

Successful utilisation of indigenous bioenergy resources for economic advancement in rural Maharashtra, India



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Figure 1: Seed purchase at one of the procurement centres in Mahajane Village (Photo: AERF, India)

This article showcases the successful establishment of cluster level biodiesel resource centres catering to rural energy demands and the creation of livelihood opportunities in over 70 villages in Raigad district of Maharashtra, India. Central to this initiative has been the ongoing experiences with communities who collect and sell seeds of the indigenous tree Pongamia pinnata. A combination of widespread awareness and promotion, technology development and demonstration, training and marketing are essential factors for success. Important to this initiative has been the notion of using the already existing (but neglected) resources rather than cultivation of any biofuel crop which needs large scale resources.

Tapping Pongamia pinnata to enhance income generation and local oil production

Growing energy needs, coupled with fluctuating international oil prices, are forcing India to tap into renewable energy resources to address the energy crisis. The Government of India launched a national programme to promote the large scale cultivation of the plants *Jatropha curcas* and *Pongamia pinnata* for biodiesel production. However, the programmes are long term and need

time to reach the farmers in remote areas. In addition, the current subsidy provisions for: kerosene to those below the poverty line; diesel to fishermen; and electricity at subsidised or free cost to farmers for irrigation, are faced with inefficient public distribution systems leading to widespread shortage of energy resources in rural areas.

In order to reduce these barriers though the utilisation of existing natural resources, the Applied Environmental Research Foundation (AERF) has been working since 2005 to set up village/cluster level biodiesel resource centres to meet local energy demands in Alibaug and

Mhasala blocks of Raigad district. In 2007, through a Global Actions Programs Fund provided by the Global Village Energy Partnership (GVEP), the AERF reached over 70 villages with a potential to create income generating opportunities through seed collection activities and employment at the resource centres. The central focus of setting up the biodiesel centres was to exploit the already existing *Pongamia pinnata* tree for extracting oil either for direct fuel use or the production of bio diesel. During the process of interaction with local communities in the second year, a good population of oil yielding indigenous tree species *Madhuca Indica* was found to exist in the local areas in Mhasala block, thereby incorporating this species into the local seed procurement and processing activities.

Establishing the supply chain for seed collection

The establishment of a good network of seed procurement in villages having *Pongamia* trees was crucial for sustaining the resource centres. Seed collection was a natural extension of activity for the

Table 1: Price rates for seed collection and the sale of Pongamia oil and oil cakes

Price rate for seed collected (in Rs/kgs)		Rate of Pongamia Oil (in Rs/litres)		Rate of Oil Cake (in Rs/litres)	
Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
6	7	30	35	10	12

Table 2: Projected benefit on account of switching to greener fuel in rural setup.

Agricultural machinery	Power (HP)	Useage (hrs/yr)	Diesel consumption (litre/hr)	Current diesel price (Rs/litre)	Annual fuel cost (Rs)	SVO price at the Centre (Rs/litre)	Saving due to substitution by SVO (Rs)
Power tiller	13	500	1.5	40	30,000	35	3,750
Irrigation/drinking water pump	5	1,000	0.75	40	30,000	35	3,750
Tractor	35	600	4	40	96,000	35	12,000
Floor mill	3.5	800	0.75	40	24,000	35	3,000

majority of collectors who were local tribal populations already involved in collection of non-timber forest produce. Additionally, local grocer shops and women's self help groups were actively involved. In both centres, the names of all collectors and the quantity of seeds collected were recorded in detail. The seeds were kept in an open yard for drying, packed in gunny bags and stored in a dry room. The average quantity of seed collected over two years was 2,100 kg at the Mahajane and 700 kg at Songhar.

The main trigger for the rapid collection of Pongamia seeds was the attractive price and standard weight measurement for the collected material. The offered price of Rs 6/kg (0.1 USD) for seeds was increased by 15% in the second year compared to the maximum price of Rs 4/kg in the weekly market before the initiative. The collectors were paid from the revolving fund that was created by AERF in the first year. In Songhar, the presence of active self help groups (4 women's and 2 men's groups) with a relatively healthy revolving fund meant that the fund could be used effectively for the purchasing of seeds from local collectors. The responsibility of seed processing was given to two young candidates, pleased to have found an occupation in the village. While planning the development of supply chain a deliberate effort was made to reach out to as many villages as possible within the radius of 10 km from the resource centre.

Production and utilisation of Pongamia Pinnata oil and oil cakes

As a first known example, two expeller-engines operate on Pongamia oil as a substitute to diesel (1.2 litres/hour) to produce about 5-6 litres of Pongamia oil/hr each from 20 kg of seeds. The expellers clocked more than 70 hours in Mahajane village and 20 hours in Songhar in the first year of operation. In the second year, the operational hours doubled due to subsequent increase in seed collection especially at the Mahajane centre.

The Pongamia oil was further used for power tiller, irrigation pump sets and flour mills. In Mahajane, an entrepreneur hired out power tillers to farmers who showed interest in using pongamia straight vegetable oil (PSVO) and bought 50 litres from the resource centre. The power tiller consumes about 1.5 litres of oil/hour at the cost of Rs 35/litre compared to 2.5 litres of diesel /hr at Rs 40/litre providing an attractive option for tractor operators. In Songhar, two 5HP electric motors were operated to lift water for drinking and domestic purpose for 4 hours every day. The farmers were relieved to find an option to lift water as power supply was intermittent and erratic, coupled with high electricity bills. By using this alternative they started saving approximately Rs 1,500/month (50% of electricity bill).

Economics of bio diesel resource centres

The seeds were bought, processed and Pongamia oil was sold and utilised to run the expellers at the centres. The Pongamia oil cakes had substantial demand utilised as fertilizer and pesticide for traditional crops such as mango, coconut and beans thereby selling at a premium rate. Prices were raised in the second year primarily because of high demand and willingness to pay (see Table 1). The rates were competitive compared to the average price of Pongamia oil at Rs 45/litre and oil cakes at Rs 15-17/Kg in the open market. The attractive pricing at the centre has resulted in advance booking of the products every year.

Both the resource centres made profits. In Mahajane, the centre made a total turnover of Rs 14,250 in the first year.

After deducting the cost of raw material (Rs 9,600), and operator's salary (Rs 3,000), the centre made a net profit of Rs 1,650. The turn over in the second year was Rs 40,800 with a net profit of Rs.10,000. In Songhar, the centre made a net profit of Rs 4,500 on a turnover of Rs 7,850 in the second year while they processed about 350 kg of seeds in the first year and sold about 60 litres of oil in the local market at Rs.30/litre.

Table 2 above provides a glimpse of the savings that could be achieved as a result of fuel substitution.

Creation of successful bio diesel resource centres

Awareness creation as key to establishing the supply chain

The first ingredient for success was the high level of awareness creation and information dissemination. Promotional materials were disseminated to at least 3,000 people in all 70 villages and 10 large posters were provided to the governing bodies from selected villages to spread the information. During the seed collecting season, 1,000 pamphlets showing the Pongamia pinnata based value chain and its role in energy sufficiency were published in the local language and distributed. A major initiative was undertaken to demonstrate the use of Pongamia oil in running diesel engines, power tillers and flour mills. The impact could well be seen in Songhar village where one engine operates daily for 2 hours on PSVO and is used for lifting water for a minimum of three days a week for four months of the year.

Figure 2: Decentralised biodiesel resource centre in operation, Mahajane Village (Photo: AERF, India)



Central to the whole idea was that community members realized that a Pongamia oil production unit could become a profit making enterprise that would support the livelihoods of all those who were ready to become part of the supply chain.

Localised adaptations to create sustainable incomes

Expecting voluntary labour from poor people for seed collection was an incorrect assumption made early on and instead seed collection was brought in as a mainstream income generation activity. The local micro-credit mechanisms were utilised effectively for payment, a major trigger for a substantial collection of seeds in a short time frame. Thus, income generation for the rural poor, unemployed youth and farmers in the project area was a major livelihood impact of the two centres as seed collection and oil production had almost doubled in the second year of operation. Profits were kept aside for use as a revolving fund for buying the seeds next year. The two centres have 7 full time employees, each earning a livelihood from their job as an operator, and almost 350 individuals supplying seed regularly to the various collection points.

Maintenance of distance between centres

The first community was resistant to the idea of second bio-diesel resource centre in nearby villages. It could have posed as competition and also the uniqueness of such a project would have faded in a short time for them. Therefore, a compromise was reached, to establish the second bio-diesel resource centre at Ramraj village, 15 km away from Mahajane.

Utilisation of locally available but un-utilised resources

In the second year, AERF found out that there was a good population of *Madhuca indica* another high oil yielding oilseed bearing indigenous tree in villages surrounding Songhar biofuel resource centre. The collection of the *Madhuca* seeds in the coming years will increase the productivity of this centre.

Unexpected impacts and the way forward

Pongamia pinnata trees were usually cut for selling as fuel wood to brick kiln operators. However, once the local communities valued the trees as a sustainable income source from seed collection, the resolve to conserve them was confirmed, also ensuring a sustainable supply to the resource centres. Easy availability of *Pongamia* oil at the centre has also contributed to the revival of traditional uses of the oil such as for medicinal and veterinary use leading to overall well being of the farming communities. The success has had an effect on other nearby communities and the demand is rising. Tests are also ongoing on the possibility of utilising the *Pongamia* oil to operate the existing 30 Auto-rickshaws in this cluster. Further selection of villages from Raigad district for development of bio-diesel resource centres are also ongoing using the main criteria of availability of water wells without pumping facilities and the presence of good populations of *Pongamia pinnata*.

To achieve long term sustainability, continuous facilitation is necessary as regards resource enhancement, marketing of produce and institutional strengthening. Moreover, strengthening of the business as an institutional set up needs more work. The plantation of *Pongamia pinnata* on community lands can be an important step towards resource enhancement. For this, nurseries need to be established so that the local bio diesel industry can grow.

The replication of establishing bio diesel resource centres looks possible; however it is recommended that a proper resource assessment is carried out before establishing the centre. Community organization and participation has to be strong for success to be achieved. Keeping tight control over raw material prices and avoiding the involvement of middlemen in the supply chain, as well as having correct information about the demand, are some of the key strategies for the scaling up of this project.

Profile of the authors

Kavita Rai has extensive international experience working in the field of energy and has a Phd in Development Studies. She has been involved for many years in promoting grass roots projects to ensure long-lasting access to clean energy. Kavita will be responsible for running GVEP International's regional programmes, will be working closely with project implementers and private sector companies, and will be supporting Wendy Annecke with the monitoring and evaluation of GVEP International programmes.

Jayant Sarnaik is the co-founder and deputy Director of the Applied Environmental Research Foundation (AERF), a registered NGO based in Pune, India. AERF works towards biodiversity conservation at the grass root level – in the field of community based conservation. Jayant is an 'enviropreneur' and works with initiatives that have market based approaches to environmental problems. His expertise lies in community based projects in medicinal plants and renewable energy and has a rich experience in developing project ideas that work at the grassroots level. He also has strong relations with several national and international funding agencies. Jayant has recently received the Alcoa Conservation and Sustainable Fellowship.

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