

Findings and Lessons Learnt

Derived from the Terminal Evaluation Report UNDP/GEF Project: Biomass Energy for Rural India (BERI) (PIMS 598)

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4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS

4.1 CONCLUSIONS

- With BERI terminated as of December 31, 2012:
 - Bioenergy assets were transferred to the GoK;
 - Operational funding for bioenergy assets after December 31, 2012 is uncertain though an exit strategy (contained within this Evaluation) has been prepared for RDPR;
 - A viable business model for BERI biomass energy plants does not yet exist; and
 - Not all bioenergy plants will have been commissioned.
- With UNDP/GEF funds already exhausted, the committed co-financing amounts from the State and Central Government is essential for continuation of BERI project operations and the sustained supply of bioenergy to the grid;
- Expectations of BERI were raised during the community mobilization phase between 2001 and 2005. However, with the strategic shift from off-grid to grid without provision of an “islanding” operation, the community had become increasingly disenfranchised with BERI:
 - Power generated from the biomass power plants was going to the grid, instead of the targeted communities being supplied with generated power from BERI biomass generation assets, mostly notably during grid outages when the entire region is without electricity;
 - There was a loss of pride when the biomass power plants could not even deliver local power to its own communities in the event of grid failure. This is mainly due to the absence of a load shift mechanism that was to provide bioenergy from the BERI generation assets to the local grid and targeted communities;
 - Biomass for Kabbigere bioenergy plant was being sourced from another plantation 40 km from the plant and not from the local plantations.
- With a grid-connected operation, the financial viability of the biomass power plants has become a significant issue since the tariffs from BESCOM were Rs 2.85/kWh and the actual price of electricity production from these plants being more than Rs 7.8/kWh;
- Biomass for the BERI bioenergy plants needs to be sourced from local plantations and

from plantations on forest wastelands; this will contribute significantly to the continued and sustained operation of these plants by obtaining the biomass at a reasonable price;

- BERI has delivered to the GoK and the Government of India three rural biomass energy generation assets and lessons on community engagement that have significant potential to improve the living standards of rural India. At this stage, only a small investment is required to reduce the cost of electricity production, improve the operating performance of the Kabbigere plant and to find the means to increase revenue from electricity sales. This will allow the project to continue to the extent that BERI assets would be more financially attractive to external investors.

4.2 RECOMMENDATIONS

With the GEF-funded BERI project terminated on December 31, 2012, the following recommendations are provided in order of priority to Rural Development and Panchayat Raj (RDPR) on actions required to sustain rural development activities of BERI Project in the Tumkur District using continuous running of biomass energy generation:

Recommendation 1: Release committed funds by Government of Karnataka and the Government of India.

The Finance Department has mainly questioned the financial viability of the BERI assets. Noting that the Project was intended to generate information, data and lessons to overcome the aforementioned barriers, the BERI project was funded with firm financing commitments from UNDP, GoK, Gol and ICEF (now closed) at the time of project formulation. At the commencement of BERI, it was not envisaged that the biomass power generation component would be grid-connected.

As can be seen from Table 3, UNDP/GEF has released most of its committed expenses for the Project implementation with the remaining funds for the Terminal Evaluation. As such, the balance of funds from Government of Karnataka should be immediately released. Any delay will cause irreparable damage to the 10 years of progress which is already sluggish due to numerous delays and the lack of funds.

Over Rs 1 crore of co-financing (in the form of capital subsidy) has been transferred to RDPR from Gol for the commissioning report for biomass gasifier power plants at Kabbigere, Borigunte and Seebanayanpalya. The subsidy for the Kabbigere plant was claimed on the basis of their operations and submitting the plant commissioning reports in the MNRE format. With the current subsidies received, plant operations can continue for another 6 to 12 months and cover costs of improving the operating performance of the plants until an investor can be found to support its operations over the long-term.

Recommendation 2: Establish load shifting mechanism.

The original 2001 project document conceptualized bioenergy as the key to providing reliable electricity to rural areas in a decentralized mode through the exploitation of a local biomass energy resource. Due to a variety of reasons, the number of biomass gasifier plants was changed from 60 small biomass gasifier plants (20kW each) to 6 large biomass gasifier plants with power evacuated to the grid through the establishment of a BERI-supported 11 kV line. When the grid is down (at times up to 4 hours per day), the plant needs to be shutdown resulting in a lower PLF (Plant Load Factor). Exacerbating this situation is that there is no power for local community when the grid is down. The lower PLF results in increased power generation costs and the unit cost of exported electricity.

A load shift mechanism can switch over to bioelectricity in case of grid failure, thereby increasing availability of reliable electricity to local rural villages and also increasing the PLF; this arrangement is similar to a captive power house which connects to the grid in normal times but switches to in-house captive power plant in case of grid power failure. The result is an improvement in the power plant capacity utilization and a lower unit cost of electricity generation. BESCO estimated a cost of Rs 50 lakh to install the load shift mechanism and had agreed to carry out the 2-month task almost 18 months ago. The BERI PMU had agreed to provide these funds in the 2011 Annual Work Plan. The installation of the load shift mechanism by BESCO, however, has yet to be done.

This Evaluation recommends that the load shift mechanism be done at the earliest possible time as it directly addresses the primary objective of BERI project and significantly enhances the community stake back into the Project. Targeted villages in Tumkur would gain confidence in BERI biomass power plants to supply reliable power even during events when there is grid failure. Furthermore, community pride from the generation of their own electricity using locally community-owned biomass resources would resurrect community participation and the income generation activities that were prevalent during the 2001-2005 period of BERI. This in turn would have likely improved the ability of the targeted villages to pay for the electricity from the biomass power plants, further contributing to the economic viability of plant.

Recommendation 3: Ensure obligations of Karnataka forest department and others to provide biomass from project plantations.

BERI has provided support to plantation development. Project reports claim close to 3,000 hectares of plantation was developed, one third each in Panchayat land, bund plantations on farmer's land, and on forest department land. The 2010-11 assessment indicated the average annual yield of 5,000 tonnes against an estimated potential of 12,000 tonnes, sufficient biomass for sustained operations of the biomass power plants. However, at present, the wood is purchased mainly from the Forest Department or from private contractors at locations more than 40 miles from Tumkur. The BERI PMU needs to review the agreements, commitments and obligations, with the Forest Department needing to avail biomass from Project plantations in the forest area at a discounted price considering that the BERI Project made substantial investments in these plantations. Irrespective of the result from this evaluation, it is vital that the wood is made available from local sources so that biomass power plant operations are not hampered. There are obvious community benefits from the procurement of biomass from project plantations that would return money back into the local rural economy, restore community pride and encourage community involvement which has been lost since 2006.

Recommendation 4: Outsource operations to encourage entrepreneurship and increase PLF.

Despite the best efforts of the BERI PMU to operate and maintain the Kabbigere bioenergy power plant, 1.35 million kWh of electricity was generated in about five years. This translates to 20% of its generation potential. In comparison to another similar but privately owned bioenergy plants, the Pointec biomass plant (just south of Bangalore)²⁰ provides electricity equivalent to 60% of its generation potential. The BERI PMU has attempted to outsource operations through bidding; however, no viable bids were submitted. On the advice of IISc, M/S Pointec submitted a proposal for providing O&M support for the Kabbigere plant consisting of a proposed tariff of Rs 11.25 per kWh for the first three months of operation, slightly lower than the Rs 14 per kWh as estimated by BERI PMU, but higher than the Rs 8.5 per kWh costs estimated by IIM Bangalore (the basis for this is the 1,000 hours benchmark operation of IISc).

This proposal should be accepted as the outsourcing of these operations to the private sector will provide more precision in the benchmarking of operational costs, and assist entrepreneurs and technical professionals in sub-megawatt scale operations. With M/S Pointec revenue linked to plant operation, it would be in M/S Pointec's interest to maximize plant operations; this would help all stakeholders gain insights from the optimized operations of a rural biomass power plant that enhances the PLF and reduces the unit cost of electricity generation.

Recommendation 5: Review institutional arrangements to operate, manage and replicate the BERI model (BERI – Society under RDPR, KSCST with funds, KREDL or KPTCL).

The Project was conceptualized with close linkages to rural development and, as such, BERI was housed in RDPR. The activities ranged from bioenergy packages such as biogas plants, improved cookstoves, bioelectricity supplies for irrigation coupled with enhanced rural electricity reliability and increase incomes. The BERI PMU was formed to focus on project deliverables as per the BERI project design and in close consultation with RDPR and guidance from PSC. Until June 2012, a full time Project Coordinator (senior officer from GoK) was deputed; after June 2012, only a part time PC was in place. Initially, 3 project officers were assigned to manage three different streams namely power plant operations (technology), biomass supply (plantations/forestry) and rural development initiatives (community). During the early periods of BERI, this arrangement helped to kick start BERI; in December 2012, it appears the efforts made will not be sustained unless continued institutional support is made available. The BERI Society (BERIS) was actually formed with the objective of promoting bioenergy in the State of Karnataka and perhaps to other states. The present set up of BERIS does not have any full time personnel and no concrete activities in hand. Under these circumstances, institutional options in a post-BERI regime are as follows²¹:

- Option 1: Strengthen BERIS by recruiting full time personnel, revitalizing community involvement, identifying gaps to make the interventions feasible and sustainable, and proliferating the BERI model. The BERI project has created unique infrastructure such as biomass power plants, 11 kV lines, plantations, and borewells for drip irrigation. RDPR should consider providing funds to BERIS on a sustained basis, and use it as a training and incubation centre;
- Option 2: KSCST was one of the implementing agencies in the original 2001 project document. Subsequently, they were only included as a PSC member and were not involved in implementing the project. Their main goal is “application of science and technology for the management of resources, improvement of environment, quality of life and socio-economic conditions of the people of Karnataka”. They have carried out innovative demonstrations, work in close collaboration with different departments of IISc, and qualify as one of the agencies with the wider vision to implement a post-BERI project. During the TE mission discussions, they showed genuine interest to undertake such programmes provided funding is in place. This is a strong option to consider;

²¹ The suggested institutional structure for any of the options is that of the agency to administer the BERI activities through the BERI society, where plant operations are outsourced to a private operator. As indicated in Recommendation 4, it ensures a cost-effective option with increased plant operation and helps enhance PLF which reduces the unit cost of power generation.

- Option 3: KREDL could own, operate and maintain the plant either directly or through outsourcing. KREDL is currently operating a 1 MW wind power plant with a 7-year agreement with MNRE. However, their core business is facilitation of renewable energy and energy efficiency promotion, and not to operate facilities themselves;
- Option 4: KPTCL is the main power transmission company in Karnataka State, and could operate the BERI biomass power plant assets;
Option 5: The Karnataka State Biofuel Board have funds available to promote bio-energy in the state. They can also operate the biomass power plants and continue community activities after the closure of BERI. A formal request from RDPR needs to be made to initiate an official response from the Board on post-BERI involvement;
- Option 6: RDPR can auction or lease the biomass power plants with conditions to run and operate it for a set duration and sharing plant performance data. To be able to exercise this option, the existing PPA of Rs 2.85 per kWh with BESCOM needs to be annulled. This will then provide the new private operator open access to sell green power at premium price to nearby bulk consumer or wheel the power to corporate clients who can buy power at premium prices. Such an arrangement will help the private plant operator to bridge the prevailing viability gap between cost of power supply and prevailing grid tariff in project area.

Recommendation 6: Develop BERI assets as a national training and incubation centre, that is jointly managed by KSCST and IISc that is 50% self-financing (or financing from other sources) and 50% from GoK

The project assets, especially the gasifier based power plants, biogas plants, and plantations can be showcased as successful working demonstrations for training and capacity building of potential entrepreneurs, operators and other stakeholders. This can help in popularizing technologies, contribute to the collection and sharing of knowledge, and contribute to large-scale promotions that will increase the likelihood of replication.

4.3 LESSONS LEARNED

- Careful preparations including a third party assessment of the technology are required for the selection of a technology provider. The technology being provided needs to be mature with minimal R&D required. In the case of BERI, it appears that the larger gas engines in the order of 100 to 250 kW_E were not market-ready until 2007. Moreover, the ASTRA technology for the 120 kW_E capacity community leaf and litter-based biogas-cum-biofertilizer plant to supply power for a domestic lighting load was dropped due to the immaturity of the technology being used on BERI;
- Public sector implementation arrangements for new technologies need to be simplified to provide the technology developer with the latitude for changes which may be unforeseen. A simplified arrangement would be engaging the technology provider in a turnkey operation and with performance standards. This arrangement would be favored by a technology provider who has a need to protect their intellectual property (IP). BERI did not have this arrangement, and as such, troubleshooting of the technology involved complex

contractual arrangements, limited time to troubleshoot, and valuable time wasted in procuring these services. Moreover, O&M functions were outsourced by the Project which would have only attracted a very small number of entities associated or sanctioned by IISc as a means to protect their IP;

- Public sector selection of technology providers for new emerging technologies (with very limited number of suppliers) needs careful selection in that such a selection cannot be procured through a routine (typical government L-1 process) tendered process. This process is not only time consuming but expensive to implement for both government and the bidders who may expend considerable effort to prepare a bid or proposal;
- Complex projects with cross-cutting sectors where there is a lack of baseline activities or baseline data is poor, should be implemented in phases similar to earlier GEF projects.

In the case of BERI which started in 2001, the successful completion of one phase would secure funding for the subsequent phase. BERI could have been implemented as a 3-phase project with:

- Phase I as a planning & community mobilization phase;
- Phase II as a phase for proof of concept pilots;
- Phase III for operations and plans for replication.

The benefit of the phased approach would be the ability of the funding agencies to halt the project after each phase.

One of the benefits of projects being associated with GEF is the access to foreign expertise. For GEF projects of long duration that have problems, there is value in having additional and periodic foreign external reviews of projects in addition to the traditional mid-term and terminal evaluations. Foreign external advice on BERI could have provided a fresh and unprejudiced approach to management arrangements and advanced global technical advice without being constrained by the structures of normal local practices; as such, BERI would have benefitted from the use of foreign expertise.