contribute to enhanced food production and also reduce land degradation. These benefits will result from the project.
- Forests act as carbon sinks absorbing large amounts of carbon dioxide from the atmosphere. Carbon dioxide contributes about 60% of global warming. The sinks will be enhanced through the project.

- In Kenya deforestation has been taking place at the rate of 12,000 hectares per year. The use of biogas will lead to significant reduction of deforestation resulting in national and global benefits.
- Methane is a powerful greenhouse gas whose global warming potential is 21 times that of Carbon Dioxide. If a household uses on the average 200 kilograms of biogas per year 120,000 households will prevent emission of about 20,000 tonnes of methane in the atmosphere per year leading to corresponding reduction of global warming resulting in global benefits.

### **2.2.6 Past and Ongoing Activities Related to the Project**

Biogas technologies have been deployed in the country for many years now and have been targeting farmers who practice dairy cows in zero grazing conditions. But the diffusion of the technology to the communities has not marched the period during which it has been deployed.

There are now Non-Governmental Organizations (NGOs) who are making efforts to deploy the technology within the rural farmers.

The Dutch Ministry of Foreign Affairs has provided funds for implementation of a five year (2009-2014) biogas project in Kenya Known as Kenya National Domestic Biogas Programme which is targeting rural households in high potential areas and who practise mixed farming that includes dairy cows under zero grazing. The main objective of the programme, which is supported by the Kenya Government through the Ministry of Energy, is to construct a total of 12,000 bio-digesters of different sizes ranging from 4-12 cubic meters depending on the specific needs of individual farmers.

The project being proposed here will build on the achievements and experiences of this project and others to diffuse the technology not only to the high potential areas but also to the dry land pastoral communities by removing the identified financial and technical capacity barriers. The project activities will be undertaken in all parts of the country in both dry and rainy areas depending on the availability of suitable wastes for raw materials.

### **2.2.7 Project Goal**

The goal of the project is to enhance sustainable development through environmental conservation and improved socio-economic conditions while addressing climate change mitigation.

### **2.2.8 Project Objectives**

**Objective 1:** To determine the Methane capture technology needs of the country.

**Objective 2:** To enhance national and technological capacity for wide diffusion of Methane bio-digesters.

**Objective 3:** To enhance financial capacity for diffusion of biogas technology in the country.

### 2.2.8.1 Outputs and Activities to Achieve Objective 1

**Table 2.1: Outputs and activities to achieve Objective 1**

<b>Output 1</b>	Report of current level of biogas installations and the views of the users	
<b>Activity 1</b>	Conduct survey of existing biogas installations in different parts of the country. This activity will help to identify and assess the present status of the technology and experiences of the users concerning its value	<b>Timeline</b> Year 1 of the project
<b>Activity 2</b>	Conduct survey of technical capacity of biogas users to operate and maintain bio-digesters. This activity will help to assess the need for organising field training activities for the users including demonstration exercises	<b>Timeline</b> Year 1 of the project
<b>Activity 3</b>	Conduct survey of existing technical capacity for construction and maintenance of bio-digesters. This activity will help to assess the training needs of the country in biogas technology	<b>Timeline</b> Year 1 of the project
<b>Output 2</b>	Report of training capacity in the country	
<b>Activity 1</b>	Conduct assessment of existing training and research institutions which have interest in biogas technologies. This activity will help to assess training and research capacity needs of the country in biogas technology.	<b>Timeline</b> Year 1 of the project
<b>Activity 2</b>	Conduct a survey of the current biogas marketing situation and potential. This activity will help to assess the current market situation and future potential for marketing of the biogas in various areas of the country.	<b>Timeline</b> Year 1 of the project

### 2.2.8.2 Outputs and Activities to Achieve Objective 2

**Table 2.2: Outputs and activities to achieve objective 2**

<b>Output 1</b>	Training programs for bio-digester technical personnel and users are implemented.	
<b>Activity 1</b>	Identified training institutions develop short and longer term training programs for technical personnel. This activity will be undertaken in consultation with the relevant government ministries, the private sector and technology suppliers	<b>Timeline</b> Year 1 of the project
<b>Activity 2</b>	Conduct training of bio-digester construction and maintenance technicians. This activity will enable bio-digester users to have easy access to technical support and hence make them technically sustainable. Training courses will be implemented in the existing institutions in the country.	<b>Timeline</b> Year 2, 3 of the project period and beyond
<b>Activity 2</b>	Conduct appropriate training of bio-digester users on operation and maintenance. This activity will enhance the capacity of users in operation of bio-digesters including efficient methods of feeding the units with raw materials and collection of the gas	<b>Timeline</b> Year 2, 3, 4 of the project and beyond
<b>Activity 3</b>	Identify institutions that have technologies which are appropriate to Kenya's conditions. This activity will help to provide ways and means of transferring the technologies for deployment in the country	<b>Timeline</b> year 1 and 2 of the project

### 2.2.8.3 Outputs and Activities to Achieve Objective 3

Table 2.3: Outputs and activities to achieve Objective 3

<b>Output 1</b>	<b>Public awareness of biogas technology is enhanced</b>	
<b>Activity 1</b>	Conduct public awareness campaigns on the benefits of biogas energy use. This activity will help to promote the use of biogas as clean energy with health, economic and environmental benefits	<b>Timeline</b> Year 1, 2, and 3 of the project
<b>Activity 2</b>	Establish demonstration centres in different parts of the country and conduct demonstrations. This activity will be extended to pastoral communities in the dry land areas of the country	<b>Timeline</b> Year 1, 2, and 3 of the project
<b>Output 2</b>	Markets for biogas are established	
<b>Activity 1:</b>	Facilitate formation of groups which can construct common bio-digesters. This activity will help in the formation of groups of manageable sizes which can have access to raw bio-digester materials and be able to share the gas products through appropriate arrangements among themselves with equal benefits	<b>Timeline</b> Year 2, 3 and 4 of the project.
<b>Activity 2</b>	Facilitate marketing of biogas by small scale farmers. This activity will enable farmers to produce biogas and sell it to other people through appropriate and safe containers. Manufacturing technologies will be developed for appropriate sizes of the gas containers which are easy to be transported.	<b>Timeline</b> Year 2, 3 and 4 of the project
<b>Output 2</b>	Financial mechanisms to support bio-digesters are developed	
<b>Activity 1</b>	Conduct awareness campaigns within financial institutions in the country on the need for granting loans at low interest rates for bio-digester construction This activity will be conducted by government ministries in collaboration with other partners	<b>Timeline</b> Year 1 and 2 of the project
<b>Activity 2</b>	Conduct information campaigns within international financial institutions on the need to provide financial support for construction of bio-digesters This activity will be undertaken by the government ministries in collaboration with other institutions	<b>Timeline</b> Year 1 and 2 of the project
<b>Output 3</b>	Bio-digesters are financially feasible	
<b>Activity 1</b>	Enhance financial incentives to make biogas technology more attractive by reviewing the existing Energy Act. This activity will be undertaken by the Ministries of Finance and Energy	<b>Timeline</b> Year 1 and 2.
<b>Activity 2</b>	Formulate mechanism for government financial support for bio-digester construction. This activity will help small scale farmers construct bio-digesters	<b>Time line</b> Year 1 of the project
<b>Activity 3</b>	Formulate framework for financial institutions to provide loans at low interest rates to construction of bio-digesters. This activity will help small scale farmers access bio-digesters through loans at repayments they can afford with their farm produce	<b>Time line</b> Year 1 and 2 of the project
<b>Activity 4</b>	Facilitate manufacturing of bio-digester accessories in the country at low costs. This activity will enable manufacturers to produce accessories at affordable prices	<b>Time line</b> Year 2 and 3 of the project.

## 2.2.9 Institutional Arrangements and Collaboration

Arrangements will be put in place for collaboration between the following institutions among others:

- The project will be implemented by the Ministry for Environment and Mineral Resources which is mandated to coordinate climate change activities. The Ministry is also responsible for implementation of the Kenya Climate Change Response Strategy Action Plan and Multilateral Environment Agreements including UNFCCC.
- Ministry of Agriculture and Livestock Development will provide extension officers to work with farmers in the country.
- Ministry for Energy has a Department for renewable energy. It will provide experts who will be members of the project steering committee
- Research and development institutions such as KARI, KEFRI, and KIRDI will conduct activities towards improvement of the technology.
- Training institutions such as University of Nairobi, JKUAT, Kenya Technical University will prepare and conduct training courses for manufacturers and users of the technology.
- The private sector will provide construction of the bio-digesters and accessories under the umbrella of Kenya Association of Manufacturers (KAM) including maintenance and hands-on training of the users.
- Non-Governmental Organizations (NGOs) and Community Based Organizations (CBOs) will be actively involved in developing links between the technology providers and the users through awareness creation and demonstration activities.

## 2.2.10 Project Duration

The project will be implemented over a period of 5 years.

## 2.2.11 Project Budget in US Dollars

The following are the proposed budget lines for the various project activities:

**Table 2.4: Project Budget**

National survey of current level of installation of bio-digesters, views of the users, training needs of construction and maintenance technicians and those of the users.	1,000,000
Training of bio-digester construction and maintenance technicians including development of training courses: year 1, 2 and 3	2,500,000
Training of bio-digester users including development of appropriate hands-on training courses that are suitable for communities in different parts of the country and construction of pilot bio-digesters: years 1, 2, 3 and 4	5,000,000
Formulation of financing framework involving government, private sector, financial institutions, NGOs CBOs and international institutions; year 1 and 2	500,000
Public awareness campaigns including site visits and demonstrations, print and electronic media: years 1, 2, 3, 4 and 5	3,000,000
Developing biogas marketing strategies for individual owners and groups: years 2, 3, 4, and 5	2,000,000
Monitoring and Evaluation including end term and end project external evaluation: years 1, 2, 3, 4, 5	2,000,000
<b>Sub-total</b>	<b>16,000,000</b>

**Office expenses:**

Office computers, printing, projectors etc.: years 1, 2, 3, 4, 5—	60,000
Workshops expenses: years 1, 2, 3, 4, 5—	1,500,000
Monthly Steering Committee meetings: years 1, 2, 3, 4, 5—	500,000
Travel expenses: years 1, 2, 3, 4, 5—	200,000
Project vehicle: year 1, 2, 3, 4, 5 —	100,000
Vehicle maintenance: years 1, 2, 3, 4, 5 —	200,000
<b>Sub-total</b>	<b>2,560,000</b>
<b>Remuneration of project staff:</b>	
Project Manager: years 1, 2, 3, 4, 5 —	250,000
Deputy project manager: years 1, 2, 3, 4, 5 —	180,000
Project technical officers-3: years 1, 2, 3, 4, 5 —	270,000
Secretaries-2: years 1, 2, 3, 4, 5 —	120,000
Vehicle driver: years 1, 2, 3, 4, 5 —	50,000
Project support staff-2: years 1, 2, 3, 4, 5 —	60,000
<b>Sub-total</b>	<b>930,000</b>
<b>Total</b>	<b>19,490,000</b>
<b>Contingency; 5% of total</b>	<b>960,000</b>
<b>Grand total</b>	<b>20,450,000</b>

**2.2.12 Sources of Funding**

- International funding institutions will be requested to provide funds for project activities.
- Government co-financing from proposed Green Fund.

**2.2.13 Project Implementation Strategy**

- The project will be implemented under the Ministry of Environment and Mineral Resources.
- The project manager will be responsible for coordination and management of all the project activities.
- The deputy project manager will assist the manager in the coordination and management of the project activities.
- The project Steering Committee consisting of experts and representatives of stakeholders will be responsible for developing project implementation plans.
- Project consultants will undertake technical activities.
- In addition to construction of bio-digesters the training activities will complement and strengthen other bio-digester projects that are being implemented by other organizations in the country in a collaborative and synergistic way.

**2.2.14 Monitoring and Evaluation**

Monitoring will be through quarterly reports to the executive ministry, funding institutions and other stakeholders.

Evaluation will be conducted through internal and external evaluation process

**2.2.15 Possible challenges**

The project may face a number of challenges such as:

- i) Community cultural barriers e.g. negative perception of energy from waste and waste handling. These barriers will be addressed through public education and awareness campaigns.
- ii) Development of other new sources of energy  
This challenge will be addressed through public education to show that different types of energy sources can be used in a household for example solar home system for lighting and biogas for cooking.
- iii) Limited sources of financial support  
This challenge will be addressed through justification of the Project activities

#### **2.2.16 Situation at the End of the Project**

At the end of the project it is expected that biogas energy will be one of the most preferred source of energy for rural communities because of its demonstrated benefits and its use will also be extended to urban areas due to adoption of more effective and attractive production, storage and portable gas containers technologies. Communities will enjoy clean indoor conditions leading to better health. Deforestation will be significantly reduced resulting in increased global benefits on account of enhanced carbon sinks among other environmental benefits. In addition, emissions of methane into the atmosphere will be reduced.

The project will therefore be a major driver of diffusion of the biogas technology long after the end of its activities are completed in support of the country's technology action plan for climate change and will therefore contribute to the achievement of the Vision 2030.

For these reasons sustainability of the biogas technology as a major contributor of energy generation in the country will be greatly enhanced.

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**ANNEX: LIST OF PARTICIPANTS IN THE MITIGATION GROUP FOR TNA STAKEHOLDER FORUM ON 29<sup>TH</sup> NOVEMBER 2012**

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**NB:** It is to be noted that, in addition to the views expressed during the above stakeholders' forum, consultations were also conducted on one to one basis especially with the following:

- i) Eng. Kiva, Director of Renewable Department, Ministry of Energy.
- ii) Ester Wangombe, Department of Renewable Energy, Ministry of Energy.
- iii) George Keya, Senior Scientist, Kenya Agricultural Research Institute (KARI).
- iv) Vincent Oeba, Director, Climate Change Department of Kenya Forestry Research Institute (KEFRI).
- v) Ester Magambo, Climate Change Section, Ministry of Agriculture
- vi) Alfred Gichu, Focal Point, REDD+, Kenya