GOOD PRACTICE (BIO GAS)

Lalita Balakrishnan, AIWC

AIWC had been implementing National Project on Bio-Gas Development, since 1994, as one of the Nodal Agencies of MNES, with the technical help from AFPRO(Action for Food Production, who had developed the popular DEEN BANDHU MODEL BIO-GAS Systems) ,and funding from MNES. This programme was being conducted through AIWC branches in various states as well as other NGOs as partners. AIWC had conducted more than 15-20 day bio-gas training programmes for the construction and maintenance of bio-gas plant and constructed more than 10,000 plants.

- One of the branches of AIWC at Chunar, which is half way in between Banaras & Mughal Sarai in U.P. is working with nearly 800 women belonging to Self Help Groups providing training in various income generating trades like carpet weaving, pottery making, etc and employing them.
- Active President of this branch Vijaya Rai had taken up the AIWC NPBD programme and had implemented a very successful biogas dissemination & implementation and constructed 300 biogas units in this area. Since women were directly involved in this programme even after four years later almost all the bio-gas units are being used by the beneficiaries & in fact there is a very big demand for more bio-gas plants to be constructed here.
- The husband of one of the beneficiaries “Laxmi” was running a poultry farm where they had around 150 birds in the big terrace in their house and through AIWC Bio-gas programme they had built a 4 cubic meter. unit in their backyard, which they were feeding with poultry litter and started producing bio-gas of highly acceptable quality and quantity. The housewife used to cook the entire meals for around 15 people including the workers in the poultry farm and the joint family breakfast, lunch, tea, dinner every day only in the biogas oven. The pressure with the gas was coming out of the bio gas unit was so high at times that they had to release it to reduce the pressure.
- When we had gone to monitor their unit, we saw a neat kitchen where nearly 60 chapattis were stacked in a big basket, big vessels full of lentil soup, vegetable curry etc. Laxmi was happy with the biogas and she told us that they never use any other fuel in their house for cooking.
- When we were about to leave the house after inspection, at the request of the lady of the house one of us engaged her husband in conversation another member of AIWC took her aside and Laxmi poured her heart to her! (There is always a social dimension to the domestic programmes we had conducted at various states and this was no exception.) It came to light, though she has been managing the entire kitchen herself & looking after the entire family as also feeding the birds, she was being tortured by her husband everyday, who wanted to marry another woman. Laxmi was not given any food to eat but the same feed with water which was given to the birds. She actually was on the verge of committing suicide because of torture meted out by her husband. To cut a long story short through our local branch members we got her husband censured by the local Govt. authorities and state women’s commission. He not only left the house for the other

woman but also sold his poultry farm to somebody. Laxmi, undaunted started running Bio-gas by feeding the poultry litter collected earlier and once it was over, she bought the litter from nearby poultry farms. The best thing she did was that she started supplying bio-gas to 6 to 7 houses nearby and charging them for the gas, she started earning a decent income. Through this plus income she started earning by working with our branch at Chunar, She gained a lot of self confidence & not only her health improved but also the standard of her life went up.

- It is yet another story that after seeing Laxmi's affluence her husband came back & apologized for his past behavior and started living with her once again. They have now a boy and the husband is behaving himself and the NGO members are keeping an eye on him!.

Like this, the dissemination of various RETs especially for women is a way of life and has a great impact on the social situations also.

- For Instance, when we visited our programmes in Maharashtra & we came to know that young girls here are refusing to get married into the families where they do not have a bio-gas for cooking & they are only using wood fire. We met quite a few Gandhian families, who have not only connected their toilets with the bio-gas units but they were also using the gas produced out of these units in their kitchen without any inhibition for cooking.
- Another group of families belonging to the service personnel especially Army & Navy, living in 24 parganas of West Bengal near Kolkata is very proud to show off their clean kitchen, toilets attached Bio-gas units & bathrooms which have been built by their own initiative after being sensitized by the Ramakrishna Mission who were funded by AIWC over the years. These men specially take leave and come home to construct the bathroom, toilets and the bio-gas unit connected to toilets which they are proud to show off.
- A group of women who are members of self help group run by our partner NGO in Kakinada in Andhra Pradesh have got their bio-gas units constructed through AIWC bio-gas programme and also paid the share of the unit from the loans taken from the SHG. They have returned the entire loan with interest and they are all happily using the bio-gas, for cooking, lighting and the slurry for their gardens and field. There is great demand for more biogas units hence AIWC experience had been that wherever the women of the house had been trained in the use of bio-gas the correct way of feeding, maintaining etc. the units are always working well since the women have understood the importance & the benefits of using these units. AIWC had constructed a 2 cm kitchen waste fed biogas nearly 12 years back at the head quarter's premises in New Delhi. The large kitchen where all the meals are cooked for around 300 working women living in AIWC hostel. A large number of kitchen wastes are produced every day. Once in two and three years, the unit had to be emptied fully and after small repairs etc. are emptied fully and after small repairs are started once again. One of the families in the premises is using the biogas. During the very cold season, December and January we had to add some more cow dung diluted with water which helps in faster methanation.

There is a big scope for hostels and hotels to use he wastes to produce gas which could serve two purposes- getting gas for cooking. The slurries could be utilized for in there own

gardens. Disposal of wastes at source is a great help to the municipalities and towns who are running out of space for garbage dumps.

Biogas production from kitchen waste at AIWC Central Office

Biogas with 65% Methane availability would 1 to 1.5 cylinder of LPG equivalent i.e. 20 to 25 kg of LPG gas. This quantity is capable of sustaining the cooking requirement of an average family 4-6 person for one month i.e. cost saving would by Rs.450/- monthly Rs. 5,400/- annually.

The plant can take 25% over loading also and hence more gas could be produced on a daily loading of around 20-25 kg bio waste of kitchen.

At the moment, daily loading of waste around 20-25 kg of kitchen waste:

If used for lighting it can light 1 lamp of 100 watt for 3 hrs., daily for 30 days also i.e. 100 x 3 x 30 = 10,000 10 kW-hr which can save (Rs. 5/- per unit) Rs. 50/- monthly.

Animal dung is being used as major raw feeding material for biogas generation, irregular and insufficient availability of animal dung calls for widening the scope of the biogas technology by tapping other alternative feedstock such as poultry waste, piggery waste, water hyacinth, spent wash, press mud and kitchen waste or Municipal waste.

In a city like Mumbai hundreds of tons of solid wastes, household kitchen waste, peels of fruits, soiled vegetables, rotten waste food materials, etc. get generated daily, There are problems of not only staring but also of transporting and disposing the waste hygienically.

The collection is normally done outside the buildings, on roads where general hygiene gets affected. It smells bad first, flies breed on it and during the monsoon, it really is only “God can save” situation. The solid waste generated include waste of hotels, canteen, vegetable markets and alike. All these are biodegradable materials. When these waste materials are digested by respective bacteria in biogas plant, the inflammable mixture of gas containing about 50-60% methane gets generated.

CASE STUDY from Britto Energy Engineers

A biodegradable waste based biogas plant working entirely on kitchen waste was designed, developed and installed during Dec. 2000 at Larsen & Toubro Ltd., Madh (Mumbai) by Virar-based Britto Energy Engineers. This plant uses about 60 kilos of canteen wastes on a daily basis. It was initiated by using cow dung mixed with water in certain proportion to acquire the culture of the methane producing bacteria, which are abundantly available in dung. The canteen's food waste and waste vegetables including bananas peels were mixed in waste and put in a tank of the plant for digestion, hoping to get the results. However, it only resulted in obnoxious odor, a mixture of non-inflammable gas comprising of mainly carbon dioxide and water vapors. Thus a modification was thought necessary. The mixture similar to household mixer grinder was used to make pulp of the vegetables waste. When this was kept for both primary and secondary digestion, it produces good results. The design parameters are consisting of following components as stages 1) Segregation of biodegradable material 2) Shredding and pulping arrangement 3) open heating in settling tank by sun or through hot water bathing 4) Primary digestion 5) Secondary digestion (Methane reactor) 6) Slurry drying beds.

Here fiberglass technology has been utilized. Both primary and secondary digester along with gasholder is made out of fiberglass. Due to FRP the installation becomes fast and easy with added advantage of corrosion resistance. A simple plant of this type could produce gas worth Rs. 25 every day using about Rs. 5 worth electricity and ½ hrs. labour for collection and disposal. The cost of this plant is approx. Rs. 60,000. Even though the initial cost looks prohibitive, considering the nuisance of canteen wastes, cost of transportation and disposal, it may well be justified. Also one gets the slurry value, output of the plant other than biogas which is very good fertilizer to nourish the plants and vegetables in gardens/farm.

Thus, a small experiment of pilot plant has proved successful, and if similar biogas projects are taken up on a large scale, the economy can become more favorable and may be done on a professional basis. One can produce fuel and at the same time get rid of the waste products systematically an avoid spoiling the environment with added advantage of quality manure. Based on the design of this prototyped pilot plant, Biogas plant of higher capacity for treating one ton, two tones and five tones of waste can be designed, developed and installed a successful at different decentralized locations nearest to source of waste.

Reference: Mr. B. J. Britto, Britto Energy Engineers.

A CASE STUDY ON AN INNOVATIVE BIOGAS MODEL WHICH EMPOWERS LANDLESS RURAL POOR WOMEN BY ADRESSESING LIVILIHOOD

By
Zareen Myles

I. Background of house hold biogas technology in India and involvement of WAFD

1. India is a pioneer in the design and implementation of household biogas, especially for the rural areas, and started the process in late 1950's with the introduction, of the KVIC model BGP, having a floating steel gas holder. The gas holder was fabricated from mild steel sheets in well-equipped workshops, and had the limiting factor of high cost, non durability and difficulty in spreading to rural areas.

2. Meanwhile, due to fossil fuel crisis brought due to the Gulf war in early seventy's attention was again brought back on biogas technology, which led to innovations and development of a low cost fixed dome biogas plants, called as Janata model in late seventy's. This model was about 30% cheaper than KVIC model, and completely replaced steel in KVIC and eliminated dependence on workshop with locally available bricks and utilization of local masons for its construction. WAFD got the first Janata model built in UT of Delhi, in the "Chirag Delhi Village" in early 1980's, which worked for several years and acted as demonstration model for many visitors from India and abroad. Though it was useful in collection of practical information, data collections and learning experience for WAFD, it was also realized that urban centers were not the place for a long term biogas programme, as it had limited value for acceptance.

3. When WAFD moved its development programmes to Bharatpur district in mid 1990's, it realized the wide potential for biogas plants as most villages had cattle, and the dung was being used mostly for burning as fuel or for making a local organic manure, by just allowing the dung to gather in a heap till required. By this time, another much improved and sturdy low cost fixed dome biogas plant, named "Deenbandhu" model was developed with in the NGO sector, which was about 25% cheaper than the Janata model plant. This was approved by the MNES, Govt. of India to provide subsidy under its national scheme, known as NPBD (National Project on Biogas Development). WAFD decided to take this opportunity to promote Deenbandhu biogas plant (DBP) model in Bharatpur district. It was realized very soon that this was not going to be an easy task, as by now many plants built by local district agency under the NPBD had failed and the local people had developed very negative attitude to wards the biogas plant. Convincing them to install a plant was a herculean task- it took a year of constant persuasion before one progressive farmer's family agreed to build a demonstration plant. The success of the first plant built by WAFD, spread in the surrounding villages, and requests for building 'Deenbandhu' started coming in. Deenbandhu model is at present the cheapest yet stronger model, therefore became very popular. A team of trained supervisor, technicians and master masons was put into place by WAFD to build this model. This biogas team constructed over 300 Deenbandhu biogas plants under the aegis of the NPBD of

MNES, first through the state nodal agency, NPBD funds routed through the district authority; and subsequently, through a national level NGO nodal agency.

II. Problems faced by WAFD and the critical issues in biogas implementation

4. When WAFD was going strong with the implementation of biogas plant in the district, and the demand was growing, suddenly we learnt that the MNES had withdrawn subsidies for the entire Rajasthan state therefore even the district was not given any target to build any plant under NPBD. This sudden withdrawal put us in a bad light with farmers therefore in desperate move we approached another national nodal NGO who allotted us some target for channelling subsidy under NPBD for building plant. While building household plants, we gradually started realizing the following problems and critical issues which need to be addressed:

   a). Rising cost of constructing household biogas plant: Due to cost of building material and labour, the cost of building plants were going up, on an average of 10% every year. Thus every year it was getting beyond the means of poor rural people, who were the main target groups of the developmental interventions of WAFD.

   b). Environmental and ecological problems: Due to use of brick (digging of good soil and burning of coal and firewood for baking the bricks) for construction of Deenbandhu model was creating environmental problem. This was affecting both, the environment and ecology of the Bharatpur which is the home of the famous national bird sanctuary- also it was felt that indirectly it may have been affecting the Taj Mahal due to closeness from it, situated 40 km from the district headquarters. Finally, as a precautionary measure, the district authority banned the making of bricks in the district, pushing up the cost due to transport and labour for bring to the site. This also resulted in the increase of the construction cost of DBP.

   c). Participation of rural women in building biogas plants: While the women were the beneficiaries of the biogas plant, the decision makers were men and the biggest gainer. The decisions to invest in the building of plants came from men if they could be convinced that biogas digested slurry (manure) was good for their agriculture, as they were not interested in it cooking value of removal of the drudgery of women. This was due to lack of awareness and concern on these important issues. Total economic dependence of women on the male in the family aggravated this situation further. Another factor was that traditionally the dung was considered the women's property and they used it to make the "upplas" for using as cooking fuel. The money from sale of extra upplas was their saving. Therefore many women viewed this as an encroachment on their right to earn from the dung. Therefore WAFD realized that the real benefit of biogas, as an important tool for development and empowerment could only become a reality if the rural women could some how take the role of financial decision makers as well as actively participate in the implementation along with men. To address the second problem, WAFD thought of training the rural women as biogas masons, however, through further interactions, the following difficulties were realized- (i) Supervising the male skilled workers for construction of plant by women

master masons would be difficult if not impossible; (ii) Even if some of the women were trained as masons, due to majority of being illiterate and lack of technical aptitude, would be taken for a ride by skilled workers working under them; (iii) women could not travel to distance places on daily basis or live away from home during the construction period, leaving their children and family; and (iv) supervising male skilled and unskilled workers inside the fixed dome plant during construction would create social problems in the home and villages. Thus training and involvement of women as masons was given up. As for the first part regarding the economic independence for women, WAFD started looking at the various biogas design options, as a part of its overall strategy for the empowerment of women.

d). Utilization of locally available material and local skills: Another important consideration by WAFD in the selection of new biogas model design would be the use of locally available building materials and local skills to a maximum extend possible to provide livelihood to the rural landless laborers. At the same time bringing down the cost of the biogas plant so that it becomes with in the reach and means of those poor people who had the required number of cattle to operate the smallest size plant of 1 m^3 capacity.

e). Participation of rural women through micro-enterprise for income generation through RETs: In order to involve rural women in an effective manner any activity which would provide income to them in their own villages and additional income either in off-season or in spare time as per their convenient would be more acceptable to them and their families.

f). Alternate means of financing for the construction of biogas plants to overcome problems of subsidy: WAFD's experience with government subsidy for biogas building was not very encouraging, in fact very unsatisfactory. WAFD is a development organisation working for the empowerment of women and children, but this was very difficult for the government functionaries with altogether different mind-set to understand- as like other agencies and individuals, they would treat WAFD as contractors working for them. In spite of submission of large number of documents, and inspections the transfer of funds for subsidies from the government agencies would get delayed, and the WAFD staff had to spend more time chasing them than doing the actual work. Thus almost the entire funds earmarked for providing construction and post construction services (called as turnkey fees or services charges under the NPBD) would remain a myth and only on paper, as WAFD ended up spending from its own saving, in effect subsidizing the so-called government sponsored programme[1]. Due to all this, WAFD felt that it was very important to have alternate means of financing, if it had to continue with the implementation of biogas in a sustainable manner in the long run. It had to be completely independent of government funding and subsidy, which lacked flexibility and followed tight jacket approach, to allow for any innovations for the implementation of technology based activities at

1. District authorities still owe an amount of Rs.38,000/- required to be reimbursed to WAFD for the plants which were built over 5 years ago spending own funds out of its savings, and it now appears that it will not come at all.

the grassroots level to respond and meet the felt-need of the local community, which we call as socio-technical approach for implementation.

g). Integration of biogas in other development programme to make it more meaning full and creating better impact: From experience we realized that a biogas plant was more than a device for delivering a clean and efficient energy to rural people. It was a good device to integrated three important disciplines for economic well being and quality of life of rural people, namely livestock, agriculture and water, while supplying clean and efficient energy, and also addressing health, sanitation, pollution, environmental and ecological issues. However, in order to empower the target group, the people had to be kept in the center of all the WAFD's interventions, and the biogas or any other RETs would only be "means" and had to be integrated with all our developmental programmes.

III. Lessons learnt by WAFD and search for new solutions

5. The implementation of biogas plant in isolation meant treating it mainly as an energy technology, preventing innovation in its use as a developmental tool[2]. Perhaps this is one of the reasons that where ever the subsidy was withdrawn BGP implementation suffered[3]. Therefore, while biogas as technical device has been partially successful because of some of the above-mentioned reasons; but it still remains an important developmental tool for empowerment of rural people, so we decided to continue to use BGP as an important tool for people-centered integrated development.

6. Based on the lessons learnt from practical implementation and WAFD's critical analysis, we decided to tackle all the problems step-by-step and solve them with in WAFD's own means, expertise and resources, in a systematic manner. Some of the key aspects in this process are summarized below:

a). Since WAFD's main thrust is on the empowerment of women, we started searching for a biogas model which would effectively address the livelihood issue of the poor rural women, especially coming from the landless agricultural families, mainly depending on the daily wages.

b). Keeping the special problems of Bharatpur in mind, we also wanted a BGP model which would replace ecologically damaging bricks as a basic building material, with environmental friendly alternate building material, which would also be available locally.

c). The other benefits/ advantages of biogas were already known to us and others involved in the implementation, but they only had to be effectively communicated to the end users, which we recognized.

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2. Due to BGP being promoted as energy device, in majority of cases became an "end" in itself, rather then becoming a "means" of achieving developmental goals-thus achieving physical target became most important than empowering local people.

3. Now we realize that subsidies should have been used as incentives for integrating biogas technology effectively with other activities so that it would empower people. That required critical awareness and capacity building of local people to improve their livelihood or use biogas implementation as a means for strengthening those activities which would continue after the withdrawal of subsidies.

IV. Innovative biogas model for empowering landless rural poor women through income

7. When our search for a new biogas plant to meet our requirement didn't yield any results, then we approached the present Secretary General of INSEDA to design and develop a model which would meet our needs. At that point of time, he was the designer-cum-leader of the team of specialists and technicians in a national technical service NGO, which designed the existing Deenbandhu[4] biogas model in mid 1980's, which was then (in early 1990's) the most popular household fixed dome model in India. This led to the design of the present Grameen Bandhu Plant (GBP) by him in mid 1990's after he took over as the Secretary General of INSEDA.

8. We were cautious, so as a first step decided to build only three GBP models using our own funds with three cooperating farmers in one of the WAFD's villages in Bharatpur district. During the construction of this model we also got two of our master masons trained, so that when in future we were convinced and ready, they would be used for implementation. We wanted to operate this plant (Grameen Bandhu Plant-GBP) for at least 1 year and monitor its operational aspects and get response of the end-users and our own supervisors and barefoot technicians based on long-period of field testing, and give these feed-backs to the designer for further improvement and finalizing the design from the point of practical-field applications.

9. All these took us almost two years when we were finally ready with a final practical field worthy design with appropriate modifications. However, at this time WAFD faced another problem- which is that the central subsidy being provided under the NPBD of the Ministry of Non-Conventional Energy Sources (MNES) was completely withdrawn from the Rajasthan state due to many defunct plants built in the state, and even Bharatpur district was affected due to this, being a district with in the state. WAFD had no funds of its own to implement this new low cost biogas technology, the Grameen Bandhu plant (GBP), which was made from bamboo reinforce cement mortar (BMRC), completely replacing bricks with bamboo as the main building material. The GBP was also comparatively cheaper than the existing most popular Indian fixed dome plant made from brick, and called as Deenbandhu plant (DBP), and was equally strong and sturdy.

V. New strategy for implementing biogas plants to address poverty

10. We got the opportunity when our integrated and joint project with INSEDA (another NGO) for converting existing 12 selected villages in Bharatpur district was sanctioned. This was the pilot project on "community oriented solar eco-villages programme", in partnership with the student union of the University of Jyväskylä (JYY) and with the financial assistance of Government of Finland, and launched in April 2002. We had planned to implement all the appropriate RETs with in these 12 villages, as per the needs and demand of the people, and biogas plant was one of

4. As per figures available about 3.5 million household plants have been built in India under the NPBD by the close of end financial-year 2004-05, and even after 10 years, out of these numbers, over 80% of the biogas plants are of Deenbandhu model).

them. This also provided us the opportunity to experiment with finding innovating solutions to empower the rural women and more so the landless poor women through socio-technological interventions, by addressing livelihood issues.

11. Fortunately, the funding agency (Finnish Government) provide flexible funding for the training and over all capacity building of local project staff, artisans (local masons) and rural volunteers (48 REEVOCs-Rural Energy and Ecological Volunteer Corps) from these 12 solar eco-villages in the broad discipline of renewable energy, environment, ecology, water harvesting and conservation and sanitation. In addition for building demonstration units and conducting field level, practical application-oriented experiments to test the field worthiness of rural oriented appropriate technology, before wide applications.

12. Out of the 12 target villages selected for converting them in to "community oriented solar eco-villages", we consciously selected village Nagla Banjara, in which majority of households were landless (mainly agricultural labourers) and working as daily wage earners. This was one of the villages located at the periphery of the Bharatpur National Bird Sanctuary (BNBS). In earlier years the villagers would go inside the BNBS and collect fodder and firewood and sell them in other villages and city to earn daily living. But after BNBS was declared as national bird sanctuary, their livelihood was greatly affected, and many youth and male members of the families had migrated or semi-migrated to other urban centers in search of employment. WAFD felt that this was an excellent opportunity to implement and see the effect of RETs in terms of livelihood, environmental protection and for improving the quality of lives of these poor people.

13. Due to three years of continuous failure of monsoon, Bharatpur district was having draught and farmers were barely able to take one crop in the winter season (Rabi crop season). This had affected these landless agricultural labourers, as both male and female, who mainly depended on sowing, and harvesting of agricultural crops and fodder collections for their 1-2 milch animals (buffalo) had no regular jobs. Some of the male youth with minor skills had migrated to urban centers and big cities. Therefore, WAFD and INSEDA found this an ideal situation to test the benefit of the new biogas model as a tool for providing employment to poor people.

14. As mentioned above, an important innovation for the construction of bio gas plants, using bamboo reinforce cement mortar (BMRC) of 2 cubic meter (2 m^3) capacity had already been experimented and field tested jointly by WAFD and INSEDA with 3 farmers in one of the villages, for over 6 years now since 1996. The response of end users (owners) and the local villagers about new model was also very positive. The use of bamboo baskets had brought down the price of this biogas plant christened as Grameen Bandhu (meaning friend of the rural people) so that it was at least 15% cheaper as compared to the existing most popular fixed dome plant, the "Deenbandhu model", while also ensuring the participation of women in the weaving of bamboo structures for constructing this model.

15. When we had funds for building a few demonstration-cum-training Grameen Bandhu plant (GBP) in the year 2002, we discussed and debated as to how best to associate women from the poor landless households. Initially there was mixed response- how these illiterate and unskilled will make (weave) bamboo structures as per the dimensions of the plant? What will happen if bad workmanship will fail the plants built at farmer's field?

16. When this issue and dilemma was discussed with the designer (Secretary General of INSEDA which is also the partner of WAFD in the Solar Eco-village programme) of the Grameen Bandhu plant, his response was that this model was developed keeping in view all the problems posed by WAFD and other developmental NGOs in early and mid 1990's. The participation of women in the fabrication of bamboo structures for building the plant was one of the considerations, so that they could also earn wages by weaving of bamboo structures with in their own villages, for the construction of this biogas model. In fact the following things were also recognized while designing this plant (Grameen Bandhu model) if women had to be effectively involved:

a). In most villages it was impossible to get women who had working with bamboo for making baskets, especially of this massive size;

b). Most of the women would be illiterate, especially coming from landless rural households;

c). Majority of them would not have technical skills or even technical aptitude;

d). Rural women would require more intensive training, re-training, refreshers training before they would come to the level of perfection, as most of them would not be from the background of the professional basket or bamboo weaver community;

e). Long period of hand-holding would be required by external professional and trained staff (technical supervisor and technicians) of the organisation even after the trainings before they developed confidence in weaving of bamboo structure, especially those ones which would be used for the construction of components with critical dimensions that would affect the performance and the efficiency of the Grameen Bandhu model.

17. Therefore, to overcome the above mentioned problems, apart from trainings, it was decided to make underground moulds for weaving the components with critical dimensions as well as to keep uniform and correct shapes of the woven bamboo structures, so that the final construction of Grameen Bandhu biogas plant at farmer's field was as per the dimensional sketch. In spite of this, if minor mistakes in dimensions due to loose weaving was noticed or the exact shape was not achieved at the weaving level in the initial stages, it could be corrected during construction at the farmers field, if the master masons/ technicians and/or technical supervisors were well trained and experienced professionals.

18. Starting from December 2002/Janauary 2003 a number of practical trainings on step-by-step building of Grameen Bandhu model were conducted for local project staff, technicians, artisans, REEVOCs. Above all the training of the women of the

landless agricultural families of the Nagla Banjara village (one of the solar eco-villages) was the watershed in the involvement of these women as active partners in the implementation of this new innovative biogas model. During the 15-21 days practical training women were given enough stipends to maintain themselves and meet their daily needs. The important thing has been that all these trainings for women weavers were held in their own villages, some of them with very small siblings were able to attend the training, as due to three years of draught they needed the job and money and it was the period of year when there were no earnings from the agricultural operations. Ten selected local women from the landless families were trained in the first training, under the direct guidance of the Secretary General, INSEDA and his team. Twenty women wanted to be trained, but to impart better training and maintain the quality of supervision during weaving only 10 were selected, as these woven bamboo structures had to be used for construction of GBP at the farmers field who were also contributing 60 % of the cost of their plants, and the guarantee of trouble-free operation was provided by WAFD.

19. One of the important decisions taken jointly by the Executive Director, WAFD and the Secretary General, INSEDA was to involve these women, who had never worked with the bamboo or any kind of weaving, was to train them from scratch. This was against the recommendations and strong reservations from the master technician-cum-trainer, who was worried that as women were not competent to slit bamboo and make them in to strips of desired width and thickness, the quality of end product at the farmer's field will suffer. He had even talked to a professional bamboo splitter to come and do the job, but this was overruled as that would make these women dependent on outside professional. Instead, the trainee women, after consulting them, were provided all the tools and gloves to do the entire job. Almost all the women hurt their fingers and hands as neither they nor we realize in the beginning that this work wasn't going to be easy for them. They wanted to earn money as that was their immediate need, and we were keen to involve them right from the beginning, to make them independent of the external professional. Therefore, in spite of cut and bleeding, women didn't want to give up and take rest, though had become slower, but we understood this and accepted in principle for additional one week time and stipend for the first training from our side. All this paid off and with each day things started improving, and even the master technician-cum-trainer felt happy with this important decision. Now, we have organized several practical trainings and refreshers training for theses women in the last three years. This has now started paying dividend as now they can finish the splitting of bamboo and weaving in lesser time, when ever we use them for plant construction, and they now get better wages for this work in their village itself.

20. Twenty women from Nagla Banjara have been trained and re-trained to weave the bamboo baskets while one man (REEVOCs) from the same village has learnt how to guide them in measuring when they start the weaving in the underground moulds (pits). The women of Nagla Banjara now weave the baskets and every year they are able to get at least 2-3 months of work and earn a small amount of Rs.1000/-per woman. From Nagla Banjara the baskets are transported to the site of the

construction of the plant. Bamboo having a long life ensures that the structure has a long life if basic care is taken.

21. The farmers have worked out the economics of their plants and realize that even if they have a 2 cubic meter (m^3) Grameen Bandhu plant (GBP) they are able to get at least 28 quintal of manure every year which is enough for 11 acres (28 beeghas ÷ 2.5) of land. So what is keeping more farmers from constructing bio gas plants in their homes? It is the cost. Our farmers being poor they are unable to bear the cost of construction at one go. This is true for even the richer and bigger farmers.

22. WAFD and INSEDA together constructed a bigger size demonstration Grameen Bandhu plant of 6 cubic meter (m^3) gas generation capacity per day for a progressive large farmer, living on the outskirt of Nagla Banjara village. The total cost of this plant came to Rs.34,000/- with pipeline with basic accessories etc, including cost of an external experience technical person for providing guidance on day-to-day construction as well as supervision, as our own technicians required more practical experience in higher capacity fixed dome biogas plant. Even though the design and drawings were available with us, but this was the first time of building this higher capacity Grameen Bandhu model plant by any body. Therefore the Secretary General, INSEDA (who is the designer of GBP model) also visited during the crucial stages of construction for providing over all guidance to the entire construction team. In addition, he also used this opportunity to impart step-by-step practical training to solar eco-village project staff, technicians, local masons and 10 landless women from the Nagla Banjara village. Due to this, approximately 40% subsidy (which came to Rs.14,000/-) was provided from the EVD project funds, and the plant owner paid Rs.20,000/-, in the form of building materials and pipe line and accessories. The 10 landless women from Nagla Banjara village weaved the quality bamboo structures for this plant and earned their standard wages.

23. The 6 cubic meter (m^3) Grameen Bandhu plant has now been commissioned and also producing enough energy to run a 5 horse power engine daily for 3-4 hours, for either providing mechanical power for irrigation by attaching appropriate size pumping-set or generating electrical power by coupling it to a generating-set. This GBP is running well and the owner is very much satisfied with its performance.

24. The large 6 cubic meter GBP has generated a lot of interest and many of the bigger farmers and dairy owners are looking at the plant to see how well it functions before they too get one constructed for themselves. This plant is useful for people having 12 to 15 large or 15-18 medium size animals, as it requires daily feeding of 150 kg of dung + 150 liters of water. This would then give about 864 quintal of manure annually and will be enough for 864 beeghas (approximately 345 acres) of land.

25. Till date 18 training-cum-demonstration fixed dome biogas (including Grameen Bandhu model) plants have been constructed with in the 'Solar Eco-village' development programme, since April 2002. Out of which 2 plants are of 2 cubic meter (m^3) Deenbandhu model, 14 of Grameen Bandhu model, one plant is an experimental double digester meant for digesting crop based biomass, like Mustard

husk, using BRCM[5] for construction, just like the Grameen Bandhu model, while the last plant is a 6 cubic meter (m^3) Grameen Bandhu plant. In all the BRCM plants, the fabrication of the bamboo structures were done by these landless women from Nagla Banjara village, earning wages.

26. In the absence of any government subsidy, and to overcome this problem we are studying the possibility of granting small loans to the women on special rates of interest for the construction of bio gas plants.

27. The 8 photos showing some of the important stages of the practical training to landless women are given on page 11 of this case study.

Summary and Conclusion

28. While we trained these landless women from Nagla Banjara initially for building Grameen Bandhu plants, but one of the spin-offs was when we decided to build our training-cum-demonstration, roof-top harvesting system- the same women were utilized for building BRCM storage tank, earning wages. Thus, we have demonstrated that women can play an effective role and also perform the jobs requiring technical-skill, only we have to keep women in the focus while designing any new technology.

29. Once the financial aspect of supporting such activities are overcome (as the technology can not be afforded fully by rural people and require appropriate financial mechanism to support construction), then RETs can provide economic benefits to the local people, especially solving the livelihood problems of the poor people in rural areas of the country. Then the RETs will be accepted much faster as those who are earning their daily wages also become stakeholders and start finding the customers (prospective plant owners) as it is happening in the case of these trained women and a man from Nagla Banjara village.

30. Starting from 1980's when WAFD first got involved in the promotion of fixed dome biogas plant we kept on making improvement in our implementing strategy, based on the 'learning curve'. However, the time taken to learn and make improvement was longer in the initial years. As our involvement in biogas and other renewable energy technologies (RETs) became more intensive in the later years, the learning curve started becoming shorter and shorter, and now it has become very short. All these learning are fed in to our institutional memory in the forms of documents (write-ups, reports and case studies) and photos documentation, to be referred and utilized as and when required. We are trying to remain dynamic in our approach to respond to the needs, based on the lessons learnt each time, and try to make appropriate mid-term corrections and improve our interventions to empower the rural poor, especially the women in more effective manner.

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5. This BRCM biogas plant was designed by the Secretary General, INSEDA in early 2003, specifically for utilization mustard husk (which is normally treated as difficult waste to digest) with certain percentage of cattle dung mixture.








Some of the important stages of practical training on fabrication (splitting, strips making and weaving etc) of bamboo structures to poor landless women with in their own (Nagla Banjara) village, to be used for building Grameen Bandhu Plant (GBP)