

## **Community Based Biodiesel Processing in Sri Lanka**

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The contribution by the agriculture sector to the GDP of Sri Lanka has been sharply declining over the last 2 decades. Although, Sri Lanka is blessed with a fine climate having a fertile soil compared to other nations in the region, most of the food and petroleum oils are still imported to the country in bulk. For food, there is a heavy dependence on imports whereas all the petroleum oils are imported. The debate on allocation and use of land previously used for food crops to cultivation of energy crops in the world continues, and has ignited national interest in Sri Lanka as well. The President has declared that no land currently used for food crops shall be allowed for energy plantation in Sri Lanka.

The making and use of biofuels in Sri Lanka is not at all a new phenomenon. Over the centuries the Sri Lankan people including indigenous communities (called the veddah community) have been harnessing oil from seeds and plants. The Ayurvedic discipline of medicine that is practiced in Sri Lanka, having its roots in India and the traditional indigenous medicines invented and preserved by practitioners from one generation to the other, all use oils expelled from almost all parts of the plants including the seeds. The oils are not only used as medicines, but also some are used for lighting of houses, making the oils as an energy resource. There is, therefore, a well established knowledge and skills base on the selection and extraction of oil from seeds in Sri Lanka.

The oil crisis of the 1970s gave some prominence to biofuels worldwide, but Sri Lanka did not respond to this crisis from the angle of the biofuels. However, with the recent trends in global warming and environmental concerns; and escalating petroleum prices and their resources depleting fast, many individuals, research institutions and scholars began talking about biofuels as a solution to the crises. However, although there was talk everywhere, when it came to ground level implementation from a community based approach, there was hardly any organisation active in Sri Lanka.

Within this scenario, Practical Action realised that it could play a role as a risk taker and role model, taking the lead to demonstrate options, and investigate many of the remaining questions relating to community based biofuels processing. The experience gained by Practical Action in Peru was taken as an example and starting point. Initially, a status audit of the sector was carried out in 2006. Having community based energy sector experience of over 20 years from the biogas, micro hydro and small wind turbines sectors. The outcomes of the status audit helped to design a project (supported by DGIS, APFED / UNEP) on community based biodiesel processing. Gurugoda, a remote village situated in the dry zone from the North-Western part of Sri Lanka was selected for project level interventions.

Gurugoda is an isolated village under the Rasnayakapura Divisional Secretariat area. Sri Lanka has a population of about 19.6 million and a land extent of 65,610 km<sup>2</sup>. The country is divided into about 250 administrative blocks called Divisional Secretariats. The project was designed to be implemented within a community governance concept which adopts a participatory framework. Within this, individuals and community organisations are strengthened and capacitated to influence the local administration and authorities, and to play a greater role in defining and carrying out their own development. There was no access to electricity or public transport at the time the community governance approach was introduced to the village 3 years ago. Even now, wild elephants encroach the village threatening the lives, crops and harvest of the communities living there. To cater to their electricity needs, a community wind electrification scheme was set up. However, during the periods when the wind is weak, they do not get sufficient electricity, and had to revert back to use of kerosene oil lamps for house lighting. This made them think about ensuring electricity supply from another source. As an alternative, biodiesel was identified as a feasible solution to meet their basic electricity needs.

Electricity is not the only energy-related need of the village. Since they do not have a public transport system, they were interested in a community based public transport system (like one that Practical Action had introduced in a nearby village). Further, as some parts of the village have no access to water, particularly for drinking during the drought, pumping water was another need. Considering these factors, the communities agreed to try the use biofuels to meet part of their energy & transport needs.

Initially, a brief study was carried out to establish the availability of different oil bearing seeds in the area. Jatropa, castor, neem, mee and domba were found in the locality. Samples of seeds were collected by the communities themselves from the naturally grown trees in the local forests or their home compounds. Further, so as to encourage the communities on the option of biofuels farming, the fence of the power house of the community wind electrification scheme was built with a mix of jatropa and gliricidia with community participation. After considering many aspects, jatropa was selected as a suitable crop to be used for farming biofuels in Gurugoda. This crop is generally used for fencing in Sri Lanka while there is a community belief that the wild elephants do not like to hang around the areas where jatropa plants are present.

Jatropa is not an indigenous plant in Sri Lanka: it was introduced only about 500 years ago. People have different traditional beliefs about jatropa. Some believe that around the jatropa trees, no other crop grows. Gurugoda is situated in the dry zone, and jatropa is naturally occurring here. Some were concerned that it would absorb too much water, affecting the growth of other crops. Some believe that jatropa causes the soil to become infertile and toxic, and that after a jatropa tree dies, no other crop will grow in that soil for some time. Beyond this, their farming patterns, land use, types of crops cultivated etc are tuned to short term food crop cultivation systems. Some of the community members had the view that growing jatropa, which has an expected life of nearly 40 years, would not be in line with their cultivation practices. On the other hand, they mostly cultivate

food crops for commercial purposes and jatropha is a non edible crop. The intention was to grow it, not as a crop on land previously used for food, but as a live fencing material. Whatever the local beliefs are about jatropha, they need to be seriously investigated, because currently scientific evidence does not exist in Sri Lanka to prove or disprove them. A key point is that, for community-based biofuel farming to be sustainable, we need to pay full attention to existing agricultural practices and knowledge of bio-fuel crops as they occur naturally.

In order to support the project with the scientific inputs, Practical Action established working relations with plantation and finance practitioners, research institutions and universities. A Technical Advisory Board was appointed from these sectors. Some members of this board were also assigned the tasks of conducting research and development on agronomics, crop science, plantation, oil expelling, transesterification (transforming oil into biodiesel) and applications of biodiesel for transport and energy (vehicle engines, water pumps, oil lamps & electricity generators). These took place in parallel to the activities that were taking place in the village. While Practical Action was managing the project with overall responsibility, a partner organisation, Sangrama (a local NGO) took the role of social mobilisation and liaising between the communities and external stakeholders.

With the participation of the communities, jatropha has been planted as fencing for home compounds in Gurugoda. There was a reluctance to mix jatropha in the fields with food crops due to the reasons discussed above. In the meantime, research is being carried out on cultivating jatropha alongside food crops to verify community beliefs about its negative effects. According to estimated data (based on limited local research findings and secondary data), each plant is expected to produce about 4-10 kg of seeds per year (in dry zone). Initially, 7000 jatropha plants were cultivated as fencing with the participation of 20 families – with the potential to produce 28-70 tonnes of seeds per year.

A Community Biodiesel Processing Centre has been established in the village. This has the capacity to process 5 litres of biodiesel per batch, requiring about 25 kg of oil-bearing seeds. Each batch takes about 2 hours to process, and it is planned that one batch will be processed per day. This volume of biodiesel would be sufficient for the community to meet their daily basic energy and transport needs. The current seed production and collection from Gurugoda cannot meet this demand, as it takes some time for each plant to produce to its potential. Therefore, different oil bearing seeds are bought at the centre giving the community an additional opportunity to earn some money.

A water pump, generator and hand-tractor for community transport have been put in place here, but are yet to commence operations. The current progress indicates the cost of production of biodiesel is around Rs 300 per litre. The high cost of chemicals (such as Methanol, Sulphuric Acid and Sodium Hydroxide etc) and the cost of oil bearing seeds leads to this higher cost. Diesel is currently sold at Rs 110 per litre, making the biodiesel economically unviable. However, additional income can be made from its production. The growers and collectors of seeds earn an income; and the by-products (Glycerin, soap, organic manure etc) made out of waste material may help bridge the gap. The project has

not yet commenced working with wastes or manure. A biogas system has been built to work on converting bio-wastes into biogas and manure.

The concept is that the biodiesel will be blended with petroleum diesel in the proportion of 1:4 since this means that no engine modifications need to be made. Studies are underway to explore the possibilities of converting engines to run with raw oils, as well as with pure biodiesel, but it may take a significant time to find ways of doing this economically. However, this seems to be a sensible angle for research. If raw oil could be used, expensive chemicals would not be required (slashing the price of the fuel), and the community would require less training in handling these potentially dangerous chemicals, and in the processing required to produce bio-diesel.

Research in Sri Lanka into community-based production and use of biofuels is still in its infancy. The initial work carried out by Practical Action will require further development, and remains the only example of its kind in the country. More time will be needed before clear conclusions can be drawn about the viability and appropriateness of this technology as a solution to the energy needs of poor rural communities.

## **References**

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