



Kitchener, ON | Canada

Executive Summary- 2005 Tech Museum Award Laureate

Community-based Technologies Exchange fostering Green Energy Partnerships

Problem

Orissa on India's eastern seaboard is among the most backward state in the country in spite of being endowed with rich natural resources. The state has a net surplus of power yet most of the remote tribal villages in forested areas are unlikely to get grid connection in the next twenty years due to the small and dispersed nature of the settlements.

Absence of electric grid connection in 90% of rural tribal villages is a major obstacle to Gram Vikas, a local NGO, realizing their mission of "providing basic water supply and sanitation, infrastructure, capacity building and equitable access to secure livelihoods" to at least 1% of Orissa's population. While Gram Vikas has already covered over 14,000 households, the aim is to reach 100,000 households by 2015 through its Rural Health and Environment Program. These tribal regions, often in the news for droughts and famines, are in desperate need for infrastructure infusion and ecosystem regeneration to reverse large-scale deforestation in the aftermath of illicit timber logging and prevalent shifting agriculture practices (swidden, locally called bogodo). Being remote there is no value addition to forest produce such as Mohua (*Madhuca indica*) Karanj (*Pongamia pinnata*) and Kusum (*Schleichera Oleosa*) or even to agriculture produce such as Niger (*Guizotia abyssinica*), a traditional crop that is exported to western countries through (exploitative) middlemen for use as bird feed.

Solution

CT_x GreEn in partnership with Gram Vikas through an award from the World Bank Development Marketplace 2003 is targeting a biodiesel based water pumping program in 4 village communities. Our objective is to provide water supply and sanitation services through a bio-energy system that is linked to a regenerative resource base and helps create local economic opportunities. After proof-of-concept through pilot testing and continuous running of two to four initial field implementations, appropriate socio-enviro-techno-economic (SETE) feasibility parameters will be established for the biodiesel energy system. The SETE will then facilitate integration of the biodiesel technology into the Gram Vikas tool kit of micro-energy initiatives for RHEP propagation in non-grid connected villages in Orissa.

Biodiesel-fuelled pump-sets (3.5-5 HP) and small-scale power generation sets (2-3kW) are being set up as a closed-loop package. Vegetable oil extracted from locally grown (and native) oil-bearing crop(s) will serve as feedstock for conversion into biodiesel. Alcohol (methanol or ethanol) and lye (sodium or potassium hydroxide) are reagents/catalysts required to convert vegetable oil into biodiesel. Both ethanol and potassium hydroxide can be produced from local biomass. Oil cake and glycerin are valuable by-products with enhanced livelihood potential.

Two village installations have already been completed (in villages Kinchlingi and Kandhabanta), where the villagers are producing biodiesel from vegetable oil using transesterification through pedal powered machines. Biodiesel fuelled water pumping is ongoing since February 2004 and biodiesel fuelled power generation is to follow shortly. Additional livelihood opportunities to maximize local circulation of money in the local economy like soap making, oil extraction and sales, flour and grain milling, cattle rearing etc. are on the anvil.

Presently the technology is anchored in Self Help Groups (in the villages of Kinchlingi, and Kandhabanta-Talataila), which are women-run informal saving and credit organizations geared towards income generating activities. Participatory technology development and continuous training, optimization of processes as well as development of recipes for new underutilized tree-based oil seeds is the raison d'être of the pilot plant established at Mohuda, the headquarters of Gram Vikas. A core team of local staff is being built-up to support the training of village-level operations and maintenance personnel. As part of the strategy for the future, this pilot plant is expected to develop as a centre for excellence for biofuels related livelihood strategies in select bioclimatic zones of Orissa. The centre will be supported by the core team of local staff with technical support and guidance by CT_x GreEn.

Progress and Plans

Starting from ground zero we have put together a decentralized biodiesel production facility in two remote villages and have provided running water to the village community using biodiesel. The Mohuda pilot plant continuously analyses and characterizes the biodiesel being produced in the field comparing it to standards. A few oil-bearing trees have been identified as locally underutilized species: mahua (*Madhuca indica*) and karanj (*Pongamia pinnata*), kusuma (*Schleichera Oleosa*), niger (*Guizotia*

abyssinica) and castor beans (*Ricinus communis*) for which we have developed preliminary biodiesel recipes. Optimization to adapt to larger batches is ongoing. We are currently lobbying for policy changes to legally allow the customary practice of ethanol brewing in a bid to combine traditional knowledge with current scientific understanding for local production of biodiesel-grade ethanol, the second ingredient after vegetable oil in biodiesel manufacture. Future R&D will include scaling up of the lab-scale process of ethanol manufacture. Locally producing lye, the third ingredient in biodiesel using wood ash is also planned. The aim is to completely localize the production of biodiesel thus maximizing inputs into the local economy. We are also looking for financial support to subsidize operating costs and to develop a system for warranties for machines for the existing field installations, to ease the burden of “innovation” on the poor village community.

Training local village youth as barefoot engineers for technology-support to the women’s group operating and managing the biodiesel unit in the village has begun in a small scale and likely to be multiplied in the near future. We are working towards putting in place a system for monitoring the impact of the program and to assess the effectiveness of the technology. Management systems and the accompanying institutional and organizational forms best suited for decentralized biodiesel production is also being studied. For all future biodiesel programs especially in the tribal areas a watershed approach will be taken in determining the optimum cluster size for supply of resources and to cater to demand for energy services.

Organization and Resources

CT_xGreEn stands for Community based Technologies Exchange, fostering Green Energy Partnerships. We began in an informal way through our association with Gram Vikas, assisting them with the entry for the World Habitat Award by documenting their Rural Health and Environment Program as a best Practice. The entry earned Gram Vikas the award. In the course of the documentation work we realized that over 70% of Gram Vikas’ target households lived in non-electrified villages where alternative energy sources are needed. With this in mind we conceived of a biodiesel based project-*locally produced biodiesel can be used directly in diesel pump sets and generator sets thus providing running water*. The biodiesel project was seeded (from Feb 2004 until Jul 2005) in two remote tribal villages and ground work is in place for at least 2 more to follow through the World Bank Development Market place Award WBDM 2003. Work on the project continues without any additional funding while avenues for finance are still being explored.

With a core of just two full-time staff we have groomed a group of competent professionals anchored in Gram Vikas including required core competencies on an as-needed basis by inviting key resource people to join us. In this manner we have worked with engineers, ecologists, agronomists and taxonomists at different phases of the project. We also maintain a close collaboration with universities in the area of operation. The University of Waterloo, Canada and The University of Behrampur, Orissa, have been partners at specific stages of the project. Our aim is to keep CT_x GreEn small *and yet maximize Growth of Impact* by leaving behind “shadows” in NGO’s we work in partnership with, to carry-on the work long after our exit.

Funding

The World Banks Development Market place award (WBDM 2003) has been the principal source of funding. The organization has been supported from time to time by volunteers, small collaborations with bilaterals and consultants, and an ongoing doctoral research. Registered as a no-profit charitable organization in Canada we are considering to do likewise in India to be able to leverage local funding to support the field interventions. Consultancies on biofuels, paid feasibility studies on green energy-particularly in biofuels, services offered from our pilot plant facility- an action research station (which we would like to develop as a centre of excellence in biofuels offering action-oriented research support to the field NGOs), installation and commissioning of new biodiesel units including South-North trainings and exchanges, are some likely sources of revenues.

Measurement and Effectiveness

A direct measure of the success of our project is the availability of piped water in un-electrified villages. The other benefits include several new livelihood opportunities. Technology is only one among several other factors that we consider important for project sustainability. It is the premise of the project that this technology can lead to land regeneration and will strengthen local level institutions at the village level.

We are putting in place procedures for monitoring the machines, pump sets, diesel generator sets, well recharge, water use (a water meter has been installed in the village). Village youth are being trained to maintain logs and monitor the technology.

A detailed resource assessment with active participation of villagers and Gram Vikas has led to the setting up of a baseline of the natural resources as well as in the selection of target species of native plants/trees that can provide biodiesel related feedstock – oil and ethanol. The baseline is likely to be used by existing Van Suraksha Samitis (Forest protection committees) to ensure that activities related to the technology do not have any negative environmental impacts (such as increased soil erosion, or requiring intensive agricultural practices). Safeguarding of local food security by avoiding conflict-of-use and identifying/protecting local aquifers through soil and moisture conservation will be other monitoring parameters. We have invested in a land use land cover assessment of the target region, and have acquired remote sensed images and extensive ground data on the state of the land. With such extensive baseline data it will be possible to monitor the impact of our intervention over the long term. The local university in Behrampur and local village youth trained as para-taxonomists assisted us in the current study and can be enlisted for future monitoring.

We believe that the monitoring has to be done by members of the local community- those impacted directly by the project. With this in mind we are nurturing local level institutions like the Forest Protection Committees, Self Help Groups and schools (with assistance of taxonomists, agronomists, linkages with local university) to be the repository of the baseline information but more importantly to identify key monitoring parameters that the community considers relevant, and to subsequently monitor them.

Contact Information

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