

2009 Ashden Awards case study Kampala Jellitone Suppliers Ltd (KJS)

Finalist's work: Agricultural residues fuel industries and institutions
Organisation: Private limited company, established in 1976. Annual turnover US\$160k and 43 staff (2009)
Location: Kampala, Uganda

Summary

The south of Uganda is a predominantly agricultural area, growing crops such as coffee, rice, and groundnuts. Large quantities of wood and charcoal are used by households and businesses for cooking and processing. This contributes to the serious problem of deforestation which is directly threatening some of the highest concentrations of biodiversity in Africa. Kampala Jellitone Suppliers Ltd (KJS), was looking for an alternative fuel to LPG for its coffee-roasting enterprise, and invested in equipment to make briquettes from agricultural residues. Because of demand from institutions like schools, KJS diversified into producing briquettes for sale, and installing efficient cooking stoves to use with them.

- Agricultural residues collected mainly from the South West of Uganda, and delivered to the KJS factory near Kampala.
- Two briquetting machines, with a total capacity of about 2,000 tonnes/year.
- 1,309 institutional stoves and ovens installed for 36 organisations (March 2009).
- About 1,530 tonnes of briquettes manufactured and sold during 2008, replacing mainly fuelwood and also charcoal.
- Customers include schools, colleges, Makerere University, hospitals and food-processing businesses.
- Briquettes cost about US\$16/tonne. Cost of cooking is similar to using firewood at US\$14/tonne because briquette stoves are more efficient. Cost of cooking is considerably cheaper than using charcoal at US\$29/tonne.
- Reducing unsustainable use of fuelwood and charcoal.
- Saving of about 6.1 tonnes CO₂ per tonne of briquettes. This is equivalent to about 9,300 tonnes/year CO₂ (2008).
- Several thousand direct beneficiaries (mainly cooks) and hundreds of thousands of indirect beneficiaries.
- Customers like the convenience of buying, handling and storing briquettes.
- Cooks like the reduced smoke, heat and charcoal dust, and faster cooking.
- KJS employs 43 staff in stove making and briquette production. Further employment provided for collecting residues, and delivering briquettes.
- Significant potential for expansion in Uganda, with a large number of institutions and supplies of agricultural residue.
- Demand for a domestic briquette stove, currently under development.

Kampala Jellitone Suppliers

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Context

Uganda is largely a rural economy. For many people, the main source of income is farming while others are employed in the food processing factories. The lush countryside in the south of Uganda supports a wide range of crops including maize, wheat, rice, cassava, bananas, peanuts, cereals, coffee, yams and vegetables. These are grown both for family consumption and as cash crops.

Wood and charcoal are the main fuels used for cooking. This has contributed to the serious problems of deforestation and environmental damage. This forest loss is directly threatening some of the highest concentrations of biodiversity in Africa.

The processing of commercial crops generates large volumes of biomass residues including rice husks, coffee pulp and maize stalks. These along with sawdust from sawmills, often go to waste. Kampala Jellitone Suppliers (KJS), a business based in the suburbs of Kampala, was looking for a cheaper fuel for roasting coffee, and recognised the potential for converting this biomass 'waste' into a clean fuel.

Statistical information, Uganda	
Population (2005) million	28.9
Urban Population % of total	13%
GDP per capita US\$ (2005)	US\$303
GDP at purchasing power parity	US\$1454
Population living on less than \$1 a day (2005)	unknown
Population living on less than \$2 a day (2005)	unknown
Population with access to grid electricity (2005)	9%
Annual electricity consumption per person (2004)	63 kWh
Annual CO ₂ emissions per person (2004)	0.1 tonnes
Population % undernourished (2002 -2004)	19%
Population with access to improved water supply (2004)	60%

Source: UNDP Human Development Report 2007/2008

Technology and use

Material preparation

Biomass residues are produced by factories such as rice mills, coffee mills and furniture factories, mostly in the south west of Uganda. Residues are usually simply dumped in large heaps which are burned to dispose of them. KJS has contracted a local agent to collect and bag the waste and transport it to the KJS factory near Kampala. At the factory the residues are sieved (to remove large pieces and stones), pulverised using a hammer mill, and dried. Drying increases the energy value of the final product, because otherwise some of heat produced would be used to evaporate water. Each type of material is poured into a separate hopper which feeds it into a mixing machine to give the required proportions. The sieves and driers were made in Uganda, and the hammer mill imported from China.

KJS has innovated with blending different residue mixtures (such as rice and peanut husks, sawdust and coffee waste) to make briquettes with a standard energy value, and consistent properties.

Briquetting

KJS uses two piston-type briquetting machines, which are electrically powered. The original machine which was purchased in 2002 was made by Maskinfabrikken in Denmark, and can produce up to 200 kg/hour of briquettes. The more recent machine, made by Facilitation in India, can produce up to 500 kg/hour.

The mixed biomass is fed into the briquetting machine, which compresses it using a piston stroke. The high pressure and resulting high temperature causes the lignin (the natural woody material in plants) to flow and bind the material together. The action of the piston pushes the material through a die, to make a continuous rod either 60 mm or 50mm in diameter. The briquette rod cools in the air and breaks into 'sticks' about 400 mm long. These are collected in sacks and weighed into 45 kg loads. The sacks are held in a dry store until delivery to the customers. Supply is kept in pace with demand, so that only limited storage is needed at the factory.

Stoves

KJS has designed an efficient briquette-burning stove, for institutions such as schools and colleges, and for food processing industries. A KJS builder and labourers visit the organisation to construct the stove, which is made from fired bricks with a grate and combustion chamber and a chimney to remove the smoke. A small hole in the combustion chamber above the grate allows the briquettes to be fed in. The cooking pot rests on top of the stove. KJS has also started work on a briquette-burning domestic stove, because of customer demand.

How users pay

£1 = 3165 USh (Uganda Shillings), 1US\$ = 2142 USh (April 2009)

Stoves cost around 1.6 million USh (US\$740). About 65% of customers pay KJS for the stove in instalments, others pay the full cost at the time of installation.

The price for briquettes is negotiated with each customer, and is typically about 35,000 USh/tonne (US\$16/tonne). This compares with around 30,000 USh/tonne for firewood and 62,000 USh/tonne for charcoal.

Training, support and quality control

The supplier of the Danish briquetting machine trained KJS staff on maintenance. Briquette manufacturing causes considerable wear in the machines due to the pressures involved, and the pistons and dies have to be changed regularly. The parts for the Indian machine are cheaper and easier to obtain than those for the Danish machine, so the Indian machine is used more often.

Staff from KJS construct the stove for each new customer and train the user to operate it, so they have a direct relationship with each customer. Detailed records are kept of all customers and their requirements. On a few occasions, customers have received poor quality briquettes but KJS have replaced each faulty batch. There have been minor problems in fitting pots to stoves but KJS have dealt with each of these. KJS would like to improve the quality and design of their large stoves, and also to develop a portable stove for householders.

Benefits

Numbers

KJS has the capacity to produce about 2,000 tonnes/year of briquettes with one-shift working on the two existing briquetting machines. Total production in 2008 was 1,530 tonnes, or about 130 tonnes/month.

1,309 stoves have been installed (March 2009) for 36 different organisations. Most are in public institutions like the halls of residence of schools, colleges and the University of Makerere. Eight stoves have been installed at Butabika National Referral Hospital. Five businesses also have a total of 50 stoves and baking ovens. These businesses include coffee roasting, baking and brewing. Only nine domestic stoves have been installed, on a trial basis.

It is difficult to estimate how many people benefit from these stoves. A few thousand cooks benefit directly from improved working conditions, but several hundred thousand students and customers are indirect beneficiaries.

Environmental benefits

The KJS briquette stoves replace firewood or charcoal. A study by the Faculty of Engineering at the University of Makerere estimated that one tonne of briquettes, used in an efficient KJS stove, replaces on average 1.2 tonnes of firewood and 0.3 tonnes of charcoal. This avoids the emission of an estimated 1.6 tonnes CO₂ per tonne of wood, and 14 tonnes CO₂ per tonne of charcoal. The CO₂ emissions related to charcoal use are high because the production of charcoal from wood is so inefficient.

Based on these estimates, an average of 6.1 tonnes of CO₂ is saved per tonne of briquettes used. The 1,530 tonnes of briquettes produced and sold in 2008 therefore save about 9,300 tonnes/year of CO₂.

Use of the briquettes reduces the pressure on wood resources and thus reduces deforestation – a serious and growing problem, particularly around Kampala. In addition, the agricultural residues used to make briquettes were previously burned as they were regarded as waste. This smoke and particulates generated from this incomplete combustion are dangerous for health, especially for people suffering from respiratory complaints. The piles of residues left outside the processing factories were a fire hazard which is now avoided.

Social benefits

The main advantage for users of the KJS institutional stove is convenience, in obtaining the fuel, storing it and using the stove

In the past users had to cut wood, or arrange for the delivery of wood or charcoal. Wood often had to be split into suitable sized pieces after delivery. The quantity of wood needed by a large institution requires a substantial woodpile for storage, and theft from these is common. By contrast, briquettes are delivered on time and are ready to use directly from the sack. They need very little space for storage, although it is essential to keep them dry otherwise they may start to crumble. Briquette stores can be locked to reduce theft.

Cooks are very enthusiastic about using briquettes, because the kitchens are so much cleaner. Less smoke is produced using briquettes than using wood, and it is removed by the stove chimney. The higher efficiency of the stove means that more of the heat goes into cooking the food and less escapes to overheat the kitchen. Cooks find that briquettes produce more smoke than charcoal when the stove is first lit. However, charcoal releases black dust, which contaminates everything including the food. Adding more charcoal to the fire during cooking was inconvenient since the heavy pots had to be removed. The briquette

stoves have a hole through which briquettes can be fed in during the cooking process. Users know how much fuel they will need because each briquette gives a standard amount of energy.

The briquette stoves cook faster. For instance, at Mugwanya Catholic Preparatory School cooks can start work at 6 am instead of 3 or 4 am when they used wood.

Economic and employment benefits

The cost of cooking using briquettes is not much different from using fuelwood, because although briquettes cost more per tonne, the weight needed is less. However, the convenience of the briquettes makes them very popular, in particular with cooks. One Headmaster faced a protest from cooks when he suggested that the school might go back to using wood.

The financial savings are significant where charcoal has been used in the past. One primary school now spends 51,000 US\$ per day on briquettes, instead of 60,000 to 75,000 US\$ per day on charcoal.

KJS currently employs 43 staff at the factory making briquettes and stoves. It also employs a contractor to collect the residues from the agricultural processors and sawmills, and bring them to the factory, and other haulage companies to deliver briquettes to customers. Company workers are provided with free six-monthly medical check-ups, first aid and food, and are offered accommodation near to the factory.

The residue producers are paid between 6,000 and 30,000 US\$ per tonne of residue, so earn increased income from what used to be a disposal problem.

Potential for growth and replication

KJS is currently the only producer of non-charcoal briquettes in Uganda. Customers like the stoves and briquettes, and KJS has demand from more customers than it can currently supply, mainly because of limited drying capacity. The company is in the process of moving to a new and larger factory, where additional driers will be installed and production increased. The intention is to double production within the next two years, and it could potentially expand much more.

Briquettes are more widely used in India and China, and the potential demand and supply within Uganda and elsewhere in Africa is significant. In Uganda, there are many more potential institutional customers, including 180,000 schools, and a wide range of agricultural and food processing businesses. Domestic users are also keen to try briquettes, when a suitable stove is available.

There is also a good supply of agricultural residues from processing businesses, in particular coffee waste, rice husks, groundnut shells and sawdust, and further residues on farms. A study by DANIDA identified 16 possible materials that could be used for making briquettes. Care must obviously be taken not to reduce the use of these residues as compost or soil improvers.

Management, finance and partnerships

KJS was established in 1976 as a business producing cosmetic products from petroleum jelly. The business diversified into coffee processing and baking, using LPG as the fuel. In 1992 Mr Musisi started to look for alternative fuels for these activities, because of increases in the price of LPG. He experimented with using loose biomass residues, but found that these burned too quickly, so looked for expertise in briquetting residues. The Danish

Embassy funded a feasibility study on briquetting, and funding was provided through DANIDA to buy the first briquetting machine and set up production. KJS recognised that other institutions were keen to buy and use briquettes, so started the stove production facility.

KJS is headed by a Board of Directors and run by the Managing Director, Abasi Kazibwe Musisi. He is assisted by a general manager Mbabaali Hussein who oversees most of the work and a human resource manager Komuhangi Resty (recently recruited), Byekwaso Wilison is in charge of the briquette production. Another manager is in charge of coffee production and other managers lead teams responsible for finance, marketing, quality, stove fabrication and security.

The company has been financed by its founder and its own income, the grant from DANIDA (DKK 0.5m) and a United States African Development Foundation grant (US\$ 85,000) for developing business plans and staff training. It has no external loans or investments. The second briquetting machine was financed by selling the KJS baking business, and the new factory is being financed by income from the existing work.

Professor Adam Sebitt, Head of Mechanical Engineering at Makerere University has worked with KJS for several years to help optimise the mixing of materials to make briquettes. He tested the mechanical properties and energy content of the briquettes. KJS set up the 'Fuel from Waste Research Centre' as an NGO to carry out research, and works with other NGOs such as Living Earth Uganda to improve the stove technology.

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This report is based on information provided to the Ashden Awards judges by Kampala Jellitone Suppliers Ltd, and findings from a visit by one of the judging team to see their work in Uganda.

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