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

Generating Power from Agro-waste

Business characteristics

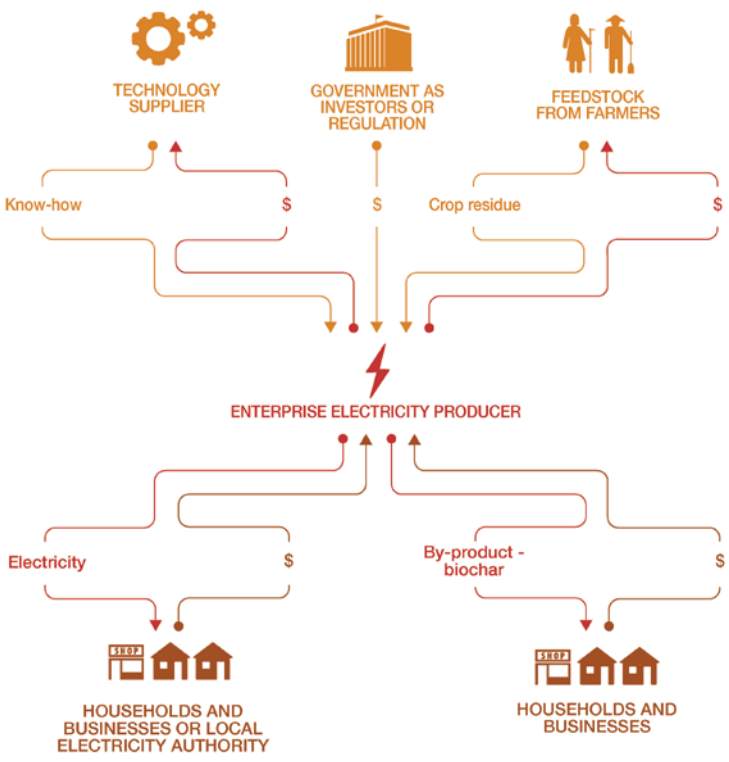
Geography	Rural areas with several hectares under crop cultivation
Scale of production	25-100 kW of electricity (with gasification) and up to 8 MW (with combustion)
Type of organization	Private or social enterprise, community-based organization, or individual entrepreneur
Investment cost range	About USD 1,000-1,400 per kW
Key costs	Investment costs (land, building, equipment, and transmission and distribution lines), operation and maintenance costs (training, input cost, utilities, labor), and debt and equity payments
Revenue stream	Sale of electricity, and potential sale of by-product (biochar, fertilizer) and carbon credits

Business model

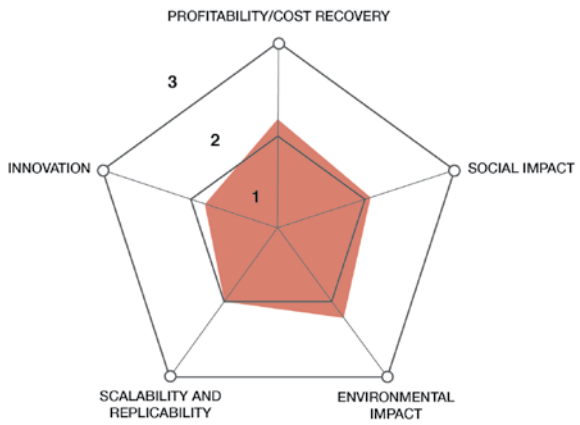
The business model processes crop residues such as wheat stalks and rice husks to generate electricity for internal use or sale to households, businesses and/or local electricity authorities. The crop residue is transformed using gasification or anaerobic technology to generate sustainable, non-polluting electricity.

The business can be set up by a standalone private enterprise, a community-based organization, a social enterprise or an individual entrepreneur on either a Build, Own and Operate basis or a Build, Own, Operate, Transfer (BOOT) basis. In all cases, the enterprise has to have strong partnerships with farmers and agro-industries to ensure a reliable supply of crop residues at an agreed price, as well as the government as a regulator and/or investor, and a technology supplier. Electricity can then be provided for social benefits or sold for profit. Carbon credits can also be obtained and traded, along with various by-products, such as biochar, depending on the process.

BUSINESS MODEL VALUE CHAIN



Business performance



The business scores particularly high on environmental impact due to the large potential impact it offers for a cleaner local environment and the reduction of greenhouse gas (GHG) emissions.

Main risks

Market risks: In areas where the electricity sector is regulated and the state utility is the sole buyer, the bargaining power of the business producing and selling electricity will be low. Also, if the business has a high dependence on the sale of carbon credits for its viability, the volatility of the carbon credit market puts the sustainability of this reuse business under risk.

Technological risks: Although the technology used is well established and mature, it requires skilled labor to operate which may not be available.

Political and regulatory risks: In regions where electricity is dominated by the public sector and regulations do not allow the sale of electricity, the business model cannot be established.

Safety, environmental and health risks: The waste processing technologies used pose a number of environmental and health risks, if appropriate measures are not taken. These include possible methane leakages, and health and safety risk for workers.

Case study: Marlanhalli, India

Greenko Group is a private Indian power producer which is utilizing new approaches to clean power by using proven, technologically advanced systems and processes. Out of its many renewable energy projects, seven generate electricity from agro-residues.

Commissioned in 2005, Greenko's 7.5 megawatts (MW) Ravikiran power project in Marlanhalli, in Karnataka state, buys low-cost agro-waste from local farming villages to generate and sell electricity at pre-announced tariffs to the regional electricity grid. Buying crop residue at USD 15 per ton, it processes this through combustion to produce steam for electricity generation. From its sales, the project makes an annual revenue of over USD 2.53 million, which it complements with the sale of carbon credits and Renewable Energy Certificates for additional revenue. In addition, the project has had a significant impact on the region by improving the local availability of electricity and infusing money into the local economy (USD 1 million), as well as reducing GHG emissions.

Greenko is currently setting up similar biomass energy projects in six other locations in India, with plants ranging in capacity from 6 to 8 MW and totalling 34 MW.

Key performance indicators (as of 2014)

Capital investment:	USD 6 million		
Labor:	Nine full-time employees		
Operation and maintenance cost:	USD 2 million/year (including fuel costs)		
Output:	46 GW/hours net electricity generation at a 7.5 MW output level		
Social and environmental impact:	Job creation for biomass collection and transport, income generation for the local population through the sale of agro-residues, indirect investment in the regional infrastructure, and 37,468 tons of CO_2 equivalent/year of carbon mitigation by avoiding of waste build-up and anaerobic conditions for agro-residues		
Financial viability:	Payback period: 4.7 years	Rate of return: 16%	Gross margin: 28%

For more information on the business model and related cases, see Chapter 5 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.