CASE STUDY - Mali

Jatropha Oil Production for Local Energy Use

By Mahamadou K. Diarra
Mali-Folkecenter Nyetaa

Summary:

Mali is landlocked with low opportunities for export, and costly imports due to the large overland distances of more than 1000 km from the coast. This also applies to fossil-fuel imports. The country spends more than 450 million USD (*data from DNE, 2007*) each year to import fuel, and this increases by 34% every year. Biofuel from Jatropha has been considered as one of the potential solutions to reduce the fossil-fuel imports.

The MFC Garalo Bagani Yelen Project was an innovative initiative representing a new paradigm in sustainable decentralised energy production. Less than 17% of Malians have access to formal electricity services, and in rural areas where two thirds of the population live it is less than 12%. To address these problems MFC has setup a 300 kW of integrated village electricity production and distribution system, supplying a village of 10,000 people, powered by pure plant oil (PPO) derived from Jatropha seed grown locally around the village of Garalo. This initiative is centred on the local production, processing and use of Jatropha oil in the form of electrical energy.

The village of Garalo is located 215 km from Bamako in the south of Mali, at a strategic crossroads for trade and hence has a lively main high street with many small businesses including wood and metal workshops, providing services to people in the village and those passing through. The population is estimated in 2005 to be 10,000 people, and 80% are farmers and engaged mainly in agriculture (mostly millet, sorghum and rice, as well as cotton for income generation), raising cattle, and fishing.

The initiative allows 450 farmers in different villages surrounding Garalo to grow Jatropha (1000 ha) on their own fields and to sell the seed to a Jatropha cooperative, which processes the seed to high quality oil. The cooperative then sells the pure oil to the energy supplier (ACCESS SARL). Currently more than 400 clients benefit from energy for 10 hours per day for business, lighting, and improvement in health and security conditions.

Present greenhouse-gas savings	Investment costs and savings	Potential greenhouse-gas savings in Mali
200,000 litres of strength vegetal oil saves 540 tons of CO_2/year from avoided Diesel use,	For 0.46 USD/kWh, (+6 USD for monthly fix tariff) saving 110 litres of diesel/day (39600 litres/yr), and other indirect fuel like kerosene.	Only for 5 million litres of fossil fuel (gasoil) of SVO, Mali can save 13,500 tons CO_2 / year.

Description, Development and Background Situation

In 2003, the government of Mali developed a rural electrification programme based on a Public-Private-Partnership model to increase energy access rates in rural areas to 25% by 2015. Villages like Garalo, situated relatively far from the national grid, were unlikely to get connected. But the rural electrification program presented a new opportunity.

Socio-Economic impact:
The sales of Jatropha seed allow the farmers to diversify their income sources. The kg of seed costs 0.16 USD. With the clean energy, the population can have some new activities for the productive use of energy.

Environment impacts:
For the savings, the use of Jatropha oil for this initiative can save each year 540 tons of CO_2. That avoids the use of fossil fuel for rural electrification.
The reforestation, with Jatropha planting, adds to carbon sequestration old and degradable field.

The Garalo Bagani Yelen is the result of a request from the commune of Garalo for the provision of electricity to its 10,000 inhabitants and was developed by MFC and a consortium of international partners. The infrastructure for power generation and distribution consists of 3 x 100 kW diesel generating sets, modified to run on pure Jatropha oil, placed in a power house, and a 13 km mini distribution grid with integrated street lighting. The pure plant oil (PPO) fuel is delivered to the generators from a press house located on-site containing a mechanical screw press, a three-stage 0.5-micron oil filtration system, and a 9,000-litre storage tank. To provide the feedstock, 1,000 hectares of pure and intercropped Jatropha plantations were established across 450 smallholdings using existing agricultural technology and practices. A tree nursery with the capacity to produce 1,000,000 Jatropha seedlings was established within the municipality to supply smallholders with all of the plants they required to establish their plantations.

Various service packages are available for customers with different needs, e.g., single-phase 230 volt domestic supply of 5 Amps, or 10 Amps, and for business & industrial users, a 380 volt three-phase supply of 10 Amps or 15 Amps. Every client has a meter at their house or place of business, and monthly readings are made to calculate billing amounts. Each customer is pays a flat monthly fee (fixed according to the rating of their meter) towards the Garalo village street lighting; the public lighting grid has its own electricity meter to allow this.

The electricity tariff is composed of a fixed monthly operational charge for public lighting and the cost of the kWh consumed by the client, 0.46 USD/kWh + 6.00USD. About 450 clients are currently connected to the grid.

Photos: Jatropha tree and seed, a generator set

Effect on Poverty Reduction, Obstacles, and Dissemination

The local communities had multiple direct and indirect economic benefits from Garalo Bagani Yelen. As Jatropha seed producers, they will benefit from a new source of revenue (0.16USD/kg of Jatropha seed), which can be developed in harmony with their existing agricultural practices. This is increasingly important as more and more farmers in the Garalo's village are abandoning cotton, which has been the main cash crop in the area for decades, due to low prices on subsidised international markets, and problems with the internal Malian cotton producing mechanisms. This can also offset the cost of paying for the electricity service, making it more affordable. In a diesel project, rural electrification is a net drain on the household economy.

Local Small and Medium Enterprises and Small and Medium Industries (SMEs and SMIs) such as metal and woodwork shops, restaurants, and other shops and services are able now to develop, improve and expand their facilities and their businesses, due to the access to electricity.

In a rural electrification project, anywhere from 50-90% of the running costs are for fuel. If spent on diesel, this money leaves the village and leaves the country to pay for costly fossil-fuel imports, which must be transported thousands of kilometres inland to Mali. So the micro-economics and the macro-economics are unattractive. With an equivalent Jatropha-powered project, this money is re-injected into the local village economy.

During the implementation, the main obstacle was the pole installation in some part of the village where streets are tiny or non-existing. This makes it difficult to cover all of the village.

After implementation, Garalo Bagani Yeelen developed communication materials and used them for large-scale dissemination nationally & internationally, through meetings, articles and the World Wide Web and at an international conference.

Effects in Greenhouse-Gas Emissions (Fossil Fuel)

The clean low-carbon electricity produced in the village improved domestic living conditions and security with lighting, TV and radio. Many new income-generating activities were available thanks to the presence of electricity.

In addition, there are the environmental benefits of a low-carbon energy supply, which significantly reduces CO_2 emissions compared to a comparable diesel system.

The project planted more than 1000 hectares of Jatropha, and had estimated CO_2 emission reductions of around 10,000 tons/year. The replacement of diesel and kerosene in addition to the reducing CO_2 savings (of 100%) and others, eliminates handling of dangerous gas. In one hectare on Jatropha, the average harvest is 800 kg of Jatropha seed; these make 200 litres of Jatropha oil (around 4kg/litre). The projected annual production is estimated at 200,000 litres of biofuel (strength vegetal oil) by year, that replaces diesel with an emission rate of 2,7 kg/litre, eliminating 540 tons of CO_2 annually. Nationally with the Jatropha oil, Mali can reduce its greenhouse-gas emissions significantly.

Analysis of Proposal as Climate Mitigation Measure

Besides the rural electrification aspect, the Jatropha plant and oil are also one of the key mitigation measures to reduce the use of fossil energy such as kerosene, and gas oil. It also contributes to reforestation for carbon sequestration. The plants are very adaptable in semi-arid areas, and do not need chemical fertilisation, or lot of water to grow. The expansion of Jatropha production can contribute to national energy autonomy, and job creation. It does allow the country to reduce its trade-balance deficit (in 2011, Mali imported 904,100 TEP m^3 of fuel around 89 bi-millions USD) and its greenhouse-gas emissions. In fact, the politicians, through the creation of Malian Agency of Biofuel, must encourage the involved actors through incentives such as tax exempt for imported materials, rules and directives for national strategy, and training centres or modular cources about the technical aspect of oil process in schools, universities or institutes.

Analysis of the Potential for Scaling Up, for instance to a National Level, and to Replicate in Other Countries.

Biofuels are not a magic solution to all the problems of climate change as was hoped by some, and as has been well documented. But for certain niche uses like rural electrification projects, there is no doubt that local biofuel production and use can be the engine for new economic development. Thus this project has strategic importance and a high level of replicability throughout Africa and the South.

Estimate of Support Needed for Scaling Up; Grants, Loans, Capacity-Building

The Jatropha speculation and sale of seed to external purchasers is a problem. For scaling up, the government must protect the cooperatives against seed speculation, which can increase the seed price. In time, as the volume of seed produced increases, this speculation will become proportionally smaller. Demand for seed for planting seems to be declining.

For the massive expansion of biofuel as a solution to reduce the fossil-fuel importation and to reduce the greenhouse-gas emissions, the government should develop some criteria and directives for a long-term biofuel strategy.