3. CASE STUDIES

Four case studies related to biogas plants are discussed under this chapter. There is a cost benefits analysis carried out for one case study and more numbers of facts are utilized to check the financial viability of the cases. All values are discussed in Indian Rupees.

3.1. Community Biogas Plant at Fateh Singh-Ka-Purwa

Fateh-Singh-ka-Pura is a tiny village in Bhagynagar block in Etawah (U.P) and is linked to Bhagyanagar-Dibiapur road by a kutcha link road. During 1978 it was assessed that 47 % of the villagers owned less than requisite cattle to own their individual family plants and accordingly it was decided to set up country's first ever community plant in this village. The plant was set up by the Planning Research and Action Division (PRAD), Lucknow, with UNICEF assistance. Site selection was influenced by the fact that it already had the Integrated Area Development Project in Etawah which provided it considerable infrastructure support. Adequate waste availability, villagers cooperation and commitment, and fairly uniform economic status of household were some of the other favorable factors for site-selection.

The community plant consisted of two units of 35 m^3 and 45 m^3 capacity with former supplying gas for meeting cooking and lighting needs and latter for running a 5 HP dual-fuel engine to power 3.5 KVA electric generator. The first unit provided gas during 7-9 a.m for preparing breakfast, during 11 a.m to 1.00 p.m for lunch and during 7-9 p.m for dinner. The second unit enables to supply electric power to 27 households each having two bulbs of 40 W each and eleven tube lights for lighting the streets daily for four hours. During initial phase of plant operation, clay burners were handed over to every household free of charge which was then replaced by steel burners as and when the earlier ones broke down and these were also supplied free. Whereas biogas for meeting cooking needs is supplied free, the one used for running the flour mill, chaff cutters and tube-wells is normally billed. Apart from supply of gas, the resulting plant effluent is also distributed among households in proportion of the cattle waste contributed by them. Gas supply was done through underground GI pipeline fitted with adequate water traps and safety valves at appropriate locations.

S.Bahadur and S.C. Agarwal carried out a cost benefit analysis of the plant based on one year of plant operation. In their analysis it was assumed that 45 % of available gas was used for cooking, 30 % for lighting and 25 % for other applications.

Manurial value of Effluent

Daily feed at two plants at Feteh-Singh-Ka-Purwa is 1,229 kg. Feed comprises animal wastes, crop residue and weeds like water-hyacinth. The feed thus on annual basis is about 450 tonnes. Before setting up plant about half of available cattle dung was providing manorial input to field through composting, the other half used as cow dung cakes or wasted. Following setting up community plant, additional 225 tons of organic manure is provided to villagers as enriched fertilizer. Uot of 225 tonnes of slurry, solid content is about 21 tonnes comprising 4.2 tonnes of nitrogen, 2.1 tonnes of phosphorous and 2.7 tonnes of potassium. The value of enriched fertilizer was estimated as Rs. 15000 per annum.

Total Benefits

Total benefits accruing from community plant = Rs. (1500+4020+4070+11780)

= Rs. 34,870/y

Total Costs

Total capital cost with generator	= Rs. 2,02,000
Operating cost	= Rs. 2,398
Salary payment to electrician @ Rs. 400/month	= Rs. 4,800/y
Fuel (Diesel) cost	= Rs. 613/y
Maintenance cost	= Rs. 1,100/y
Total cost	= Rs.8,811/y

Details of cost benefits analysis intangible are summarised in Table 3.1. It does not take into account several benefits liked improved health, sanitation and extra leisure

time. If these benefits are also taken in to account, benefits cost ratio can improve further. However, even without taking them into account, the analysis establishes economic viability of the project (It is to be noted that costs relate to 1978 price level and since then these have gone up considerably).

Table 3.1 - Cost benefits Analysis of Community Plant at Fateh-Singh-Ka-Purwa

Year	Capital cost	Operating cost	Benefits	Net Benefits (Rs)	Depreciation (10%)	Present value of capital cost (Rs)	Present value of net benefits (Rs)
1	20,2000	4,405	17,435	13,080	0.909	183,618	11,844
2	-		34,870	26,059	0.826		21,525
3	-		34,870	26,059	0.751		19,570
4-20	-		34,870	26,059	6.028		157,135
Total						183,618	210,074

Benefit-Cost ratio = 210074/183618 = 1.14:1, Source: (Mital, K.M, 1997)

3.2. Community Biogas Plant at Jainpur

A fixed type community plant consisting of three units of 1000 ft3 capacity with each unit costing Rs.6 lakh was set up at village Jainpur in 1982. The plant could meet fuel need of 60 households out of a total of 126 with each household consuming about 60 ft3 of gas daily. Gas supply was restricted to 6 hours daily during summer and 4 hours during winter. Two labours were engaged for transporting animal waste on wheel-barrows from individual households to the plant size. For utilizing gas, households were charged at a flat rate of Rs. 25 per month but subject to revision from time to time. Besides meeting cooking needs, gas was also used for domestic and street lighting and running a 10 KVA generator for operating a chaff-cutter, flour mill and oil expeller. A supervisor was engaged to manage plant operation and maintain record of wastes-collection and gas and effluent supply to individual households.

3.3. Community Biogas Plant at the KCP Sugar Factory, Vuyyuru

This plant is located in the premises of the KCP Sugar Factory in Krishna district has over 1600 employees. It is fed by waste from cattle owned by over thirty employees residing in company's township. The factory contributed Rs.40,000 in setting up the plant which included Rs.3000 as subsidy from the KVIC. Necessary control in plant operation was provided by the factory management and requisite technical assistance by the Vidyanam Public Trust. The Trust helped in determining plant capacity in keeping with waste availability and energy needs. It also provided guidance in obtaining subsidy and constructing the plant. There were over hundred households who could be the possible users of gas. The houses were located in five rows having twenty units each. Initially, fourteen houses were provided with biogas which was later extended to four more households. Distant houses which involved extra pipe line costs were not connected in the first instance. Plant operation was looked after by a full-time paid employee. Gas was supplied three hours from 6 to 7:30 a.m and 7 to 8:30 p.m. Later when more gas was generated, period was increased. Except for some minor difficulties initially faced, the plant functioned smoothly. There existed feeling of general satisfaction with the plant performance.

In Maharashtra, a biogas plant utilized spent wash generated by the sugar factories as feed. It is managed by the Shivadasan Griha Nirman Society Ltd. A mill discharging 500,000 liters of spent wash daily can generate 15,000 cubic meters of biogas everyday which can run its boilers for seven hours, and produce 21,000 tonnes of enriched fertilizer. The plant effluent is dried, supernatant liquid diluted and fed into ponds for cultivating water-hyacinith. The purified water is chlorinated and recycled for industrial applications. Water hyacinith is chopped and mixed with plant sludge for obtaining rich compost which can be utilized in sugarcane cultivation. The plant is situated near the factory boiler room and the water hyacinith treatment ponds on a wasteland near sugarcane fields. The entire process was developed as a natural and inexpensive technique of recycling liquid wastes.

3.4. Community Biogas Plant at Bidhlam, Sonepat

A community biogas plant of 85 m3 capacity with technical and financial assistance from the then DNES was set at Bidhlam village in 1987. It is duly linked by roads with Delhi, Sonepat and Rohtak and surrounded by some 40 villages within a radius of 15 km. Decision for setting up the plant was made on the basis of energy survey carried out to asses overall energy demand in the village. For plant maintenance and workers trining a workshop-cum-training centre equipped with necessary machines, equipment and tool was set up. A committee comprising representatives of plant beneficiaries was formed for solving day-to-day operational problems such as collection of wastes, schedules for gas supply, disposal of slurry and pricing of gas and plant effluent. From the plant, gas connections through an underground pipeline were given to 36 families to meet their cooking needs. Gas supply was made twice a day for five hours.

Biomass gasifier developed by the IIT, Delhi and a five HP engine along with a pump was coupled to a tube well for supplying drinking water. The engine is run on producer gas from the gasifier that can also be run on biogas. It consumes a duel fuel of 80 % gas and 20 % diesel under normal operating conditions. With one charge of biomass such as wood, or other agricultural wastes, the gasifier can supply gas to run the engine for eight hours. When gas supply is cut-off, the engine automatically switches over to diesel without interruption. The engine can be used to pump water for meeting drinking water needs of the village school children. Extra water pumped was proposed to be used in raising community demonstration farm at the project site.