

A Successful Story: The Biogas Project at SUST in 2014, and into 2015.

On 9th September 2014 a workshop was held in the Deans Hall, Al-Mogran campus, at the Sudan University of Science and Technology, running from 9.30 am - 1:30 pm. It was organised under the Deanship of Scientific Research and coordinated by Dr Hazir Farouk Abdelraheem. It was sponsored by the Vice Chancellor Professor Hashim Ali Salim, and with support from Mr Andrew Lang of the World Bioenergy Association.

The purpose of this workshop was to progress and gather support and input for a project to be conducted by a number of SUST engineering faculty students under the supervision of Dr Farouk into the potential for a renewed support from utilisation of suitable wastes and residues in Sudan for producing biogas, with this to be used for cooking and lighting at smaller scale, and at larger scale for industrial heat and electricity production.

Dr Farouk had made a visit to Sweden in June of 2014 to attend and speak at the World Bioenergy conference, and had seen how anaerobic digestions systems at city, farm and industry level were widely used for production both of heat and electricity, and also for upgrading into biomethane for use as a vehicle fuel for cars, trucks and buses. During this visit to Sweden she had also been elected to become a board member of the World Bioenergy Association for Sudan and the North Africa region, as well as for the Arabic-speaking countries of the region.

The objective of the workshop at SUST on the 9th September was to bring together the active people – including from NGOs and companies – involved in the use of biogas for energy in Sudan. This workshop also included people from SUST staff and some students involved in the early stages of a project to look at the economic feasibility, value the less tangible benefits for households and small off-grid settlements from installing biogas systems, and to investigate other issues relevant to this project – including optimal or most cost-competitive designs for small and larger systems.

The workshop heard from a good cross section of people who came to contribute information and thoughts for this project and who were in support of the general concept. The included Dr **Jakeline John George** Director of Research Outcomes and Patents, representing the Deanship of Scientific Research the organisers of the workshop and the source of funding for the project of biogas production, under the sponsorship of the Vice Chancellor.

Presentations and addresses were made by:

Mr Andrew Lang (World Bioenergy Association Vice President) on biogas development worldwide

Mrs Muna Mergani – Corporate Social Responsibility at Haggar, which has funded some of household biogas units for family farm cooperatives in North Kordofan in collaboration with Agricultural Technologies Transfer Society (ATTS).

Dr Mahmoud Onsay – University of Khartoum, who has been working with research students into biogas production from slaughterhouse wastes.

Dr Elyaman Fadlalla – an expert in biogas. She did her PhD on biogas system and has been working in this field since 1982. She recommends that any renewed development must start by looking at the history of installed systems and analysing reasons for any failures.

Eng. Musa Ibrahim – from the NGO Practical Action. Practical Action is working with development of improving energy access and efficiency for off-grid rural households, and is open to how biogas systems might fit into this.

Prof. Muna Mahjoub – president of Agricultural Technologies Transfer Society. ATTS has been promoting biogas systems and use as part of the support for small cooperatives to be

established to improve living standards and quality of life for rural communities, including by production of value-added product for which there is a domestic and possibly international demand.

Eng Faisal Al-Jozouli – founder of Akir Tai, a company manufacturing and installing biogas digestors in Sudan since 1983.

Others present at the workshop included students interested in involvement in this project.

During, between and after the talks by the above people, the chairs of the sessions guided the workshop participants to work through the various questions that had been listed, and also explore a number of other issues that came up during the meeting. The details on the program and objectives of the workshop are contained in *Final Report Biogs to Energy in Sudan Project Proposal*.

As was hoped, this workshop and the information it produced materially assisted the development of the framework of the biogas project and clarified and broadened its objectives.

In the same week as this workshop the group of project students and Dr Farouk and Mr Lang met several times to discuss details and work out the priorities for the research project. The group also visited the Al-Sahafa slaughter house in north Khartoum. They met with the manager who gave them the critical data of numbers of beasts processed, volumes of blood and other wastes part processed on site, available space for a anaerobic digester, present energy use and its costs, volume of water use, and present forms of disposal of the slaughterhouse residues. They looked over the stock yards and effluent water primary treatment system that this plant has installed.

This business is reasonably representative of many others in Khartoum and regional cities. It is clear that there are many places where well-designed and cost-effective anaerobic digestors could play an important role in reducing industry costs, improving reliability of electricity supply and in utilising wet organic wastes generated by the industry which otherwise have a significant disposal cost.

Following the workshop, slaughterhouse visit and meetings of this week, the commitment was made by the Vice Chancellor to fund the installing of this recently commissioned anaerobic digester at the Agricultural Production campus of SUST, designed to take 150-250 kg (wet weight) of manure from 30 cows, plus up to 100 kg (wet weight) per day from the chicken production facility and of other agricultural putrescibles wastes.

On about the 23rd of September the proposal was received from Eng. Faisal Aljozoli for a 12m³ biogas plant at the SUST Faculty of Agricultural Studies. The forecast was that this would produce 8-10m³ a day of biogas, with a peak of production up to 12m³/day. The digester residues were estimated to be about 180 m³ of liquid sludge over the year, with extra sludge of about 2 tonnes. This residue is relatively odourless and has a composition making it suitable as an agricultural fertiliser, with significant phosphorus and potassium levels.

Work started on the site preparation and excavations for the biogas digester in the first weeks of November, with completion of the digester about a month later in mid December. Filling of the digester with cow and chicken manure in the proper mix with water began almost immediately, and some usable biogas was becoming available within two weeks. Biogas of good quality was being produced within 21 days after the start of filling (by 2nd January 2015), and the official commissioning of the fully operational biogas digester took place on the 4th of January. At this point it was producing sufficient biogas of adequate quality for running a small motor driven generator, and for providing gas to up to 17 lamps.

The gas storage volumes in the digester dome and in the purpose-built reservoir will allow the gas building up during periods of low use over a 24 hour period to be used at steady pressure for lighting in the chicken production area and for laboratory work.

During this period of construction and commissioning of the anaerobic digester, the project group had had numerous planning meetings. They also had -

- developed the design for the required laboratory-scale batch digestors and these were fabricated out of commercially available materials
- been granted the use of a room to use as a biogas lab, and this was painted and equipped
- obtained the necessary scientific equipment for measuring and monitoring temperature, pH, and gas volume
- done the literature reviews for the number of project areas, and commenced some initial reports on biogas feedstocks
- begun work on adaptations or designs for low cost and effective household digestors

In my role as the vice president of the World Bioenergy Association I have regarded it as a privilege to be involved in providing some support and input to this project. I found the workshop process illuminating in the array of expertise that was on hand and freely being offered, and in the collaboration between the departments and administrative levels in the university.

I have been impressed by the enthusiasm and mature approach of the students who are involved and in the obvious organisational skill, vision and dedication displayed by the project team and particularly Dr Farouk. It has been gratifying to witness the design and construction skills and professional approach of Eng Faisal Al-Jozouli and his team.

The outcomes of this project promise to be far greater than one working biogas plant and one group of engineering students with an understanding of anaerobic digestion. It could mean a renewed understanding by industry, institutions, local government and NGOs and government departments of the potential for production of energy from wet organic wastes by this technology. It should mean that there will be an annual number of engineers graduating from SUST who have a sound knowledge of anaerobic digestion and possibly other bioenergy technologies, and even ideally of the full suite of renewable energy technologies.

Andrew Lang

World Bioenergy Association vice president, board member for Australasia-Oceania

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