GTZ-Germany

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

GTZ introduced and disseminated biogas plants in bilateral projects in **Ethiopia, Cameroon** and **Lesotho.** In addition biogas was promoted in two supraregional programmes:

a) Biogas dissemination programme (1980 – 1992) with activities in Belize, Bolivia, Jamaica, Nicaragua, **Burkina Faso**, **Tanzania**, **Kenya, Burundi**, and Thailand)

b) Special Energy Programmes (Biogas Extension Programme) with activities in **Tanzania**, **Burundi, Kenya**; **Ivory Coast, Burkina Faso, and Mali**

Pilot biogas plants

GTZ introduced and supported the construction of pilot biogas plants in

- Cameroon (43 plants in the range of 1.5 – 12.5m³ for households, hospitals and farmers).
- Burkina Faso (6 plants)
- Mali (34 plants)

Biogas dissemination projects

Burundi

The Biogas Dissemination Programme of the GTZ in Burundi started in 1984 in the region Cankuzo with the training of craftsmen, establishment of a service systems and the opening of material credit funds, all in cooperation with a Belgium research project and a Chinese training programme for biogas constructors. By 1992, 206 household plants, and 84 institute plants with digester volumes over 100m³ had been constructed (tunnel and fixed-dome plants). Experiments with slurry as fertilizer were carried out. Six out of ten households examined under Biogas survey in 1992 used liquid slurry. Outgoing from Burundi biogas units were also constructed in BUKAVU Zaire/Kongo.

Ethiopia

Biogas technology was introduced to Ethiopia in 1977 through the German NGO BORDA and GTZ. In a recent bilateral project GTZ in cooperation with DED supported the construction of 100 biogas plants between 1999 and 2002 by informal private firms and the local NGO –SELAM.

The Ivory Coast

Two large balloon type plants were developed and constructed at the slaughterhouse in Ferkessdougou. The gas from these was used to produce electricity for the slaughterhouse in a generator. In 1982, the first six household plants with balloon-type gas-holders were built for the cattle herdsmen and their families in the slaughterhouse pen to save wood. Light produced by biogas plants played a great role in the demand for small biogas plants. By 1991, a total of 80 household biogas plants had been built .

Kenya

First attempts to use biogas technology to gain energy from coffee-pulp in Kenya go back to the mit-fifties. In the following 25 years , more than 100 plants of various types were sold mainly to large-scale farmers by a private entrepreneur. After the energy crisis, the GTZ – special energy Programme trained several craftsmen in 1983/1984 in the construction of biogas plants, As a result 40 biogas plants were build in the Meru region. As an extension of

the dissemination into other regions around 250 floating-drum plants were installed in various regions by the SEP in cooperation with the Ministry for Energy by 1988. Based on the opinion that an extensive project apparatus with a good financial background has time limitations, right from the beginning emphasis was placed on private entrepreneurs (construction of the plant, biogas accessories etc.). Only demonstration plants in new project areas were subsidised by the project, in other cases biogas customer paid the market process for his plant.

A survey carried out in 1992 with 49 plant owners showed that 9 plants built between 1984 and 1988 are no longer in operation. The reasons for this are stated as being:

- is no longer filled: 5
- inferior gas production: 1
- gas leaks and pipes defect: 2
- inlet pipe broken: 1

Lesotho

In cooperation with the Lesotho-based NGO TED , more than 65 digesters of varying sizes were built. The TED - biodigester proved to be especially suitable for wastewater and worked well on household and settlement level as well as for an industrial abattoir. Currently, nearly 25 units of this model will be constructed per year.

Morocco

The dissemination of biogas has mainly be taking place in the Souss-Massa region. Initially the rehabilitation of 3 fixed-dome plants, the construction of three 12 m^3 plants, five 20 m^3 plants and two 85 m^3 plants (mainly to drive motors) were carried out. By 1998 80 digesters have been installed (10 – 100 m^3) for a total 2.000^3 volume (800 MWh).
In 1995 a biogas plant was constructed at the wastewater treatment plant in Ben Sergao which used waste slurry for biogas production. The project was not successful due to lack of interest and maintenance. There is a new start for biogas in wastewater treatment supported by GTZ.

Tanzania

The history of biogas dissemination in Tanzania dates back to 1975 when the Small Industries Development Organisation (SIDO) built 120 floating-drum plants up to 1984. In 1982 the newly founded Centre for Agricultural Mechanization and Rural Technology (CAMARTEC) continued the promotion of biogas in Arusha area. In 1983 GTZ introduced an biogas extension service and disseminated biogas plants mainly in the region around Arusha where favourable agricultural and socio-economic conditions let expect a high dissemination for biogas plants. The project worked with a standardized plant design, clearly defined administrative procedures, and offered a warranty of 2 years and technical advice to the users in the villages. In 1984/85 household plants were offered with a digester volume of 8, 12 and 16 m^3, in 1990 the programme comprised standardised plants of sizes with 12, 16, 30 and 50 m^3 for households and institutions as well as a toilet biogas plant for institutions.
Orders which could not be covered by the standardised range of plants and services and which required additional research and development work had to be financed completely by the customer. The team introduced the *biogas unit concept.* Such a *unit* comprises an appropriate stable with solid floor, a pressure tested piping system, gas use appliances and a slurry utilization system adequate to the individual farm. The costs for a Biogas Unit increased from around TSh 300,000 in 1989 to TSh 400,000 to 7000,000 in the beginning of the nineties. Despite this, the number of units constructed until 1992 increased to about 400. Between 1990 and 1993 CAMARTEC conducted 4 International Training courses (with national and international participants) which led to a popularization of the CAMRTEC design in Ethiopia, Kenya, Uganda and Thailand.
The dissemination strategy and project structures underwent decisive changes around 1990 as a result of transfer of the project to the counterpart organisation.

GTZ studied also large scale application of industrial biogas units for Sisal industry, the first unit is now under construction supported by UNIDO and executed by China and German companies in relation with GTZ/CIM support.

Tunisia

Biogas was introduced in the Sejenane region in 1982 with a 11m³ floating drum plant. In 1986 the first fixed-dome plant (6m³) was built. In 1989 the SEP Tunisia rehabilitated non-functioning plants in the region and built 10 additional plants. First technician had been trained in Burundi and Germany. At the Technical University in the framework of GTZ cooperation a biogas laboratory had been installed supported by DAAD and FAL Braunschweig. The activities focused on the modification of the technical side (mainly gas appliances), training measures and slurry experiments. Between 1990 and 1992 , 16 more plants were constructed. China took over the activities supporting Tunisia up to date in training of biogas technicians.

Rwanda

In Rwanda, biogas technology is quickly catching up through the efforts of Kigali Institute of Science Technology and Management (KIST), where several former Counterparts of the GTZ Project in Tanzania (with CAMARTC) are working . KIST has designed and built a 150m^3 fixed dome digester in Cyangugu prison that is fed with waste generated by 1,500 prisoners. This digester produces methane gas that caters for 50% of the cooking needs in the 6000 inmate prison. KIST has also solved the sewerage and hygiene problem at Lysee de Kigali School by providing a 25m^3-Fixed Dome digester connected to 6 bio-latrines. The methane gas produced is used to cook for 400 students and for operating bunsen burners in the school science laboratories.

Success factors:

- Strong promotion and support for biogas by governmental institutions
- Appropriate financing mechanism for poor households
- Already existing experiences of households with gas as energy source for cooking, lighting and other purposes
- High quality of construction work.
- In-depth training of technicians and engineers, and knowledge exchange through networking
- Reliable and professional after sales/construction service
- In-depth training of households and farmers in the proper use of biogas plants

Failures:

- High costs of the technology for low income households
- Technical troubles and interferences (e.g. leakages)
- Improper filling or not enough manure causing low gas production
- Poor design and construction of digesters
- Wrong operation and lack of maintenance by users due to insufficient ownership (*a well designed and performing system will require a certain amount of attention) .*
- Lack of government commitment (policy) and limited private sector input because of low profit incentive

- Bad experiences and poor image created by many failed simple Biogas plants (bag type, floating drum)
- Poor dissemination strategy by the promoters (trial and error).
- Lack of project monitoring and follow-up by promoters
- Lack of after sales/construction services

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

Biogas plants for rural households/farms cost between 100 and 2500 US $ depending on the type, size and quality of the material. The investment costs are often too high for poor households but economically feasible for middle income households in villages. The running costs are generally low. Biogas plants are economically and technical attractive for large farms. The market potential of small households is lower due to the cost barrier and the lack of the necessary technical skills of the users.

The technical potential of the biogas technology is related to the characteristics of the different agricultural production and agro-ecological zones. Best results have been achieved e.g. in coffee/banana producing areas or higher rainfall areas and in stable feeding zones. Also agro-forestry areas are well suited as here animals are kept indoors in general. Milk producers also keep animals to some extend indoors. For dryer areas a precondition for feasibility is that animals are confined over night in stables. It can be concluded that in periurban areas the market is higher as financial flows are higher as well.

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

- Households with sufficient manure and scarcity of traditional cooking fuels
- Sufficient Government involvement
- Government incentives or subsidies for energy from RES
- Biogas promotion requires a long term strategy
- Potential user must be able to pay for the investment cost. Access to credits under attractive conditions or subsidies on material have to be guaranteed
- Sufficient population density otherwise the expenditures for biogas dissemination are unfavourable compared with the economic benefits
- Adequate maintenance/repair service
- Mechanism to ensure basic technical standards
- Training of masons,
- Appropriate gas appliances
- Availability of a cheap standardised biogas plant
- Capacity building / training for decission makers, engineers and technicians,

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

- Liaise with governments
- Identify potential partners, public and private
- Establish inventory on available designs and appliances according to specific regional conditions
- Carry out awareness raising campaigns
- Train technicians/engineers/masons
- Support the establishment of a biomass network including all relevant stakeholders
- Support credit schemes for poor farmers
- Support small firms and interested individuals financially and through capacity building to set up effective business operation with biogas.
- Provide information exchange on recent developments (e.g. about recycling of livestock wastes through biodigesters, anaerobic treatment of wastewater, solid organic waste and agroindustrial waste)
- Popularization and awareness creation to create demand
- Train users in the proper handling of the plant (quality and consistency of inflow material and required treatment)
- Promote the necessary technology for the local production of the construction materials

5. How to organise the Biogas Initiative for Africa?

Do be discussed during the workshop