

COMPETE - Competence Platform on Energy Crop and Agroforestry Systems - Africa

*J. Woods, P. Helm, A. Hofer, D. Rutz, R. Janssen

Company / Institute(s): *Centre for Energy Policy, Imperial College London,
WIP - Renewable Energies, Munich, Germany

Address: *Imperial College, South Kensington Campus, London, SW7 2AZ
Tel. 0044 (020) 7594 9338 (*) email: jeremy.woods@imperial.ac.uk.

ABSTRACT: As global fossil energy resources become constrained, bioenergy is emerging as a major potential resource to supply the energy services currently provided by these fossil fuels. Africa and Latin America have, in theory, very large areas of land resources 'available' for bioenergy production. However, the production of biomass for energy on the scales necessary to supply significant shares of national and global energy provision, will result in very substantial impacts (positive and negative) on the ecosystems and cultures of these target regions. The protection of biodiversity, rural livelihoods and management of scarce water resources are critical considerations in any analysis of the potential for sustainable bioenergy provision. The objective of this Competence Platform on Energy Crop and Agroforestry Systems - Africa (COMPETE) is to stimulate bioenergy implementation in Africa. COMPETE will establish a platform for policy dialogue and capacity building in the major multi- and bi-lateral funding organisations and key stakeholders throughout the bioenergy provision and supply chains.

Keywords: bioenergy, sustainable production, Africa development

1 INTRODUCTION

At the beginning of the 21st Century, Africa contains some of the poorest and most technologically backward regions in the world, with civil conflicts, diseases, droughts making further exacerbating the lives of the poor. Over the previous decades their quality of life has continued declining, and currently about 52% of the sub-Saharan Africans live on less than US\$ 1 per day and about 43% of the urban residents have incomes below US\$ 47 per person-month [1].

The poor economic performance and the shortage of work does not allow for a level of income that is sufficient for obtaining modern, clean, energy supplies. Hence, about 80% of the African population is still dependant on charcoal and firewood to fulfil their energy needs[2]. According to the World Energy Council (WEC)[4], the Food and Agriculture Organization (FAO)[5] and the UNDP[6], it is likely, that traditional biomass will be the main energy source for the sub-Saharan population for the foreseeable future, with demand continuing to grow.

According to the World Energy Council (WEC)[3], the Food and Agriculture Organization (FAO)[4] and the UNDP[5], it is likely, that traditional biomass will be the main energy source for the sub-Saharan population for the foreseeable future, with demand continuing to grow. This trend in development will impose additional pressures on natural resources, particularly on the vulnerable arid and semi-arid ecosystems of Africa. Poor individuals can remain trapped in a cycle of increasingly unsustainable dependence on declining local resources. For the majority, the only known agricultural methods are the traditional ones, which, without sufficient inputs, can cause soil degradation and desertification and have already led to overuse, with a regional decline in available biomass. Concerning energy supply, there is no easy alternative to traditional biomass use unless options emerge to break this cycle.

Modern, locally adapted, wisely implemented and planned, bioenergy systems may provide one such option (see below). Today, at least 16% of the world's agricultural land, especially cropland and pastures in Africa, already show a

significant decline in productivity and about 65% of the cropland and pastures of Africa are degraded.7. Additionally, the traditional agricultural methods are not able to cope with increased pressures climate change already causes.

2 LINKING MODERN BIOENERGY WITH DEVELOPMENT

2.1 A number of studies have estimated the resource base for the supply of biomass for energy highlighting the large areas of 'unused potential agricultural land' in Africa (c. 750Mha) and Latin / South America (850Mha) [7]. Smeets and Faaij [8] predicted for Africa that between 41 and 410 EJ of energy could come from biomass by 2050, with the upper estimate equivalent to current total global primary energy consumption. A further 46 to 310EJ could be provided from South America once food and other land uses had been accounted for. At the same time as this huge potential for modern bioenergy is being highlighted, the health and environmental consequences of expanded and uncontrolled use of traditional biomass fuels is increasingly being associated with health and drudgery problems that disproportionately affect women and children in the poor areas of developing countries [9]. Finally, the increased cost of the fossil fuel alternatives to traditional biomass use for energy means that those that had switched to cleaner, less demanding alternatives to traditional fuels are now being forced back into using them because these alternatives may no longer be affordable.

2.2 COMPETE Objectives

The objective of this Competence Platform on Energy Crop and Agroforestry Systems - Africa (COMPETE) is to stimulate bioenergy implementation in Africa. COMPETE will establish a platform for policy dialogue and capacity building in the major multi- and bi-lateral funding organisations and key stakeholders throughout the bioenergy provision and supply chains [10]. It is a co-funded project by the European

Commission in the 6th Framework Programme and the Specific Measures in Support of International Cooperation.

The COMPETE partnership comprises 20 European and 23 non-European partners - 11 partners from 7 African countries, 3 regional African policy and financing bodies (African Development Bank; Food, Agriculture and Natural Resources Policy Analysis Network of Southern Africa; UEMOA -Biomass Energy Regional Program), 9 partners from Latin America and Asia - and the Food and Agriculture Organisation of the United Nations (FAO).

2.3 COMPETE Activities and previous experiences.

A comprehensive, multi-disciplinary, assessment of current land use, energy demand and technology innovation focused on Africa, will be carried out to identify pathways for the sustainable provision of bioenergy, which will:

- improve the quality of life and create alternative means of income for rural populations in Africa
- aid the preservation of the critical functions of arid and semi-arid regions in Africa as intact ecosystems
- enhance the equitable exchange of knowledge between EU and developing countries

COMPETE activities considered also previous projects in Africa such as the coordination action plan for savannas [11]. This network reviewed the works on arid and semi-arid regions which typically contain savanna ecosystems and have complex biophysical and human dynamics associated with them. In order to ensure a full understanding of these dynamics and how they can best be harnessed for bioenergy, COMPETE will also collaborate with the Southern African Savannas Network (SASN) which has extensive experience and knowledge and expertise in these ecosystems. The project concentrates on the opportunities for modern bioenergy to support sustainability of human activities in these ecosystems. Management systems that support biodiversity and are therefore compatible with the Convention on Biodiversity (CBD) will be a critical part of the acceptance of the widespread adoption of biomass production systems for energy, and is an important component of WP3 (Sustainability). The interaction within the COMPETE framework between SASN and the other network partners who have extensive practical experience in all aspects of biomass production, conversion and supply, will facilitate the identification and dissemination of best practice in the use of energy crops and agroforestry systems in testing environment of the arid and semi-arid ecosystems of Africa.

3 POTENTIAL IMPACT

3.1 The project will provide an arena for relevant policy making and for project development and funding. It will collaborate with the Africa Development Bank (AFDB). It is expected that a number of demonstration and fully commercial bioenergy projects will have a spawn through the opportunities of review of resources and their sustainable production and support generated through product generation.. Detailed and active policy development at the national, regional and international levels is also expected and a number of policy-relevant deliverables will occur and be documented.

The urgent need to develop competitive and practical renewable energy solutions capable of securing substantial shares of national energy supplies in Africa and elsewhere is apparent as a result of five converging but separate agendas. COMPETE will highlight and develop the bioenergy-relevant options presented by these agendas:

- Energy security
- Climate change
- Modern bioenergy technologies
- Biofuels trade

1. Energy security

Increasing expensive oil and gas mean that coal is becoming the only affordable fossil energy supply in selected areas of Africa with good internal reserves or good transport infrastructures. Outside South Africa, it is not possible to use coal for providing transport fuels and its use as a fuel for cooking leads to worse respiratory and general health problems than traditional biomass. The project will quantify the potential for bioenergy to substitute for current and future demand for fossil fuels.

2. Climate change

Fossil fuel use and land use change (some as a result of traditional biomass use) exacerbate climate change and increase the vulnerability of Africa's poor rural populations crop failure, drought and flooding. Modern bioenergy could provide a local value-added function to land use and increase resilience by providing the local energy services needed to meet the MDGs e.g. emergency irrigation to save crops during droughts or the provision of clean water. COMPETE will evaluate the potential for substituting for fossil fuels and mitigating land use change impacts, thereby reducing GHG emissions.

3. Emerging modern bioenergy technologies

These novel technological pathways could provide cost-effective and sustainable supplies of energy at the local level. In addition, being non-intermittent, bioenergy could provide a good solution for the penetration of other renewable energy technologies. COMPETE will evaluate emerging bioenergy technologies and supply pathways

4. International trade / sources of biofuels

The EU has aggressive targets for the implementation of renewable energy supplies and GHG reductions but will not be able to achieve these in the near to medium term without importing significant quantities of biofuels. Only Africa and South America have the resources to produce sufficiently large amounts of biomass for energy to impact on EU fossil energy demand.

5. Employment and local investment

The potential for the development of jobs in Africa through the substantive development of bioenergy resources has been highlighted by the World Bank which estimates that up to 9 million jobs could be created by 2050 [12,13].

3.2. African Institutions collaboration

Different institutions and stakeholders already working with issues to develop sustainable long term options for the management of indigenous resources will collaborate to add value at the local level and simultaneously provide energy security and decrease vulnerability to climate change. This considers the sustainable development objectives as set out by the World Summit on Sustainable Development (WSSD) as follows:

- *poverty alleviation*: COMPETE will help to establish local sustainable value-added energy provision services from biomass that should allow ground-level development to occur [14]. Evidence from Sao Paulo State in Brazil supports the hypothesis that bioenergy systems simultaneously enhance food production, local wealth creation and the provision of bioenergy supplies [15].
- *Water*: the provision of affordable and reliable energy is one of the basic requirements in the provision of safe water. Small scale modern bioenergy systems are often used to provide water pumping at the village level, both for clean potable water supplies and for irrigation.
- *MDGs*: ensuring that local people have access to secure, clean and affordable supplies of modern energy services is one of the key underpinning actions necessary to meet all of the eight MDGs.
- *Diversify income generation*: being an inherently rural and extensive activity based on using the land, bioenergy systems must be designed so that much of the value-added by the conversion of biomass to modern energy carriers is retained at the local level. Furthermore, the careful coupling of bioenergy supply to enhanced food production and income generating activities will be promoted within the project.
- *Traditional Knowledge*: traditional knowledge and traditional uses of natural resources are one of the main life-supporting and wealth generation activities of the rural poor in the countries of Africa. New systems of land management or alternative uses of natural resources must either provide alternative livelihood options for those currently dependent on traditional uses and/or ensure that existing resources are protected.

4 REPORTING AND FUTURE ACTIVITIES

COMPETE will deliver a matrix of multi-disciplinary and cross-sectoral work-packages, each led by globally recognised scientists and implementers, to:

- provide an evaluation of current and future potential for the sustainable provision of bioenergy in Africa in comparison with existing land use patterns and technologies.
- facilitate South-South technology and information exchange capitalising the world-leading RD&D in bioenergy in the key countries Brazil, Mexico, India, China and Thailand
- develop innovative tools for the provision of financing for national bioenergy programmes and local bioenergy projects, including: carbon credits, bilateral and multi-lateral funding instruments, and the role of international trade
- develop practical, targeted and efficient policy mechanisms for the development of bioenergy systems that enhance local value-added, assist local communities and address gender inequalities

5. REFERENCES

- [1] ECA. 2001. Transforming Africa's Economies. Economic Report on Africa 2000, Economic Commission for Africa, Addis Ababa.
- [2] African Ministerial Statement. 2001. African Preparatory Conference for the World Summit on Sustainable Development, Nairobi, Kenya; 18. October 2001.
- [3] WEC. 2000. World Energy Council, WEC Statement 2000.
- [4] Gustafson, D. 2001. The role of woodfuels in Africa. Food and Agriculture Organisation. In *Proceedings of the African High-Level Regional Meeting on Energy and Sustainable Development* (N. Wamukonya, Ed.) 10–13 January 2001, Nairobi, Kenya. pp 99–101.
- [5] Goldemberg, J. 2000. *World Energy Assessment. 2000*. UNEP. New York.
- [6] United Nations Development Programme (UNDP), World Bank, World Resource Institute (WRI). 2001. A guide to World Resources 2000-2001, People and Ecosystems – The Fraying Web of Life“, chapter 2. Taking Stock of Ecosystems“, Washington D.C.
- [7] Alexandratos N (ed) (1995) *World Agriculture: Towards 2010*. An FAO Study. Food and Agriculture Organization of the United Nations, Rome / Wiley and Sons, Chichester. 488 pp
- [8] E. Smeets, A. Faaij, *Biomass resource assessment on global scale for identifying biomass production and export potentials*, Report prepared for NOVEM and Essent, Copernicus Institute for Sustainable Development – Utrecht University, April 2004. Pp. 67 + Appendices.
- [9] Kartha, Leach and Chella Rajan, 2005. Advancing Bioenergy for Sustainable Development. Guideline for Policymakers and Investors Volumes I, II, and III. Stockholm Environment Institute. Energy Sector Management Assistance Program (ESMAP). The World Bank. Washington.
- [10] COMPETE. Terms of reference. EU. FP6-2004- INCO-DEV-3.
- [11] www.savannas.net
- [12] Utria, B., 2005. “Ethanol and gelfuel: clean renewable cooking fuels for poverty alleviation in Africa”, *Energy for Sustainable Development*, Vol. VIII No. 3, September, pp. 107-114
- [13] World Bank, 2005. *World Development Indicators*, <http://web.worldbank.org>
- [13] ESMAP. 2005. Potential for Biofuels for Transport in Developing Countries. Report 312/05. Washington, DC: World Bank.
- [14] Moreira, 2004 (pers com.) in: Woods, J. and Reed, P. 2005. Arguments for bioenergy development. Policy Debate on Global Biofuels Development. SEI. Stockholm.