

Turning waste into energy

A NIGERIAN INITIATIVE TO REDUCE POLLUTION AND GENERATE CLEAN ENERGY



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There are many ways to improve the environmental performance of an organisation. One option is to work in partnership with other stakeholders. Often, this requires more time and greater initial investment than independent activities, but the solutions achieved are often more sustainable. This article highlights the 'Cows to Kilowatts' initiative in Nigeria, a partnership project to reduce the water pollution and greenhouse gas emissions of a slaughterhouse. With the help of innovative technology from Thailand, the project turns abattoir waste into household gas and organic fertiliser, providing local communities with a clean and cheap source of household fuel.

LOCAL PARTNERSHIPS AND THE SEED INITIATIVE

In the face of the challenges of climate change, environmental degradation and poverty, an increasing number of companies, governments and NGOs are opting to join forces. Large scale partnerships involving global players are the most visible examples of such cooperative approaches. Yet projects initiated at the local level are often more concrete and offer tangible outcomes.

The Seed Initiative (Supporting Entrepreneurs for Environment and Development) was founded by UNDP, UNEP and IUCN-The World Conservation Union to promote and support locally driven, entrepreneurial partnerships for sustainable development. It found that a huge number and variety of such local initiatives exist, often working to enhance environmental sustainability while at the same time alleviating poverty and hunger. In doing so, such initiatives often rely on the generation or transfer of relevant knowledge and technology.

The Nigerian project, 'Cows to Kilowatts', is an example of such a project, which aims to reduce water pollution and greenhouse gas (GHG) emissions and was one of five Seed Award winners in 2005. The Cows to Kilowatts initiative epitomises how innovative and cooperative approaches can have a real impact on the environment as well as local communities.

UNTREATED SLAUGHTERHOUSE WASTE

Slaughterhouses are a major source of water pollution and GHG emissions, especially in the developing world. Specific regulations for abattoirs often do not exist or are poorly monitored and enforced, with wastewater often remaining untreated and entering local rivers and water sources. This represents an immediate environmental problem, affecting the development of aquatic life. In addition, slaughterhouse waste often carries zoonotic diseases, animal diseases that can be transferred to humans, and the anaerobic degradation of wastewater generates methane and carbon dioxide, which contributes to climate change.

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The biogas plant at Ibadan, due to open in 2008 is designed to produce 1,500 m³ of biogas per day and reduce daily GHG emissions by over 1.4 tonnes of CO₂.

In Ibadan, Nigeria, the NGO Global Network for Environment and Economic Development Research (GNEEDR) drew attention to this issue. Founder and Executive Chairman, Dr Joseph Adelegan, studied the effects of wastewater discharged from the Bodija Market Abattoir. He found that levels of organic pollution were highly elevated and had strongly negative impacts on nearby communities.

WASTEWATER TREATMENT

Dr Joseph Adelegan joined forces with two other Nigerian organisations to develop a solution. These two organisations were the Centre for Youth, Family, and the Law, a group of lawyers dedicated to environmental protection and community projects and the Sustainable Ibadan Project, part of UN-HABITAT's Sustainable Cities Programme.

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The first solution embraced by this group was to build an effluent treatment plant. Discussions with experts, however, revealed a need for improvement of this initial plan. Treating effluents with conventional methods effectively reduces water pollution, but leads to increased emissions of methane and carbon dioxide. The team therefore set out to find an alternative approach which would minimise the carbon footprint of the initiative.

COWS TO KILOWATTS

A solution involved capturing and transforming the gas emissions into a useful product. Relevant technology for achieving this had been created by a Thai research institution, the Center for Waste Utilization and Management at King Mongkut University of Technology Thonburi. Anaerobic fixed film reactors were developed to treat agroindustrial waste and produce biogas. With the help of an adapted form of this technology, slaughterhouse waste could be turned into clean household cooking gas, as well as organic fertiliser.

This approach offers at least three crucial advantages. Firstly, it minimises water pollution from slaughterhouse waste. Secondly, it significantly reduces the GHG emissions generated by the slaughterhouse and/or the treatment of its waste. Thirdly, it creates valuable biogas products. Through biogas sale, the project can not only become economically self sustainable, but turn into a profitable enterprise.

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Implementation I: building the partnership

The Cows to Kilowatts initiative went through various phases, beginning in 2001 with the waste treatment and biogas production plant currently being built and expected to start operations in early 2008.

In a first crucial step, the project's initiator GNEEDR had to find relevant and competent partners. As head of an NGO, Joseph Adelegan needed others to contribute their expertise and resources to develop a sustainable solution to the problem of water pollution in Ibadan. Several organisations provide key inputs to the project:

- ▶ GNEEDR developed the initial project idea, conducted primary research on water pollution, represents the initiative and handles the construction of the plant.
- ▶ The Nigerian Center for Youth, Family, and the Law provides legal advice and helps engage local stakeholder groups, such as the local butchers' association and the Bodija market development association.
- ▶ The Sustainable Ibadan Project was crucial in securing the support of the government.
- ▶ The World Bank's Global Development Marketplace gave an important impetus to the initiative by suggesting the integration of a renewable energy component in its design.
- ▶ The Thai research institute provided the initial technology and adapted it for use with slaughterhouse waste.
- ▶ The Seed Initiative provided further input into the development of the project and brokered a crucial contact to UNDP Nigeria.

Implementation II: financing the initiative

Capital requirements for designing and constructing the waste treatment and biogas plant, as well as administering the project and consulting with local stakeholders amounted to around US\$500,000. The project is designed to be commercially viable and envisages selling its household cooking gas at 25 per cent of current market prices: US\$7.5 per 25 litres. Producing around 270 m³ of compressed biogas a month, the plant would generate returns on investment after two years. With an estimated lifespan of 15 years, the plant is expected to create substantial economic returns.

Despite these features, it proved difficult to get affordable commercial finance for a promising but untested project in Nigeria. The initiative gained international recognition through its selection as a finalist in the World Bank Global Development Marketplace and as a Seed Award winner, but

no financial support. Finally, UNDP provided the necessary start-up capital through its Programme in Energy and Environment.

Implementation III: adapting the technology

The Thai research institute at King Mongkut University of Technology Thonburi had developed an innovative technology for treating agroindustrial waste and generating biogas. Through the use of anaerobic fixed film reactors, the institute managed to achieve much higher treatment efficiency, handling larger quantities of waste and generating high quality biogas at a faster rate than conventional technologies. It successfully applied this technology for treating waste from a rice starch factory and a fruit canning factory.

In an excellent example of South-South cooperation, the institute agreed to adapt its anaerobic fixed film reactor technology for use with slaughterhouse waste after being contacted by the Cows to Kilowatts initiative. Test results show that the adapted reactor can handle an organic load rate ranging from two to 10 kilograms of chemical oxygen demand (COD) per m³ (COD is used as a measure of organic pollution in wastewater) and operates with a retention time of two to four days. The technology yields between 0.4 and 0.5 m³ of biogas per kilogram of COD, containing 60 to 70 per cent methane. The tests also indicate that the technology is stable.

Implementation IV: plant construction

Even with secured finances, project implementation did not start immediately. UNDP's Programme in Energy and Environment is nationally executed, which means that funds are normally only disbursed to national governments. In the Cows to Kilowatts case, the Nigerian Federal Ministry of Environment agreed to receive and transfer the resources to the partnership. This, however, implied that the initiative had to go through complex formalities and deal with bureaucratic hurdles.

With the adaptation of the relevant technology completed and the design of the biogas and waste treatment plant finalised by the Thai research institution, construction began in 2007. The plant is scheduled to be completed by March 2008.

IMPACT OF THE INITIATIVE

Once the waste treatment and biogas production plant starts operating, it is expected to generate several positive environmental, economic and social impacts. The plant is designed to produce 1,500 m³ of biogas per day and to capture 900 m³ of pure methane per day. This is equivalent to a daily reduction of GHG emissions of the slaughterhouse of over 1.4 tonnes of CO₂. In addition, the plant will treat 3,500 m³ of wastewater a day and produce 1,750 litres of organic fertiliser.

The captured methane will be upgraded and compressed for use as household cooking gas. It is expected to be sold locally, generating additional employment. The gas is expected to be distributed to around 5,400 households each month. The predominantly poor families will benefit from the gas because it constitutes a cleaner alternative to other commonly used fuels. At significantly lower cost than currently available sources of natural gas, it will reduce indoor air pollution and associated health hazards in poor communities.



ROLL-OUT AND REPLICATION

Many other cities in Nigeria and across the African continent are facing similar environmental and health challenges from untreated slaughterhouse waste. Once proven successful, the Cows to Kilowatts initiative carries great potential for further roll-out and replication.

Through its use of innovative technology, the Cows to Kilowatts initiative offers a solution to waste treatment which at the same time minimises the carbon footprint of slaughterhouse operations. Moreover, it is economically self sustainable and even profitable, generating a classic win-win situation. Finally, the pilot project in Ibadan is financed with the help of international donor money. Since the plant is expected to repay its start up capital within two years, the necessary financial resources will be available for replicating the project by 2010.

Author

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Organisation

The Global Public Policy Institute (GPPi) is an independent, nonprofit think tank based in Berlin and Geneva. Its research focuses on effective and accountable governance and its consulting practice offers services for public and private institutions. GPPi provides a platform for debate and fosters strategic communities bringing together the public sector, civil society and business. Until 2006, GPPi coordinated and led the Research & Learning Channel of the Seed Initiative, which supports locally driven partnerships for sustainable development.

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