



Summary of ICSU ROA Projects

on

Sustainable Energy

Project SE01: Development of energy models and scenarios for Africa

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Background

Due to deficiencies of energy and energy-related data, limited skilled professionals, non-availability of suitable analytical tools, lack of co-ordinated energy planning infrastructure, and weak linkages between the different institutions in the energy sector, the effective energy management and planning in Africa needs improvement. In Africa, there are few national and sub-regional efforts that are organised enough to be used for carrying out investigation on regional energy futures. The region also lacks adequate and fully developed energy facilities that can help creating an opportunity for countries to try out both conventional and bold new technological options in mapping out energy futures. Embarking on such ventures will need the necessary scientific and technological tools in the form of models to effectively visualise energy future energy scenarios. This situation allows countries in the region to select from a broad range of models and scenarios that have been tried and tested in other parts of the globe; an act that will ensure a more technically and economically efficient, environmentally sound, climate-friendly, and socially responsible energy future for Africa.

The weaknesses in the existing energy situation and the challenges for energy planning call for a concerted and systematic effort for the region to strengthen its capabilities to come up with effective and robust energy planning. There is a need, therefore, to set up a coordinated and integrated mechanism that will not only harness the existing skills and human resources, but also further develop them to the required standard so that Africa becomes more competitive in the global energy sector. Furthermore, it will provide a basis for collaboration with similar structures in developing countries and other parts of the world.

Mathematical models have proved (in other parts of the globe) to be indispensable tools that are used in the endeavour to look into the increasing complexity of energy planning in which social and environmental aspects are factored together with technical and economic considerations. It is therefore imperative to develop suitable and appropriate energy models and scenarios using these techniques and expertise within and outside Africa, through collaborative approaches and maximizing the use of available tools and instruments in order to provide improved energy plans.

Objectives

The main objective of this project is to develop energy models and scenarios with related activities for optimizing, managing effectively, and planning energy production usage in Africa.

Specific Objectives

- ◆ To collect and organise national energy and energy related data and set up a system for easy retrieval and access.
- ◆ To identify capacity needs and strengthen human and institutional capacities for effective development of models and scenarios for the region.
- ◆ To harmonise national, sub-regional and regional plans, models and scenarios in Africa.
- ◆ To develop a harmonised energy database useful for scenario-building and modelling.
- ◆ To develop appropriate models and scenarios for future energy use in the region.
- ◆ To develop knowledge networks and other collaborative links among specialists in energy modelling and scenario-building.
- ◆ To keep track of developments in scientific and technological advances in the energy sector.

Activities and proposed implementation sites

To achieve these objectives, the following action plans were suggested:

- ◆ Collecting existing energy and energy related data for all countries in the region and identify existing gaps in the data system.
- ◆ Identifying and assessing the capacity needs for effective development of models and scenarios for the region.
- ◆ Collecting and assessing the different national, sub-regional and regional energy plans and develop common generic variables which will form the basis for establishing consistent storylines that reflect the national, sub-regional and regional conditions.
- ◆ Enhancing human capacities in the region by undertaking several knowledge building activities in the form of seminars and workshops, but more particularly undertaking direct post-graduate training.
- ◆ Developing links with existing initiatives, such as AFREC, AU/NEPAD, RECs and UNECA to improve the modelling and scenario building exercise.
- ◆ Creating a system to fill up information/energy gaps so that accurate energy data can be obtained for all countries.
- ◆ Enhancing human and institutional capacities in scenario-building and modelling for energy and energy related sectors.
- ◆ Developing detailed scenarios and models for the energy sector in Africa taking into consideration the diversified energy sources, and new and emerging energy technologies.
- ◆ Developing inter-institutional collaboration within and outside the region in energy and energy related modelling.

- ◆ Creating an effective medium for the training of highly placed energy professionals for the region.

Expected outcomes

- ◆ Established sub-regional networks as well as a regional network that serve as medium of cooperation between energy modellers and planners whose involvement will strengthen and harmonize collaborative networks on energy sector planning in the participating countries and institutions.
- ◆ Energy databases suitable for scenario-building and modelling.
- ◆ Different energy scenarios and models for various policy testing exercises.
- ◆ Trained personnel and enhanced institutional capacity in energy scenario building and modelling.
- ◆ Creation of an African modelling forum for scenario and modelling developers on a sustained basis.
- ◆ Enhanced human and institutional collaboration between modelling centres in the region and similar institutions elsewhere.
- ◆ Regional energy planning centres of excellence that will enhance regional cooperation and help to sustain the national and regional capabilities in energy planning.
- ◆ 25 PhDs and 50 Masters students in each sub-region

Furthermore, as a result of the implementation of this project, the region will be able to:

- ◆ Develop suitable energy scenarios and models capable of responding to present and future challenges of the energy sector in the region.
- ◆ Develop energy planning capabilities equipped with suitable analytical tools and having the ability to create and maintain energy data bases.
- ◆ Conduct comprehensive studies for preparing energy plans and strategies based on appropriate energy, economic, social and environmental assessments.
- ◆ Develop awareness about the importance of energy for socio-economic development.
- ◆ Strengthen interaction between various energy departments/institutions and between sectoral planning entities thereby ensuring harmonization of energy policies with national socio-economic development programmes.
- ◆ Strengthen the skilled national energy professionals in national and regional planning.

Project SE 02: Increase in access to high quality, reliable and affordable energy in a sustainable manner: Renewable energies – Bio-energies

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One of the biggest challenges in the area of sustainable energies is the new developing sector of bio-energies where biomass and organic wastes are used as the raw materials. The Africa has the largest potential for the use of biomass and organic waste for the use as bio-energy in the world. In the interest of protecting the environment, and for social and economic development, a knowledge base for sustainable energy sources has to be developed in Africa. Implementation of the project proposed herein presents an African solution to African challenges through the application of science and technology in the bio-energy sector. The proposal is divided into three sub-projects.

Project SE 02.1: Establishment of a knowledge network including an electronic library in the sector of bio-energy

Background

Currently, there are no existing databases in the Africa of professionals and experts who are working in the bio-energy area. At the same time, there is no information on bio-energy crops that is readily available electronically to the public. Apparently, there is no knowledge platform that can be used by industries, entrepreneurs and to communicate/inform the public who are the primary users of the bio-energies. African scientists and technologists have also limited access to other databases, and to research findings and projects of bio-energy carried out in other parts of the world.

The purpose of this sub-project is to prepare a platform and allow comprehensive access to the existing worldwide knowledge for African scientists in order to improve the knowledge base, accelerate the use of science in socio-economic development and strengthening the bio-energy sector. The research will be structured under the guidelines of sustainable development principles, particular in view of the support of food production by developing the production of food and fibre.

Objectives

The major objective of the project is to establish a world class standard science information and communication platform on bio-energy that allows the integration of African scientific work to the international research done in other parts of the world. The specific objectives are:

- ◆ To develop a knowledge network and other collaborative links as a means of building strategic partnerships between bio-energy professionals, scientists, decision makers and government authorities in a sensitive environment as in Africa.
- ◆ To establish an Electronic Library as a means of providing information and knowledge for decision makers and professional experts in the field of bio-energy to ensure a substantial increase in the supply of and access to reliable and affordable renewable sources of energy in both rural and urban areas.
- ◆ To develop a harmonized bio-energy database that serves a support to the scientific communities at local, national, regional and international levels.
- ◆ To level the playing field among the member countries by ensuring the easy flow of information and the sharing of ideas about the best practices as well as the lessons learned.
- ◆ To transfer scientific information and knowledge that will serve to ensure that scientific knowledge is linked effectively to policy-making.
- ◆ To promote bio-energy research and usage across the African continent.

Activities and proposed implementation sites

The process of developing an Electronic Library and a Knowledge Network of Bio –energies will be characterized by:

- ◆ Establishing central and sub regional nodes in participating countries, and forming research clusters that bring together representatives from the different nodes to implement joint regional research activities.
- ◆ Identifying organizations and professionals to be roped in the knowledge network, for example, at the level of each country, the local statistics office or agricultural research office will be required to provide data on agriculture, climate, land, water, crops and other relevant institutions in bio-energy processing and utilization.

- ◆ Forming research clusters that bring together representatives from the different nodes to implement regional joint research activities.
- ◆ Developing communication mechanism for keeping close contact between research cluster member nodes through research cluster workshops, electronic library, and other related scientific gatherings.
- ◆ Establishment of a Project Secretariat responsible for the overall, day to day coordination and communication of the network activities.
- ◆ Integration of bio-energy research projects in the day by day activities of African universities, particular in Honours, Masters and PhD degree programmes.
- ◆ Providing access to reliable information in the area of bio-energy to help producers and users in the African region as well as for policy makers.
- ◆ Linking agricultural data for bio-energy crops to technical parameters for bio-energy processing, quality testing and finally promoting the bio-energy utilization.
- ◆ Creating regional knowledge hubs in east Africa, southern Africa, central Africa, West Africa and Indian Ocean islands.

Expected outcomes

E-library

- Information platform accessible for free to each African country showing bio-energy crops suitability to climatic and agricultural conditions as well as bio-energy technologies, quality characteristics, policies and bio-energy events in the continent.
- Reports for policy makers on bio-energy state of the art and recommendations.
- Newsletter where ongoing bio-energy research activities and initiatives in Africa are published.
- Research findings on matters related to bio-energy and bio-energy projects in other parts of the world.

Knowledge network

- Provide at least one research project per node.
- Mphil/PhD students and graduates.
- Integration a bio-energy module in Bachelor Engineering courses run by African universities
- Development of bio-energy technologies adaptable to the African context.
- Codes of practice for communities to set up bio-energy projects.

As a result of this project, the region will be able to:

- Develop suitable bio-energy scenarios capable of responding to present and future challenges of the regional transport -energy sector.
- Develop the ability to create and maintain bio-energy databases.
- Develop awareness about the importance of bio-energy, especially bio-energy technology for socio-economic development.
- Strengthen interaction between various energy departments/institutions and between sectoral planning entities such as transport, agriculture, engineering thereby ensuring harmonization of energy policies with national socio-economic development programs.

Project SE 02.2: Bio-energy technology piloting and testing for the implementation in Africa

Background

At present, bio-energy technologies are structured in three generations and only the first generation (involving extraction, fermentation and digestion) is available and accessible to Africa. In comprehensive research activities and programs, African scientists, economists and decision makers have to be exposed to the new opportunities and challenges offered by new technologies in view of the implementation in the African continent and make high bio-energy technology generations available to Africa. The project entails comprehensive scientific work on bio-energy technologies, tertiary education for African students, testing of the technologies in the laboratory and pilot stage as well as making results available throughout Africa.

Objectives

The main aim of this project is to contribute to the strengthening and retention of energy related human and institutional capacities in Africa. The specific objectives are:

- ◆ To pilot and demonstrate bio-energy process plants adapted for African conditions.
- ◆ To provide evaluating, testing and certificating facility for Africa's bio-energy.
- ◆ To help with the bio-energy policy development in African countries and regions.

Activities and proposed implementation sites

- ◆ Testing and piloting of a bio-diesel process under licence (probably in Mozambique, Madagascar as there are already major activities and programmes or another African country with such activities and programmes).
- ◆ Testing and piloting of bio-ethanol process under licence (probably Mauritius which has a huge sugar industry or Malawi where some major activities are underway or in any another African country where such activities are currently ongoing and infrastructure is available).
- ◆ Testing and developing bio-energy testing facility (probably in South Africa where such a facility is currently being developed at Stellenbosch University) to:
 - ◆ Test engines.
 - ◆ Blend, mix and store bio-fuels and mixtures of fossil fuels and bio-fuels.
 - ◆ Analytically test the quality of bio-fuels.

Expected outcomes

- ◆ A report on the status of human and institutional capacity needs in the energy sectors, and recommendations of interventions to be implemented.
- ◆ A comprehensive human and institutional capacity database for energy and energy-related issues
- ◆ Enhanced collaborative research and development programmes amongst individuals and institutions in the energy sectors within and outside Africa.
- ◆ Training programmes at all levels of human resource development, especially in research institutions, the private sector, policy-makers, and consumers.
- ◆ A strategy for retaining energy experts within the region and harnessing the potential of those in the Diaspora.
- ◆ Enhanced entrepreneurial capacity within the energy sector.

Project SE 02.3: Energy efficiency in transport

Background

Mobility costs in some African countries account for more than 70 % of the cost of energy. With the reduction of available fossil fuels resources, energy efficiency in public transport becomes one of the most vital issues for social and economic development in Africa. The project will address these cross-cutting issues by developing alternative solutions, providing access to know how and support human and international capacity building in African countries.

Objective

To contribute to the development of an efficient and sustainable bio-energy based transport sector and promote environmental stewardship in Africa.

Proposed activities

- ◆ Determining the potential of bio-energies in terms of their utility in the public transport sector in Africa.
- ◆ Assessing the regional supply infrastructure needs/options for the production, delivery and utilisation of bio-energy in the public transport sector.
- ◆ Developing highly efficient and reliable fuel combustion and propulsion systems for the use of bio-energy in the public transportation system, particularly the buses.
- ◆ Configuring policy instruments, marketing incentives, codes and standards for sustainable uptake of bio-energy.

Expected outcomes

- ◆ Report on potentials of African bio-energy in terms of their utilisation in the African public transport sector.
- ◆ Report on the prospects of a regional supply infrastructure for production, delivery and utilisation of bio-energy in the public transport sector.
- ◆ Report on current and future energy carriers and the potential utilisation in African public transport.
- ◆ Report on migration strategies including the ratio between additional costs for innovative propulsion systems and saving potentials.
- ◆ Report on green house gas emission reduction strategies in public transport and consequences for life cycle cost.