Producing Biogas from Kitchen Waste

Business characteristics

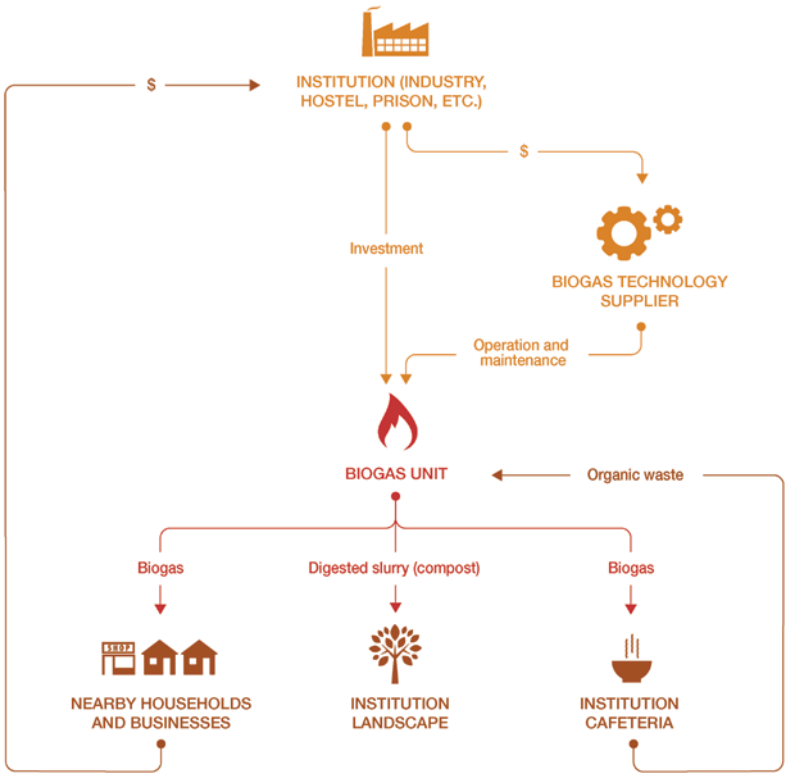
Geography	Institutions with large kitchen facilities to cook for large numbers of people
Scale of production	About 100-300 m^3 of biogas per day used to cook food for around 3,000 to 7,000 people, and about 1-4 tons of sludge per day produced for compost
Type of organization	Institutions with large kitchen facilities (e.g., prisons, schools) or private technology provider on a BOOT arrangement
Investment cost range	About USD 75,000 to 125,000
Key costs	Investment costs (land, building, equipment and gas distribution lines), and operation and maintenance costs (training, utilities, labor)
Revenue stream	Sale of biogas and bio-slurry (fertilizer), savings from avoided fuel purchases, and potential sale of carbon credits

Business model

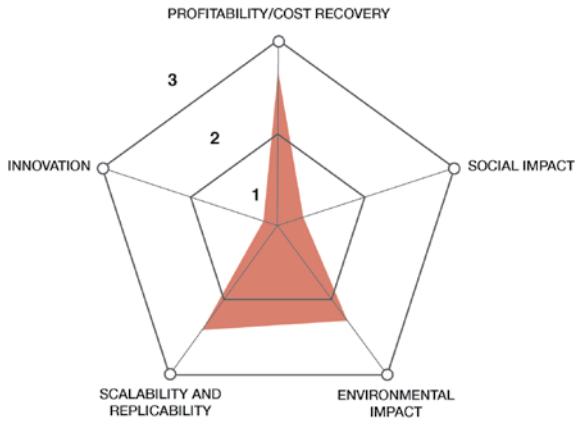
The business model coordinates the collection, segregation and transfer of organic kitchen waste to a bio-digester in order to produce biogas for cooking or for sale to households and businesses. Using anaerobic technology, this model allows institutions with large kitchen facilities to sustainably manage their organic kitchen waste and generate savings from reduced energy costs or make a profit from the sale of biogas.

The business model can be set up by either the institution producing kitchen waste or a private company entering into a Build, Own, Operate, Transfer (BOOT) arrangement with the institution. In the first case, the institution itself builds and operates the biogas plant through the assistance of a technology supplier, and produces biogas mainly to be used in its kitchen, thereby reducing operating costs. In the second case, a private biogas technology supplier installs the biogas digester and operates the system by selling biogas to the institution as well as to households and businesses. This is done for an agreed amount of time until the private company has recovered its investment costs and can later transfer ownership to the institution. In both models, the biogas plant produces bio-slurry which can be used internally or sold to farmers as fertilizer.

BUSINESS MODEL VALUE CHAIN



Business performance



Although the business model does not generate a strong revenue source, it performs highly in terms of cost recovery. It also has a strong positive environmental impact, with overall safer management of organic waste and reduced greenhouse gas emissions. However, due to low job creation and basic technology, the model scores low on social impact and innovation.

Main risks

Market risks: In the case of a private biogas supplier operating the business, there is a potential risk in the host institution's willingness to participate in a BOOT arrangement.

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. If the policy is extended to commercial entities and institutions, it can diminish the economic advantage offered by the biogas plant.

Safety, environmental and health risks: Processing 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: India

Established in 1945, Wipro Limited is a large information technology (IT) business conglomerate with revenue of over USD 7.3 billion and more than 75,000 employees in India. In 2008, as part of its Corporate Social Responsibility program, the company partnered with Mailhem Engineers Pvt. Limited, a waste management technology firm, to install, operate and maintain a biogas plant for treating waste from its canteen at the office headquarters in Bangalore. Catering to over 5,000 employees, the canteen generates about 1,500 kg of waste per day.

Thanks to the biogas plant, this waste now produces between 69,300 m^3 to 74,250 m^3 of biogas annually. This has replaced liquefied petroleum gas (LPG) as the cooking fuel, saving four 19-kg LPG cylinders per day, leading to annual fuel cost savings of USD 24,480. The plant has also created employment for four people, as well as generating 108 tons of bio-sludge annually, which is used as manure in the gardens on Wipro's campus. This has also led to reduced pollution and carbon emissions from avoided municipal waste for landfills and the replacement of LPG burning for cooking.

Key performance indicators (as of 2014)

Capital investment:	USD 100,000		
Labor:	Three full-time employees and one part-time employee for operation of the biogas plant		
Operation and maintenance cost:	USD 10,320/year		
Output:	210-225 m^3/day of biogas and 2 tonnes/day of bio-sludge		
Social and environmental impact:	Job creation, waste reused without being discharged into municipal waste, and carbon emissions saved: 37.26 tons CO_2/year from waste recycling and 306.77 tons CO_2/year from LPG		
Financial viability:	Payback period: 3.5 years	Rate of return: Less than 51%	Gross margin: 25%

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.