ACP S&T PROGRAMME

# ACP SCIENCE & TECHNOLOGY PROGRAMME

## Western Africa biowastes for energy and fertiliser (WABEF)

**Using existing scientific data and industrial references, a stepwise approach and tools will be devised in a participatory way with public decision makers and executives, researchers and teachers, trainers from non-governmental organisation (NGOs), engineers and technicians. They will assess anaerobic digestion technologies and practices for recycling agricultural, agro-industrial and municipal biowastes into energy (i.e. biogas) and fertilisers (i.e. bioslurry, compost) with local applications that are relevant for Sudano-Sahelian Africa. The results will be disseminated through regional schools and e-learning curriculums for practitioners and universities to further promote the use of biowastes.**

### Challenge

In the WABEF project, biowastes are defined *lato sensu*; these include all organic residues issued from agricultural and agro-industrial productions and from municipalities. Conversion of these biowastes through anaerobic digestion to generate energy and fertilisers should allow the closing of the organic loop and generate a move towards an agronomic management of nutrients while addressing global issues such as food security, public health improvement, environmental management and climate change mitigation. Over the past five years, particularly in Europe, a booming development of anaerobic digestion plants has occurred, increasing the scientific and technological divide even more between African, Caribbean and Pacific (ACP) member states and most industrialised countries. This development could also take place in the Sudano-Sahelian zone where the climatic conditions are favourable for anaerobic digestion processes.

### Focus

Anaerobic digestion will be promoted for recycling agricultural, agro-industrial and municipal biowastes into energy and fertilisers using local applications. An innovative and participative approach will support the development of policies on biowaste management through the implementation of viable anaerobic digestion technologies in the Sudano-Sahelian context.

### Rationale

Waste management has become a priority in Africa due to the rapid growth of the population, together with a high urbanisation rate. Based upon an African population of 1 billion (0.6 billion in Western Africa alone by 2045) of which 40% are urban, the production of biowastes is estimated at about 50 million tons annually, which will be mainly land-filled. At the same time, 6.3 million hectares of agricultural land will have lost their fertility and ability to retain water. According to the Food and Agriculture Organization of the United Nations (FAO), these must be regenerated to meet the demand for food. Also, a large proportion of people, earning less than USD 2 per day, still rely on traditional biomass as an energy source.

Experiences with medium- and large-scale anaerobic digestion plants have been successful all over the world, but not in Africa. This is an incongruity because of its favourable hot and dry climatic conditions. In addition, access to energy is not easy, which should promote a decentralised production. The technical viability of small-scale biogas systems has been proven, but widespread dissemination has not yet been achieved across the continent. The dissemination has been limited due to poor baseline information, high initial investment costs and weak dissemination strategies, and a lack of human capacity is still limiting a wider spread and application across Africa.

For biowaste conversion, methodological tools are needed, such as evaluation guides of treatment processes and different technological options for project owners (communities, industry managers and farmers), prime contractors and operators.

### Method

Barriers to the uptake of anaerobic digestion by municipalities, industries and large-scale farms are a combination

Raw manure for fertilisation near a cabbage field in Rufisque, a suburb of Dakar, Senegal (December 2010). © F. Guerrin

**Grant**
FED/2013/330-225

**Co-ordinator**
CIRAD -
Centre de coopération Internationale en Recherche Agronomique pour le Développement, France

**Partners**
Université Cheikh Anta Diop (UCAD), Senegal
Institut Africain de Gestion Urbaine (IAGU), Senegal
Association d'Entraide pour le Développement Rural – Teriya Bugu (AEDR), Mali
Songhai Regional Centre, Benin
International Network of Resource Centres on Urban Agriculture and Food Security (RUAF Foundation), The Netherlands

**Project duration**
36 months
1/2/2014 – 31/1/2017

**EU grant**
EUR 742,892.50

Technical Assistance Unit
www.acp-st.eu
acp-st@acp-st.eu



This publication has been produced with the assistance of the ACP Secretariat and the European Union. The content of this publication is the sole responsibility of the authors and can in no way be taken to reflect the views of the ACP Secretariat or the European Union.

ACP S&T PROGRAMME

# ACP SCIENCE & TECHNOLOGY PROGRAMME

of financial, technological and managerial issues. An innovative stepwise and participatory approach will support the development of appropriate practices and reliable technologies for the anaerobic digestion of biowastes.

### Anaerobic digestion experiences and technology comparison

- Identify an array of relevant anaerobic digestion technologies adaptable to and viable in the Sudano-Sahelian context;
- Assess the identified technologies into the local context by using a simulation model;
- Compare the identified technologies to support decision making.

### Demonstration plants and business model

- Identify all the pre-conditions for a feasible business model sustained by a biogas and fertiliser demand-driven approach;
- Demonstrate the model to public decision makers and executives, researchers and teachers, trainers from non-governmental organisations (NGOs), engineers and technicians (target groups) who work in and with agriculture, municipalities and agro-industries, as well as communities, students and young entrepreneurs, industrial parks and agro-industries' managers, and farmers (final beneficiaries); provide training for students; provide data for additional references, if necessary, on logistics that could help to achieve the business model.

### Stakeholders involvement, knowledge transfer and awareness raising

- Identify training material on the stepwise approach and tool design; involve representatives from the target groups;
- Deliver ready-to-use information dedicated to the target groups and strengthen their capacity by improving and/or upgrading the training and curriculum of academic institutions on anaerobic digestion technologies;
- Organise two multi-stakeholder events for a policy uptake of the results using a combination of tools (policy brief, practical toolkit and promotional materials on anaerobic digestion technologies);
- Raise awareness amongst a pan-African audience on anaerobic digestion technologies and their implementation.

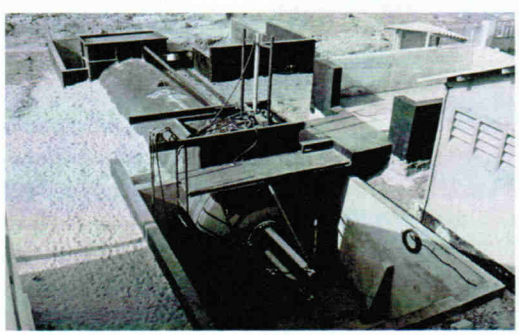
## Results

A compendium (i.e. database and technical datasheets) on anaerobic digestion technologies and a simulation model to compare matter balances and to assess the investments and running costs of these technologies, and to support a reasoned choice of the most suitable technology by decision makers (public authorities and communities, industry managers, farmers and groups of farmers).

A business model framework giving support on: how to set-up an organisational structure; how to organise the supply of the treatment unit in biowastes and the distribution of the issued co-products; and how to assess the market for the distribution of biogas and fertilisers and its related financial feasibility.

Two anaerobic digestion units in Benin (Songhaï Regional Centre) and in Mali (AEDR Teriya Bugu Centre) will be fully operational to serve as demonstration sites for decision makers and operators, and as practical training sites for students.

Specific courses on the stepwise approach and the design tools support the organisation of regional schools for practitioners and enrich decision makers. An existing Open and Distance Learning (ODL) module entitled 'Agronomic and environmental impacts of organic material recycling in agriculture. Application to the South' has been upgraded from the ODL resources of the French Virtual University on Environment and Sustainable Development (http://uved-matorg.cirad.fr/).



Plug-flow continuous biodigester at the slaughterhouse of Thiès, Senegal (February 1991). © J.-L. Farinet

Biodigesters at the wastewater treatment plant of Cambérène, Senegal (July 2009). © H. Saint Macary

**ACP regions and countries involved**
Western Africa – Senegal, Mali, Benin

**Programme theme(s)**
Energy access and efficiency
Agriculture and food security

**Sector**
Biomass
Waste management / disposal
Post-secondary education

**Keywords**
organic residues management
biowaste
anaerobic digestion
agricultural recycling
biogas
participatory approach
capacity building

**Project contact**
Mr. Jean-Michel Médoc
CIRAD – UR Recyclage et Risque
TA B-78/01
Avenue Agropolis
34398 Montpellier Cedex 5
France

Tel: +33-4-6761.6559
Fax: +33-4-6761.7148
jean-michel.medoc@cirad.fr
www.cirad.fr

**Project website**
wabef.cirad.fr

Implemented by the ACP Secretariat

Financed by the European Union