Poo Power in Ghana's Biggest Slum

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In many Ghanaian schools ash is used to wash your hands after using the toilet; a lot easier to find and the same amount of cleanliness according to the World Health Organisation. Photo by Safi Sana / Facebook

According to ECOWAS this is the first grid-connected biogas plant in Ghana and the second in West Africa. Located in the city of Ashaiman, Ghana's biggest slum community (population about 300,000) where sanitation facilities are non-existent or dilapidated and poorly managed, the Poo Power plant built by Safi Sana Ghana Limited is a novelty. It also offers great relief in terms of sanitation and the supply of power to the grid to serve the people in the community.

With the rapid growth of population in communities like Ashaiman, demand for sanitation facilities is high and the situation deteriorating. Mostly sanitation facilities have never existed. Where they do exist, their condition and management are very poor. The Safi Sana sanitation model intervenes along the entire sanitation value chain, ending up with the treatment that generates two main outputs, organic fertiliser and electricity. The article details the Safi Sana model, the process of biogas to electricity, the impact of the project in the Ashaiman community as well as the partners involved in the project.

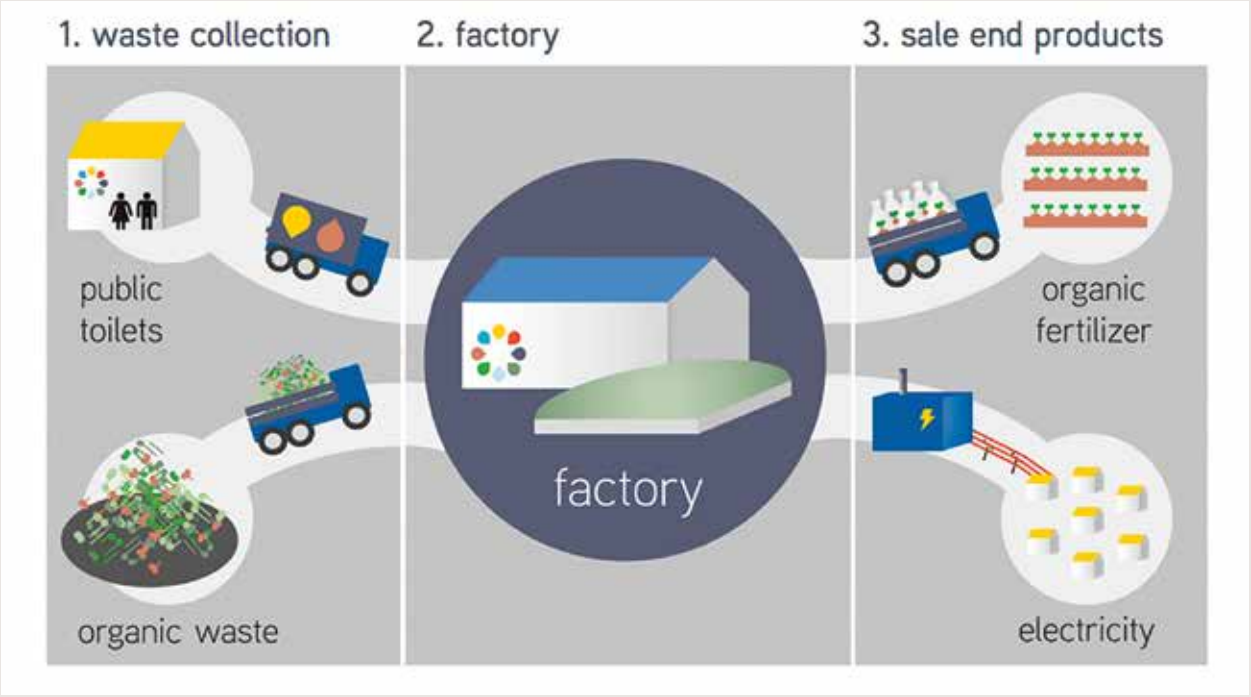
The Safi Sana model

The Safi Sana model is based on seeing waste as a resource. Faecal and organic waste is collected from urban slum communities, for example from toilet blocks, restaurants, markets and slaughterhouses and used as input in our factory. Here waste is treated in a biogas digester to produce biogas, organic fertiliser and irrigation water. The biogas is subsequently used to produce electricity.

Communal toilet blocks to serve about 200-300 people are built in the areas of the slum where they are most needed. Management of the blocks is franchised to local NGOs or individuals in the locality who charge subsidised user fees. This ensures communal ownership and sustainability. Safi Sana company trained a team of cesspit truck owners, forming a Toilet Services Network. They are supported to transport the toilet waste from the nooks and crannies of the community to the treatment site. Travel time and cost is reduced as the treatment plant is located within the community.

Safi Sana also collects solid organic waste from the market, local restaurants and slaughter houses. The waste collection activities cover about 20 km radius around the factory. Young men and women have been recruited, trained and supported financially to move round the community with tricycles to designated collection centres, markets and the slaughter houses. In some cases existing waste collection companies are used to transport waste to the site. Market women and the slaughter house operators have been trained to segregate their waste according to the various fractions. The biggest challenge so far has been getting clean waste to feed the plant.

The local municipal assembly is also involved in educating the inhabitants and promoting sound sanitation practices through a committee of opinion leaders and leaders of various associations in the community. The aim is to support the local population through a market-driven approach. Safi



Sana Company works together with national and local governments, NGOs and the private sector. Our 'tri-partite' philosophy combines government support, social and sustainable values and a commercial business plan. Together we work to establish a stable and financially sound company.

The process

Through a process of fermentation, the organic waste goes through four biological and chemical stages to generate the biogas. These stages are: hydrolysis, acidogenesis, acetogenesis and methanogenesis. Anaerobic digestion (AD) is a process dependent on microbiological activities in the absence of oxygen. This microbiological process exists naturally in such environments as swamps and the stomachs of ruminants. Using an engineered approach and controlled design, the anaerobic digestion process is applied to process organic biodegradable matter in a reinforced PVC airproof reactor tank to generate the biogas. The process ends up

Different groups of microorganisms play different roles in the process. The hydrolysis phase involves the breaking down of the complex biomass into simple molecules using enzymes and water to separate the chemical bonds between the compounds. In the next stage, acidogenesis, bacteria convert the biomass of simple sugars into short fatty acids. It is this stage that alcohol, hydrogen and carbon dioxide are produced. In the third phase of the process, acetogenesis, acetate is generated from energy sources with the end-products carbon dioxide and hydrogen. For proper and effective anaerobic digestion and methane production, this phase is very important. The final stage in the digestion process, methanogenesis, is when methane production occurs. The bacteria that produce methane are so unique that scientists have categorised them into a new evolutionary domain referred to as Archaea. Biogas is the end-product of the digestion process. Though a mixture of many gases, biogas is predominantly made up of two, methane and carbon dioxide, which account for 80-90% of the mix. Hydrogen sulphide and ammonia gases are found in very small proportions.

New good and promising results for fertiliser on plant test using faecal matter as input. Photo by Safi Sana / Facebook

Safi Sana site cleaning team Photo by Safi Sana / Facebook

with two main outputs: energy-rich biogas and a nutritious digestate which can be used as organic fertiliser.

This biogas generated in the anaerobic reactor is connected to a power generation unit, a combined heat and power plant with an installed capacity of 100KWh of electricity. This electrical power is fed into the grid in Ashaiman.

Safi Sana signed a power purchase agreement with the Electricity Company of Ghana so the electricity which is fed in to the national grid is paid for by the utility provider. Being the first of its kind in the country, there were some initial challenges. Negotiating the power purchase agreement took close to a year, with clauses on legal and technical issues generating disagreements, plus technical challenges on linking to the grid.

Impact

By offering an integrated waste-as-resource programme, Saf Sana achieves two important results:

- First, the means to maintain the service for many years: waste is collected from the community and treated, with the end-product ploughed back into the community as affordable organic fertiliser. Also, the project has a nursery where high quality seedlings are raised using the organic fertiliser and treated waste water. Including the sale of these seedlings to local farmers at very affordable prices, jobs are created all along the entire chain.
- Secondly, a long-term perspective is created for the local inhabitants. The estimated effects of the new plant in Ashaiman are:
  - 13 tons of toilet waste treated daily and not pumped into the sea or nearby bush
  - 15 tons of solid organic waste recycled daily and not left to feed rodents or block sewers
  - 40,000 people will have access to improved toilets
  - Electricity generation sufficient to serve over 3,000 families daily
  - 720,000 m2 farmland gains access to vital nutrients using the organic fertiliser.
  - 25 people directly employed and many more supported as suppliers or partners

For more details go to www.safisana.org/en

Photo by Jean Michel Médoc

Climate change and migration to cities continue to put pressure on existing infrastructure. The Safi Sana end products -biogas, organic fertiliser and irrigation water – add to water productivity, food security and climate resilience. They also deliver direct and indirect health and economic benefits to 125.000 slum dwellers in Ashaiman.

Project partners

For the first project in Ashaiman, partners include: the African Development Bank; RVO Netherlands; Via Water; Ashaiman Municipal Assembly (provided a 5 acre piece of land); WASTE and WereldWaterNet; Royal Haskoning DHV; IFDC; Wageningen University; and Aqua for All. The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) carried out a survey that revealed Faso Biogas in Burkina Faso is the first grid-connected biogas plant in West Africa and Safi Sana is the second.
www.ecowrex.org/news/west-africas-first-grid-connected-biogas-plant-burkina-faso.

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