CLIMATE INNOVATION AND ENTREPRENEURSHIP IN TANZANIA

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EXECUTIVE SUMMARY

Existing Technology Needs Assessments carried out in African countries within the framework of UNFCCC and findings coming out of the dialogue within the African European Climate Innovation Initiative (AECII) have revealed that Africa faces special conditions, challenges and opportunities for climate innovation entrepreneurs, investors and policy makers. In Africa, the institutional frameworks for facilitating innovation in general and climate innovation in particular are largely little developed. Secondly, awareness of and aspiration for overcoming climate challenges through actively pursuing climate innovation opportunities is not well developed. A study was initiated to provide a response to these shortfalls and thereby facilitate an improved foundation for African countries engaging into global climate change efforts and in benefitting from new growth opportunities provided by climate innovation and entrepreneurship. This initial assessment in Africa was intended to review the general conditions for facilitating climate innovation through joint efforts among stakeholders within the triple helix with a particular emphasis on supporting climate innovation entrepreneurs in bringing their products (i.e. their “climate solutions”) to the market. Initial countries selected for the study were Ghana and Tanzania.

The Tanzania study reveals that there are a number of innovative activities in Tanzania directly addressing climate change. There are clear indications of collaborative work involving Government, Entrepreneurs, NGOs and Academia. An analysis of such efforts shows that most activities on climate innovation and entrepreneurship are conducted by the private sector in collaboration with local and international NGOs with minimal inter-institutional coordination. Knowledge institutions are engaged in supporting climate entrepreneurship and innovation through their outreach programmes and specific courses on climate change and the environment. The Government departments and agencies are mainstreaming climate change, climate innovation and entrepreneurship into policies, strategies and plans while executing specific programmes aimed at environmental conservation. Policy review is being undertaken in the context of fragmented sectoral policies and a lack of a comprehensive national policy addressing the issues of climate change, climate innovation and entrepreneurship. The key institutions and components comprising the National System of Climate Innovation exist but they do not operate as a coherent system with formalised Institutional collaboration and structured interaction frameworks.

There is general awareness especially in the private sector of the potentials and opportunities that climate change poses for innovation and entrepreneurship in Tanzania. There is, however, lack of clear approaches on how to exploit these potentials and opportunities. Knowledge institutions and other actors in the field of climate innovation and entrepreneurship generate a lot of information, but there is lack of a formal knowledge management system. Entrepreneurs in this field face the following major challenges:

- Lack of information on technologies and markets
- Lack of financial instruments to facilitate climate innovation and entrepreneurship
- Lack of business management skills to fully engage in a continuously competitive business environment
A poor business enabling and regulatory environment

To build an environment which will accelerate climate innovation and entrepreneurship in Tanzania the following recommendations are made:

**Policy:** The Government should harmonise its policies to ensure the mainstreaming of climate change, climate innovation and entrepreneurship into a national climate change policy. Similarly, Private sector and Civil Society Organisations should include climate innovation and entrepreneurship into their institutional policies, programmes, and projects. The government, Private sector, and Civil society should all engage in policy revision/formulation to come out with policies that provide a conducive environment for climate innovation and entrepreneurship. In a collaborative effort, all stakeholders should also engage in determining the national position in international climate change negotiations.

**Coordination and harmonisation of Government Initiatives:** Harmonisation of policies on climate change, climate innovation and entrepreneurship need an operational environment which ensures sustainable implementation of the policies. The government needs to establish a mechanism that ensures coordination of the various initiatives undertaken by the various Ministries, Departments, Agencies and other actors.

**Stakeholders Collaboration and Interaction:** A platform should be created for structured stakeholders' interaction where climate innovation and entrepreneurship issues will be addressed. The platform will also provide an opportunity for knowledge exchange and networking.

**The National System of Climate Innovation (NSCI):** The current interactions of the various components/elements of the NSCI needs to be further studied to determine a more organised NSCI with the objective of developing a structure which will accelerate climate innovation and climate entrepreneurship.

**Knowledge Management:** Information generated by the various stakeholders should be collated, packaged, stored and disseminated. There is need to identify an institution to undertake this task and promote knowledge sharing among the stakeholders.

**Climate Innovation & entrepreneurship development:** Interaction between knowledge institutions and entrepreneurs should be promoted. Collaboration between local enterprises and foreign firms and organisation involved in climate innovation should be promoted to facilitate Access to Technology

**Entrepreneurship and Business Management skills development:** Entrepreneurs need to muster business skills and recognise opportunities posed by climate change. Institutions involved in entrepreneur development should engage in imparting skills related to the exploitation of climate innovation and enhance the competitiveness of enterprises engaged in businesses relating to climate change.
**Investment promotion:** District and Regional Business Councils should promote investments involving the exploitation of opportunities arising out of climate change in their locations and provide incentives for such investments. The Tanzania Investment Centre should promote local and foreign investments in climate change related projects.

**Access to Finance:** More studies need to be done to determine how entrepreneurs in Tanzania can benefit from the international financial facilities provided for under COP resolutions. Individual entrepreneurs and support organisations need to study, understand and exploit the funding opportunities provided by the COP resolutions. Financial institutions need to be fully involved in providing innovative solutions to facilitate financial access to climate entrepreneurs and to end users of technologies.

**Markets and Market information:** Private sector organisations, NGOs and support institutions should assist entrepreneurs by providing them with market information and promoting linkages to markets. Financial institutions can also contribute by extending financial packages to end users to enable them procure products that are a result of innovations from entrepreneurs.
List of Abbreviations

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<tr>
<td>CAMARTEC</td>
<td>Centre for Agricultural Mechanization and Rural Technologies</td>
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<td>CDM</td>
<td>Clean Development Mechanism</td>
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<td>CoET</td>
<td>College of Engineering and Technology</td>
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<td>COP</td>
<td>Conference of the Parties of the UNFCCC</td>
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<td>COSTECH</td>
<td>Commission for Science and Technology</td>
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<td>DCCFF</td>
<td>Department of Commercial Crops, Fruits, and Forestry</td>
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<td>MAFC</td>
<td>Ministry of Agriculture Food and Cooperatives</td>
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<td>MECI</td>
<td>Morogoro Engineering Cluster Initiative</td>
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<td>MITM</td>
<td>Ministry of Industry Trade and Marketing</td>
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<td>MOP</td>
<td>Meeting of the Parties</td>
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<td>REA</td>
<td>Rural Energy Agency (in the Min. of Energy)</td>
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<td>REDD</td>
<td>Reduced Emissions from Deforestation and Degradation</td>
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<td>Sida</td>
<td>Swedish International Development Cooperation Agency</td>
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<td>SIDO</td>
<td>Small Industries Development Organisation</td>
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<td>SUA</td>
<td>Sokoine University of Agriculture</td>
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<td>TASEA</td>
<td>Tanzania Solar Energy Association</td>
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<td>TaTEDO</td>
<td>Tanzania Traditional Energy Development Organization</td>
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<td>TCCIA</td>
<td>Tanzania Chamber of Commerce Industry and Agriculture</td>
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<td>TCMP</td>
<td>Tanzania Coastal Management Partnership</td>
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<td>TIC</td>
<td>Tanzania Investment Centre</td>
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<td>TIRDO</td>
<td>Tanzania Industrial Research and Development Organisation</td>
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<td>TPSF</td>
<td>Tanzania Private Sector Foundation</td>
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<td>UDSM</td>
<td>University of Dar es Salaam</td>
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<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<td>WIOMSA</td>
<td>Western Indian Ocean Marine Science Association</td>
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<td>WWF</td>
<td>World Wide Fund</td>
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<td>ZALWEDA</td>
<td>Zanzibar Livestock Welfare and Development Association</td>
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<td>ZaSCI</td>
<td>Zanzibar Seaweed Cluster Initiative</td>
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<td>ZASEA</td>
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<td>UDSM</td>
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1. INTRODUCTION
The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992. The treaty is aimed at stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The UNFCCC recognises the “The specific needs and special circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change ...” (Article 3.2). Details of the UNFCCC and COP meetings are shown in Annex i for the readers’ information.

Global efforts to address the impact of climate change and the institution of necessary steps to mitigate and adapt to climate change recognise the special situation of developing countries in realising the full potential of technologies for combating climate change and related constraints associated with access to these technologies. The need to provide innovative solutions to the special challenges for developing countries is the focus of the World Wild Wide Fund (WWF) initiative. A climate innovation is defined by WWF as “a transformative technology (non-fossil, non-nuclear goods or services) that can have a significantly positive effect on climate change if applied at scale.”

Climate innovations have been identified by the WWF network as an inevitable component in society’s transformation to a low-carbon economy. By addressing the field of innovations WWF wants to highlight measures that can accelerate the dissemination of new technological systems and other innovative solutions. The objective for this analysis is to build decision makers understanding for the conditions for climate innovation research, development and diffusion (RD&D), and to provide input for WWF’s work on improvements of these conditions.

African countries are typical developing countries. Climate change can bring an immediate disastrous effect on people’s livelihoods there or even worse for the poor, especially when extreme weather conditions occur more often and natural resources depleted due to increased temperature and other nature disasters. Existing Technology Needs Assessments carried out in African countries within the framework of UNFCC and findings coming out of the dialogue within the African European Climate Innovation Initiative (AECII) have revealed that Africa faces special conditions, challenges and opportunities for climate innovation entrepreneurs, investors and policy makers. There should be a renewed thrust to institute development and poverty reduction into the climate agenda especially due to the fact that developing countries are better placed to provide solutions to challenges posed by climate change. To tackle the climate change, we need innovative technologies and solutions. WWF respect and support the developing countries’ right to development. Besides the technology transfer from developed countries to developing countries, WWF also sees the potential in developing countries to develop their domestic innovation and Ghana and Tanzania in Africa with rapid economic growth can be good examples. It is this view that provides the backbone for the two country studies.
This report presents the findings of the Tanzanian study primarily set to find out the climate innovation conditions in Tanzania. The study has involved climate innovators and entrepreneurs, academia, civil society and the government. The first section provides the methodology employed in conducting the study. The second section presents the findings and an analysis of the findings while the last section provides conclusions and recommendations.

2. METHODOLOGY

The methodology started with desk study of available literature on climate change and climate innovation initiatives in Tanzania. Following the literature survey, the methodology included a combination of direct (face to face) interviews, focus group discussions, questionnaire filling-in, and personal observations. The interviews and questionnaire administration were conducted to individuals and groups of people. Interviews were conducted mostly at the interviewees’ work places. Where the interviewees could not be met at their working places meetings were arranged out of work places such as discussion dinners, lunches, meetings in seminar rooms, discussions at sites on innovation activities, and so on. Information was also obtained at a workshop in climate innovation and entrepreneurship held in Dar-Es-Salaam on 16th July 2009 (Annex ii).

Questionnaires were used to either guide the discussion or were left with the interviewees to fill in at their own capacity and time and then the questionnaires were collected after the agreed period. Some interviewees filled in the questionnaires electronically whereas others filled in the hard copies. Examples of filled in questionnaires are shown in Annex iii. The interviews were followed by visits to different areas where entrepreneurs had ongoing activities or the interviewees were working with groups of people or individuals.

The main interviewee groups were:

1. Government ministries, departments and agencies responsible for energy, environment and/or climate change issues
2. Knowledge institutions e.g. universities, technical colleges, and vocational training colleges,
3. Private entrepreneurs/practitioners such as users of biogas, solar power, etc
4. Private Sector Organisations such as TPSF and TCCIA.
5. NGOs including TaTEDO, TASEA, ZALWEDA, ZASEA.

The list of interviewees is shown in Annex iv.

3. GENERAL FINDINGS

3.1 General situation in Tanzania

There are some innovative activities in Tanzania that are directly or indirectly addressing climate change. From the government level to knowledge institutions and the private sector there are individual and combined efforts to address climate change. An analysis of such efforts shows that most activities on climate innovation and entrepreneurship are conducted by the private sector in collaboration with local and international NGOs. Knowledge institutions are engaged in supporting climate entrepreneurship and innovation through their outreach
programmes, collaborative research work, and extension but there are no specific courses on climate change. The Government, departments and agencies are mainstreaming climate change, climate innovation and entrepreneurship into policies, strategies and plans while executing specific programmes aimed at environmental conservation.

According to Kihedu et al. (2006), in 2006, Renewable Energy Organizations operating in Tanzania were as follows: A total 167 organisations grouped as: Government Organisations (21), Projects and Development Partners (27), Private Companies (73) and Non-Governmental Organisations (46). There are also users of renewable energy systems which are: Large (Tanzania Telephone Company Ltd, Mobile Telephone Companies, Tanzania Railways Corporation, Tanzania-Zambia Railway Authority, Tanzania-Zambia Mafuta, Tanzania Harbours Authority) and small (Institutions and domestic users).

3.1.1 Government Ministries, Departments and Agencies
It was observed that at the government level, there has not been much innovation on the climate issues but all the ministries and departments responsible for climate change are already making efforts through:

1. Revision of the existing policies and regulations to include climate change issues and defining the role of government. Most of the policies and regulations address conservation of the environment. Issues like coastal erosion (shoreline changes, sand mining, coral protection etc), forest degradation, destructive fishing and so on feature very well in the policies and regulations. The issue of climate change and especially climate innovation and entrepreneurship are not addressed in any specific policy.

2. There are efforts by some departments to address climate change including writing proposals for implementation of some strategies or working with entrepreneurs in addressing issues such as renewable energy. These were observed in the Rural Energy Agency in the Ministry of Energy in Dar es Salaam and Department of Crops and Fruits in Zanzibar.

Whereas most Government ministries, departments and agencies (MDAs) have sections dealing with environment issues there is very little coordination and interaction between these MDAs and each MDA handles issues related to the implementation of specific institutional policies. The absence of a single policy framework on climate change and the lack of a structured interaction framework are a result of lack of a comprehensive national guidance/policy on climate change, climate innovation and entrepreneurship.

3.1.2 Non-Governmental Organisations
Local Non-Governmental Organisations (NGOs) such as SURUDE, TaTEDO, TASEA, ZASEA, and ZALWEDA are actively engaged in programmes promoting climate change mitigation and climate entrepreneurship. Their programmes include: biogas plant installation, economy stoves manufacture and utilisation, solar energy installations, tree planting, training and sensitisation. International NGOs including Sida, DANIDA, GTZ, are supporting climate innovation activities through government agencies and local NGOs in areas of biogas utilisation and training of trainers in renewable energy entrepreneurship.
3.1.3 Knowledge and R&D Institutions
There are very limited initiatives within the knowledge and R&D institutions such as the University of Dar Es Salaam which through its College of Engineering and Technology is running a programme on innovation systems and clusters where two cluster initiatives are preparing to address issues of climate innovation and entrepreneurship. These are biofuel cluster initiative and sisal cluster initiatives whose activities are expected to be implemented in the next 2 – 3 years. Within the University also the Institute of Resource Assessment is implementing the Reduced Emissions from Deforestation and Degradation (REDD) programme with international organisations to address climate change issues. Tanzania Industrial Research Organisation (TIRDO) designs, manufactures prototypes, and promotes the use of solar dryers for fruits, vegetables and fish drying in southern Tanzania and Kigoma regions. The Centre for Agricultural Mechanisation and Rural Technology (CARMATEC), a parastatal organisation under the Ministry of Industries, Trade and Marketing is engaged in the design development and installation of biogas plants, solar cookers and solar heating systems. The Commission for Science and Technology is actively engaged in the promotion of domestic energy efficient systems by providing entrepreneurs with training in the manufacture of economy stoves.

3.1.4 The Private Sector and Private Sector Organisations
The private sector is the most active in climate innovation. There are a number of groups and individuals running different innovative activities directly addressing climate change issues. These include bio-energy (e.g. biogas, biodiesel), solar energy, wind energy, water use projects etc. What is interesting is the high level of awareness on climate change among the ordinary citizens. Although not many people are engaged in activities related to innovation and entrepreneurship, they are aware of climate change through advertisements put by the different stakeholders and their personal observations of changes in climatic conditions affecting their own lives. The Tanzania Private Sector Organisation (TPSF) and the Tanzania Chamber of Commerce Industry and Agriculture (TCCIA) are mainstreaming climate innovation and entrepreneurship into their institutional programmes to promote and support climate innovation and entrepreneurship in Tanzania. This is done mainly through accepting proposals with climate change components, training on issues related to climate change, and supporting such initiatives through technical assistance.

3.2 DETAILS OF FINDINGS
3.2.1 Government Ministries Departments and Agencies
The government of the United Republic of Tanzania using the Environment Management Unit (EMU) of the Ministry of Agriculture, Food and Cooperatives is addressing climate change and climate change innovation issues in the following areas:
1. EMU is engaged in Conservation Agriculture where it is developing a Natural Land Use Master Plan to influence the formation of policy on the correct land use addressing conservation in order to prevent misuse of land e.g. using land for house construction instead of agriculture. The policy is being developed.
2. To conduct research on types of crops that need to be planted according to existing weather conditions and their associated cropping systems to ensure land conservation.
3. In this ministry, like in many other ministries, there is no policy that is directly related to climate change and climate innovation. However, the EMU has developed a statement on climate change and climate innovation that will be included in the main Environment Policy. This will be the first ministry to have such a statement in the country main Environment Policy.

4. It has been established that all projects that will be funded under the ministry should have an Environmental Impact Assessment (EIA) before implementation. The ministry is using projects and programmes such as Agricultural Sector Development Programme (ASDP), District Agricultural Development Projects (DADPs), and District Development Programmes (DDPs) to work on incorporation of climate change and climate change innovation issues through EIA.

The government is embarking in developing National REDD Strategy in response to global REDD initiative (www.reddtz.org). There are various programs and projects that are currently being implemented as REDD quick start initiative in the country. Among others are the UN-REDD Programme- Tanzania Quick Start Initiative, a joint programme by UNDP, FAO and UNEP and Facilitation for the Preparation of a National REDD Strategy in Tanzania, a project being implemented by the Institute of Resource Assessment of the University of Dar es Salaam. The government through the Vice President’s Office and Ministry of Natural Resources and Tourism has established a National REDD Task Force. The Task Force is responsible for administering the process of developing a National Strategy for REDD and for enhancement of the voluntary carbon market in Tanzania. A National Climate Change Steering Committee has also been formed which links with National Climate Change Technical Committee; together with the NMCM and National REDD Trust Fund. REDD as a concept introduced in climate change policy negotiations, is a crosscutting issue involving various sectors and broad range of stakeholders. Thus REDD initiative in Tanzania involves various National and Sectoral Policies and Acts to explore on a number of policies, programs and Acts that are directly or indirectly related to the establishment and implementation of REDD initiative in Tanzania in order to bring significant attention to the importance of carbon storage as an ecosystem service.

In the Ministry of Energy and Minerals, the government through the Rural Energy Agency (REA) is supporting entrepreneurs in renewable energy in a number of initiatives of wind, solar, hydro, and biogas energy. Entrepreneurs who write proposals on use of renewable energy can be funded and given technical support through REA. They are currently working with the following entrepreneurs:

1. Energy Efficient technology –making bricks out of crop bio-products and grass. This is done in Mpwapwa district in Dodoma Region.
2. Biogas from food left-over (e.g. tomatoes) is being produced in Songea district, Ruvuma region where they have about 9 projects going on. In this project, they help the communities to use small credit systems such as Village Community Banking (VICOBA) as source of fund for the biogas projects. They also collaborate with an NGO called Appropriate Rural Technology Institute (ARTI) that originated in India.
3. To reduce the use of wood fuel, REA is helping the Tanzania Electricity Supply Company (TANESCO) to extend its grid to rural areas, where otherwise, TANESCO would not have been able to reach.

4. REA is also planning to conduct stakeholders’ inventory in order to know where climate entrepreneurs and stakeholders are. REA is also conducting training in rural areas on hydropower in all 26 regions of Tanzania, Solar energy in Sumbawanga (Rukwa) and Kigoma.

The funding is provided as a grant to enable rural communities implement renewable energy projects. Currently, the projects are implemented only on mainland Tanzania. REA collaborates with institutions such as Community development in Ilonga-Morogoro, CoET-UDSM, Vocation Education and Training Authority (VETA), Dar es Salaam Institute of Technology (DIT) and rural technology centres (e.g. Mpwapwa Solar Wind Workshops in Dodoma and Diocese of Rorya in Mara Region) and Collaboration Youth Centres Development Programme in Ilonga. REA gets its funding from the government through allocation of the treasury but it also gets funding from the World Bank, Sida (Sweden), and the Norwegian NORAD. They have recently added the Clean Development Mechanism (CDM)\(^1\) component in which they will encourage development of proposals on use of clean energy.

Main challenges that they face are:

- Limited investments in the renewable energies sector which is resource intensive.
- Low financial capacity of rural communities to procure and run renewable energy projects e.g. purchase of solar energy systems.
- Limited resources for implementation of designed project.

The Centre for Agricultural Mechanization and Rural Technologies (CARMATEC) is a parastatal organisation under the Ministry of Industries Trade and Marketing with its headquarters in Arusha. Its aim is to improve rural life through development, adaptation and implementation of appropriate technologies in the field of agricultural mechanisation, water supply, building construction and sanitation, rural transport and energy. (CARMATEC) carries out applied research to facilitate the designing, adaptation and development of machinery and equipment suitable for use in agricultural sector and rural development. It also develops and manufactures approved prototypes and components of farm implement, and evaluates their suitability for local use. It also performs tests on all types of machinery and equipments intended for use in agricultural and rural development in the country and offers consultancy services on designing, testing and other technical aspects of agricultural mechanisation. To reach its goals, CARMATEC has installed and commissioned more than 1000 biogas plants in Tanzania. CARMATEC works in collaboration with the other institutions, NGOs and so on mentioned here and therefore some of the bio, an effort that is directly addressing climate innovation and entrepreneurship.

\(^1\) Clean Development Mechanism (CDM) is an initiative that creates new opportunities for Tanzanian companies and institutions to secure investment through the implementation of well designed projects that generate carbon credits. Funded by UNEP, Tanzania had registered one CDM project (Mtoni landfill gas recovery project, with a total of 202,271 CERs/year) in early 2008 and more than a dozen others are in the pipeline.
The government has a partnership with the United States of America through its International Cooperation Agency (USAID) called the **Tanzania Coastal Management Partnership** (TCMP) under the National Environment Management Council (NEMC). TCMP gives advices to the government on policy issues as well as developing and running projects that address climate change but with little bearing towards climate innovation and entrepreneurship. In recent efforts, and in recognising the importance of climate change issues, TCMP is working in projects on combating coastal erosion such as set coastal buffer zones, set back lines, tree planting and so on.

Apart from the Ministry of Energy and Minerals which is directly involved in issues on climate change, in its 2009/2010 budget, Tanzanian government through its ministry of water and irrigation has put strategies to cope with effects of climate change including rainwater harvesting at household level and use of hydropower. According to MWANAHALISI (July 15-21), (www.ippmedia.com) in presenting the budget, the minister for the Ministry of Water and Irrigation, Hon. Prof. Mark Mwandosya stated that the ministry will implement rainwater harvesting as one of the strategies to cope with climate change. He mentioned that the following main meetings were held and their outcomes defined:

1. Meeting of the ministers responsible for water from the Southern African Development Community (SADC) held in Mwanza, Tanzania on 6\textsuperscript{th} November 2008 developed the **strategies to cope with climate change and to give priority to developing infrastructure for hydropower.**
2. Meeting of ministers responsible for water, agriculture, and energy held in Sirte, Libya on 15 – 17 December 2008 (preceded by a meeting of professionals of water and irrigation held in Gaborone, Botswana on 14\textsuperscript{th} November 2008), had the agenda of **Water for Agriculture and Energy in Africa: the Challenges of Climate Change**-to urge each country to promote irrigation agriculture.

The minister urged that having seen the effects of climate change and need to act fast, the government (including his ministry) will incorporate climate change issues in its policies to able to come out with strategies to combat climate change.

In the Zanzibar Islands, the government through its ministries and departments has initiated activities towards climate innovation. One such department is **Department of Commercial Crops, Fruits, and Forestry** (DCCFF) which is developing a proposal (with the Institute of Marine Sciences-IMS-UDSM in Zanzibar) to work with the University of Turku in Finland to look into practical measures to tackle climate change through coastal buffer zones and shoreline change in Zanzibar. DCCFF is also collaborating with Solar Africa for installation of solar cookers and stoves in different parts of Zanzibar. To reduce the cutting of trees, DCCFF is training villagers in handcraft, the aim being to provide them with optional skills as a source of income in order to reduce cutting of wood. DCCFF is also working to raise awareness on the REDD project to reduce carbon emission especially on conservation and rehabilitation of forests and vegetation. The department encourages people to use gas rather than electricity and to show an example, all the staff of DCCFF in town use gas as source of energy in their houses. DCCFF conducts exhibitions and demonstrations on gas cookers. They had worked on promotion and distribution of improved stoves that use less charcoal and now they are working on solar energy. In addition to the collaborations mentioned, DCCFF collaborates with Salama Gas in Zanzibar, Tanzania Meteorological Agency, Zanzibar station, and NGOs such as CARE. DCCFF has
developed a Forest Reserve Management Plan for Zanzibar as its 2020 plan and issues on climate change are part of the plan.

The Department of Environment (DoE) in Zanzibar like other government departments is reviewing the Environment policy to include climate change issues. It is now involved in tree planting as carbon sinks and also conducting a study on status of erosion in Nungwi area in the northern tip in order to know what is there, ready for action after the policy is reviewed. DoE carries out climate change awareness programmes such as annual exhibitions on biogas, solar, and efficient cookers. On world environment day, DoE conducts a tree planting day and also exchange programmes on environment practitioners to e.g. Pemba (2008), Tanga (Usambara and Lushoto forests), and Morogoro. This is mainly to address the issue of use of wood fuel because the poor coastal communities rely mostly on wood fuel. DoE collaborates with Environment Committees, Community Based Organisations, Forestry Department and Agriculture Institute in Kizimkazi, Zanzibar. For funding, DoE gets money from private efforts, the government, and projects such as Marine and Coastal Environment Management Project (MACEMP, WB), Regional Programme for the Sustainable Management of the Coastal Zones of the Indian Ocean (ReCoMap, EU), and Sustainable Management of Land and Environment in Zanzibar (SMOLE, Finland).

DoE faces some challenges which are:

- Limited funding to implement its activities
- Priority setting – policy makers do not think that climate change activities are a priority
- The poor communities do not readily understand how to start and run climate change technologies.
- Poor technology innovation
- Poor coordination among stakeholders

DoE recommends that climate change and climate innovation should be mainstreamed into government policies and priorities. Climate change and climate innovations need incorporated into the government’s poverty reduction strategy and more efforts need to be put in promoting use of alternative energy. It is recommending more collaboration between government departments, companies, and other stakeholders on climate change.

3.2.2 Knowledge institutions

The College of Engineering and Technology (CoET) of the University of Dar es Salaam (UDSM) is working together with Sida and VINNOVA of Sweden to run the ISCP-Tz. Under this programme, a number of cluster initiatives have been formed and some of them are conducting activities related to climate innovation and entrepreneurship. The cluster initiatives include: Biofuel cluster in Dar-Es-Salaam, Seaweed cluster in Zanzibar (ZaSCI), Engineering cluster in Morogoro (MECI), Sisal cluster Initiative in Tanga etc. The sisal cluster is preparing to produce biofuel from sisal bi-products. The Biofuel Cluster Initiative in Dar-Es-Salaam is in the developmental stage. Activities of ZaSCI and MECI will be discussed in the section on private sector and private sector organisations (section 3.2.3.6).

The Institute of Resource Assessment (IRA) of UDSM is the Secretariat to the National REDD Task Force for the implementation of the REDD project (see 3.2.1 above). IRA among other
things handles applications for research projects on issues prioritised in the REDD project which are mainly concerned with estimating extent of deforestation, carbon sequestration and emissions. IRA has conducted some studies to show the activities on renewable energy such as the use of biogas in Rungwe district (SW) where there are already some households that use biogas. In this district there is a high potential of biogas use because of high number of cattle and scarcity of firewood. The study showed that apart from the already existing biogas use households, there is a 90% potential for more use of biogas (Mwakaje 2008).

The **Vocational Education and Training Authority (VETA)** and **Agricultural Training Institutes** e.g. those based in Dar es Salaam, Morogoro, and Zanzibar have not included climate change innovation and entrepreneurship in their curricula but having realised the need for that, they are planning to review the curricula to include climate change and especially innovation and entrepreneurship. However, they do send their students to do climate change related field works and perform demonstrations on issues like tree planting for carbon sequestration and coastal set back line issues. They also work with NGOs such as ZALWEDA, SURUDE, TASEA, ZASEA and government departments e.g. DoE as trainers of members of the NGOs and also to conduct collaborative demonstrations and exhibitions.

**Tanzania Commission for Science and Technology (COSTECH)**

COSTECH is a parastatal organization affiliated with the government, created by an act of the Parliament of Tanzania in 1986. The Commission is a subsidiary institution to the Ministry of Higher Education, Science and Technology. The function of COSTECH is that of “co-ordinating and promoting research and technology development activities in the country.” Government-funded science activity in the country is governed by the commission, and duties include the administration of research grants, maintenance of research registry and science information services, setting research policy and creating incentive for invention and innovation.

Through its energy programme, COSTECH has facilitated and coordinated the use of renewable energy technologies in rural areas as follows:

- Two solar energy projects for lightening of the village school, dispensary and community centre in Zanzibar and Mtwara.
- Prepared a 10-year solar energy programme document which was tabled at the UNESCO organized World Solar Summit in Harare 1996.
- Coordinated and facilitated TaTEDO to train 26 artisans in production of improved stoves in Kilimanjaro region.
- Facilitated the popularization of smokeless stove that has solved the problem of excessive heat and smoke developed by experts from CoET-UDSM.
- COSTECH is coordinating and facilitating the development of technology to manufacture coal biomass briquettes from Kiwira coal dust, and has designed and developed a prototype of the briquette pellets coal-stove known as KUUTE coal-stove.
- Supported CAMARTEC in the manufacturing and demonstration of solar parabolic and solar box cookers.
- In order to popularize wind energy technologies COSTECH prepared a TV programme that raised a lot of interest and enquires for the technology after being aired in a television.
• In collaboration with other stakeholders including the Ministry of Energy and Minerals, COSTECH has participated and provided funds for carrying out a study of the status of wind energy technologies in Tanzania. A survey of wind energy has been covered in ten (10) regions in Tanzania. After the study, COSTECH repaired wind driven water pumps that
• COSTECH in partnership with Tanzania Traditional Energy Development Organization (TaTEDO) and the Institute of Social Work (NISW) has won a bid to establish SADC Sub-regional Centre for Sustainable Rural Energy Programme (SCRED) under the SADC Land Degradation and Desertification Control Programme. A programme has been prepared which will be used to mobilize resources from both internal and external development partners.
• Currently COSTECH is reviewing the National Science, Technology and Innovation policy to include climate change issues.

Tanzania Industrial Research and Development Organisation (TIRDO)
TIRDO is an Organization under the Ministry of Industry Trade and Marketing charged with responsibility of carrying out applied research and provision of technical services to industries. The core areas are:
• Agro technology and Industrial Chemistry,
• Food and Microbiology,
• Energy and Environment,
• Information Technology and Instrumentation,
• Leather and Textile
• Materials Science Technology.

TIRDO tests the efficiency of the newly developed fuel efficient stove produced by e.g. TaTEDO before being disseminated to end users.

Tanzania Engineering and Manufacturing Design Organisation (TEMDO)
TEMDO is a parastatal organisation based in Arusha. Its mission is to promote engineering design, technology development and enhancement of the competitiveness of local manufacturing enterprises through provision of quality technical support services. The main functions of the organisation include:
• To design and promote the designing of products and processes for Tanzania industry in accordance with national Industrial development Policy.
• To adopt foreign design for machinery and equipment to suit local conditions of manufacture, use and maintenance.
• To manufacture and develop prototypes and spares based on the designs produced by the organization as well as those which may be brought to the organization.

TEMDO has developed fuel efficient stoves such as Waste-oil stove- without oven and water heater that uses less than 1 litre of waste oil mixed with water in the ratio of 3:1 per hour and Multipurpose stove that combines a hot plate for cooking, an oven for baking and a water heater in one unit. The latter uses one litre of waste (used) oil per hour of continues use.
3.2.3 The Private Sector and Private Sector Organisations

Individual enterprises should take the lead in exploiting opportunities posed by climate change and bring to market products and services that mitigate the impact of climate change or adapt to climate change. Entrepreneurs have to operate in an environment that interacts with many actors. It is only when all the actors have a common understanding of the challenges posed by climate change and a common resolve to address these challenges is it possible to get full support for climate innovation and entrepreneurship. There is evidence that some enterprises in Tanzania are seizing opportunities posed by climate change with the support of Government, local and International NGOs and knowledge institutions.

3.2.3.1 Biogas Technologies

Among the entrepreneurs working in promoting and using biogas is the Zanzibar Livestock Welfare and Development Association (ZALWEDA) which started two years ago. Based in Zanzibar, the NGO works with livestock keepers who use the animal wastes for producing and using biogas in their homes. It has 116 members 30-40% of whom are women. Currently there are 162,000 cattle, 60,000 goats, and 1,000,000 poultry under ZALWEDA. ZALWEDA has developed a “Super Class System” of biogas production (Fig. 1) which they install for its members.

Fig 1. A super class biogas system (photo on the right) developed by ZALWEDA

Two pilot biogas installations have been done and six more are in the pipeline, and later they will install fifteen more. ZALWEDA is currently funded through a collaborative project with the Danish organisation DANIDA, the Dan – Tan Project. It collaborates mainly with other NGOs and is also a member of the association of NGOs in Zanzibar, ANGOZA. An example of an entrepreneur working with ZALWEDA in producing and using biogas at home is the home of Ms. Lucy John shown in Box 1. Having appreciated the work done by ZALWEDA, the Ministry of Agriculture and Livestock has offered ZALWEDA to review its Livestock Policy (Facilitators of ZALWEDA are also staff members of the Ministry). Upscaling of biogas technology through awareness campaigns & training and installation of more biogas plants is the strategy of ZALWEDA. It also aims at collaborating with knowledge institutions such as the Institute of Marine Sciences, Kizimbani Agricultural College etc in the future. ZALWEDA sees the low magnitude of understanding of the community on effects of climate change and their role to
reduce carbon emissions, understanding of alternative energy such as biogas, difficulty of changing their mind set, and lack of readily available and affordable option for energy source as their main challenges.

**Box 1. Ms Lucy John, Biogas producer & user**

Ms Lucy John lives in Kitope area in Zanzibar. She has three big cows and two small ones whose waste she uses to produce biogas. The installation of the biogas machinery was effected through ZALWEDA who helped with the purchase of the materials required and installation of the biogas plant which cost 750,000 Tsh. (~600 US$). She was required to contribute the land. Lucy uses the bi-product of biogas in her 1.5 ha farm as fertiliser.

There is also a Danish supported Sustainable Energy Project based in Karatu, Arusha. The Project has developed and built 2 biogas plants to test the possibilities of using biogas plant in energy supply to households in the area. It is being run by Karatu Development Association Econet (www.sepk.org/?lang=en&page=10).

**3.2.3.2 Solar Energy Technologies**

In the solar energy entrepreneurship there are some NGOs and individuals working in installing and using solar energy and solar energy devices and equipment. Zanzibar Solar Energy Association (ZASEA), an autonomous NGO for the development of solar energy on islands of Zanzibar, was officially registered in the Ministry of Home Affairs in 2006. With a mission to “provide people of Zanzibar with sustainable solar energy and knowledge about it that may allow them to have access to electricity and to fight poverty”, it works with entrepreneurs in villages in Zanzibar. ZASEA’s aim is to reduce the amount of fossil fuels used in households in Zanzibar by implementing the use of solar energy stating that solar energy “easily replaces kerosene lights and even raises the standards of living without any carbon dioxide pollution”. ZASEA in collaboration with the Department of Energy and Minerals-Zanzibar, and Deutsche Tansanische Freundschaft e.V. conducted the first day Solar Day in the history of Zanzibar on 21st – 22nd February, 2009, which consisted of awards presentations, exhibitions and paper presentations (Fig. 2). Other than creating awareness among Zanzibar residents, in the solar energy day solar companies from Tanzania mainland learnt the available market opportunities in islands of Zanzibar and in order to facilitate solar products diffusion in Zanzibar, Dr. Bilali proclaimed that the Revolution Government of Zanzibar has waived Value Added Tax on the solar products since September, 2008. Funded currently by Deutsche Tansanische Freundschaft e.V., ZASEA plans to be self-reliant, using its own funds in the future.
Working with photo-voltage systems, ZASEA has installed Solar Home Systems (SHS) for schools in more than ten schools and a number of households both in Unguja (Zanzibar) Island and in the sister Island of Pemba. In Uzi they had installed solar systems in 50 households by 2003 and Tumbatu, Pemba in 24 households. In Pemba ZASEA has installed a large system capable of producing 600 W in a centre for disabled people in Makundeni. In all these areas, ZASEA makes follow-ups for maintenance of the systems. Receiving financial support from One such household use of a small system installed by ZASEA is in Fuoni Kwarara area in Zanzibar where Mr. Juma Nassor Kombo uses the systems for household needs (Box 2).

Box 2 Mr. Juma Nassor Kombo and his solar system in Fuoni Kwarara Zanzibar

Mr. Juma Nassor Kombo lives in Fuoni Kwarara at the outskirts of Zanzibar town. He is a member of ZASEA. Through this NGO he has managed to obtain a solar system installed by ZASEA for his use as a source of light, for television and radio operation, and for charging mobile phones. He also provides the service of charging mobile phones to his neighbours for a small fee. Juma contributed 1,180,000 Tsh. (~US$ 1,000) for the installation of the system and he has been using it for six months now. He says that this is very economical for him as he would have used more than this amount if he were using the electricity from the national grid.

There is also a Solar Energy Station in Matemwe, Zanzibar (Fig. 3), where a demonstration solar system is installed for the villagers to use for their activities or to use as a model to build their own systems. The Solar Station (or "Kituo cha Jua" in the local language- Kiswahili) has objectives of: Providing a centre point for meeting, work, training and storage; Providing
alternative technologies to compensate fuelwood shortage (solar cookers, ‘rocket’ stove, insulation baskets); Providing means for harvesting rain water (installation roof and 20,000l cistern); and Dedicating an education/training programme to generate awareness and encourage its reproduction (www.solarfrica.net/activity/kituo/kituo.pdf). It aims at providing 12 k-14 parabolic reflector solar cookers of which five will be allocated permanently to the Kituo cha Jua itself and seven distributed to community households for implementation, research and awareness. At the same time 30 insulation baskets will be placed as a complimentary technology to energy efficient cooking, and adjacent to the building a ‘rocket’ stove (efficient burning fuelwood and charcoal technology) will be constructed for communal use. Funded by the Germany Embassy in Dar es Salaam, the solar station is part of the Solar Africa Project.

TASEA
Tanzania Solar Energy Association is a Private Sector Organisation engaged in the promotion of application of renewable energy technologies for sustainable economic development in Tanzania mainland. It is a member based organisation drawing its membership from corporate, associates, professionals and students. Among its active corporate members include: Ensol Tanzania Ltd, Umeme Jua, and BP Ltd, all engaged in solar energy technologies. TASEA has developed and distributed solar panels to a number of entrepreneurs in Tanzania. It tries to make cheaper solar panels that are affordable to the local community although prices are still high for village consumers. TASEA is currently collaborating with REA in a Sida project for promotion of solar technology utilisation in Tanzania. The component implemented by TASEA is the Training of Trainers where youths are sent abroad for studies and on returning they are
posted to the villages where they train installation technicians on the professional installation of solar systems.

In northern Tanzania there is a company called **Zara Solar Ltd, Tanzania** which has the aim of providing affordable solar systems in Northern Tanzania. Zara Solar, based in Mwanza, has recently opened a second branch in Dar-es-Salaam. The company was launched in 2005. Terming itself a "leading provider of solar PV in Northern Tanzania" Zara Solar employs five full-time technicians and has a network of 25 self-employed technicians spread around the region reaches rural customers. Zara Solar and its sister company Mona-Mwanza Electrical & Electronics both based in Mwanza provide high-quality, affordable PV systems in Northern Tanzania. It is a rapidly growing business that uses a network of self-employed technicians to reach out to the remote rural areas. Recognising that the customer base is poor and difficult to reach for servicing, Zara Solar insists on high-quality equipment that is less likely to break down, but buys it in bulk to get good prices. Zara plans to offer micro-credit facilities to make solar PV available to people (e.g. for home use, shops etc, Fig. 4 Source: www.ashdenawards.org/winners/zara). To date over 3,600 systems have been sold by Zara Solar Tanzania.

A man stands in front of his solar-home-system in Northern Tanzania.

Zara Solar shop

### 3.2.3.3 Biofuels

An emerging entrepreneur in biodiesel, Mr. Michael Mwakilasa, has a biodiesel company "Mafuta Sasa Biodiesel Ltd" in Keko Mwanga Gerezani area in Dar es Salaam. Having lived and worked in the USA for more than 10 years, Michael started the initiative six months ago to reduce dependence on fossil fuels. Michael's system uses discarded (used) cooking oil which he buys from hotels. He has established a mini-refinery which has so far produced 350 Litres of biodiesel (Box 3). To make biodiesel, the oil is mixed with sodium hydroxide and methanol. The process of producing biodiesel produces glycerine which he plans to use for making soap. He is an example of a real entrepreneur as he uses his own funds i.e. his source of funding is his own money.

**Box 3. Mr. Michael Mwakilasa, a biodiesel producer in Keko Mwanga Gerezani, Dar es Salaam**
A biodiesel entrepreneur, Mr. Michael Mwakilasa with his refinery in Keko Mwanga Gerezani area in Dar es Salaam. His refinery is expected to go into full production in the next few weeks where he will be able produce 3,000 Litres of biodiesel per day. He describes his biodiesel as an environmentally friendly safe, low pollution fuel for most internal combustion and turbine diesel engines. He sells the biodiesel to car users but his plan is to make tractor owners his main clients. Michael is planning to use Jatropha as a source of oil in the next few months.

SEKAB
SEKAB, a Swedish ethanol-producer, is an international company targeting large scale sugar cane Biofuel production in Tanzania. The company intends to use the Integrated Cluster Approach (Fig. 5). It is currently involved in a USD 550 Mio investment project to establish a 20,000 ha sugarcane-energy combine plant in Bagamoyo. The facility will on completion produce 100 GWh per year (roughly 8% of Tanzania current power generation) and 270,000 m$^3$ ethanol valued at approximately USD 500 Mio per year. SEKAB and other investors in large-scale biofuel are currently faced with great challenges for realizing such investment projects from a financial perspective and a global debate on the pros and cons of large-scale biofuel production viz-a-viz food production and land conservation. The disadvantages of large scale biofuel production include:

- Issues of land distribution, habitat damages resulting from mono-cropping, and deforestation
- Stress on water resources
- Insufficient participation and marginal benefits to local communities; and limited impact on overall poverty reduction resulting from an export oriented system for products and profits.

Some potential opportunities provided to Tanzania by large scale biofuel production may include:

- Knowledge and technology transfer
- Investment attraction to increase agricultural productivity;
- Natural resources stress relief as a result of increased productivity and fuel substitution away from wood fuel, job creation and increased export earnings.

The debate on the environmental and socio-economic sustainability of large scale remains heated.

The challenges with first generation biofuel – whether real or due to misunderstandings in an often heated debate – and the current economic crisis have made it difficult to attract investors.
for implementation of first generation biofuel plants. It has also become increasingly difficult to attract investors for development of commercially viable second generation biofuel production facilities. SEKAB is working with government, local communities, outgrowers, and other stakeholders to facilitate a participatory development and investment process a move that is aimed at overcoming the challenges it is facing.

Fig 5. SEKAB Cluster model for Biofuel production from sugar cane

3.2.3.4 Carbon Sinks
Tree planting initiatives.
Apart from the national Tree planting initiative various NGOs are supporting entrepreneur groups in tree planting activities. TaTEDO is operating in 19 districts in eight regions of Tanzania in Tree planting for wood fuel and as a multipurpose carbon sink. DoE in Zanzibar is working with local people in various villages, village environment committees, and NGOs to conduct tree planting. Tree planting is done either as initiatives of the different groups, on national tree planting day, or world environment day. The national tree planting day is conducted each year through Tanzania. TCMP is also working in tree planting projects.

3.2.3.5 Wind Energy technologies
Various institutions are actively promoting wind energy technologies for water pumping. These include: COSTECH, CAMARTEC, TASEA, and TaTEDO while others like ZALWEDA, ZASEA, TCMP, WIOMSA etc are planning to engage into wind energy initiatives. There are indications of investments in wind powered electricity generation investments in Singida Region in Central Tanzania.

3.2.3.6 Energy Efficiency Technologies
The Morogoro Engineering Cluster Initiative (MECI) produces environmentally friendly machines for use in e.g. processing seeds for oil. Enterprises in the Cluster Initiative manufacture machinery which inputs into programmes of other stakeholders: e.g. the Multifunctional Platforms promoted by TaTEDO is fitted with an Oil Expeller manufactured by Intermech Engineering Ltd a member of the MECI. Entrepreneurs in MECI working with COSTECH are manufacturing and selling economy stoves designed and developed by COSTECH. One successful entrepreneur working under this programme is Mr. Sokola Mwinyikondo (Box 4).
Mr. Sokola Mwinyikondo with his and MECI products

Sokola Mwinyikondo is a manufacturer of the KUUTE Model of economy stoves in the Morogoro Municipality. With his company, “Sokola workshop and general supplies”, he is a member of the MECI. Apart from increasing the entrepreneur's income by 500% over a three year period the number of stoves in use has resulted in an almost 40-50% reduction in domestic charcoal use. MECI is working with COSTECH where COSTECH trains members of MECI.

<table>
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<td>107,700,000</td>
<td>149,000,000</td>
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</table>

TaTEDO is also active in promoting fuel efficient domestic energy systems.

3.2.3.6 Organic farming and related activities

Other climate change innovation initiatives include those who practice organic farming. Examples are Gando Farmers Association based in Pemba Island, Zanzibar. In this association, farmers use only organic fertilisers and not industrial ones. In addition, they use plant based traditional plants such as neem tree to control pests in their crops rather than industrial pesticides and insecticides.

Likewise, members of the Zanzibar Seaweed Cluster Initiative (ZaSCI) also practice organic farming and selling of organic products so as to avoid use of industrial chemicals. They farm seaweed and they make sure that there is no source of chemicals near their farms such as fishing with poisonous chemicals or runoffs from land based farms that use industrial chemicals. To avoid destruction of the environment through harming intertidal animals and plants, ZaSCI farmers are implementing a method of farming seaweed in deep waters where they will not step on the intertidal organisms. ZaSCI members also purchase perfumed oils that they put in their seaweed soap from organic farmers such as Gando Farmers Association. ZaSCI is adding value to the farmed seaweed, an activity that will help to keep the farmers (and fishermen and other family members) out of using destructive fishing methods (and increased fishing pressure) resulting from effects of climate change especially when fishers look for cash to feed their household members. Members of ZaSCI are also using a new method of farming seaweed that enables to farm the higher priced seaweed thus bringing back men who had gone back to do fishing.

3.2.4 Intellectual Property Right
There is a University Intellectual Property Policy of 2008 which is based on the link between the university and the private sector. In this policy it is stated that while the private sector is interested in using the knowledge based assets, the university is interested in disseminating its intellectual property assets in a manner that will benefit the public, the researchers, and the institution. There is also collaboration between the university and researchers and institutions outside Tanzania. The university thus sees the importance of having an elaborate institutional intellectual property policy to govern relationships. It is stated that the initiative to put in place the institutional IP policy began in December 2003 and was borne out of one of the UDSM Five Years Rolling Strategic Plan (FYRSP) of 2002/03-2006/07. The goal is to establish an IP Unit at the UDSM under the Directorate of Research.

According to the policy, Tanzania has two level pieces of legislation that govern IP which are:

1. At the municipal level the legislations are:
   a. Patents Act of 1987,
   b. The trade and Service Marks Act of 1986,
   c. The Copyright and Neighbouring Rights Act of 1999 and

2. At the national level Tanzania does not yet have a comprehensive National Policy on IP. However, there are isolated statements relating to IP in various policy documents such as the Higher Education Policy of 1999, the National Science and Technology Policy for Tanzania of 1996, and the Sustainable Industrial Development Policy of 1996-2020.

More information shows that at the international level, Tanzania is a signatory to a number of international instruments governing intellectual property which include the Agreement on Trade Elated Aspects of Intellectual Property Right (TRIPS) of 1994, the Paris Convention for the Protection of Industrial Property of 1883 (The Paris Convention), and the Berne Convention of the Protection of Literary and Artistic Works of 1886.

3.2.5 Workshop on climate innovation and entrepreneurship

On 16 July 2009, 31 representatives of the business community, knowledge institutions, government and non-governmental organizations gathered at a workshop organized by the Western Indian Ocean Marine Science Association (WIOMSA) - in cooperation with the Tanzania Chamber of Commerce, Industry & Agriculture and the consulting firm Innogate Aps. The workshop was organized as part of an initiative of the World Wide Fund (WWF) and the Swedish International Development Cooperation Agency (Sida) to accelerate climate innovation and entrepreneurship in Africa. Within this initiative an assessment of the level of development of the national climate innovation system and the conditions facing climate entrepreneurs in Tanzania is being undertaken.

The presentations from stakeholders showed that a number of visionary climate innovation entrepreneurs in Tanzania - coming from enterprises as well as NGOs/CBOs - have demonstrated that it is possible to develop commercially viable business ventures and products that not only provide new development opportunities but also make a contribution to mitigate and adapt to climate change.
Challenges:
Entrepreneurs have a particularly important role to play in bringing forward new products and services for mitigating climate change and to enable people in adapting better to the consequences of current climate change. However, climate innovation entrepreneurs face a number of challenges in Tanzania. The key challenges were identified as:
- Lack of awareness of innovation opportunities.
- Lack of capital for funding product innovation.
- Lack of access to technology.

Knowledge institutions can play an important role in developing and transferring research and innovation to entrepreneurs for commercial application. However, the knowledge institutions are faced with a number of challenges that reduce their ability to support climate innovation and entrepreneurship. The key challenges were identified as:
- Little research outreach and thereby commercial application of existing and new research.
- Lack of research funds (possibly due to lack of priority).

The government obviously has an important role to play in terms of providing policies and incentives to facilitate climate innovation and entrepreneurship. However, it was agreed that:
- Climate innovation and entrepreneurship seems not to be a policy priority and the few initiatives that are in place suffer from weak implementation and enforcement structures.
- There is currently little dialogue between government and other climate innovation and entrepreneurship stakeholders in policy development.

A number of NGOs and CSOs are active in the field of climate innovation and entrepreneurship. However, they are faced with a number of challenges that reduce the overall impact of society. These are:
- Weak capacity and technical know-how.
- Outreach difficulties.
- Dependency on foreign funds.

Strategies and actions:

**Short term Actions**
- Implementation of climate innovation and entrepreneurship information and awareness campaigns
- Development of platform that enable better linkages and collaboration with a particular view to ensure that non-governmental stakeholders can engage in policy development.

**Medium term actions:**
- Development of financial mechanism that will enable
  - entrepreneurs to engage into prioritized climate innovation activities.
  - people to apply and benefit from available climate innovations.
- Development of climate innovation knowledge centres ("one-stop centres").
• Review and harmonise existing policies in order to enable them to better promote climate innovation and entrepreneurship.
• Sustained information and awareness activities that ensure an effective dissemination of information on climate innovations and markets to entrepreneurs as well as the general public.

3.2.6 Some summary extracts and illustrations from the study findings
Sample extracts of the responses from the different interviews are summarised in Annex v to give a summary of ideas given and actions taken or planned. These were extracted from results of all parts of the methodology, from filled-in questionnaires to personal observations. A theoretical illustration of the Entrepreneur’s Operational Environment and a National System of Climate Innovation are shown in Annex vi. These illustrations show the existing agencies and groups that should have close collaboration in dealing with climate innovation and entrepreneurship in Tanzania.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. CONCLUSIONS

Policy Framework- There is no comprehensive national policy addressing the issues of climate change, climate innovation and climate entrepreneurship.

National System of Climate Innovation- The key institutions and components comprising the National System of Climate Innovation exist but they do not operate as a coherent system with formalised Institutional collaboration frameworks.

Awareness-There is general awareness especially in the private sector of the potentials and opportunities that climate change poses for innovation and entrepreneurship in Tanzania. There is, however, a lack of clear approaches on how to exploit these potentials and opportunities

Knowledge management: Knowledge institutions and other actors in the field of climate innovation and entrepreneurship generate a lot of information. There is no single knowledge centre for collation, compilation, analysis and dissemination of knowledge in this field.

Climate Innovation & entrepreneurship development- Entrepreneurs in this field are faced with the following major challenges:
• Lack of information on technologies and markets
• Lack of financial instruments to facilitate climate innovation and entrepreneurship
• Lack of business management skills to fully engage in a continuously competitive business environment
- A poor business enabling and regulatory environment

4.2 RECOMMENDATIONS

Policy

Government:
The Government should harmonise its policies to ensure the mainstreaming of Climate change, climate innovation and entrepreneurship into a national climate change policy.

Private Sector Organisation and Civil Society
Private sector and Civil Society Organisations should include climate innovation and entrepreneurship into their institutional policies, programmes, and projects.

Policy engagement
The government, Private sector, and Civil society should all engage in policy revision/formulation to come out with policies that provide a conducive environment for climate innovation and entrepreneurship.
All stakeholders should also engage in determining the national position in international climate change negotiations.

Coordination and harmonisation of Government Initiatives
Harmonisation of policies on climate change, climate innovation and entrepreneurship needs an operational environment which ensures sustainable implementation of the policies. The government needs to establish a mechanism that ensures coordination of the various initiatives undertaken by the various Ministries, Departments, and Agencies.

Stakeholders Collaboration and Interaction
There should be created a platform for structured stakeholders’ interaction where climate innovation and entrepreneurship issues will be addressed. The platform will also provide an opportunity for knowledge exchange and networking.

The National System of Climate Innovation (NSCI)
The current interactions of the various components/elements of the NSCI need to be further studied to determine a more organised NSCI with the objective of developing a structure which will accelerate climate innovation and climate entrepreneurship

Knowledge Management
Information generated by the various stakeholders should be collated, packaged, stored and disseminated. There is need to identify an institution to undertake this task and promote knowledge sharing among the stakeholders.

Climate Innovation & entrepreneurship development

Access to Technology
Interaction between knowledge institutions and entrepreneurs should be promoted. Likewise, collaboration between local enterprises and foreign firms and organisation involved in climate innovation should be promoted

Entrepreneurship and Business Management skills development
Entrepreneurs need to muster business skills and recognise opportunities posed by climate change. Institutions involved in entrepreneur development should engage in imparting skills related to the exploitation of climate innovation and enhance the competitiveness of enterprises engaged in businesses relating to climate change.

**Investment promotion**
District and Regional Business Councils should promote investments involving the exploitation of opportunities arising out of climate change in their locations and provide incentives for such investments. TIC should promote local and foreign investments in climate change related projects.

**Access to Finance**
More studies need to be done to determine how entrepreneurs in Tanzania can benefit from the international financial facilities provided for under COP resolutions.

Individual entrepreneurs and support organisations need to study, understand and exploit the funding opportunities provided by the COP resolutions.

Financial institutions need to be fully involved in providing innovative solutions to facilitate financial access to climate entrepreneurs and to end users of technologies.

**Markets and Market information**
Private sector organisations, NGOs and support institutions should assist entrepreneurs by providing them with market information and promoting linkages to markets. Financial institutions can also contribute by extending financial packages to end users to enable them procure products that are a result of innovations from entrepreneurs.

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7. ANNEXES
Annex i  The United Nations Framework Convention on Climate Change and Conferences of Parties

A brief outline of the background to international concern and efforts in addressing climate change and its impact on sustainability of life on earth is provided below:

a. Climate change has become a prioritized challenge on the global agenda for policy makers, the business community, academia and NGOs. The global platform has been the UNFCCC. The UNFCCC Conferences of Parties (COP) have been held every year since 1995, resulting into declarations and protocols to operationalise the UNFCCC treaty. The famous one is The Kyoto Protocol on Climate Change adopted at COP-3 in Kyoto, Japan in 1997. COP 15 will be held in Copenhagen, Denmark and will last two weeks from 7 December to 18 December 2009. Vast efforts are currently invested in securing a strong, global climate agreement in Copenhagen.

b. Conferences of the Parties:
To provide a better understanding of the process for implementing the UNFCCC treaty below is a brief outline of the key issues and resolutions resulting from the Conferences of the Parties. Some of the decisions and resolutions provide opportunities for innovative solutions to address challenges arising from climate change:
i. COP-1, The Berlin Mandate

The UNFCCC Conference of Parties met for the first time in Berlin, Germany in the spring of 1995. Concerns were raised about the adequacy of countries' abilities to meet commitments under the Convention. The key output of COP-1 was the "Berlin Mandate", which established a 2-year Analytical and Assessment Phase (AAP), to negotiate a "comprehensive menu of actions" for countries to pick from and choose future options to address climate change which for them, individually, made the best economic and environmental sense.

ii. COP-2, Geneva, Switzerland

The Second Conference of Parties to the UNFCCC (COP-2) met in July 1996 in Geneva, Switzerland. Its Ministerial Declaration was adopted July 18, 1996, and:
1. Accepted the scientific findings on climate change proffered by the Intergovernmental Panel on Climate Change (IPCC) in its second assessment (1995);
2. Rejected uniform "harmonized policies" in favour of flexibility;
3. Called for "legally binding mid-term targets."

iii. COP-3, The Kyoto Protocol on Climate Change

The Kyoto Protocol to the United Nations Framework Convention on Climate Change was adopted by COP-3, in December 1997 in Kyoto, Japan, after intensive negotiations. Most industrialized nations and some central European economies in transition (all defined as Annex B countries) agreed to legally binding reductions in greenhouse gas emissions of an average of 6 to 8% below 1990 levels between the years 2008-2012, defined as the first emissions budget period.

iv. COP-4, Buenos Aires

COP-4 took place in Buenos Aires in November 1998. The parties adopted a 2-year "Plan of Action" to advance efforts and to devise mechanisms for implementing the Kyoto Protocol, to be completed by 2000.

v. COP-5, Bonn, Germany

The 5th Conference of Parties to the U.N. Framework Convention on Climate Change met in Bonn, Germany, between October 25 and November 5, 1999. It was primarily a technical meeting, and did not reach major conclusions.

vi. COP-6, The Hague, Netherlands

COP-6 convened November 13-November 25, 2000, in The Hague, Netherlands, and focused on major political issues. These included:
- To allow credit for carbon "sinks" in forests and agricultural lands,
- Consequences for non-compliance by countries that did not meet their emission reduction targets;
- Financial assistance to developing countries to deal with adverse effects of climate change and meet their obligations to plan for measuring and possibly reducing greenhouse gas emissions.

There being no consensus on the major issues the talks in The Hague collapsed and later resumed in Bonn, Germany, in the second half of July 2001.

vii. COP-6 "bis," Bonn, Germany

COP-6 negotiations resumed July 17-27, 2001, in Bonn, Germany, the United States delegation to this meeting chose to act as observers at that meeting. The agreements reached included:
1. **Flexible Mechanisms**: The "flexibility" mechanisms were put together, including emissions trading; Joint Implementation (JI); and the Clean Development Mechanism (CDM) which allow industrialized countries to fund emissions reduction activities in developing countries as an alternative to domestic emission reductions. One of the key elements of this agreement was that there would be no quantitative limit on the credit a country could claim from use of these mechanisms, but that domestic action must constitute a significant element of the efforts of each Annex B country to meet their targets.

2. **Carbon sinks**: Credit was agreed to for broad activities that absorb carbon from the atmosphere or store it, including forest and cropland management, and re-vegetation, with no over-all cap on the amount of credit that a country could claim for sinks activities. In the case of forest management, an Appendix Z establishes country-specific caps for each Annex I country, for example, a cap of 13 million tons could be credited to Japan (which represents about 4% of its base-year emissions). For cropland management, countries could receive credit only for carbon sequestration that increases above the 1990 levels.

3. **Compliance**: Final action on compliance procedures and mechanisms that would address non-compliance with Protocol provisions was deferred to COP-7, but included broad outlines of consequences for failing to meet emissions targets that would include a requirement to "make up" shortfalls at 1.3 tons to 1, suspension of the right to sell credits for surplus emissions reductions; and a required compliance action plan for those not meeting their targets.

4. **Financing**: Three new funds were agreed upon to provide assistance for needs associated with climate change; a fund for climate change that supports a series of climate measures; a least-developed-country fund to support National Adaptation Programs of Action; and a Kyoto Protocol adaptation fund supported by a CDM levy and voluntary contributions.

A number of operational details attendant upon these decisions remained to be negotiated and agreed upon, and these were the major issues of the COP-7 meeting that followed.

**viii. COP-7, Marrakech, Morocco**

At the COP-7 meeting in Marrakech, Morocco October 29-November 10, 2001, negotiators in effect completed the work of the Buenos Aires Plan of Action, finalising most of the operational details and setting the stage for nations to ratify the Protocol. The completed packages of decisions are known as the **Marrakech Accords**. The main decisions at COP-7 included:
- Operational rules for international emissions trading among parties to the Protocol and for the CDM and joint implementation;
- A compliance regime that outlines consequences for failure to meet emissions targets but defers to the parties to the Protocol after it is in force to decide whether these consequences are legally binding;
- Accounting procedures for the flexibility mechanisms;
- A decision to consider at COP-8 how to achieve a review of the adequacy of commitments that might move toward discussions of future developing country commitments.
ix.COP-8, New Delhi, India
COP-8 was held in New Delhi, India from October 23 – November 1, 2002

x.COP-9, Milan, Italy
The 9\textsuperscript{th} COP was in Milan, Italy from 1 – 12 December 2003

xi.COP-10, Buenos Aires, Argentina
COP-11 was held in Buenos Aires, Argentina, 6 – 17 December 2004

xii.COP-11, Montréal, Canada
The United Nations Climate Change Convention (COP 11 or COP/MOP 1) was a global event which took place at the Palais des congrès de Montréal in Montréal, Quebec, Canada from November 28 to December 9, 2005.
The meeting, the 11th COP to the UNFCCC, was also the first Meeting of the Parties (MOP) to the Kyoto Protocol since their initial meeting in Kyoto in 1997. The event marked the entry into force of the Kyoto Protocol.
The Montréal Action Plan is an agreement hammered out at the end of the conference to "extend the life of the Kyoto Protocol beyond its 2012 expiration date and negotiate deeper cuts in greenhouse-gas emissions."

xiii.COP-12, Nairobi, Kenya
The second meeting of the Parties to the Kyoto Protocol (COP/MOP 2), in conjunction with the twelfth section of the Conference of the Parties to the Climate Change Convention (COP 12), was held in Nairobi, Kenya from 6 to 17 November 2006.

xiv.COP-13, Bali, Indonesia
COP-13 and MOP-3 took place at Nusa Dua, in Bali, Indonesia, between December 3 and December 15, 2007. Agreement on a time lined negotiation on the post 2012 framework (a successor to the Kyoto Protocol) was achieved.

xv.COP-14, Poznań, Poland
The COP-14 was held in Poznań, Poland on 1–12 December 2008. Delegates succeeded to agree on principles of financing for a fund to help the poorest nations cope with the effects of climate change. And also they approved a mechanism to incorporate forest protection into efforts.

xvi.COP-15, Copenhagen, Denmark
COP15 will be held in Copenhagen, Denmark and will last two weeks from 7 December to 18 December 2009.

\textit{Annex ii. Workshop report}

CLIMATE INNOVATION AND ENTREPRENEURSHIP IN TANZANIA

LUTHER HOUSE, DAR-ES-SALAAM, TANZANIA, 16\textsuperscript{TH} JULY 2009

WORKSHOP REPORT
Flower E. Msuya

Peter Chisawillo
I. Project and assessment background

On 16 July 2009, 31 representatives of the business community, knowledge institutions, government and non-governmental organizations gathered at a workshop organized by the Western Indian Ocean Marine Science Association (WIOMSA) - in cooperation with the Tanzania Chamber of Commerce, Industry & Agriculture and the consulting firm Innogate Aps.

The workshop was organized as part of an initiative of the World Wide Fund (WWF) and the Swedish International Development Cooperation Agency (Sida) to accelerate climate innovation and entrepreneurship in Africa. Within this initiative an assessment of the level of development of the national climate innovation system and the conditions facing climate entrepreneurs in Tanzania is being undertaken. The assessment will identify preferred systems for innovative actions, technology transfer, and stakeholder collaboration that will enable climate innovation stakeholders to develop and grow.

A similar assessment is being undertaken in Ghana. Together the assessments will make a contribution to build national and international decision makers’ understanding of the conditions for climate innovation research, development and diffusion (RD&D). At international level the assessment will be communicated to the United Nations Framework Convention on Climate Change (UNFCCC) amongst others. With regard to the UNFCCC it is important to note that a meeting with The Vice-President’s Office preceding the workshop had revealed that the Technology Needs Assessment (TNA) provided by UNFCCC – and on which the WWF-Sida the assessment partly builds – is not yet adopted by the government of Tanzania.

It is an important objective of the assessment to identify and communicate best practices – and thereby demonstrate that challenges of climate mitigation and the need for adaptation can also be used as additional development opportunities to grow new enterprises; more and better jobs; and improved quality of life.

Some useful definitions:

“A climate innovation is a transformative technology (non-fossil, non-nuclear goods and services) that can have a significantly positive effect on climate change if applied at scale” (WWF)

“A climate entrepreneur is someone who undertakes the organization and management of an enterprise, applying a climate innovation, and assuming the risks as well as the opportunity for profit” (Innogate)

2. Summary of the main workshop findings and conclusions

2.1 Introduction
There is much evidence in Tanzania that climate change is already taking place and seriously affecting the quality of life for many people and resources in Tanzania. Some examples are the depleting icecap on Mount Kilimanjaro; migrations of people dependent on herding livestock; extreme weather resulting in droughts and floods; diseases such as malaria becoming apparent in regions that have previously not been affected, and adverse effects in many coastal zones and communities.

The underlying reasons for these changes are global as well as regional and local. Whereas much emphasis in the international dialogue on climate change mitigation and adaptation is on CO\textsubscript{2} emissions, and in particular emissions coming from activities in the developed countries of the North, so far little attention has been on regional and local causes of climate change and needs for mitigation and adaptation.

Even if Tanzania is not a major contributor of CO\textsubscript{2} emissions at global level, Tanzania has tremendous potential for development and improvement of livelihoods through climate innovation and entrepreneurship.

For example, in Tanzania as many as 98% of the rural population depends entirely on wood fuels and kerosene for household energy needs (cooking, lightning, etc.). At country level the number is 90%. The dependence on the wood fuels for energy supply results in both deforestation and serious respiratory diseases due to air pollution in households. In fact it is estimated that the dependency on wood fuel in Tanzania results in annual deforestation amounting to 400,000 ha (4000 km\textsuperscript{2}), equalling twice the area of Zanzibar.

In addition WHO has estimated that for Sub-Saharan Africa as a whole, close to as many people are dying each year by respiratory diseases due to air pollution in households (743,000 deaths in 2002) as the number of people dying from malaria. With Tanzania being above average on dependency on wood in Sub-Saharan Africa, the health problems seem only more real for Tanzania.

Innovations enabling a substitution towards renewable and clean energy and innovations that can help people to better adapt to adverse impacts of climate change have a very important role to play – both in terms of addressing climate change and in terms of addressing more general poverty related problems.

2.2 Presentations

A number of stakeholders gave presentations of their work and experiences within the area of climate innovation and entrepreneurship. Below are brief summaries of some of the main messages.

Prof. Burton Mwamila of the University of Dar es Salaam (UDSM) provided an overview of a recent feasibility study on large-scale bio-fuel production in Tanzania. It was pointed out that
more than 40 companies from the United States, Europe and Asia have shown interest in investing in bio-fuel production in Tanzania. The attractiveness of Tanzania is for a large part due to good weather and soil conditions as well as good port infrastructure. Two of these companies are BioShape Tanzania (which will cultivate Jatropha) and SEKAB BioEnergy Ltd. (which will cultivate sugar cane and palm oil).

The feasibility study has concluded that Tanzania has large potentials as producer of bio-fuels. To safe-guard improvements in both national development and local livelihoods, however, a number of issues are critical. For example Tanzania has a rich bio-diversity and wildlife that could be threatened by land clearing and deforestation. Also, in Tanzania most land is already in use, whereby large-scale bio-fuel production will entail changes of land-use. The study furthermore points to a number of other challenges with bio-fuels production that should be properly addressed – not least that bio-fuel production may drive up prices of food and intensify resource competition.

Mr. Mohammed Salum Ali of Zanzibar Solar Energy Association (ZASEA) provided an overview of ZASEA’s work and experiences. Zanzibar Solar Energy Association (ZASEA) is a NGO for the development of solar energy on the islands of Zanzibar that was started in 2003 and officially registered in 2006.

ZASEA has a vision of Zanzibar becoming a society that has skills of, knowledge about, and access to the sustainable energy for poverty reduction. ZASEA’s mission is to provide people of Zanzibar with sustainable solar energy and knowledge about it that may allow them access electricity and fight poverty.

ZASEA promotes solar energy through information dissemination, sensitization through interaction with villages, school solar energy education, solar energy technicians training, dissemination of solar photovoltaic gadgets and advice on the equipment procurement and installation.

The most important challenges identified by ZASEA in promoting solar energy innovations and products are a general lack of awareness of this source of energy supply and high initial costs of installation. A solar panel to supply a household with light will for example involve an initial investment of USD 300, approximately equal to 2 years of kerosene consumption for kerosene lamps.

Mr. Abbas Juma Mzee from Department of Cash Crops Fruits and Forestry (DCCFF) of the Forestry Department in Zanzibar provided insights on practical measures to tackle climate change, namely coastal forest buffer zones and monitoring shoreline changes in Zanzibar.

Coastal areas are predicted to be most affected by climate change. Impacts will be increasing floods and storms, rising sea level, groundwater salinisation, and infrastructure destruction.
The Forestry Department of Zanzibar have, therefore, undertaken an effort to examine the current environmental state of the shoreline and the coastal strip of north-eastern Zanzibar, its change during the past 50 years and the implications of these changes to local livelihood, coastal biodiversity and infrastructure development. On this basis a participatory model will be developed for the use of coastal forest buffer zone development as a climate change adaptation tool. The partnership between communities and institutions will thereafter develop a plan for creation of coastal forest buffer zones and a proposal for local implementation including specific areas, costs, species, ownership and use rights.

Ms. Mary Swai from Tanzania Traditional Energy Development Organization (TaTEDO) followed up with TaTEDO's experience on climate change and entrepreneurship opportunities in the energy sector.

It was pointed out that in particular the reliance on wood fuel and simple three-stone-fireplaces pose large energy challenges – both in terms of emissions and deforestation and forest degradation.

TaTEDO’s vision is to enable poverty free and self-reliant communities in Tanzania accessing sustainable modern energy services.

Working towards this vision TaTEDO aims to: a) improve quality of life of Tanzanians by contributing to the availability of improved and sustainable modern energy services, employment and income generating opportunities; b) reduce environmental degradation resulting from increased use of wood and fossil fuels; and 3) assist the country to reduce dependence on imported energy sources.

In more practical terms TaTEDO has activities to: provide training to support charcoal producers to use sustainable production methods; reduce the consumption of firewood by promoting more efficient woodstoves in households and institutions; promote and support alternative energy technologies such as solar energy – both for electricity and drying of fruits and vegetables; support small scale farming and use of biofuels for income generation and rural electrification.

TaTEDO has through its works experienced that there are a number of unexplored opportunities for improving energy use and alternatives. To realize the opportunities there is a need for both technical and business development capacity building. Also, there is a need for improving rural financing for supporting development of and access to modern energy services. Furthermore there is a particular need for well managed decentralised energy systems that provide reliable energy solutions with potential to provide employment, income and environmental conservation.

Pär Oscarsson from SEKAB BioEnergy Tanzania Ltd, provided the perspective of the investor in large-scale biofuel. He started out by quoting Lord Nicholas Stern for saying:
“We will not overcome world poverty unless we manage climate change successfully...it’s crystal clear that we succeed or fail on winning the battle against world poverty and managing climate change together. If we fail on one, we fail on the other.”

One of the points made is that if Tanzania is to make a contribution to mitigate and adapt to climate change, important issues restraining the general development of Tanzania must be resolved. These include amongst others a low level of productivity in the agricultural and forestry sectors – and thereby suboptimal resource use – as well as population growth leading to growing resource demand.

In agriculture there is a need for increasing food production as well as cash crop production. Tanzania has much potential for both. One of the agricultural opportunities for Tanzania is biofuel – and in particular sugarcane production due to this crop’s high ethanol per ha convent. The sugarcane convent is, for example, 4 times that of wheat – giving Tanzania a comparative advantage to for example European biofuel producers.

To give an example of the opportunity for large scale biofuel production in Tanzania, it is estimated that a 20,000 ha sugarcane-energy combine plant will produce 100 GWh per year (roughly 8% of Tanzania current power generation) and 270,000 m$^3$ ethanol valued at approximately USD 500 Mio per year. The total investment involved for establishing one such sugarcane-energy combine plant would be USD 550 Mio. Undertaking such investments will require venturing with international partners.

SEKAB is aware of the challenges identified for example in feasibility study presented by Prof. Mwamila. Consequently, SEKAB is working with government, local communities, outgrowers, and other stakeholders to facilitate a participatory development and investment process with sustainable benefits to local communities.

Dr. George Jambiya, World Wide Fund Tanzania, provided some remarks from the point of view of WWF. Dr. Jambiya stressed that the problems of climate change are very real and already painful to a number of people, also in Tanzania.

In addressing climate change there are solutions available but also pitfalls to be avoided. In general “we should avoid creating new problems – but if we need to, then those problems should be lesser problems”. In other words, one needs to move with the best alternatives and technologies currently available – and maximize Tanzania’s comparative advantage on those.

There are no "quick fixes", “it is the sum of all small and large initiatives that will successfully confront climate change, reduce risks, vulnerability and poverty, and open for new opportunities”.

It was stressed that with regard to commercial application climate innovations, one should take the path on “business as unusual” – implying in particular a strong linkage between business and ethics.
**Challenges and proposed actions**

The presentations from stakeholders showed that a number of visionary climate innovation entrepreneurs in Tanzania – coming from enterprises as well as NGOs/CBOs – have demonstrated that it is possible to develop commercially viable business ventures and products that not only provide new development opportunities but also make a contribution to mitigate and adapt to climate change.

However, the issue of climate innovation and entrepreneurship is largely little developed in Tanzania.

The workshop participants discussed during two breakout sessions: 1) the challenges facing the respective stakeholders for enhancing climate innovation and entrepreneurship, and 2) the strategies, systems and actions that are needed to enable climate innovation and support climate innovation entrepreneurs to develop and grow.

**Challenges:**

Entrepreneurs have a particularly important role to play in bringing forward new products and services for mitigating climate change and to enable people in adapting better to the consequences of current climate change. However, climate innovation entrepreneurs face a number of challenges in Tanzania. The key challenges were identified as:

- Lack of awareness of innovation opportunities.
- Lack of capital for funding product innovation.
- Lack of access to technology.

Knowledge institutions can play an important role in developing and transferring research and innovation to entrepreneurs for commercial application. However, the knowledge institutions are faced with a number of challenges that reduce their ability to support climate innovation and entrepreneurship. The key challenges were identified as:

- Little research outreach and thereby commercial application of existing and new research.
- Lack of research funds (possibly due to lack of priority).

Government obviously has in important role to play in terms of providing policies and incentives to facilitate climate innovation and entrepreneurship. However, it was widely agreed that:

- Climate innovation and entrepreneurship seems not to be a policy priority and the few initiatives that are in place suffer from weak implementation and enforcement structures.
- There is currently little dialogue between government and other climate innovation and
entrepreneurship stakeholders in policy development.

A number of NGOs and CSOs are active in the field of climate innovation and entrepreneurship. However, they are faced with a number of challenges that reduce the overall impact of society:

- Weak capacity and technical know-how.
- Outreach difficulties.
- Dependency of foreign funds.

**Strategies and actions:**

The stakeholders agreed on the following key systematic shortfalls:

- A poor enabling business environment and in particular heavy bureaucracy for business registration and taxation.
- Lack of financial instruments to support climate innovation and entrepreneurship.
- Lack of access to technology and market information.
- Little research outreach and research communication.

To address the systemic shortfalls and challenges workshop participants agreed to call for the following actions within the next 12 months:

- Implementation of climate innovation and entrepreneurship information and awareness campaigns that reach out at all levels (general public, businesses, knowledge institutions, government and NGOs/CBSs).
- Development of platform that enable better linkages and collaboration with a particular view to ensure that non-governmental stakeholders can engage in policy development.

In the medium term – i.e. within the next 3 years – participants agreed to the following actions:

- Development of financial mechanism that 1) will enable entrepreneurs to engage into prioritized climate innovation activities, and 2) will enable people to apply and benefit from available climate innovations.
- Development of climate innovation knowledge centres ("one-stop-centres").
- Review and harmonise existing policies in order to enable them to better promote climate innovation and entrepreneurship.
- Sustained information and awareness activities that ensure an effective dissemination of information on climate innovations and markets to entrepreneurs as well as the general public.

*All workshop participants (see annex i) have been provided with copies of the full presentations.*

Annex i. List of participants to the Climate Innovation and Entrepreneurship in Tanzania, Luther House, Dar-es-salaam, Tanzania, 16th July 2009

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<td><a href="mailto:pchisawillo@yahoo.com">pchisawillo@yahoo.com</a></td>
</tr>
<tr>
<td>24</td>
<td>Dr Flower E. Msuya</td>
<td>Western Indian Ocean Marine Science Association/IMS</td>
<td>P O Box 668 ZNZ</td>
<td>0786 629374</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Adam A. Zuku</td>
<td>Tanzania Chamber of Commerce, Industry and Agriculture</td>
<td>P O Box 9713 DSM</td>
<td>0784527750</td>
<td><a href="mailto:azuku@tccia.com">azuku@tccia.com</a></td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td><a href="mailto:adzuku@gmail.com">adzuku@gmail.com</a></td>
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<td></td>
<td>REPORTERS</td>
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<tr>
<td>26</td>
<td>Neema Mbuja</td>
<td>Independent Television</td>
<td>P O Box 4374 DSM</td>
<td>0787990099</td>
<td><a href="mailto:ncmyy@yahoo.co">ncmyy@yahoo.co</a></td>
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<tr>
<td>27</td>
<td>Fadhila Omari</td>
<td>Independent Television</td>
<td>&quot;</td>
<td>0756773476</td>
<td><a href="mailto:Fadhilaomari2007@yahoo.com">Fadhilaomari2007@yahoo.com</a></td>
</tr>
<tr>
<td>28</td>
<td>Hynes Dugilo</td>
<td>Independent Television</td>
<td>&quot;</td>
<td>0715359119</td>
<td><a href="mailto:hndugilo@yahoo.com">hndugilo@yahoo.com</a></td>
</tr>
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</table>
### Annex III. Examples of filled in questionnaires

| Building Capacity to Accelerate Climate Innovation and Entrepreneurship |
| By WWF and Sida in collaboration with Integate and WHO/MSA |
| Interview Minutes: Government and NGOs |

#### Respondent Organization:
- Department of Commercial Crops, Foods and Fisheries (DCCFF)

#### Main Point:
- There is no written policy.
- Department plans and conducts pilot help to reduce climate change.
- Introduce other alternative sources of energy (e.g., LPG and improved stoves) to reduce carbon emissions.

#### Key Observations:
- Awareness raising on REDD
- Conservation of natural forests
- Awareness in the forest protection
- Rehabilitation of degraded areas
- No measurement of carbon emissions

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| Building Capacity to Accelerate Climate Innovation and Entrepreneurship |
| By WWF and Sida in collaboration with Integate and STEPHI |
| Interview Minutes: Government and NGOs |

#### Respondent Organization:
- Department of Environment

#### Date and Place:
- 10th June 2009, Mombasa, Kenya

#### Key Observations:
- The general policy is to cooperate with other international stakeholders to combat climate change.

#### Key Activities:
- Awareness raising on climate change
- Provision of alternative energy
- Planning for the next contributions to climate change mitigation

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44
<table>
<thead>
<tr>
<th>S/N</th>
<th>NAME</th>
<th>AFFILIATION</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Mohammed Salum Ali</td>
<td>Zanzibar Solar Energy Association, Zanzibar</td>
</tr>
<tr>
<td>2</td>
<td>Julian Fitz</td>
<td>Zanzibar Solar Energy Association, Zanzibar</td>
</tr>
<tr>
<td>3</td>
<td>Hamad Omar Juma</td>
<td>Department of Environment, Zanzibar</td>
</tr>
<tr>
<td>4</td>
<td>Asha Khatib</td>
<td>Department of Environment, Zanzibar</td>
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<tr>
<td>5</td>
<td>Sihaba Juma</td>
<td>Department of Environment, Zanzibar</td>
</tr>
<tr>
<td>6</td>
<td>Chief Rashid</td>
<td>Department of Commercial Crops, Fruits, and Forestry, Zanzibar</td>
</tr>
<tr>
<td>7</td>
<td>Asha Ali Juma Mzee</td>
<td>Department of Commercial Crops, Fruits, and Forestry, Zanzibar</td>
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<tr>
<td>8</td>
<td>Rajab Ali Ameir</td>
<td>Ministry of Agriculture, Zanzibar</td>
</tr>
<tr>
<td>10</td>
<td>Eng. Mathew Matimbwi</td>
<td>Tanzania Solar Energy Association, Dar es Salaam</td>
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<tr>
<td>11</td>
<td>Alphonce Kyariga</td>
<td>Ministry of Energy, Rural Energy Agency, Dar es Salaam</td>
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<tr>
<td>12</td>
<td>Grace</td>
<td>Ministry of Energy, Rural Energy Agency, Dar es Salaam</td>
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<tr>
<td>13</td>
<td>Prof. Burton Mwamila</td>
<td>College of Engineering and Technology-UDSM/AIST, Dar es Salaam</td>
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<tr>
<td>14</td>
<td>Jeremiah Daffa</td>
<td>Tanzania Coastal Management Partnership, Dar es Salaam</td>
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<tr>
<td>15</td>
<td>Dr. George Jambiya</td>
<td>University of Dar es Salaam/WWF, Dar es Salaam</td>
</tr>
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<td>16</td>
<td>Dr Ningu Julius</td>
<td>Ministry of Agriculture, Environment Management Unit), Dar es Salaam</td>
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<tr>
<td>17</td>
<td>Estomih N. Sawe</td>
<td>Tanzania Traditional Energy Development Organization, Dar es Salaam</td>
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<td>18</td>
<td>Mary Swai</td>
<td>Tanzania Traditional Energy Development Organization, Dar es Salaam</td>
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<td>Gisela Ngoo</td>
<td>Tanzania Traditional Energy Development Organization, Dar es Salaam</td>
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<td>Michael Mwakilasa</td>
<td>Mafuta Sasa Biodiesel Ltd, Dar es Salaam</td>
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<td>21</td>
<td>Prof. Sebastian V. Sarwat</td>
<td>Sokoeine University of Agriculture, Morogoro</td>
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<td>22</td>
<td>Sokola Mwinyikondo</td>
<td>Sokola workshop and general supplies, Morogoro</td>
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<td>23</td>
<td>Lucy John</td>
<td>Kitope, Zanzibar-ZALWEDA</td>
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<td>Juma Nassor Kombo</td>
<td>Fuoni Kwarara, Zanzibar, ZASEA</td>
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<td>Gando Farmers Association, Zanzibar</td>
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<td>Emanuel Saiguran</td>
<td>Small Industries Development Organisation, Dar es Salaam</td>
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<td>27</td>
<td>Neema Tindamanyire</td>
<td>Tanzania Commission for Sciences and Technology, Dar es Salaam</td>
</tr>
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</table>
### Building Capacity to Accelerate Climate Innovation and Entrepreneurship

**By WWF and Sida in collaboration with Innogate and WIOMSA**

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th>NGOs</th>
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</table>
| **Description of general policy towards climate change and climate entrepreneurs** | There is no written policy on climate change  
Review of the current Environmental Policy to include climate change  
Cooperation with other international stakeholders to combat climate change | At National level there is a policy gap with respect to Climate change |

| **Description of general objectives towards climate change and climate entrepreneurs** | Decrease emissions of Carbon Dioxide ($CO_2$), Methane($CH_4$) and Nitrous Oxide ($N_2O$)  
Improve conditions necessary to restore regular weather | |

| **Ongoing activities aiming at decreasing or limiting CO2 emissions, or similar estimations for its contribution to climate change mitigation.** | Tree Planting  
Combating erosions  
Promoting alternative energy  
Awareness creation on climate change  
Promoting use of Economy stoves  
Promoting use of biogas  
Annual sensitization events on alternative energies  
Conservation of natural forest | Crop Diversification, Soil water conservation, Organic agriculture  
Introduction and installation of biogas technology  
Improved technology for biomass utilization  
Solar energy utilization  
Biofuel for domestic use |

| **How are these activities measured for their contribution to climate change mitigation and/or adaptation?** | Grassroots interaction  
Current level of interaction with companies not good enough  
The situation is likely to change with increased awareness and the need to take joint efforts | Stakeholders meetings and dialogue on climate change  
Collaboration with International institutions  
Mali= multifunctional platforms  
Vietnam- Low-cost biogas plants  
Local collaboration  
Ministry of Energy and Minerals  
Rural Energy agency  
Ministry of Natural Resources and Tourism  
Vice Presidents Office -Environment |

| **Describe the current level of interaction with companies/markets, (including investors) knowledge institutions, NGO’s and other government institutions. – is this likely to change in the future?** | | |

| **Describe your institution’s mode(s) of interaction with entrepreneurs, investors,** | Interaction at meetings and workshops  
Through implementation of planned activities | |
| NGOs and other government institutions | Set collaboration structures (elaboration not provided)  
On a case by case basis | Organised interactions through MOUs |
<table>
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<tbody>
<tr>
<td>Is the interaction organized in set collaboration structures or does it happen on a case by case basis?</td>
<td></td>
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</tbody>
</table>
| Status and approach on IPR (what activities or policies are in place – and what can we expect for the future?) | Public funds available for the tree planting activity | Funding through International NGOs and Agencies  
- Sida  
- EU  
- Norwegian Government |
| Approach and experiences with financing of technology and knowledge transfer to enhance climate innovation in companies (e.g. public funding, loans, external investors, revenues from customers etc) | Mainstream international agreements into government policy  
Promote alternative energies  
Enhance carbon sink through Tree planting by community groups | Upscale biogas technology through training and awareness creation |
| What is your strategy and objectives for climate innovation and entrepreneurship for the next 12-36 months? | Strengthen community groups and establish new ones  
Tree planting to address beach erosion  
Promote use of alternative domestic energy sources  
Raise awareness | Installation of more biogas plants |
| What key activities will be implemented to reach the objectives? | Fuel, vehicles, Training materials Alternative energy models | Resource mobilisation |
| Needed resources, financing and support to fulfil the objectives – from whom? | National Challenges  
Funding to implement activities (Low financial capacity)  
Low innovation capacity and technology absorption/adaptation capability  
Poor coordination among stakeholders  
Policy priority—Some policy do not yet appreciate the urgency  
Poverty  
Lack of Involvement in the negotiations of international agreements  
International Challenges  
Unwillingness of developed countries to reduce emissions | Evaluation of climate change impact of organic farming  
Developing a simple carbon payment mechanism for small holder farmers  
Advocating for organic farming as a climate change mitigation mechanism  
Advocating for climate friendly organic products  
The Community lack of understanding the magnitude of the climate change problem  
Mindset  
Lack of readily available optional |
<table>
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<tr>
<th>Low contribution/unwillingness to support activities which combat climate change</th>
<th>energy sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other knowledge institutions, governments institutions, NGOs and/or companies that you would advice us to talk to?</td>
<td>There are some efforts to combat climate change and promote climate entrepreneurship. The efforts are afforded low priority in an environment where other poverty and livelihood issues receive higher priority and resource allocation</td>
</tr>
<tr>
<td>Please summaries your views on the general conditions for promoting climate friendly business and products in your country. What is the day-to-day reality and availability of technology, knowledge and finance for climate innovation and entrepreneurship?</td>
<td>Majority of the people are not aware of the effect of climate change and their role in mitigating effects and action to reduce emissions</td>
</tr>
<tr>
<td>What is in your opinion the three most important actions needed in order to promote climate innovation and entrepreneurship?</td>
<td>Sensitization and Awareness creation Research Capacity building Promote alternative energies Reduce cost of electricity Reduce import duty on renewable energy inputs Need to expand use of natural gas stoves Plant more trees (Promote tree planting)</td>
</tr>
<tr>
<td></td>
<td>Awareness creation Publishing/broadcasting consequences of climate change giving examples Training and exposure to real situations</td>
</tr>
<tr>
<td>Any other comments?</td>
<td>Policies review so that Climate change is integrated into other national development policies and strategies such as MKUKUTA and MKUZA. There should be standards for used cars to eliminate the problem of importing cars which contribute to increases in emissions</td>
</tr>
</tbody>
</table>
Annex vi. Entrepreneur Environment and National System of Climate Innovation Illustrations

1. THE ENTREPRENEUR’S OPERATIONAL ENVIRONMENT
2 THE NATIONAL CLIMATE INNOVATION SYSTEM

[Diagram showing various stakeholders and relationships within the national climate innovation system]