BUSINESS MODEL PROFILES: ENERGY
SUMMARIZED FROM THE FORTHCOMING PUBLICATION
RESOURCE RECOVERY FROM WASTE

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems
LED BY: IWMI International Water Management Institute

Producing Biogas from Fecal Sludge at Community Level

Business characteristics

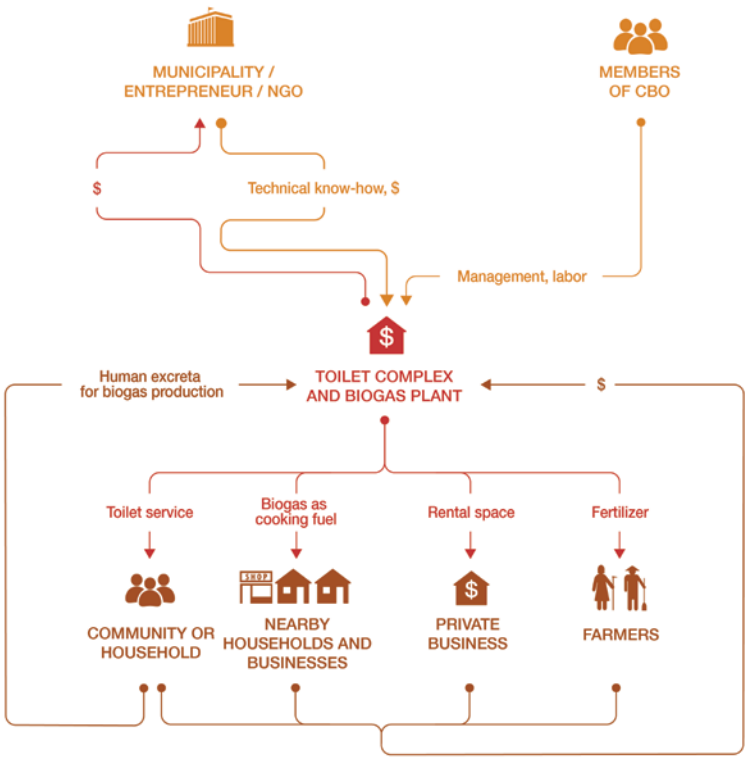
Geography	Applicable to residential institutions and public toilets that provide toilet facilities to underserved communities
Scale of production	From 10 m^3 up to 200 m^3 of biogas per day
Type of organization	Private and public-private partnership (PPP)
Investment cost range	About USD 10,000-85,000
Key costs	Investment costs (land, building, equipment and gas distribution lines), and operation and maintenance costs (toilet facility cleaning, toilet paper and consumables, training, utilities, labor)
Revenue stream	Toilet usage fees (pay-per-use), sale of biogas, sale of carbon credit, sale of compost and rental space income

Business model

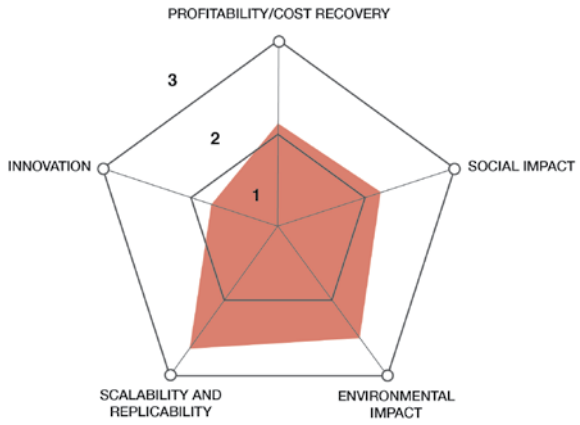
The business model involves the treatment of fecal sludge collected from either public toilets or toilets in residential institutions, using bio-digesters to generate biogas for lighting and/or cooking or for sale to households and businesses. Using anaerobic technology, the treatment of toilet waste provides safer sanitation and produces pollution-free biogas for energy. The model also provides organic compost from the biogas plant which can be used as fertilizer.

The business can operate in two ways: through (i) an enterprise, municipality or nongovernmental organization (NGO) providing sanitation services; or (ii) a residential institution (e.g., hostel, hospital, prison) that produces large quantities of human waste. In the first case, a toilet complex is installed in which human waste is fed directly to a bio-digester. The owner of the business charges a fee for toilet usage, rents out space within the complex for other businesses, and sells surplus biogas as well as fertilizer to various users. In the second case, the human waste of a residential institution is transferred to a bio-digester in order to produce biogas for the kitchen, thereby reducing energy costs (with potential to sell excess biogas). Both these business models offer carbon offset and can sell carbon credits for additional revenue.

BUSINESS MODEL VALUE CHAIN FOR A PUBLIC TOILET COMPLEX



Business performance



The business model has a high potential for replication in developing countries, with no limiting factors except for the social acceptance of the product, and can be scaled up by expanding the business to other sectors such as compost and selling cooked food. It scores low on innovation as the model does not require any sophisticated technology or financing.

Main risks

Market risks: In both cases of the model, there is a potential risk that consumers will be unwilling to use biogas, food/bakery items made using biogas or bio-fertilizers generated from human waste due to social perceptions.

Technological risks: Although the technology used is well established and mature, it might not be available in developing countries and requires skilled labor.

Political and regulatory risks: In most developing countries, the price of cooking fuels such as kerosene is subsidized for domestic consumption. Such government policies can diminish the economic advantage offered by the biogas supplied to households. Also, if the policy is extended to commercial entities, the business model is unviable.

Safety, environmental and health risks: Processing human waste poses a high risk for environmental pollution and human health, if appropriate measures are not taken. These include possible gas leakages, and health and safety risk for workers.

Case study: Nairobi, Kenya

The Total Sanitation and Hygiene Access (TOSHA) 1 bio-center, located in Nairobi's biggest slum, Kibera, is a multi-purpose sanitation facility which has contributed to improving hygiene in the community as well as producing biogas and bio-slurry from human waste. Run by the community-based organization (CBO), TOSHA, the center contains toilet facilities, a bio-digester, showers, an operator's office, biogas cooking facilities for women street food vendors and restaurants, a bio-slurry for farmers, rental spaces for private businesses, and a meeting hall. It is used by an average of 1,000 people per day and has a production capacity of 54 m^3 of biogas per day.

The bio-center was built by the civil society organization/NGO, Umande Trust, which continues to provide technical support and training to TOSHA on running the complex. The center currently makes a profit of about USD 1,100 per month from user fees and the sale of biogas and bio-slurry. In addition, the business has provided a wide number of benefits for the Kibera slum, including improved sanitation, fostering of entrepreneurship in the community, changing people's attitude towards reusing human waste, and reduced emissions from the burning of other fuels.

Key performance indicators (as of 2012)

Capital investment:	USD 22,500 for construction of each bio-center; USD 10,000 for advertisement/campaign		
Labor:	Skilled and unskilled labor for construction and running the bio-center		
Operation and maintenance cost:	USD 3,720/year		
Output:	Toilet facility for 1,000 users/day and biogas capacity of 54 m^3		
Social and environmental impact:	Improved community health, hygiene and environmental sanitation, improved livelihood and capacity building of community, job creation, and reduced environmental pollution		
Financial viability:	Payback period: 3 years	Rate of return: 33%	Gross margin: 77%

For more information on the business model and related cases, see Chapter 4 of **Otoo, M.; Drechsel, P. (Eds.). 2017. *Resource recovery from waste: Business models for energy, nutrient and water reuse in low- and middle-income countries.* London: Earthscan/Routledge. In press.** The book has been produced by the Resource Recovery and Reuse subprogram of the International Water Management Institute (IWMI), under the CGIAR Research Program on Water, Land and Ecosystems (WLE) and its Rural-Urban Linkages Research Theme. The support of the Swiss Agency for Development and Cooperation (SDC), the International Fund for Agricultural Development (IFAD), and CGIAR Fund Donors (www.cgiar.org/about-us/our-funders/) is gratefully acknowledged.