# RE4Food Stakeholders Workshop Report





**Venue: AICAD (JKUAT–Juja)**

**March 2014**

**Energy Efficient Rural Food Processing**
**Utilising Renewable Energy (RE4Food) Project**

# Contents

## Acronyms and Abbreviations

| | |
|---|---|
| AICAD | African Institute for Capacity Development |
| AIDC | |
| ASALs | Arid and Semi Arid Lands |
| ATDL | |
| CBOs | Community Based Organizations |
| EFA | Environmental Foundation for Africa |
| EnDev | Energising Development |
| EOI | Expression of Interest |
| GIS | Geographical Information System |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| GM | Gender Mainstreaming |
| HCDA | Horticulture Development Authority |
| ICS | Improved Cookstoves |
| JKUAT | Jomo Kenya University of Agriculture and Technology |
| KARI | Kenya Agricultural Research Institute |
| KEBS | Kenya Bureau of Standards |
| KENDBIP | Kenya National Domestic Biogas Programme |
| KENFAP | Kenya National Federation of Agricultural Producers |
| KIRDI | Kenya Industrial Research and Development Institute |
| KNUST | Kwame Nkrumah University of Science and Technology |
| Ksh | Kenya shilling |
| KWFT – DTM | Kenya Women Finance Trust - Deposit Taking Microfinance |
| MFI | Microfinance Institution |
| MoALF | Ministry of Agriculture, Livestock and Fisheries |
| MoEP | Ministry of Energy and Petroleum |
| NGOs | Non-governmental Organizations |
| PAC-EA | Practical Action Consulting – Eastern Africa |
| RE | Renewable Energy |
| RE4Food | Energy Efficient Rural Food Processing Utilising Renewable Energy |
| RETs | Renewable Energy Technologies |
| SACCOs | Savings and Credit Cooperative Societies |
| SCODE | Sustainable Community Development Services |
| SH | Small Hydro |
| SHP | Small Hydro Project |
| SMEs | Small and Medium Enterprises |
| SoMCODI | Songa Mbele Community Development Initiative |
| UoN | University of Nairobi |
| USD | United States Dollar |
| VEP | Visionary Empowerment Programme |

## Executive Summary

**RE4Food project:** Energy Efficient Rural Food Processing Utilising Renewable Energy (RE4Food) https://research.ncl.ac.uk/re4food is a three year collaborative research project addressing research challenges associated with increasing food security and reducing reliability on fossil fuels. The project commenced on 1st July 2013 has an international focus and involves academics from Newcastle University and academic institutions in Germany, Ghana, Kenya, Sierra Leone and South Africa as well as British Non-governmental Organisations (NGOs) based in Sub Saharan Africa. It is implemented through four work packages (WP) with activities in Kenya focusing on WP1 (post-harvest food chain, loses, wastage and current energy demand analysis) lead by Jomo Kenyatta University of Agriculture and Technology (JKUAT) in collaboration with Practical Action Consulting – Eastern Africa (PAC-EA). The project is funded by UKAID through The Engineering and Physical Sciences Research Council (EPSRC).

**Workshop objectives:** RE4Food project organized a one-day stakeholders' consultative forum on March 20, 2014. The forum was held at the African Institute for Capacity Development (AICAD), JKUAT and officially opened by Prof. E. M. Kahangi, EBS, Deputy Vice Chancellor (Research, Production and Extension) JKUAT. The participatory workshop was jointly organised by JKUAT and PAC with the following objectives:

- **Overall objective:** To develop a stakeholder network for RE4Food.
- **Specific objectives:**
  - To develop stakeholder network for the RE4Food project in Kenya.
  - To collect information on the status of post-harvest food wastage and strategies currently used to reduce this.
  - To gather information on the status of using RE to reduce post-harvest food losses and wastage.
  - To select priority crops with huge post-harvest wastage, and at the same time with greatest possible impacts on improving rural livelihoods.

**Workshop participants and process:** The 36 workshop participants included representatives from academic and research organizations, policy and regulatory agencies/associations, farmer organizations, Non-governmental Organisations (NGOs)/civil society, cooperatives and financial institutions. The workshop process included plenary presentations and discussions, group discussions/ feedback. The workshop programme included an opening ceremony and four sessions: i) Overview of current situation; ii) Experiences in the RE for enhancing food security; i**ii)** Stakeholder feedback on project activities; iv) Way forward and closing remarks. In the official opening speech, Prof. Kahangi said RE4Food, focuse on utilising RE to improve rural livelihoods through efficient food processing, is a noble and timely project. Among others, she urged RE4Food stakeholders to focus on empowering rural communities and to deliver tangible results on budget, time and quality.

**Workshop outputs:** The workshop succeeded in bringing together a cadre of stakeholders for sensitization and feedback on RE4Food project activities; identification of other relevant stakeholders whose input is critical for delivery of the project; and establishment of linkages for networking and collaboration. Another output is a

workshop report that outlines: a) Stakeholder experiences in RE for enhancing food security; b) Stakeholder feedback on RE4Food project activities; c) Way forward in RE4Food project implementation.

# 1. Introduction

## 1.1 RE4Food Project Background – presented by Prof. Christopher Kanali (JKUAT)[1]

**Introduction**

RE4Food https://research.ncl.ac.uk/re4food is a collaborative three year project addressing research challenges associated with increasing food security and reducing reliability on fossil fuels. The project which commenced on 1st July 2013 has an international focus and involves academics from Newcastle University and academic institutions in Germany, Ghana, Kenya, Sierra Leone and South Africa as well as British Non-governmental Organisations (NGOs) based in Sub Saharan Africa.

RE4Food partners include:

- Newcastle University, United Kingdom http://www.ncl.ac.uk/energy/
- PAC http://practicalaction.org/
- Environmental Foundation for Africa (EFA) http://www.efasl.org.uk/
- Njala University, Sierra Leone http://njalauniversity.edu.sl/
- JKUAT, Biomechanical and Environmental Engineering Department, Kenya http://www.jkuat.ac.ke/
- Stellebosch University, South Africa http://www.sun.ac.za/Home.aspx
- Kwame Nkrumah University of Science and Technology (KNUST) http://www.knust.edu.gh/
- University of Kassel, Germany http://www.uni-kassel.de/fb11agrar/en/sections/agrartechnik/home.html

**RE4Food Objectives**

**General objective**

- To provide research which will support rural community business models for low and RE input into optimized food processing which minimize loss and waste in selected food value chains.

**Specific objectives**

- To investigate the opportunities and barriers to the use of RE for rural food processing as well as optimization of the processes to:
  - minimize losses along the value chain while at the same time aiming for improved product quality, and

[1]Presented on behalf of:

- **JKUAT team:** Prof. D. Shitanda, Prof. J. Mailutha, Dr. U. Mutwiwa, Dr. G. Kituu, Dr. J. Mung'atu, Mr. F. Njoka and Prof. C. Kanali.
- **PAC/Kenya team:** Ms T. wa Gathui and Mr. V. Esendi

- increase local value addition by SMEs and organized community groups.
- To assess the losses in the food value chain for the products chosen, in Kenya, Sierra Leone and Ghana, and:
  - identify low carbon and energy efficient storage and processing technologies and practices
  - which can be de-centrally applied, reduce these losses and take advantage of RE sources in a cost-effective way.
- To deliver focused support to stakeholders through a network facilitating engagement, dissemination and knowledge transfer to reduce postharvest losses and energy demand.
- To explore the opportunities for rural livelihoods in reducing post-harvest losses and adding value (through initial produce preparation, storage, washing, packing and common process unit operations, such as sterilization, pasteurization, drying, and evaporating).

**Work packages, Tasks and Milestones**

- **WP1: Post-harvest food chain, loses, wastage and current energy demand analysis (Lead JKUAT, Kenya):**
  To establish where the most promising opportunities exist to reduce loses and waste and to reduce energy demand and integrate RE it is necessary to assess and evaluate these selected food value chains.

- **WP2: Existing rural food processing and RE use (Lead Njala University, Sierra Leone):**
  A move towards more effective and energy efficient rural food processing will require the adoption of successful business models, the integration and use of RE and the use of appropriate technology in food processing which builds on existing regional rural structures and best practices.

- **WP3: Innovative post-harvest food processing approaches utilising RE (Lead KNUST, Ghana):**
  Investigate the feasibility of integrating RE, and evaluate the economic implications of adopting post-harvest food processing approaches utilising RE.

- **WP4: Multi-stakeholder engagement, dissemination and knowledge transfer (Lead EFA, Sierra Leone)**
  Key to the success of the project is the gathering of post-harvest food chain and processing data and information and this will require input from all relevant stakeholders. Any subsequent adoption of recommendations and guidance as a result of the research to reduce post-harvest losses and the integration of RE sources will need proactive dissemination and knowledge transfer.

**Achievements so far**

- The project has forwarded progress report on selected food products to Newcastle University.
- Kenya will focus on vegetables (specifically kales, cowpeas, amaranth, and stinging nettle) while Ghana and Sierra Leone on cassava and fish, respectively.
- Finalizing a report on SMEs that deal with agro- processing and RE.

## 1.2 RE4Food Stakeholders' Workshop: Objectives, Participants and Process

**Workshop Objectives**

- **Overall objective:** To develop a stakeholder network for RE4Food.
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  - To select priority crops with huge post-harvest wastage, and at the same time with greatest possible impacts on improving rural livelihoods.

**Participants**

The 36 workshop participants included representatives from academic and research organizations, policy and regulatory agencies/associations, farmer organizations, NGOs/civil society, cooperatives and financial institutions. Appendix 1 shows the list of participants, institution/organization and contact details.

**Process**

The workshop process was participatory and included plenary presentations and discussions, group discussions/ feedback. The workshop programme included an opening ceremony and four sessions: i) Overview of current situation; ii) Experiences in the RE for enhancing food security; i**ii)** Stakeholder feedback on project activities; iv) Way forward and closing remarks.

## 1.3 Opening Speech – by Prof. E. M. Kahangi, EBS, Deputy Vice Chancellor (RPE) JKUAT

"Distinguished guests, ladies and gentlemen, it is a great pleasure to be with you and to open this workshop for a great project. One of the most limiting factors for rural agribusiness is power. National grid is off limits for many who are out of reach and the cost of energy is high. RE4FOOD focuses on utilising RE to improve rural livelihoods through efficient food processing is therefore a noble and timely project that should have been done yesterday.

"This workshop brings together various stakeholders, including academicians, research institutions, non-Governmental Organisations, policy and regulatory agencies, technology developers and suppliers, and international organizations from whom we may adopt and do adaptive research. The team is excellent and well formulated with each bringing expertise into the project.

“RE4FOOD involves many organisations and has a well formulated team that is excellent for delivery of the project. The consortium of collaborating international organizations includes the University of Newcastle - United Kingdom, which is the lead institution; Njala University - Sierra Leone; Jomo Kenyatta University of Agriculture and Technology - Kenya; Practical Action Consulting - Kenya and United Kingdom; Kwame Nkrumah University of Science and Technology - Ghana; Stellenbosch University - South Africa; Kassel University - Germany and Environmental Foundation for Africa - Sierra Leone. The project runs for three years from 1st July 2013 and is funded by the UKAID through Engineering and Physical Sciences Research Council (EPSRC).

“According to the World Health Organisation, 60 percent of the world population is malnourished and we must remember that majority of these are in Africa. A lot of effort has been directed towards food production and the Millennium Development Goals aim at reducing hunger. However, losses in the food value chain are approximately 1/3 of the total world yield and are estimated to range from about 15 percent for cereals up to 50 percent for fresh fruit and vegetables in some developing countries. The losses occur during harvest, processing, storage, transportation, retail and use of a range of foods. Significant losses are a result of a number of factors that include insufficient drying, inadequate storage, insufficient cooling and poor transport – all of which rely on high levels of energy input. In sub-Saharan Africa, losses are predominantly at the producer end of the food chain and reducing these losses is often beyond the means of individual producers, who are predominantly local farmers.

“RE4FOOD aims to provide research which will support rural community business models for renewable energy input into optimized food processing which minimize loss and waste in the food value chains selected. The use of a range of integrated renewable energy solutions is vital and can combine a range of options and possible solutions such as: wind power; solar PV and solar thermal for heating and cooling; tri-generation (combined cooling, heating and electrical power); the use of bio-gas/syngas produced by anaerobic or gasification of food processing residues and wastes.

“The food processing and renewable energy mix will be dependent on the particular food chains, and resource availability, and may incorporate additional bio-mass and waste streams from other local sources to enhance the bio-gas/syngas production. In addition to direct energy use in the food, processing chains there may also be the potential to produce excess energy (electricity and biogas) which can be sold to the local population. Decentralized food processing systems, supported by distributed energy supplies cannot only improve food security but also increase employment and income generation in rural communities. The local processing of food enables better storage and easier transportation, longer shelf life, reduces seasonal supply effects, and produces products with benefit. Additional benefits include social entrepreneurship, environmental management and nutritional health.

“Various work packages will be accomplished during the RE4Food project period. Key among the packages is analysis of post-harvest food chain, losses, wastage and current energy demand that is led by Jomo Kenyatta University of Agriculture and Technology. Another important package is multi-stakeholder engagement, dissemination and knowledge transfer. Therefore, the aim of this workshop is to refine the framework for the project implementation and to develop a network for future collaboration during project execution.

"RE4Food addresses local processing of food which yields better results. Fortunately, in Kenya we have many examples on the use of renewable energy so we can learn from them and save time in delivering the project. As you implement RE4Food, ask what is in it for the rural community so that you can make it better for them. You must deliver on budget, time and quality. The budget must be well accounted for and we must have something tangible to show. The project's value-chain approach is going to be a good example since quality of food is very important and nutrients should be retained to prevent malnutrition. I also urge the Kenya team to observe processing of fish as it is a very important commodity in Kenya. Rural communities have many fish and we need to connect communities to markets.

"I wish you all the best as you address this vital area that can make a big difference to our rural community. Congratulations for being part of this great team."

# 2. Overview of Current Situation

## 2.1 Post Harvest Challenges in Horticultural Crops and Impact on Food Security in Kenya – presented by Dr. Margaret Muchui (KARI-Thika)

**Introduction**

Most horticultural products are highly perishable except those that are utilized as roots e.g. bulbs and tubers. Harvested produce are living and therefore undergo all the processes associated with life – they draw energy through respiration from their reserves of starch, sugars and other stored products, and during growth, raw materials for respiration are continually replenished through photosynthesis.

After harvest, supply of the raw materials is cut off and the produce starts deteriorating unless properly handled and stored leading to high postharvest losses (40-50 percent). The losses can be physiological or mechanical while disease and insects cause other losses, leading to loss of quantity especially due to bruising (physical damage), dragging, using a blunt *panga* (machete) for harvesting. Once the produce is shrivelled customers will say: "reduce the price!" Loss is also due to water loss, decay and diseases. This reduces nutritional value, and market value.

**Causes of post-harvest losses**

- Loss of quantity
  - Bruising-physical damage – the top cause of PH losses
  - Water loss - transpiration
  - Decay and diseases
- Leads to loss of quality
  - Nutritional value
  - Market value

**Kenyan situation**

- Rainfed agriculture (glut period versus scarce period)
- Poor infrastructure
  - Roads
  - Storage facilities-cool chain lacking
  - Poor market structures/poorly designed
- Low level knowledge on postharvest handling/processing
- Theft from farms
- Poor funding for postharvest improvements (5 percent versus 95 percent for production)

**Reduction of post-harvest losses**

- Start with good quality produce
  - Role of variety
  - Influence of environmental conditions
  - Effect of cultural management
- Avoid physical damage
- Control environmental factors
  - Temperature, relative humidity, gases in the environment, diseases and pests
- Use proper handling procedures
  - harvesting, trimming, sorting, packaging, commodity treatments, transportation and storage

**PH loss reduction**

- Postharvest technologies for loss reduction include: use of harvest indices, improved packages, shade, sorting/grading, field packing, cooling, use of packinghouses, improved storage structures, small scale food processing methods (e.g. solar drying)
- The technologies/techniques have to be appropriate to the needs of local communities
- Needs vary depending on crop type, region, weather, infrastructure among other variables
- Would drastically reduce postharvest waste and improve food security

**PH food losses versus food availability**

- Reducing postharvest losses for fresh produce, reported to be in the 40 to 50 percent range, has been demonstrated as an important part of sustainable agricultural development efforts for increasing food availability
- Increasing food security, nutrition and incomes for millions of small holder farmers can be made certain by making sure that all produce is stored properly (fresh or processed) and delivered efficiently from farm to table (farm to fork)

**Food security**

- Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life
- PH losses reduce valuable incomes and profitability-leading to food insecurity

- One percent reduction in PH losses can lead to a gain of 40 million United States Dollars (USD) annually (staples)
- Just under one-half of the Kenyan population lives below the poverty line
- Reducing/minimizing PH losses is more sustainable in:
  - Achieving food security
  - Environmentally friendly than increasing production area to compensate the losses - only 20 percent of Kenya's total area is arable
  - Increasing population - need to minimize the losses

**Conclusion**

Appropriate small scale postharvest technologies can reduce fruit and vegetable crops waste, improve incomes by at least 30 percent for smallholder farmers and marketers and hence enhance food and nutritional security through:

- Use of improved containers to reduce mechanical damage of horticultural crops (plastic crates, liners in rough containers, smaller packages)
- Use of shade to reduce water loss (cloth, woven net or thatch shade structures, market umbrellas)
- Field packing to improve quality (sorting, trimming, quality grading and packing in the field)
- Use of low cost cooling practices to maintain quality and extend post-harvest life
- Field curing to extend storage life and maintain quality of root, tuber and bulb crops
- Low cost cold storage structures for successful longer term storage of potatoes and onions
- Solar drying to transform perishables into more stable processed food products through use of RE
- Village scale canning, bottling and pickling to transform perishables into more stable products

**Way forward**

- Need for market linkages for horticultural produce-fresh and processed (use of information technology)
- Farmers to concentrate on horticultural varieties on demand for both fresh and for processing
- Incentives to investors to set up processing plants (land, waivers)
- Capacity building of stakeholders on proper postharvest handling/processing along the horticultural value chains. For example, train farmers to harvest properly and at the right time and reduce negative effects during marketing – for instance produce like bananas spoil quickly when placed/stored next to kales and cabbages
- Improve access to postharvest tools, equipment, packages, supplies
- Government of Kenya, County Governments - improve infrastructure, irrigated agriculture, improve produce distribution
- Use of RE in processing

## 2.2 Summary of Plenary Discussions on Current Situation

- **Documentation on how much RE is used in horticultural products**
  This has not yet been done.

- **Has KARI done any research on commercial dryers for processing?**
  No.

- **Has KARI developed any maturity indices for agricultural crops?**
  Yes, maturity indices developed for several crops but the farmers also know when the crops are ready. However, capacity building of farmers is important.

- **Are there any equipment for cooling at the farm level and cooling beyond the farm level? Is such equipment available and are there any maintenance issues?**
  KARI demonstrates use of various technologies by working with groups and training farmers at the village level (e.g. on cooling methods for use at the farm level for example sheds) and has developed a solar dryer for mangoes. KARI also works with partners such as FARM Concern to promote marketing by teaming up with marketers, and advises farmers on when to transport the produce.

# 3. Experiences in Renewable Energy for Enhancing Food Security

## 3.1 Potential of Renewable Energy in Agro-processing: Biogas Potential – presented by Ms. Roda Kilonzi (KENFAP)

KENFAP is a federation of farmers' organizations that represent the interests of smallholder farmers organized into farmer groups, commodity association and cooperative societies. The organization works with farmers in efforts to eradicate poverty and ensure food security in Kenya.

**Kenya National Domestic Biogas Programme**

KENFAP promotes the use of biogas for domestic lighting and cooking, and was involved in implementation of Phase 1 of the Kenya National Domestic Biogas Programme (KENDBIP) from 2009 - 2013. The programme aimed at improving farmers' livelihoods through the benefits of domestic biogas and developing a commercially viable market for the biogas sector in Kenya. The programme's objectives included: i) Reaching 12,000 households with clean and sustainable energy; ii) Strengthening institutions for development of the biogas sector; iii) Ensuring continued operation of biogas plants; iv) Optimizing benefits of gender, environmental, employment creation, food security, carbon finance, among others. During Phase II KENDBIP intends to construct 40,000 digesters over the next four years.

**Achievements**

The programme has resulted in construction of over 12,000 biogas digesters, over 90 percent of which are serviceable. Training of over 500 artisans (masons) on biogas construction and maintenances has been achieved, while clients have been trained on slurry utilization, management and maintenance of biogas digesters. The

programme has established collaboration with government departments and other organisations, for example SCODE and VEP. KENFAP is also encouraging and supporting trained masons to form business associations that will promote biogas use, construction and maintenance of digesters.

**Opportunities for biogas in agro-processing and other uses**

Biogas produces clean energy and besides lighting and cooking, it offers various opportunities for agro-processing for example:

- Drying (radiant heating);
- Processing (e.g. pasteurizing milk)
- Refrigeration and electricity generation.

Biogas is also a means of agro-residue management, recycling and sanitation. KENFAP encourages farmers to use biomass as their fertilizer of choice to increase production and enhance food security. Other benefits include reduction in indoor air pollution, increased agricultural productivity, soil improvement, reduced drudgery for women and children (who are usually involved in procuring firewood for domestic use), employment creation, environmental conservation and mitigation of global warming.

**Challenges**

- Ensuring quality of installation and maintenance of digesters by masons/contractors,
- Lack of national biogas standards, which are however currently being developed,
- Increasing costs/prices of construction materials,
- High cost of credit,
- High cost of biogas appliances due to unfavourable tax regime and
- High labour costs.

## 3.2 Funding Opportunities for Renewable Energy and Value Addition of Agricultural Products

### 3.2.1 BIMAS Kilimo Maji Loan – presented by Mr. Backson Ndira (BIMAS Ltd)

**BIMAS Vision and Mssion**

The vision of BIMAS is to be the leading micro finance institution in Kenya.
The mission is to offer innovative financial and non-financial services to the rural economically productive poor for sustainable wealth creation.

**Irrigation development in Kenya**

The economy of Kenya relies on agriculture but 80 percent of the country is arid or semi-arid. In the arid and semi-arid areas sustainable agriculture can only be achieved through well planned and operated irrigation. The Government of Kenya has identified irrigation as an important tool for improving food self-sufficiency and enhancing household incomes in the rural sector.

**Capacity building in commercial agriculture**

Training farmers is very important to assist them to view agriculture as a commercial enterprise for which they have to plan, implement, evaluate and control all the faming activities. They are able to minimize cost, maximize profits and to make informed decisions on farming e.g. which seeds and fertilizer to buy, what crops to grow, where to market their output and value addition to fetch better prices in the market.

**Requirement for successful irrigation**

A number of conditions must be met for successful small-scale irrigated horticultural development to succeed:

1. Availability of suitable land;
2. Availability of water resources;
3. Availability of labour;
4. Availability of non-irrigation inputs to production;
5. Access to markets;
6. Capital resources;
7. Appropriate water lifting technology.

**Conditions for successful irrigation**

In addition to appropriate irrigation technology, a number of conditions must be met for successful small-scale irrigated horticultural development to occur:

- **Availability of land resources**
  A horticultural development project is justified if it has strong potential for achieving increased production and incomes. Land is one of the most important factors of production linked to this achievement.

- **Water resource availability**
  Irrigation of vegetables requires significant quantities of water of suitable quality. To avoid over expenditure of labour, water must be relatively close to the surface. Groundwater and surface water with a considerable salt content is not suitable quality for irrigation purposes.
- **Availability of labour**
  Traditional irrigated horticulture is a highly labour intensive activity. Labour time is devoted to irrigation related tasks and other non-irrigation activities.
- **Access to Markets**
  Market outlets for vegetable and fruit production are imperative for successful irrigated horticulture to occur. Relative proximity and reliable physical linkages to a market must exist. BIMAS in partnership with other stakeholders links farmers to exporters to promote continuous and guaranteed incomes to farmers.
- **Access to capital**
  Financial capital is important to the expansion of horticultural production. BIMAS has come to the rescue of farmers by providing the Maji Kilimo loan. Income earned from irrigated horticultural production is well above the earnings of the average of traditional farmers practising rain fed

agriculture, where there is little or no cash income; this revenue makes new investments in the horticultural subsector much more feasible. BIMAS empowers farmers to finance their irrigation projects. The irrigation pumps are powered by solar so as to make use of clean and RE that is environmental friendly.

**Irrigation loan**

Irrigation Loan is an asset financing loan intended to assist the farmer members and clients acquire or purchase farm irrigation equipment such as water pumps, cables, pipes (P.E and P.V.C), valves, sprinklers, filtration systems, drip lines, fertigation equipment, irrigation controller, water tanks, drilling of borehole and wells among others.

**Loan acquisition process**

- **Eligibility and loan application**
  - Active farmers who are either members of a group registered by the Ministry of Social Services or individual farm owners currently engaged in mango farming and export vegetables; either contracted to a marketing agent or not. This means that the applicant must show proof of the acreage farm under the horticulture farming or other farm produce.
  - Individual loaned must register as members by paying Kshs. 500 and maintain a personal account with savings.
- **Guarantee and Security**
  Irrigation equipment is taken as the first security and the equipment is insured where possible.
- **Loan disbursement**
  An application for loan is evaluated by BIMAS before disbursement.

### 3.2.2 Research and Development in Kenya Women Finance – presented by Ms. Veronica Karoki (KWFT - DTM)

Kenya Women Finance Trust - Deposit Taking Microfinance ((KWFT-DTM) is a microfinance institution (MFI) with nationwide operations in Kenya. It provides savings and loan products to approximately 370,000 clients, focussing exclusively on financial services to women mainly through group lending – the objective is to collaborate with women in financial access. KWFT – DTM together with its parent company Kenya Women Holding (an established and reputable NGO) has been providing loans to women since 198I. KWFT – DTM, which has grown substantially over the last few years, is a successful institution with a strong record of accomplishment and a total loan portfolio of approximately USD 127 million. The company that was recently licensed by the Central Bank of Kenya to operate a deposit taking entity is currently undergoing transformation.

KWFT-DTM that directly or indirectly supports agribusiness deals with the family through the woman and has over 600,000 clients (80 percent of whom are rural based including many farmers), 236 offices and 2,500 staff. KWFT-DTM also conducts research on the needs of clients and enables them to grow their products.

In 2013, KWFT-DTM disbursed loans worth 20 billion Kenya shillings. Loans are accompanied by training on business management and promotion of agribusiness. The credit officers who train farmers to promote agribusiness have practical experience and KWFT – DTM is in touch with the challenges experienced by farmers,

for example uncontrolled expenditures. The institution offers innovative RE products; it sources for players to provide these services and seeks to establish partnerships with organisations such as KENFAP and Improved Stoves Association of Kenya, among others. Partnerships have been established with agencies promoting solar panels and energy saving *jikos* (stoves).

## 3.3 Renewable Energy for Food Processing: Regulatory Framework – presented by Mr. John K. Maina (MoEP)

**MOEP's Vision and Mission**

- Vision: Affordable quality energy for all Kenyans
- Mission: To facilitate provision of clean, sustainable and secure energy services at least cost while protecting the environment

**What is food?**

Food is any substance consumed to provide nutritional support for the body. It can be of plant or animal origin and contains essential nutrients such as carbohydrates, fats, proteins, vitamins or minerals. In the past food was secured through hunting, gathering and subsistence agriculture. Today, most of the food consumed is supplied by the food industry.

**Food processing**

Food processing is a procedure in which food is prepared for consumption. Food processing is often used to refer to packaging if foods. Technically anything that transforms raw ingredients into something else is a form of food processing, i.e. value addition.

**What is renewable energy?**

RE is energy derived from naturally occurring resources including geothermal, solar, wind, hydro, biogas etc. The Government recognizes the need to exploit RE potential as explicitly spelt out in the National Energy Policy. RE contributes over 67 percent of the total installed generation capacity in Kenya.

**Policy framework**

a) Energy Policy, 2004 (under review) - Recognizes RE as a critical energy source in Kenya and also encourages energy efficiency and conservation in all sectors of the economy.
b) Energy Act No. 12 of 2006 (under review) - Empowers the Minister to promote development of RETs.
c) Feed in Tariff (2008 (revised in 2010 and 2012) - Allows sale of RE sourced/generated electricity at a predetermined fixed tariff for a period of 20 years.
d) Least Cost Power Development Plan - Identifies key green energy projects for geothermal, hydro and wind.

**Regulatory framework**

a) Energy (Solar Water Heating) Regulations, 2012 – To promote uptake and guide the incorporation of low temperature solar water heating systems in industrial, commercial and residential buildings.

b) Energy (Energy Management) Regulations, 2012 – To facilitates efficient use of energy through better understanding of supply and use, management and the implementation of energy efficiency and conservation measures.
c) Energy (Solar PV) Regulations – To improve the quality of products and services offered in solar PV sector and to streamline the manufacture, design, installation, maintenance and use of solar PV systems.
d) Energy (Improved Biomass Cook-stoves) Regulations (draft) - Relate to mandatory use of energy efficient cook-stoves for institutions and large biomass energy users.
e) Energy (Biodiesel Licensing) Regulations, 2009 (Draft) - For licensing of Biodiesel business in the country.

**Other activities on RE sources**

- Biogas standards preparation – At final stages.
- Small hydro standards development – On going.
- Cook stoves standards development -Testing has been going on and preliminary results are ready.
- Small hydro (SH) resource mapping – National SH Atlas aimed at displaying potential for SH programmes in the country on the basis of a Geographical Information System (GIS) platform almost complete.
- Solar/wind resource survey and analysis – On going
- Study on RETs in three counties to commence soon.

**RE for food processing**

- Use of RE in food processing improves the value of agricultural products.
- However, household cooking seems to get more attention than development of food processing technologies, especially at farm level.
- Several concepts have been developed and tested, which indicate that huge potential exists to improve the postharvest treatment of agricultural produce by using RE.

**RE application in food processing**

- Drying agricultural products using solar - various designs of solar dryers have been developed.
- Drying using hybrid systems that use a secondary energy source, such as biomass and biogas, as backup for gloomy days and at night.
- Grain milling using water powered systems.
- Drying using air current.
- Water treatment using solar energy.
- Desalination of water for irrigation and domestic use.
- Solar water pumping for irrigation and domestic use.
- Generation of electricity from agricultural wastes to run processing plants - Olivado EPZ Ltd., Murang'a extracting avocado oil - plans to use biogas for electricity generation for processing.
- Controlled cooking using improved cook stoves coupled with fireless cookers.

**Conclusion**

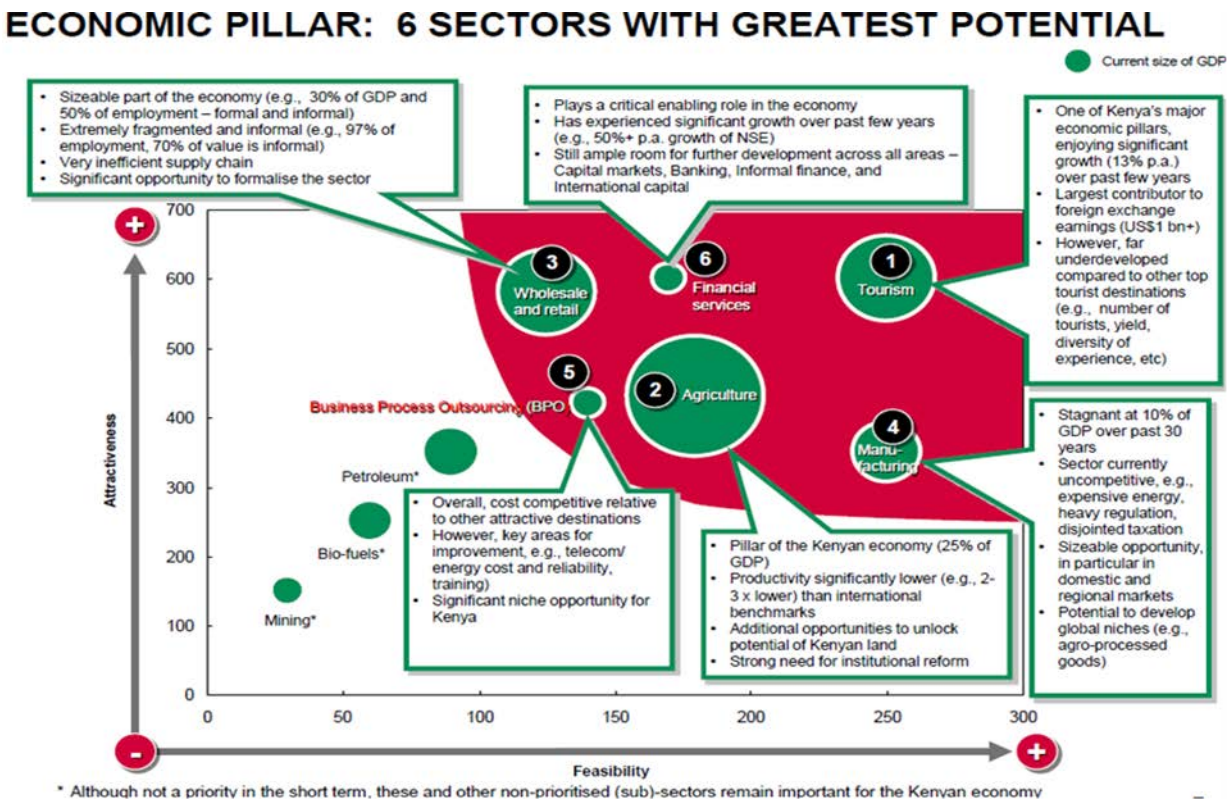
RET is indispensable for food processing and therefore no effort should be spared in developing innovative methods of harnessing it due to its availability, safety and cost effectiveness.

## 3.4 Product Market Opportunities for Value Added Products – presented by Mr. John Njoroge (MoALF)

**A. Introduction- current policy frame work**

**Kenya Vision 2030**

- **Overarching vision:** A globally competitive and prosperous nation with a high quality of life by 2030.
- **Strategy (plans and implementation):**
  - **Economic:** To maintain a sustained economic growth of 10 percent per annum over the next 25 years
  - **Social:** A just and cohesive society enjoying equitable social development in a clean and secure environment
  - **Political:** An issue-based, people-cantered, result-oriented, and accountable democratic system




**Agricultural Sector Development Strategy 2010-2020**

- **Vision:** Innovative, commercially oriented and modern agriculture sector
- **Challenges: a)** Productivity; b) Low exploitation of available land – many parcels remain underutilized; c) Markets – inefficiencies in supply chain – exploitation by middlemen; d) Value addition – low value addition – affects competitiveness of Kenya; e) Unfavourable institutional framework.
- **Strategy**
  - **Institutional reform:** Transform key institutions into complementary and high-performing entities that enable private sector agricultural growth

- **Increase productivity:** increase productivity of crops and livestock
- **Transform land-use structure:** Better utilization of high and medium potential lands
- **Prepare new lands for cultivation:** Strategically develop irrigable areas of Arid and Semi-Arid Lands (ASAL) for both crops and livestock
- **Increase access to markets:** improve market access to smallholders by establishing aggregators (addressed in retail sector)

**National agribusiness strategy**

- **Theme**: **Making Kenya's agribusiness sector a competitive driver of growth**
  (*all businesses involved in agricultural production, including farming and contract farming, seed supply, agrichemicals, farm machinery, wholesale and distribution, processing, marketing and retail sales).*
- **Vision**: to bring about a highly productive and efficient agribusiness sector, competitive both locally and internationally.
- Proposes how the agribusiness sector can play a key role in realising Kenya's 2030 vision of annual economic growth rates of 10 percent from 2012.
- Shift focus from subsistence to meet market and commercial demands.
- Increase the competitiveness of large-scale producers as well as smallholder farmers.

**Strategic priorities**

1. Put **markets** at the centre of all production, processing, product development and packaging
2. Focus **research and development and innovation** to better catalyse growth of a vibrant agribusiness sector
3. Promote **smarter organisation of the actors** in the sector to enable enterprises to benefit from economies of scale and improved productivity
4. Improve the range and **effectiveness of financial and nonfinancial services**
5. Attract **investment by creating an enabling environment** and putting performance above politics

**Framework for agribusiness development**

- Building an enabling environment:
  1. An enabling and predictable policy and institutional framework
  2. Market-driven product development and value addition
  3. Competitive cost structures from production to markets
  4. Communication, knowledge and facilitation services

DIAGRAM 1: Enhancing agribusiness in Kenya – a conceptual framework


**B. Introduction to value addition**

- **Value addition** - is about **improving products with the intention to increase returns** for operators in the Value Chain
- **Value addition -** aims at **seizing opportunities** offered by **selected markets**

**Value chain**

- There are two possibilities to add value - value capturing and value creation
- **Value capturing:** improving current production, processing, trading structures / processes (increasing productivity, reducing waste, reducing costs, etc.), entering new markets with existing products, etc.
- Value can be captured by overcoming **existing short-comings** at any stage of the value chain
- Opportunities for value capturing along value chains:
  - increase **productivity/ efficiency** at every stage of the value chain;
  - improve **cooperation and coordination along the value chain** to reduce transaction costs and waste rates.

**Value creation**

- **Value creation:** innovating products (e.g. new varieties, new processed products)
  - **To successfully sell innovative products it is necessary to: a)** Identify viable markets; b) Invest in market research; c) Invest in product development; d) Calculate return on investments.

**C. Categories of dried products**

- **Plant origin:** fruits -pineapples, mangoes, bananas; vegetables-leafy vegetables; roots and tubers- Irish/ sweet potatoes, arrow roots; medicinal; spices- chillies
- **Livestock:** meat e.g. fish

**D. Challenges facing dried agricultural products**

- Strict standards, such as the European Retail Standards for Good Agricultural Practice
- Low market demand
- Lack of access to technology, skills, equipment
- Lack of affordable credit/ finance

**E. Opportunities for dried agricultural products**

- Rapid urbanisation and increasing demand for processed foods
  - Promotion of utilisation of dried agricultural products
  - Improve nutrition and health
- Seasonality of agricultural production
  - Products preservation
  - Reduction of post-harvest losses
- High world food prices
- Large potential to generate export earnings

## 3.5 Experiences with Value Addition Groups: Brief on SoMCoDI – by presented by Sister Veronica Thiga (SoMCoDI)

**Introduction**

Songa Mbele Community Development Initiative (SoMCoDI) is based on livelihood improvement approach that lays strong emphasis on utilization of locally available resources, group leadership, local resource mobilization and building the institutional capacity of local farmer groups. The approach is currently being carried out in all the provinces.

**Vision:** Empowering communities in utilization of their locally available resources

Mission: To promote and facilitate use of locally available raw materials for food security and income; advance agro based industries and improve livelihoods

The project started with 10 groups in 1989 and has grown to over 503 groups with a membership of 20, 003 in 24 counties by the year 2013.

**Services offered by SoMCoDI**

- Training on group dynamics
- Training value addition on the farm produce
- Training on livelihood improvement practices
- Training on tie and dye
- Bead work and weaving
- Marketing
- Leadership skills
- Training on development of business plan
- Training on record keeping
- Basic computing skills

**Achievements (2010 – 2013)**

- We have been able to conduct 50 Training of Trainers (ToTs) with 2,428 participants from 503 groups. The ToTs are now training 20, 003 members of their groups
- We have trained 50 technical staff in various counties on livelihood improvement practices.
- We have 10 direct sales shops selling value added products, one in Kimilili, two in Machakos, three in Kangundo, one each at SoMCoDI training centre, Meru, Makueni and Muranga.
- Farmer groups already have loans from financial institutions to start income generating projects.

**Challenges**

- We would like to thank the MoALF for allocating us enough funds to construct the training centre. Construction has been completed and we are conducting our trainings in those new premises. SoMCoDI has three technical staff, one driver and two casual employees. Due to the amount of work, more technical and support, staffs are needed.
- SoMCoDI uses a vehicle bought in 2005 and it keeps breaking **down hence requires replacement.**

**Way Forward**

- SoMCoDI groups intend to establish more direct sales shops to market members' value added products in every county.
- To increase the number of staff trained on SoMCoDI approach, to expand the number of groups who are utilizing locally available resources.
- To have a roadside market along Nairobi - Nyeri highway near SoMCoDI Centre.
- Have a processing unit in every county specifically in every Agriculture Training Centre.
- Start livelihood improvement practices in every Agricultural Training College.

**Collaborators and Stakeholders**

| | **Institution** | **Collaboration** |
|---|---|---|
| 1. | Ministry of Agriculture | Financing and staffing |
| 2. | NHRC- Thika | Training and planning:<br>• Materials<br>• Support in building and tendering process |
| 3. | Japanese International Cooperation Agency | Staff training – KAIZEN |
| 4. | Equity Bank | Savings |
| 5. | JKUAT | Training on value addition |
| 6. | United States Agency for International Development | Offering advice to farmers in production and marketing |
| 7. | Metrological Department Thika | Offer advice to farmers on weather patterns |

**Conclusion**

- It is notable that the Japanese government selected Kenya to host international trainings on skills and knowledge in `Rural Community Development' through Livelihood Improvement Approach. So far five internal groups have visited SoMCoDI to be trained on Livelihood Improvement practices.
- We hope to complete the modern training Centre which will be the Centre of excellence to train farmers on Livelihood Improvement Practices, value addition and marketing.

## 3.6 Practical Experiences in Renewable Energy in Food Processing – presented by Mr. Duncan Muchendu (SCODE)

**Introduction**

Sustainable Community Development Services (SCODE) is a Kenyan grassroots community development organization registered in 1996 as a national NGO. The organization has offices and a community-training and resource centre in Nakuru town, Rift valley province, Kenya.

**Vision:** To be the lead NGO in the promotion and development of the most efficient and effective Clean Energy Technologies and sustainable land use approaches for sustainable livelihoods of both men and women.

**Programmes**

SCODE works through two main programmes:-

1. **RETs programme:**
   This programme focuses on the conservation and sustainable utilization of RE resources to reduce indoor air pollution, enhance food security and improve income of both men and women.
2. **Sustainable Land Use Management:**
   This programme aims at improving food security and income levels of small scale men and women farmers through the adoption of low external input environment friendly technologies and approaches.

**1. Cook stoves demonstration project**

This involves the following activities:-

- Awareness creation, training and Installation, market linkages and production among men and women.
- Training of men and women artisans/entrepreneurs in the fabrication of quality ICS.

***Kunimbili stove***

***KCJ stove***


***Maendeleo stove***

**2. The Biogas/Bio Latrines demonstration project**

This project aims at:

- Building the capacity of local men and women artisans in biogas and bio-latrines technology.
- Demonstrating that biogas/bio-latrines provide safe and environment friendly means of disposing waste, converting waste into high quality fertilizer for agricultural use and providing gas for cooking (this reduces the drudgery women go through in fetching firewood ), heating and lighting.

The project involves the following:-

- Training of local male and female artisans on design, construction and maintenance of biogas and bio-latrines.
- Installation of biogas and bio-latrines
- Monitoring and documenting performance and impact of biogas /bio-latrines on women and men users and/or installers.

*Use of biogas slurry improves soil fertility and increases crop production.*

**3. The solar (PV) Energy Project**

This project is aimed at building the capacity of men and women from grassroots communities in installation and maintenance of solar home lighting systems and solar lanterns. This helps to demystify the technology, localize it and encourage its uptake. The project involves the following:

- Training of local female and male electrical artisans on solar PV systems design, installation and maintenance.
- Design, installation and maintenance of small solar home lighting systems for men and women.
- Training men and women on operation and maintenance as well as documenting experiences of men and women using solar PV systems.

**4. Agro Forestry Project**

This project works with women and men farmers in planting trees on their farms as a source of fuel for their kitchens, fodder for livestock and soil fertility improvement. The project trains women and men farmers on basic agro forestry skills and knowledge and supports them to establish tree nurseries on their plots. The project is involved in the following activities: i) Training men and women on agro forestry, tree nursery establishment, out planting, tree seeds harvesting , processing and management; ii) Providing men and women with basic nursery materials and tools.

**5. Gender Mainstreaming (GM) Project**

The projects' aim is to achieve improved quality of life of rural men and women ICS entrepreneurs and users and improve SCODE's performance in planning and implementing RE projects. Through mainstreaming gender into ongoing ICS project activities and the organization, GM project intends to attain its ultimate goal through the following objectives:

- To increase men and women participation in production and distribution of ICS

*Towards gender equity: gender balanced participation in stove assembling*.

- To increase benefits of ICS to men and women ICS entrepreneurs and users
- To build capacity of SCODE to mainstream gender in ICS and other RE projects**.**

**6. The ICS for households and Institutions project**

- The ICS for households and institutions project has provided SCODE with the opportunity to upscale its ICS project.
- The project's overall objective is to improve livelihoods of rural and peri-urban poor households in Kenya by improving access and use of efficient, renewable and clean energy options by both men and women.

**7. KENDBIP Partnership**

- Since inception SCODE has been in the fore-front in the promotion and dissemination of biogas technology in Kenya.
- SCODE has entered into a partnership with KENFAP as an **implementing partner** in KENDBIP.
- The partnership is aimed at accelerating the rate of uptake of biogas among women and men small scale farmers in Kenya.

**8. Solar Drying technology**

The project aims at supporting rural men and women to adopt solar drying technology in order to reduce post-harvest loss of fruits, vegetables, tubers and grains, improve their market value and make them available for food and market throughout the year. The project involves the following activities:

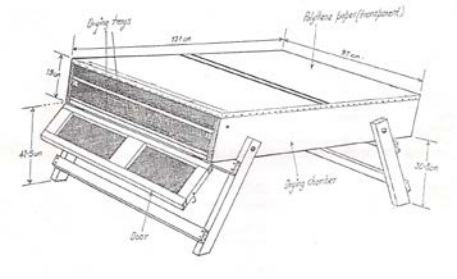
- Training of men and women on design, construction and maintenance of solar dryers.
- Construction of solar dryers for demonstration among men and women on cost recovery basis.
- Market research on solar dried products in Kenya.
- The low cost solar drying for food security project enabled SCODE to win the Energy Globe Award in 2006.

The technology and capital required to dry fruit and vegetables by solar dryers is basic and the entire operation can be completed in most kitchens. The structure can be very basic, e.g. a box frame covered with plastic sheeting.

**Advantages of solar dryers**

- Drying is faster because inside the dryer it is warmer than outside.
- Less risk of spoilage because of the speed of drying (if the drying process is slow the fruits start to ferment and the product is spoilt).
- The product is protected against flies, pests, rain and dust.
- It is labour saving. The product can be left in the dryer overnight or during rain.

***Solar dryer***



- The quality of the product is better in terms of nutrients, hygiene and colour.

## 3.7 Summary of Plenary Discussions on Experiences in Renewable Energy for Enhancing Food Security

1. **Production of ethanol**
   Ethanol blending was initiated in Kisumu but the project did not move forward due to the small quantities produced.

2. **Small hydro for tea processing and other uses**
   The MoEP encourages establishment of SHP for tea processing to mitigate deforestation and has done some feasibility studies on this. The Ministry is also developing standards for SHPs.

3. **Biogas technology**
   Whether or not to use fixed or plastic digesters is an issue of durability. While the underground digester does not take up much space, the plastic ones are also durable. KENFAP plans to use plastic digesters in Phase 2 of KENDBIP and is encouraging stakeholders to participate in comparative assessment and evaluation of fixed and plastic digesters. The most important issue is to ensure the digesters are of good quality. KENFAP is encouraging and supporting formation of sector associations for the masons so that they are empowered to construct and maintain quality biogas systems.

4. **Collateral for loans (RE)**
   Low-income groups do not have large assets and KWFT-DTB does not give loans for RE in cash but in kind. For construction of biogas systems KWFT-DTB pays the masons directly to ensure money that is intended for construction is used for this purpose. KWFT – DTB recognizes that the low income earners may not have enough securities so the financier uses alternatives such as social collaterals, co-guarantee systems, business and home assets. Similarly, for construction of biogas systems, solar and ICS, KENFAP pays directly for the construction to ensure the money goes where it should. Repayments come from transferred costs – e.g. savings on energy. BIMAS Ltd. uses the solar powered water pump as the collateral for the loan.

5. **Quality of solar powered water pumps**
   A list of certified solar products has been developed, including pumps.

6. **Devolvement of the SoMCoDI model to all Counties**
   Devolvement of this type of model depends on the resources available and level of training. SoMCoDI experience demonstrates the importance of individual commitment and devotion, and the need to empower staff so that they are in turn able to empower farmers. The national government has various training programmes and Counties must ready to absorb technologies and to link with the national government to benefit their constituents.

# 4. Stakeholder Feedback on Project Activities

## 4.0 Group Formation and Assigned Tasks

The plenary was split into four pre-assigned groups to discuss and give feedback on the four RE4Food research questions shown on Appendix 3. Group constitution was carefully designed to ensure that each group had at several representatives with expertise in each area covered by the four research questions. Feedback from group reports was intended to provide critical information to enable RE4Food refine the research questions and to prioritize areas of research on efficient RE for food processing that can empower farmers and improve their livelihoods.

The four groups addressed the following issues drawn from RE4Food research questions:

- Group 1: Potential Crops and Value Chain Losses and Energy Requirement
- Group 2: Potential SMEs, Technology and RE Use
- Group 3: Existing Business Models and Opportunities Available
- Group 4: Developing Synergies and Identifying Practical Models for RE and Food Processing

### 4.1 Group 1: Potential Crops and Value Chain Losses and Energy Requirements

**1. Assess and identify commodities and products which have potential benefits to rural livelihoods especially if value added**

- Widely used
- Widely produced
- Potential of value addition - seasonally produced (if value added) that farmers will have in abundance in space and time (reduce losses)

**Identified crops and sites**

| Crop | Site |
|---|---|
| Tomato | Kirinyaga, Loitokitok, Subukia |
| Cabbage | Nyandarua, Central Rift valley, Nyeri |
| Mango | Muranga, Makueni (Central and Eastern |
| Carrots | Nyandarua, C. Rift valley, Nyeri |
| Sweet potato | Western, Nyanza, Homabay |
| Bananas | Meru, Kisii, Taveta |
| Avocado | Muranga/ Central Kenya |
| Stinging nettle/ Managu | Central rift |

**2. Analyze and assess post-harvest food chain losses and waste during handling, cleaning, cleaning**

**Ranking according to commodity and perishability**

**Vegetables**

1. Cabbage
2. Stinging nettle
3. Managu ( Black night shade)

4. Tomato

**Root crops**

1. Sweet potato
2. Carrots
3. **Fruits**
4. Bananas
5. Avocado
6. Mangoes

**3. Evaluate current energy inputs across various stages along the food chain**

| Crop | Energy | Percentage energy on processed |
|---|---|---|
| Tomato | Human- Fresh | 100% (processing 20% electricity human 80% |
| Mango | Human for fresh | 90% human, 10% drying, (juice- 60% human 40% electricity) |
| Sweet potato | Human for fresh | 60% human, 40% (electricity, DAT, solar drying) |
| Bananas | Human for fresh | 98% human, 2% electricity |
| Stinging nettle/ Managu | | Human 50% , solar 50% |

## 4.2 Group 2: Potential SMEs, Technology and Renewable Energy Use

**1. Existing SMEs and Co-operatives**

Self-help groups i.e. women and youths groups

- Traders
- Micro-processors
- Jua Kali (informal sector)
- Training centres e.g. village polytechnics
- Farmers co-operatives
- Savings co-operatives
- Relevant SACCOs

Training

Extend credit facilities

**2. Technical and human resources required**

- Engineering workshops
- Engineers
- Village Polytechnics
- Kenya Bureau of Standards (KEBS) – to achieve standard processing
- Technicians
- Food technology
- Artisans

- Operators
- Managers
- Support staff

**3. Rural food processing (categorized)**

1. Drying
2. Crashing
3. Boiling
4. Cooling
5. Smoking

*Nb: Processing at this level is very small at a range of approximately 15 percent which is mostly done for instant consumption.*

**Technologies used**

- Solar drying
- Pasteurization
- Milling
- Crashing
- Squeezing
- Charcoal cooling
- Solar cooling
- Cool boxes
- Shades cooling

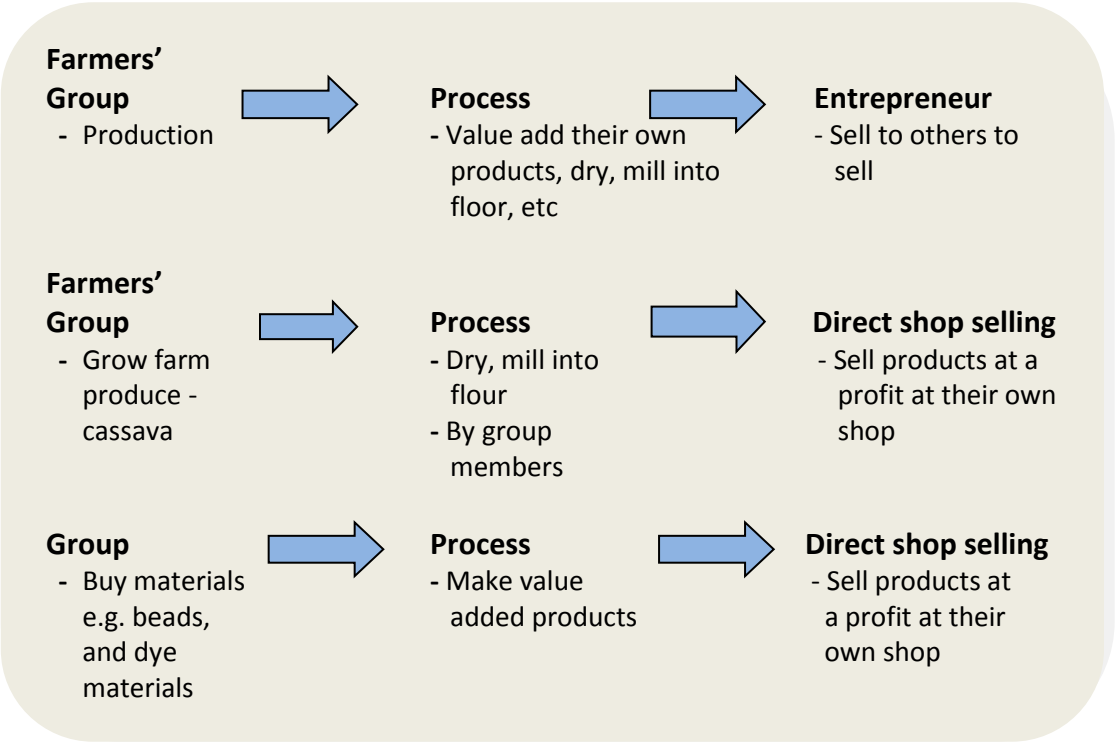
*NB: Use of technology is very low (approximately 10 percent).*

**4. Potential for various forms of RE**

| **Form of RE** | **Potential [%]** | **Existing [%]** |
|---|---|---|
| Solar | 30 | 1.5 |
| Biomass | 60 | 80 |
| Electricity (Hydro) | 5 | 3 |
| Wind Energy | 3 | 0.5 |
| Others | 2 | 15 |

## 4.3 Group 3: Existing Business Models and Opportunities Available

**1. Business models currently used for rural food processing and exploitation of RE**




**2. Successes**

- More money from products
- Increased shelf life
- Increased many uses resulting to increased demand
- Increased versatility

**3. Limitations**

- Lack of certification and standardization
- High risks of losing the products
- Low level equipment and facilities
- Expensive standardized equipment

**4. Best Practices**

- Each party concentrates on their area(s) of expertise
- Kenya Tea Development Agency model- farmers own product and factory but hire professionals and gain immediate and end season profits.

## 4.4 Group 4: Developing Synergies and Identifying Practical Models for RE and Food Processing

**1: Innovative food processing technologies**

**Solar drying**

- Traditional solar drying
- Green house solar drying for large quantities of produce and those that take longer time to dry e.g. cassava
- Box solar drier

**Cooling technology**

- Charcoal cooler
- Sand cooler
- Packing shades

**Traditional technologies**

- Smoking
- Salting
- Open air drying

**2: Techno-economic models**

- Green house drying
- Use of solar on drying and use of other sources of energy during bad weather and at night
- Traditional use of shades to maintain the quality of produce

**3: Impact of reduction on postharvest losses**

| | | | | |
|---|---|---|---|---|
| 1. | Capital investments | Job Creation | Income generation | Energy Cost |
| 2. | Cost of production is reduced | More jobs are created | Increased household income | Reduced energy cost |
| 3. | Cost of food reduced | | | |

**4: Key stakeholders**

| **Institutions** | **Food processors** | **Financiers** | **Energy Suppliers** | **Educationists** |
|---|---|---|---|---|
| MoALF | CBOs (Voi) | BIMAS Kenya | MoEP | Universities |
| MoEP | Meru Herbs | KWFT | KENDBIP | |
| Ministry of Devolution | | | | |
| KENFAP | CBOs in Embu county | CISDO | Daima Energy | |
| KARI | OLivido Ltd. | Fountain | Davis and | |

| Institutions | Food processors | Financiers | Energy Suppliers | Educationists |
|---|---|---|---|---|
| | | Enterprise Programs | Shirtliff | |
| KIRDI | Kevian | FAULU | Ramco group of companies | |
| Universities | Sunny Mango | Small Medium Enterprise Program | SCODE | |
| | Agri-business Depart (MoALF) to provide names of CBOs in different regions | Jamii Bora | VEP | |
| | Marungu alovera, Voi | Rafiki | | |
| | | Equity Bank | | |
| | | VEP | | |

## 4.5 Summary of Plenary Discussions on Stakeholder Feedback on RE4Food Project Activities

- **Omission of cassava from list of crops**
  Cassava was left out to avoid duplicating what the group in Ghana doing – however, the stakeholders can still recommend cassava to be included in the list of crops since it is a staple food. Post harvest handling and consumption of cassava is a critical issue due to the risk of exposure to cyanide is a constraint - risk mitigation depends on how the food is processed.

- **Prioritization of crops**
  As follow-up to issues emerging on post-harvest wastage participants were requested to write down a list of prioritized crops that are most affected by post-harvest wastage but have greatest possible impacts on improving rural livelihoods.

  The criteria for prioritizing was identified as crops which can be processed using RE, including four vegetables and four fruits from what participants prefer most. Participants recommended that ranking of crops that can be processed should aim for higher levels of value addition. For instance it was noted the value of banana processing is low compared to its usage when it is fresh. The table below shows list of crops identified and prioritized by stakeholders.

**Stakeholder prioritization of the preferred crops**

| | | Frequency in each priority class (1 rep most preferred) | | | | |
|---|---|---|---|---|---|---|
| | **CROP** | **1** | **2** | **3** | **4** | **5** |
| **VEGETABLES** | | | | | | |
| 1 | Tomato | 13 | 2 | 0 | 0 | 0 |
| 2 | Managu | 2 | 4 | 2 | | |
| 3 | Amaranthus | 2 | 2 | | | 0 |
| 4 | Stinging Nettle | 1 | 5 | 1 | 1 | 1 |
| 5 | Carrots | 0 | 1 | 2 | 0 | 0 |
| 6 | Cabbage | 1 | 1 | 2 | 2 | 0 |
| 7 | Spinach | 0 | 1 | 0 | 0 | 0 |
| 8 | Kales | 0 | 1 | 1 | 0 | 0 |
| 9 | Potatoes | 0 | 1 | 0 | 0 | 1 |
| **FRUITS** | | | | | | |
| 1 | Mangoes | 10 | 5 | 1 | 1 | 0 |
| 2 | Avocados | 0 | 4 | 3 | 0 | 0 |
| 3 | Bananas | 7 | 2 | 2 | 0 | 0 |
| 4 | Guavas | 0 | 0 | 0 | 1 | 0 |
| 5 | Pawpaws | 0 | 0 | 0 | 1 | 0 |
| 6 | Oranges | 0 | 1 | 0 | 0 | 0 |
| 7 | Passion | 0 | 0 | 0 | 1 | 0 |
| **ROOT CROPS** | | | | | | |
| 1 | Cassava | 5 | 0 | 0 | 0 | 0 |
| 2 | Sweet potatoes | 4 | 4 | 0 | 0 | 0 |
| 3 | Arrow roots | 1 | 0 | 1 | 0 | 0 |

**Summary**

- Vegetables: Tomatoes, traditional vegetables and leafy vegetables (cabbage, Kales)
- Fruits: Mangoes, bananas, avocadoes
- Root crops: Cassava, sweet potatoes, arrow roots

- **RE4Food baseline**
  Stakeholders emphasised on the need for RE4Food to do a real baseline. They indicated that the issues, ideas and recommendations emerging from the workshop deliberations will be a good starting point for initiating baseline information collection. Information collection should take into consideration ongoing activities in RE for food processing activities and entrepreneurship that are undertaken in different parts of the country, for example processing of cassava at Matungulu, milk processing in different parts of the county, etc.

- **Gender issues**
  Stakeholders emphasised on the need to include gender issues, to address the needs and priories of different age groups, i.e. youth, women and men, and to equip the groups with different types of skills. When groups are being trained, it is important to mix genders and ages. Young people are more active,

but older people can keep budgets and encourage the young people as they themselves keep accounts. Empowering of youths through training is hence a vital component.

- **Use of existing structures to empower farmers**
  Since there are many existing structures and farmers are already involved in different types of crop processing and marketing is it possible to empower farmers to engage in processing of indigenous vegetables and other crops.

- **Strengthening RE4Food partnerships**
  Participants noted the need for all stakeholders at the workshop to avail themselves to contribute to the project. They noted the need to partner with other organisations and to use these and other existing partnerships as leverage for accessing existing structures. They identified the need to bring in other critical stakeholders to enhance the quality of project activities, including:
    - Ministry of Devolution
    - KEBS
    - Techno Serve
    - Farm Concern
    - Ministry of Industry
    - Ministry of Gender
    - Sola Yetu
    - Span Technical Enterprises Kenya

  Stakeholders also urged RE4Food to consider eliciting the participation of middlemen since they play a critical role in getting crops to the market and the farmers need them. Although farmers also market their own products in some cases the only outlet to the market is middlemen – the situation is often such that farmers specialize on production while middlemen are agents linking them to distant markets.

## 5. Way Forward

- Formation of a stakeholder taskforce that can assist in developing more ideas and marketing of RE4Food.

- Collection of RE4Food baseline information with particular focus on the list of prioritized crops, establishment of the Network and refining of the list of prioritized crops; promoting of RE for processing as a cheaper and environmentally friendly alternative. A quality baseline will also ensure that RE4Food data and information is authenticated with reality on the ground.

- Mapping out technologies, how and by whom they are used and addressing crosscutting issues such as gender and vetting of suppliers and other vendors.

- Identification and/or development of efficient and affordable RETs and coming up with good equipment that can help us to do value addition and commercialise.

- Identification of market linkages, and learning from those who are already involved in similar activities – for example Farm Concern is already effectively involved in markets and linkages.

- Eliciting support from the government in areas such as power generation and distribution, irrigation for all year round production, training on post-harvest technologies, economic analysis for best pricing.

- Capacity building of farmers, e.g. in areas such as what to produce (based on demand) for fresh consumption and for processing. The process of capacity building can begin by eliciting participation of community groups, starting with groups that are already formed and which are active and have been working together – such groups pick ideas and activities very quickly and know what they want to do. However, there is need to train farmers on what to produce based on demand. Capacity building will ensure that farmers' produce can be sold anywhere in the world, hence the need for partnering with agencies such as KEBS.

- Identification of financiers - this is a gap that needs to be addressed. Financial inclusiveness is very critical and we need to continue working together.

## 6. Closing Remarks

Prof. Kanali said: “We are humbled that so many of you came today. We got support to implement RE4Food after undergoing a rigorous vetting process. We did EOI and were one of the 400 groups that responded. Out of these groups 80 were selected for interviewing. After three days 40 proposals were submitted. After this we had to prove the project is worth supporting; proposals from Newcastle, Ghana, Sierra Leone and Kenya received support - our proposal was one of the ones sponsored and we appreciate and are happy that we can bring people together like this. This workshop has demonstrated that there is a lot we can do together and this creates synergy. We thank you for the collaboration and we will continue to consult you in the process of project implementation. Thank you.”

Thanking the workshop organisers on behalf participants, Ms. Karoki said: “Quite a lot has been said but since you must deliver, you need to prioritize. We also learned some tips on how to bring together all the stakeholders. Thank you for this opportunity and we look forward to project activities and to continue partnering with you all.”

Prof. Shitanda said: “We appreciate your participation. Attendance was eighty five percent which is very impressive. As we implement RE4Food project let us look out for what will brings a difference. The battles we have are not just technical but there are other unknown factors. Let us have a wide scope in spiritual, social and economic aspects. I trust this group will lead us into a project with an impact to utilise the few technologies we have for the benefit our people. We thank you all and wish you all the very best.”

# Appendices

## Appendix 1: List of Participants – RE4FOOD Stakeholders Workshop

| Organisation/Institution | | Name | E-mail Address | Tel. No. |
|---|---|---|---|---|
| **Academic and Research Institutions** | | | | |
| 1. | KARI –Thika | Dr. Margaret Muchui | margaretmuchui@yahoo.com | 0722 615590 |
| 2. | KARI –Thika | C. Gathambiri | cgathambiri@yahoo.com | - |
| 3. | KIRDI | Joseph K. Kamau | dir@kirdi.go.ke/jkkamau@kirdi.go.ke | 0722 704410 |
| 4. | UoN | Dr. Fridah W. Mugo | fridahmugo@yahoo.com | 0710 806139 |
| 5. | Egerton University | Musa Njue | musanjue@yahoo.com | 0726 128779 |
| 6. | JKUAT | Prof. E. M. Kahangi, EBS DVC (RPE) | estherkahangi@yahoo.com | - |
| 7. | JKUAT | Hesborn Ondiba | hondiba@gmail.com | 0725 942305 |
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| 9. | JKUAT | L.O. Mulamu | livingstonemulamu@yahoo.com | 0722 385948 |
| 10. | JKUAT | Prof. F. D. Shitanda | shitandad@yahoo.co.uk | 0722272265 |
| 11. | JKUAT | Dr. J. Mung'atu | kmungatu@yahoo.com | 0720824708 |
| 12. | JKUAT | Eng. S. Njuguna | snjuguna@yahoo.com | 0727 436412 |
| 13. | JKUAT | Prof. C. Kanali | c_kanali@yahoo.com | 0721 351700 |
| 14. | JKUAT | Dr. Garth M. Kituu | mgmkituu@yahoo.com | 0727 495380 |
| 15. | JKUAT | Jane N. Luswet | jluswet@gmail.com | 0725 130415 |
| 16. | JKUAT | Christine W. Kituku | cwanza@yahoo.com | 0710 357140 |
| 17. | JKUAT | Clifford Obiero | cliffordobiero@yahoo.co.uk | 0722 631512 |
| 18. | JKUAT | Michael Kamwere | kamwere2006@yahoo.com | 0722 621042 |
| **Farmer Organisations, NGOs/Civil Society, cooperatives and financial institutions** | | | | |
| 19. | KENFAP | Roda Kilonzi | roda@kenfapbiogas.org | 0721 203344 |
| 20. | GIZ – EnDev | Pauline Wanjohi | pwanjohi@endev-kenya.co.ke | 0722 775419 |
| 21. | ATDL Ruiru | Ruth Njeri | atdlruiru@gmail.com | 0723 921852 |
| 22. | Practical Action Consulting EA | Tameezan wa Gathui | tameezan.gathui@practicalaction.or.ke | 0729 401 079 |
| 23. | Practical Action | Victor Esendi | esendiv@gmail.com | 0723 346 726 |
| 24. | SoMCODI | Sister Veronica Thiga | srverothiga@yahoo.com info@somcodi.or.ke | 0722 780 092 |
| 25. | BIMAS Ltd. | Backson Ndira | bndira@bimaskenya.com | 0723 209040 |
| 26. | KWFT - DTM | Susan Maina | smaina@kwft.com | 0721 464 778 |
| 27. | KWFT - DTM | Veronica Karoki | vkaroki@kwft.com | 0722 240257 |
| 28. | HCDA | Nicodemus Ngeka | yavinicodemus@gmail.com | 0723 987 769 |
| 29. | AIDC – Nakuru | Otieno Abich | aidcnakuru@yahoo.com | 0716 809 201 |
| 30. | SCODE | Duncan Muchendu | dmuchendu@scode.co.ke | 0723 466982 |
| 31. | Farm Concern | Silas Langat | info.kenya@farmconcern.org | 0720 342 315 |
| 32. | PELUM – Kenya | Jeff Kahuho | kahuho@pelum.net | 0721 778939 |
| **Policy and Regulatory Agencies/Associations** | | | | |
| 33. | MoEP | John Maina | mainajkm@yahoo.com | 0722 655161 |
| 34. | MoALF | John Njoroge | irungu.njoroge@yahoo.com | 0726 088502 |

| Organisation/Institution | | Name | E-mail Address | Tel. No. |
|---|---|---|---|---|
| **Others** | | | | |
| 35. | Rapporteur | Wairimu Ngugi | wairimu.ngugi@gmail.com | 0720 172917 |
| 36. | Assist. Rapporteur | Breda Gutu | brendagutu@rocketmail.com | 0707 154099 |

**Appendix 2: RE4Food Stakeholders Workshop Programme**

| **20th March 2014** | | **Moderator** |
|---|---|---|
| **0830 -0900hrs** | **Arrival and registration** | Mike/Njoka |
| **0900 - 0930hrs** | **Opening ceremony**<br>▪ Workshop briefing and introductions - **Team Leader (JKUAT)**<br>▪ Welcome & Speech by the Deputy Vice Chancellor (RPE) JKUAT | Dr.Mutwiwa |
| **0930 - 0940hrs** | *Group Photo* | Eng.Njuguna |
| **0940 – 1000hrs** | ***SESSION 1 – The current situation (15mins presentation)***<br>▪ Post-harvest challenges in horticultural crops and impact on food security in Kenya.**Dr.Margaret Muchui(KARI)** | Victor Esendi |
| **1000- 1030hrs** | ***Tea break*** | |
| **1030-1200hrs** | ***SESSION 2 – Potential cases (10 mins presentations)***<br>▪ Potential of RE in agro-processing/agriculture– **KENFAP**<br>▪ Funding opportunities for RE and value addition of agricultural products– **BIMAS Kenya/KWFT**<br>▪ Regulatory frameworks–**MoEP**<br>▪ Product market opportunities for value added products**–MoALF**<br>▪ A practical experience on RE in food processing–**SCODE**<br>▪ Experiences with value addition groups**–SOMCODI**<br>*Q and A* | Dr. Mung'atu |
| 1200-1300 | ***SESSION 3-Group discussion on key project activities***<br>Group 1: Potential crops and value chain losses and energy requirement<br>Group 2: Potential SMEs, technology and RE use<br>Group 3: Existing business models and opportunities available<br>Group 4: Developing synergies and identifying practical models for renewable and food processing | Dr.Kituu/ Tameezan wa Gathui |
| 1300 - 1400hrs | ***Lunch break*** | |
| 1400 - 1600hrs | ***SESSION 4– Group presentation*** | Tameezan wa Gathui / Dr.Kituu |
| 1600 - 1630hrs | ***Tea break*** | |
| 1630 - 1715hrs | ***SESSION 4 - Closure of***<br>• Way forward-**Prof Shitanda**<br>▪ Closing remarks | Dr.Mutwiwa |
| 1720hrs | ***Departure*** | |

## Appendix 3: Working Groups and Questions

**Group 1: Potential Crops and Value Chain Losses and Energy Requirement**

- Assess and identify commodities and products which have potential benefit to rural livelihoods especially if value added
- Analyze and assess post-harvest food chain losses and waste during handling, cleaning, drying, transport and storage( e.g. at what stage, magnitude)
- Evaluate current energy inputs across various stages along the food chain for each of the products(focusing on postharvest activities e.g. level of usage of human power, RE, etc in the various activities)

Members

1. Nicodemus Ngeka- HCDA
2. Silas Langat- Farm Concern
3. Jeff Kahuho- PELUM
4. Veronica Karoki- KWFT -DTM
5. Christopher Kanali- JKUAT
6. Margaret Muchui- KARI
7. D. Mutwiwa- JKUAT

**Group 2: Potential SMEs, Technology and RE Use**

- Identify existing SMEs/Cooperatives that have potential for up scaling through use of RE and have potential impact on food security in rural communities
- Identify the technical and human resources necessary to address RE and value addition in rural communities
- Assess the extent of rural food processing, the technologies utilized, the energy mix and level of inputs currently required
- Identify the potential for various forms of RE and assess existing deployments in rural regions

Members

1. Joseph K. Kamau - KIRDI
2. Musa Njue - Egerton University
3. Jane N. Luswet - JKUAT
4. Christine W. Kituku - JKUAT
5. Clifford Obiero - JKUAT
6. Ruth Njeri – ATDL Ruiru
7. John Maina - MoEP

**Group 3: Existing Business Models and Opportunities Available**

- Identify and Examine the business models currently used for rural food processing and exploitation of RE
- Identify successes, limitations and failures of business models for food processing and RE enterprises and demonstrations of existing activity

- Identify any existing best practice and learning opportunities/barriers for both food processing and RE **applications**

**Members**

1. Susan Maina – KWFT
2. John Njoroge – MoALF
3. Pauline Wanjohi – MoALF/GIZ-EnDev
4. Duncan Muchendu – SCODE
5. Dr. Joseph K. Mung'atu – JKUAT
6. Sis. Veronica Thiga - SoMCoDI

**Group 4: Developing Synergies and Identifying Practical Models for RE and Food Processing**

- Identifying innovative food processing technologies and practices which increase the food quality, decrease the yield gap and maximize the use of RE sources
- Develop techno-economic models for integration of RE and food processing
- Assess potential impact of changes on capital investment, job creation, income generation, decreased post-harvest losses and energy costs
- Identify key stakeholders (e.g. farmers, food processers, energy suppliers, local government, financiers, educationalists, etc.) and establishing a post-harvest food chain multi-stakeholder network to support the project

Members

1. Fridah Mugo - UoN
1. Backson Ndira – BIMAS Ltd.
2. Rhoda Kilonzi -KENFAP
3. Otieno Abich- ATDC
4. C. Gathambiri-KARI
5. Victor Esendi –PAC
6. U. Mutwiwa-JKUAT

**Appendix 4: Group Photograph**