

## Information for biogas workshop

### 1. Which efforts on biogas have been undertaken in Africa so far and what have been the success and failure factors of these efforts?

#### Efforts that haven undertaken in Africa

Country	Project and its implementers	Programme Budget	Number of Units and Sizes?
Zimbabwe - 8/00-7/03  - 12/97-12/00	<ul style="list-style-type: none"> <li>• <b>Maqhina Biogas Project- MP (Community Based Organization : GEF</b></li> <li>• <b>Insiza Biogas and Woodstoves Project - IBWP (Community Based Organization : GEF</b></li> </ul> <p><b>Chinese and Carmatec:</b> Department of Energy, Silveira House , Biomass Users Network</p>	<p>- 12 581.00 USD</p> <p>- 24 59,00 USD</p>	<p>-(not given)</p> <p>-Aimed 5 but constructed 15 family size</p> <p>-Small scale scattered all over the country</p>
Rwanda 2001-present	<ul style="list-style-type: none"> <li>• <b>Rwanda prisons biogas plants:</b> Kigali Institute of Science, Technology and Management (KIST) – What was the programme name?</li> </ul>	-£50,000/500m <sup>3</sup> plant	- 6 large-scale (Expecting to construct 3 more each year)
Nigeria 2005-present	<ul style="list-style-type: none"> <li>• <b>Cows-to-Kilowatts:</b> Global Network for Environment and Economic Development Research, Technology innovators from Thailand and the Sustainable Ibadan Project</li> </ul>		1 Large-scale
Sudan 2001	<ul style="list-style-type: none"> <li>• <b>Biogas Pilot Project at the Rumbek Secondary School:</b> UNICEF/OLS</li> </ul>		- 1 Small- scale pilot then community may install as per wish
Kenya  1950-1958  1980-1990	<ul style="list-style-type: none"> <li>• <b>Floating and Fixed Dome type digester projects:</b> Technology Limited (TTL),</li> </ul> <p>Christian Intermediate Technology Center (CITC), Tunnel Kentainers Limited,</p>		<p>- 150 different sizes</p> <p>-300 different</p>

	Ministry of Energy and Regional Development		sizes
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**Failure factors:**

**Status of projects**

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**Maqhina Biogas Project**

By 2003 the biogas plants were not yet completed

The community participated in designing the project and selecting biogas as an alternative form of energy

Active involvement of participants through "hand-on" experience was to be used in the skills development thereby building their capacity to manage their project

**Insiza Biogas and Woodstoves Project**

Instead of constructing biogas 5 plants in one village, plants were constructed in the whole ward and were all functional in 2000

Six members of the community were trained and are in turn training others to construct biogas digesters and the trained the rest of the community, which participated in the construction of plants. Heifer International Zimbabwe has provided 75 heifers to boost the dung for feeding into the digesters

**Chinese and Carmatec**

A survey carried out by ZERO Regional showed that more than half of the installed plants are not functional to date mainly due to poor maintenance.

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**Rwanda prisons biogas plants**

Biogas plants are functional at six prisons and 3 more are to be installed each year.

**Floating and Fixed Dome type digester projects**

Many biogas projects have failed and were abandoned less than five years after installation. Up to date only 25% of the plants installed between 1980 and 1990 are functional.

**Biogas Pilot Project**

In 2002, the plant was still operational but was giving operational problems. During holidays, the plant the plant would be unattended and hence stops functioning. The trained group was able to train communities accepted the technology. A garden that utilizes the fertilizer from the plant was set up for income generation

**Key failure factors**

- Poor design and construction of digester, wrong operation and poor maintenance by the users
- Poor dissemination strategy by the promoters
- Lack of project monitoring and follow up by the promoters

- Poor ownership responsibility by the users
- Failure by government to support biogas technology through a focused energy policy.
- Failure by private and financial institutions to provide financial support
- Under subsistence agricultural conditions, access to cattle and other animal (animals move about freely) dung and the necessary water to mix the slurry has been more limited than expected during dry season.

### Key success factors

- Involving the community from the start of the project including energy problem and solution identification
- All partners involved in programme implementation have clearly defined role.
- Great emphasis on quality and reliability in the design and construction of the biogas plants
- Use of better designs e.g. anaerobic fixed-film digester design, which shortens the retention time.
- The construction of the plants carried out using local manpower and materials.
- Training of few community members that would in turn train others to construct biogas digesters (on-job-training)
- Community participation in providing labour and local materials.
- Support from private sector in getting materials.
- Tremendous potential for projects to be replicated in other areas.

### 2. What and where is the technical and/ or market potential of biogas in Africa?

**Market potential: Please expand, you have just provided scant information. Look at West Africa, East Africa, North Africa, Southern Africa and describe as given below. (I failed to complete this question)**

- Off-grid communities for household use:
- Potential irrigation schemes that are not connected to the grid
- Large institutions such as:
  - Boarding schools: 45% of schools do not have access to electricity, 27% do not have clean water, 65% have inadequate sanitation in South Africa
  - Hospitals
  - Prisons: 100% OF Zimbabwean prisons use wood or coal for cooking which can be substituted with biogas.
  - Colleges
- Large farms and dairy operations

Market Potential is a function of {no. of animals, scarcity of grid electricity, shortage of wood, water supply, population density, and type of farming}  
Give statistics in terms of quantities of these statistics.

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### 3. Which conditions need to be fulfilled for the successful introduction of large-scale biogas programmes in Africa

- **Reduction in investment cost:** High initial investment cost for the common types of biogas plants is inhibiting set up of plants. Effort should be made to come up with cheaper and efficient designs. (the cost of a family size floating drum plant is US\$1667 - beyond the means of most given that more than ½ the African population is living below US\$1 /day) .
- **Maintenance of existing plants:** Bad experiences and poor image created by many failed Biogas plants does not attract new players in the system. Users should be properly trained on operating biogas plants so that they last longer. Promoters should make a follow up of the plants until users are able to maintain them.
- **Different stakeholder involvement:** Lack of government commitment and limited private sector input does not attract new players in the system. Governments and private sector should greatly participate in the implementation of biogas programmes.
- **Providing enabling policy:** Governments must have clearly defined energy policy that promotes both local and foreign investors to play greater role in implementation of biogas programmes e.g. importation of parts such as biodigesters can be made free of import duty.
- **Research on the technology:** Researchers must be involved in the development of better technologies that would lead to reduction in unit energy cost over a long period. Recent research information on biogas technology from within and from countries where the technology has been successful should be made available since it will promote different stakeholder involvement in provision of energy using this technology.
- **Financial support:** Provision of financial support through loans and/or grants to small firms and serious individuals to set up effective business operation in the appropriate technology energy sector will promote set up of large plants.

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#### 4. Which necessary actions are required (by whom) to set up and implement programmes on domestic biogas in Africa

Setting up a programme:

##### Key stakeholders:

- Users
  - Small scale farmers integrated biogas production with poultry, aquaculture, dairy, piggery
  - Institutional setups (boarding schools, prisons, colleges, small municipalities sewage works)
  - Community (household level use)
- Designers (Private consultants, NGOs, government employees)
- Research and Academics (Universities, other government research institutes)
- Government (Dept of Energy, Agriculture, Forestry)
- Finance (Microfinance, Building societies, NGO grant funding)
- Industry (manufacturers of gas equipment and appliances)

- Technicians (Construction, repair and maintenance)

### **Lead Agency**

Government, Non-governmental organizations (NGOs) and private sector

These organization usually have wider sources of income and manpower that can be used to disseminate and implement biogas programmes.

### **Roles and Actions:**

#### **Users**

- Gas users and the direct beneficiaries of the programme
- Must provide sufficient resources (waste input: animal, crop residue) for biogas production.
- They have to be provided with necessary information, education, awareness and sensitisations
- Need capital investment (building of plant and the purchase of appliances)
- Need to have gas appliances
- Participatory energy service needs identification
- Be equipped with necessary knowledge and have adequate financial resources for plant operation, maintenance and repair.
- Keep a proper record of daily measurements that are required for optimization of the existing biogas unit
  - Amount and type of substrate mixed and the amount of mixing water.
  - Substrate temperature
  - Gas production
  - Electricity and heat production from co-generation units
  - Records on breakdowns and their causes
- Operate and monitor the functioning of the plant
  - Repair the plant components if necessary
- Analyse the fertilizer value of the biogas slurry to determine the amount of slurry to be spread on the fields.

#### **Designers**

- Knowledge about the technology
- They need a clear understanding of user needs
- Have knowledge of natural/ agricultural conditions
- Do the selection and economic viability analysis of available designs
- Design plant
- Give plant drawing and all details required for construction and implementation

#### **Research and Academics**

- Constant monitoring of available plants so that they:
  - Detect problems in the unit's performance
  - Have a base for comparing different models and different modes of operation
  - Have a base for economic analysis for different models
- Use these measurements, records together with information from users and evaluations analyse errors.

- Disseminate and optimize biogas technology and prevent mistakes of the past.
- Come up with cheaper and better models so that many can afford the technology.

### **Government**

- Work different stakeholders to ensure that biogas units are constructed, maintained and if necessary repaired. The following approaches may be facilitated:
  - The farmer technician approach
  - The cluster approach
  - The subsidized transport approach
- Training technicians, builders and designers
- Provision of subsidies for construction of plants
- Train communities to use the biogas and manure for income-generating projects so that they are able to repay loans

### **Finance**

- Provision of loans with varying interests rates to suit various clients
- Provision of grants for set up of community plants for very poor people who cannot afford loan repayment

### **Industry**

- Manufacture gas equipment such as pipes, valves digesters gas holders, pumps
- Manufacture gas appliances

### **Technicians**

- Construct biogas plants all the instructions from the designer's plan
- Repair the plant parts when necessary

## **5.How to organize the biogas initiative in Africa**

- Provide information on recent developments in recycling of livestock wastes through biodigesters and water plants to biogas promoters and owners.
- Promote and perfecting research on low-cost designs in rural communities and institutions to reduce the investment cost hence making biogas affordable.
- Provide scholarships for students from developing countries to study Biogas related subjects in developed countries where the technology is advanced.

Initiate a farmer-to-farmer exchange visit program to enhance technology transfer and friendship at the community level through sharing of experiences and cultures within a given country.

## **Implementation methodology**

- i. Involve the community in identifying its energy needs.
- ii. Provide the community with various available options for solving their problems clearly explaining the advantages and disadvantages of each options so that they make an informed decision in selecting the option
- iii. Help the community to select few members who can be trained on biogas technology so that they would in turn train the rest of the community starting from construction, monitoring and maintenance of the plant.
- iv. Involve this few community members in thorough training so that they grasp everything for transmission to others.
- v. Set up plants
- vi. Make a follow-up on the monitoring of the plants until the community s ready to work alone

This methodology will make the community feeling of programme ownership and hence are bound to work towards its success.