MANAGEMENT ISSUES OF BIOGAS PROGRAMME : A CASE OF BIHAR (1984 - 1986)

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Abstract

In these days of depleting sources of conventional energy the development of non conventional energy and renewable sources of energy has gained momentum. India, has about 75% of it's population in rural areas. Biogas being a clean, efficient, renewable energy source holds considerable potential for rural households. The launching of National Project on biogas Development in 1981 has provided an added impetus to the promotion of biogas technology . About 1.9 lakh biogas plants have been installed in 1985-86 alone which has exceeded the target set for that particular year. But, alongwith this increase in installation certain issues have also cropped up.

The present study has monitored the performance of the biogas programme in relation to technolgy, administration, operation and various other infrastructural facilities. Out of the biogas plants installed how many are actually functioning ? What are the problems faced by the users and how can they be solved ? Solutions to these problems are necessary for smooth functioning of biogas programme. Besides, there are certain organizational issues also, like an effective monitoring system , planning the programme etc. which have to be followed . The implementing officials should be committed towards the programme and people's participation also plays a major role in the efficient running of the programme. There should be an effective Management Information System and a mason training programme for immediate solution of post installation and maintenance and repairs of biogas plants.

1. INTRODUCTION

The Government of India launched the National Project on Biogas Development (NPBD) in 1981-82. Since 1982, the newly created Department of Non-Conventional Energy Sources (DNES) has been implementing the NPBD. During the period 1981-82 to 1986-87, over 7.4 lakh biogas units were installed in the country. Basically two distinct types of biogas-technologies are being promoted in India - the floating - dome KVIC model and the fixed-dome Janata model. While the KVIC-models are popularized through KVIC and the organizations/institutions promoted/sponsored or recognized by KVIC (popularly known as Khadi-institutions), the Janata models are popularized mainly through government agencies often with the help of various NGOs. The share of Janata model over KVIC-model has become over whelmingly large (more than 70% in recent years) in NPBD. Apart from organisational factors, the decline in KVIC-model is due to relatively low cost of the Janata model which does not require steel and fabrication facilities of steel-dome.

The popular response to biogas programme seemed to be spectacular. As the achievements often surpassed the targets in many states in terms of installation of plants - DNES had to restrain the targets demanded by many states. While the biogas programme reached an encouraging take-off stage, there were often reports of failures of plants, administrative and operational problems. There should be a conscious organisational response to tackle the problem. The evaluation of biogas programme in various states by independent organisations, as reported in the

case of Bihar here, has been a deliberate and conscious organisational effort of DNES to monitor the programme for mid-course correction on a regular and continuing basis.

While DNES has the overall responsibility for implementing the programme at the national level, the actual implementation is carried out at the state level by a designated nodal agency. Biogas programme in Bihar was originally implemented by the department of agriculture. Subsequently, when the programme was enlarged and NPBD started along with other programmes on non-conventional energy sources, the department of energy became the nodal agency in Bihar for implementing all DNES-sponsored programmes. The KVIC, has been implementing the programme in a few districts of Bihar.

The other agency involved in implementing the programme in Bihar is the Command Area Development Authority (CADA). The nodal agency,the State Energy Department, however, is required to monitor the programme.

1.1 SCOPE AND OBJECTIVES

This study is in relation to the State of Bihar. Since the biogas programme has been in operation in India for more than two decades and NPBD itself is about 6-7 years old, there would be existing plants of different ages. For a meaningful evaluation, therefore, it is necessary to have a particular reference year so that biogas plants of a particular age-group can be studied. It is envisaged that the evaluation of 1-2 year old biogas plants would be a correct strategy for monitoring the progress of the programme in order to implement necessary mid-course corrections

before the plants become too old. Hence, the evaluation of biogas programme in Bihar under report is in relation to the year 1984-85 and 1985-86.

1.1.1 Broadly, the study aims to monitor the performance of the biogas programme of 1984-85 and 1985-86 in Bihar in relation to technology, administration, operation and various other infrastructural facilities. More specifically, the study has the following objectives :

- To determine the proportion of functional biogas plants by type of model and year and identify plants having structural and other problems out of the non-functional plants.
- The report also covers the problems faced by households in the operation of biogas plants and the benefits from biogas usage, the utilization of slurry as fertilizer and condition of soil after installation of biogas plants.
- To find out the land holding size, cattle holding size, caste and the number of family members of biogas plant users.
- To study the difference in demand of other fuels like firewood, kerosene and cowdung before and after utilization of biogas.
- To examine infrastructure available at present at State/district/block level for implementation of the programme and to recommend suitable organizational requirements for prospective plan programme.
- To study and determine the extent and quality of follow-up action which the plant owners have received for maintaining the plants.
- To make recommendations for developing the procedure, strategies for revival of non functional plants and regular post-installation servicing of plants and to recommend measures required for overall improvement in implementation of the programme.

1.2 SAMPLING

The present study was conducted in 21 districts in Bihar covering 1671 household biogas plants comprising 1350 Janata plants and 321 KVIC plants. (See Table 1). For the two years

TABLE 1

NUMBERS OF BIOGAS PLANTS DISTRICTWISE, VILLAGE WISE

	DISTRICT	NO. OF VILLAGES	BIOGAS PLANTS	
			JANATA	KVIC
1	GAYA	142	160	29
2	GIRIDIH	46	69	-
3	BEGUSARAI	24	23	32
4	PURNEA	33	82	2
5	BHAGALPUR	60	117	18
6	SAMASTIPUR	103	127	38
7	ROHTAS	25	52	2
8	PATNA	58	34	74
9	HAZARIBAGH	17	60	4
10	RANCHI	41	57	2
11	MADHUBANI	17	64	3
12	NALANDA	55	79	30
13	NAVADA	23	51	6
14	LOHARDAGA	7	25	2
15	GUMLA	24	36	17
16	MONGHYR	27	44	12
17	KHAGARIA	21	29	7
18	MUZAFFARPUR	48	80	-
19	VAISHALI	50	82	12
20	BHOJPUR	45	56	25
21	SINGHBHUM	8	23	6
	TOTAL	874	1350	321

1984-85 and 1985-86, Bihar had a target of about 34000 Janata biogas plants over and above the KVIC plants . Thus the total sample covered almost 5 per cent of the targetted biogas plants in Bihar for the year 1984-85 and 1985-86.

1.2.1 In order to ensure that the survey represented various agro-climatic & administrative/demographic characteristics of Bihar the districts were selected accordingly. Nine intensive biogas development districts in Bihar - Bhagalpur, Bhojpur, Monghyr, Patna, Gaya, Purnea, Ranchi, Rohtas and Samastipur were covered in the sample. They also represented various agro-climatic and administrative/demographic characteristics covering North and South Bihar.Thus, while Ranchi being predominantly tribal district with hill, and forests, Bhojpur and Patna have particularly high water table and largely plain land. Some of the districts like Bhagalpur, Bhojpur and Purnea have some areas under different Command Area Development Authority (CADA). Following the same principle of wider representation of various characteristics, 12 more districts were included in the sample in addition to the 9 intensive districts. Some districts like Navada, Madhubani and Vaishali were selected largely to capture sufficient number of KVIC plants which were found to be in larger numbers in these districts.Initially, 250 blocks were selected.A group of villages were selected in each block representing varying level of concentration of biogas plants. In selecting villages two factors were considered : first, as far as possible not more than 5 to 10 plants could be selected in a village representing different types or models of plants; and secondly, the total number of plants in the selected villages should be at least 10

per cent higher than the total required number of the sample in the State i.e. 1600.

For selecting KVIC plants, a different methodology had to be adopted. As the data on KVIC plants was not easily available the villages were selected in such a way that they were not far from the villages selected for Janata plants. However, there were some villages where both types of plants were reported to be existing and such villages were preferably included in the sample.

As all blocks did not have plants constructed during the reference years, 1984-85 and 1985-86 these blocks were eliminated thus, finally out of 350 blocks, the survey was undertaken in 230 blocks covering 874 villages .

1.2.2 The following information was collected for each biogas plant owner in each village :

- name and address of the plant owner
- type and capacity of biogas plant
- Status and operating conditions of the plant (commissioned or non-commissioned, functioning or not functioning)

In selecting the plant owners the following parameters were ensured :

- all the biogas plants in the final sample should represent the target of 1984-85 and 1985-86
- the biogas plants should represent all types and capacities
- the biogas plants should represent varying status (commissioned or non-commissioned) and operating conditions (functioning or not functioning etc.)

2. COVERAGE OF BIOGAS PLANTS.

2.1 The sample consisted of 1671 biogas plants of which 1350 were of Janata type and 321 were of the KVIC type. These plants were located in 21 districts. Two districts namely, Giridih and Muzaffarpur did not have any KVIC plants .The distribution of plants according to model, year and functioning status is given in Table 2. It can be observed that 16.76% of KVIC plants of the year 1984-85 were functioning while 16.52% of Janata 1984-85 plants were functioning. Of the total plants 89.11% were functioning.

3. CAPACITY OF PLANTS

3.1 The capacity of biogas plants varied from 2 m3 (cubic metre) to 20 m3 so it was decided to group the plants in the following manner : 2 m3, 3-4 m3, 6-8 m3, 8-20 m3.

3.2 Table 3 shows the functionwise, capacitywise, distribution of both the Janata and KVIC biogas plants. 64.7% of all Janata plants were of 3-4 m3 size; while 24.3 % were of 2 m3, and 11% fell into the 6-8 m3 category. There was a greater concentration of 3-4 m3 plants for both Janata 1984-85 and Janata 1985-86 i.e. 59% and 66.5% respectively. 39.3% of all KVIC plants were of 6-8 m3 size while 35.8% were of the 3-4 m3 and 21.2% consisted of 8-20 m3. Only 3.7% of all KVIC plants were of 2 m3 size. The highest percentage of plants for the year 1984-85 KVIC plants was in the 6-8 m3 size which was 41.5%. On the other hand 35.3% of KVIC 1985-86 plants consisted of 3-4 m3 size.

TABLE 2

NUMBERS & PERCENTAGE OF PLANTS YEA -WISE,FUNCTION-WISE

MODEL & YEAR	FUN	%	N.FUN	%	TOTAL	%
JANATA 1984-85	276	16.52%	46	2.75%	322	19.27%
JANATA 1985-86	899	53.80%	129	7.72%	1028	61.52%
NVIC 1984-85	280	16.76%	7	0.42%	287	17.18%
NVIC 1985-86	34	2.03%	--	--	34	2.03%
TOTAL	1489	89.11%	182	10.89%	1671	100.00%

TABLE 3

NUMBERS & PERCENTAGE OF PLANTS FUNCTIONWIWISE, CAPACITYWISE

CAPACITY (in cu.mt.)	JANATA (1984-85) FUN	N.FUN	TOTAL	%	JANATA (1985-86) FUN	N.FUN	TOTAL	%	TOTAL JANATA PLANTS	%
2	69	35	104	32.3%	173	51	224	21.8%	328	24.3%
3-4	130	60	190	59.0%	362	322	684	66.5%	874	64.7%
6-8	24	4	28	8.7%	66	54	120	11.7%	148	11.0%
8-20	-	-	-	-	-	-	-	-	-	-
TOTAL	223	99	322	100.0%	601	427	1028	100.0%	1350	100.0%

CAPACITY (in cu.mt.)	KVIC (1984-85) FUN	N.FUN	TOTAL	%	KVIC (1985-86) FUN	N.FUN	TOTAL	%	TOTAL KVIC PLANTS	%
2	5	2	7	2.4%	1	4	5	14.7%	12	3.7%
3-4	79	24	103	35.9%	4	8	12	35.3%	115	35.8%
6-8	82	37	119	41.5%	5	2	7	20.6%	126	39.3%
8-20	24	34	58	20.2%	-	10	10	29.4%	68	21.2%
TOTAL	190	97	287	100.0%	10	24	34	100.0%	321	100.0%

4. COMPLETION OF PLANTS

4.1 Table 4 shows the percentage of complete; complete but uncommissioned and incomplete plants. . The percentage of completed Janata plants showed a distinct increase i.e.74%, as compared to completed KVIC plants 64.5%. The Janata 1984-85 completed plants were 83.5% , while the Janata 1985-86 completed plants were 71%. The percentage of completed KVIC 1984-85 plants was 68.6% which was greater than the percentage of KVIC 1985-86 plants which was 29.4%.

4.2 The percentage of Janata 1984-85 complete but uncommissioned and incomplete plants of the same year was 16.5% . While the percentage of Janata 1985-86 plants for complete but uncommissioned and incomplete plants was 29.0% . The KVIC 1984-85 percentage of complete but uncommissioned and incomplete plants was 31.4% The KVIC 1985-86 complete but uncommissioned plants and incomplete plants was very high 70.6%

4.3 Various causes were found for the complete but uncommissioned and incomplete plants. They are as follows :

a) No more interest left in completion of plants once the subsidy is fully paid up .

b) Family problems like illness in the family, housebuilding etc.

c) Inspite of subsidy farmers did not have enough finance to invest their money.

d) Accessories such as mantle, stoves, gas pipe not available from either the block office or locally.

e) Plant was completed but not enough cowdung for initial feeding.

f) Rain water had flooded the plant so initial feeding was not done.

TABLE 4

NUMBERS & PERCENTAGE OF COMPLETE , COMPLETE & UNCOMMISSIONED .INCOMPLETE PLANTS.

	JANATA						KVIC					
COMPLETION-WISE	1984-1985	%	1985-1986	%	TOTAL JANATA PLANTS	%	1984-1985	%	1985-1986	%	TOTAL KVIC PLANTS	%
COMPLETE	269	83.5%	730	71.0%	999	74.0%	197	68.6%	10	29.4%	207	64.5%
COMP & UNCOMM + INCOMPLETE	53	16.5%	298	29.0%	351	26.0%	90	31.4%	24	70.6%	114	35.5%
TOTAL	322	100.0%	1028	100.0%	1350	100.0%	287	100.0%	34	100.0%	321	100.0%

5. SOCIO ECONOMIC BACKGROUND

Socio economic factors have played a major role in biogas technology. Previously biogas plant installation was the domain of rich farmers who possessed a large head of cattle. But in the last couple of years the scene has changed. Introduction of government subsidy, land loan, levy cement has helped small and marginal farmers to install their own biogas plants. The new biogas technology has also helped in installing plants of smaller sizes which need only a few cattle. Despite the innovations of technology, socio economic factors like family size, cattle size, land holding, caste, agro climatic conditions etc. do influence the adoption of biogas plants.

5.1 Caste : Until recently majority of plant owners used to be from the general category and very few scheduled castes and scheduled tribes adopted biogas technology. However, government has started giving enhanced subsidy to them with the result that quite a few families have started adopting biogas.

5.1.1 Table 5 shows the castewise distribution of biogas plant owners. 90.7% of total Janata owners and 92.8% of KVIC owners were from general category; only 7.4% of Janata respondents and 4.4% of KVIC respondents fell into scheduled castes category. The scheduled tribes formed a negligible 1.9% for Janata owners and 2.8% for KVIC plant owners.

5.2 Family Size

5.2.1 The larger the family the greater amount of fuel required. Biogas can make a major contribution towards the fuel needs of a family.

TABLE 5

NOS. & PERCENTAGE OF PLANTS FUNCTIONWISE, CASTEWISE

CASTE WISE	JANATA(1984-85) FUN	N.FUN	TOTAL	%	JANATA(1985-86) FUN	N.FUN	TOTAL	%	TOTAL JANATA PLANTS	%
SC	4	2	6	1.9%	59	35	94	9.1%	100	7.4%
ST	1	-	1	0.3%	13	11	24	2.3%	25	1.9%
GEN	218	97	315	97.8%	529	381	910	88.5%	1225	90.7%
TOTAL	223	99	322	100.0%	601	427	1028	100.0%	1350	100.0%

CASTE WISE	KVIC(1984-85) FUN	N.FUN	TOTAL	%	KVIC(1985-86) FUN	N.FUN	TOTAL	%	TOTAL KVIC PLANTS	%
SC	9	5	14	4.9%	-	-	-	-	14	4.4%
ST	5	4	9	3.1%	-	-	-	-	9	2.8%
GEN	176	88	264	92.0%	10	24	34	100.0%	298	92.8%
TOTAL	190	97	287	100.0%	10	24	34	100.0%	321	100.0%

5.2.2 Table 6 shows that only 4.3% of plant owners of total Janata plants had 1-5 family members, while 51.6% had 6-10 family members and 44.1% had 11-20 members 25.9% of the total KVIC plants owners had 6-10 family members and 74.1% had 11-20 members. None of the KVIC plants had family members in the 1-5 category.

5.2.3 Janata 1984-85 had only 14.3% in the 1-5 family member category while Janata 1985-86 had 1.2%. 48.4% were in the 6-10 category of the Janata 1984-85 plants, while 52.6% were in the Janata 1985-86 year. The 11-20 members category had 37.3% for Janata 1984-85 and Janata 1985-86 had 46.2%. In contrast to the Janata plants, the KVIC plants did not have any number belonging to 1-5 family members category, while KVIC 1984-85 had 21.3% in 6-10 family members category and KVIC 1985-86 had 64.7%. For the 11-20 members category KVIC 1984-85 had 78.7% and KVIC 1985-86 had 35.3%.

5.3 Land Holding of Plant Owners

5.3.1 Table 7 shows that the representation of small farmers was highest in Janata 1985-86 plants which was 39.3%. The Janata 1984-85 plants had 38.8% while KVIC 1984-85 table comprised of 38.7% and KVIC 1985-86 had 29.4% of small farmers.

5.3.2 The percentage of marginal farmers in Janata 1984-85 was the largest with 41.9% while the Janata 1985-86 had 36.8%. The KVIC 1984-85 and KVIC 1985-86 had 30.3% and 26.5% respectively of marginal farmers.

5.3.3 KVIC 1985-86 had the largest percentage of others category of farmers ie. 44.1% followed by KVIC 1984-85 with

TABLE 6

NUMBERS & PERCENTAGE OF PLANTS FUNCTIONWISE,FAMILY MEMBERS WISE

FAMILY MEMBERS WISE	JANATA (1984-85) FUN	N.FUN	TOTAL	%	JANATA (1985-86) FUN	N.FUN	TOTAL	%	TOTAL JANATA PLANTS	%
1-5	39	7	46	14.3%	12	-	12	1.2%	58	4.3%
6-10	105	51	156	48.4%	301	240	541	52.6%	697	51.6%
11-20	79	41	120	37.3%	288	187	475	46.2%	595	44.1%
TOTAL	223	99	322	100.0%	601	427	1028	100.0%	1350	100.0%

FAMILY MEMBERS WISE	KVIC (1984-85) FUN	N.FUN	TOTAL	%	KVIC (1985-86) FUN	N.FUN	TOTAL	%	TOTAL KVIC PLANTS	%
1-5	-	-	-	-	-	-	-	-	-	-
6-10	42	19	61	21.3%	5	17	22	64.7%	83	25.9%
11-20	148	78	226	78.7%	5	7	12	35.3%	238	74.1%
TOTAL	190	97	287	100.0%	10	24	34	100.0%	321	100.0%

TABLE 7

NUMBERS & PERCENTAGE OF PLANTS FUNCTION WISE, LAND HOLDING CATEGORY WISE

LAND HOLDING CATEGORY WISE	JANATA(1984-85) FUN	N.FUN	TOTAL	%	JANATA(185-86) FUN	N.FUN	TOTAL	%	TOTAL JANATA PLANTS	%
SMALL	87	38	125	38.8%	236	168	404	39.3%	529	39.2%
MARGINAL	97	38	135	41.9%	227	151	378	36.8%	513	38.0%
OTHERS	36	23	59	18.3%	137	108	245	23.8%	304	22.5%
LANDLESS	3	-	3	0.9%	1	-	1	0.1%	4	0.3%
TOTAL	223	99	322	100.0%	601	427	1028	100.0%	1350	100.0%

LAND HOLDING CATEGORY WISE	KVIC(1984-8-85) FUN	N.FUN	TOTAL	%	KVIC(1985-86) FUN	N.FUN	TOTAL	%	TOTAL KVIC PLANTS	%
SMALL	84	27	111	38.7%	2	8	10	29.4%	121	37.7%
MARGINAL	59	28	87	30.3%	3	6	9	26.5%	96	29.9%
OTHERS	45	42	87	30.3%	5	10	15	44.1%	102	31.8%
LANDLESS	2	-	2	0.7%	-	-	-	-	2	0.6%
TOTAL	190	97	287	100.0%	10	24	34	100.0%	321	100.0%

30.3%. The Janata plants have a comparatively smaller percentage of category of other farmers. Janata 1984-85 had 18.3% while Janata 1985-86 had 23.8%.

5.3.4 The landless category was hardly represented with Janata ta 1984-85 having 0.9%, Janata 1985-86 having 0.1% and KVIC 1984-85 having 0.7%.

5.4 Cattle Holding

5.4.1 Generally, the size of the plant to be installed is decided after taking into account the number of cattle head owned by the farmer and number of family members in the household. Number of cattle head is an important factor as the biogas plant is functional only after dung is fed into the plant.

5.4.2 Table 8 depicts the cattle holding size table. From the table it can be observed that Janata plants had 7 % in 1-2 cattle holding size whereas KVIC plants had 1.2% only. In the 3-5 cattle holding size, Janata plants had 52.3% ,while KVIC had 27.7%. In 6-10 cattle holding size category,Janata had 32.5% while KVIC had 40.8%.

5.4.3 In the greater than 10 category Janata plants had the cattle holding size of 8.2% while KVIC plants had 30.2%.

5.5 Agro-Climatic Factors

5.5.1 Agro - climatic conditions also play a role in the installation of biogas plants.The survey revealed that majority of the plants were situated in plain area.

5.5.2 Table 9 shows the land areawise situation of plants. Only 2.4% of total Janata plants were placed in the Hilly area, while no KVIC plants were situated in the Hilly region. The

TABLE 8

NUMBERS & PERCENTAGE OF PLANTS FUNCTIONWISE,CATTLE HOLDING SIZE

CATTLE HOLDING SIZE	JANATA 1984-85 FUN.	N.FUN	TOTAL	%	JANATA 1985-86 FUN	N.FUN	TOTAL	%	TOTAL JANATA PLANTS	%
1-2	21	18	39	12.1%	50	5	55	5.4%	94	7.0%
3-5	111	48	159	49.4%	297	250	547	53.2%	706	52.3%
6-10	71	29	100	31.1%	203	136	339	33.0%	439	32.5%
>10	20	4	24	7.5%	51	36	87	8.5%	111	8.2%
TOTAL	223	99	322	100.0%	601	427	1028	100.0%	1350	100.0%

CATTLE HOLDING SIZE	KVIC 1984-85 FUN	N.FUN	TOTAL	%	KVIC 1985-86 FUN	N.FUN	TOTAL PLANTS	%	TOTAL KVIC PLANTS	%
1-2	1	2	3	1.0%	-	1	1	2.9%	4	1.2%
3-5	51	24	75	26.1%	5	9	14	41.2%	89	27.7%
6-10	87	35	122	75.0%	5	4	9	26.5%	131	40.8%
>10	51	36	87	30.3%	-	10	10	29.4%	97	30.2%
TOTAL	190	97	287	100.0%	10	24	34	100.0%	321	100.0%

TABLE 9

NUMBERS & PERCENTAGE OF PLANTS FUNCTIONWISE, LAND AREA WISE

LAND AREA	JANATA 1984-85 FUN	N.FUN	TOTAL	%	JANATA 1985-86 FUN	N.FUN	TOTAL	%	TOTAL JANATA PLANTS	%
HILL	3	2	5	1.6%	19	9	28	2.7%	33	2.4%
ROCKY	19	7	26	8.1%	49	42	91	8.9%	117	8.7%
PLAIN	201	90	291	90.4%	533	376	909	88.4%	1200	88.9%
TOTAL	223	99	322	100.0%	601	427	1028	100.0%	1350	100.0%

LAND AREA	KVIC 1984-85 FUN	N.FUN	TOTAL	%	KVIC 1985-86 FUN	N.FUN	TOTAL	%	TOTAL KVIC PLANTS	%
HILL	-	-	-	-	-	-	-	-	-	-
ROCKY	14	4	18	6.3%	-	-	-	-	18	5.6%
PLAIN	176	93	269	93.7%	10	24	34	100.0%	303	94.4%
TOTAL	190	97	287	100.0%	10	24	34	100.0%	321	100.0%

maximum number of both Janata and KVIC plants were situated in Plain area 88.9% and 94.4% respectively. Only 8.7% of the total Janata plants and 5.6 % of the total KVIC plants were situated in the Rocky area.

5.5.3 While 90.4% of the Janata 1984-85 plants were placed in plain area 88.4% of the Janata 1985-86 plants were in the plain area. All the KVIC 1985-86 plants (100%) were situated in plain area, while 93.7% of KVIC 1984-85 plants were in plain area.

5.5.4 Table 10 shows the percentage of plants functionwise and land areawise. 48.5% of the total Janata plants, were situated in the low area, while 43.4% were in high area out of which 8.1% were flood prone. 52.5% of all KVIC plants were in high area, 37.2% in low area and 10.3% were situated in flood prone areas.

6. TIME GAP IN DELIVERY SYSTEMS

Quite a few farmers complained that the time between the application for biogas plant installation and completion is quite long. There is either some problem in getting the subsidy amount or delay in completing construction etc.

6.1 Time Gap between Application & Starting of Construction and Construction and Commissionig of Plants

6.1.1 Table 11 shows the time gap between application and starting of construction and time gap between construction and commissioning of plants. The total Janata plants percentage shows that 45.1% of respondents said that the time gap between application and construction was 4-6 months while 41.1% of KVIC

TABLE 10

NUMBERS & PERCENTAGE OF PLANTS FUNCTIONWISE,LAND AREA WISE

LAND AREA	JANATA 1984-85 FUN	N.FUN	TOTAL	%	JANATA 1985-86 FUN	N.FUN	TOTAL	%	TOTAL JANATA PLANTS	%
LOW	116	45	161	45.7%	340	211	551	49.3%	712	48.5%
HIGH	107	54	161	45.7%	261	216	477	42.7%	638	43.4%
FLOOD PRONE	21	9	30	8.5%	46	43	89	8.0%	119	8.1%
TOTAL	244	108	352	100.0%	647	470	1117	100.0%	1469	100.0%

LAND AREA	KVIC 1984-85 FUN	N.FUN	TOTAL	%	KVIC 1985-86 FUN	N.FUN	TOTAL	%	TOTAL KVIC PLANTS	%
LOW	75	41	116	36.0%	6	11	17	47.2%	133	37.2%
HIGH	115	56	171	53.1%	4	13	17	47.2%	188	52.5%
FLOOD PRONE	24	11	35	10.9%	-	2	2	5.6%	37	10.3%
TOTAL	214	108	322	100.0%	10	26	36	100.0%	358	100.0%

TABLE 11

TIME GAP BETWEEN APPLICATION AND STARTING OF CONSTRUCTION OF PLANTS

	JANATA PLANTS						KVIC PLANTS					
	1984-1985	%	1985-1986	%	TOTAL PLANTS	%	1984-1985	%	1985-1986	%	TOTAL PLANTS	%
>1	-	-	-	-	-	-	-	-	-	-	-	-
1-3	78	24.2%	337	32.8%	415	30.7%	138	48.1%	17	50.0%	155	48.3%
4-6	156	48.4%	453	44.1%	609	45.1%	118	41.1%	14	41.2%	132	41.1%
7-12	86	26.7%	236	23.0%	322	23.9%	31	10.8%	3	8.8%	34	10.6%
>12	2	0.6%	2	0.2%	4	0.3%	-	-	-	-	-	-
TOTAL	322	23.9%	1028	76.1%	1350	100.0%	287	89.4%	34	10.6%	321	100.0%

TIME GAP BETWEEN CONSTRUCTION & COMMISSIONING OF PLANTS

	JANATA PLANTS						KVIC PLANTS					
	1984-1985	%	1985-1986	%	TOTAL PLANTS	%	1984-1985	%	1985-1986	%	TOTAL PLANTS	%
>1	1	0.4%	333	-	1	0.1%	-	-	-	-	-	-
1-3	133	49.4%	325	32.8%	466	46.6%	127	64.5%	6	60.0%	133	64.3%
4-6	113	42.0%	71	44.1%	438	43.8%	63	32.0%	4	40.0%	67	32.4%
7-12	22	8.2%	1	23.0%	92	9.2%	7	3.6%	-	-	7	3.4%
>12	-	-	-	0.2%	1	0.1%	-	-	-	-	-	-
TOTAL	269	26.9%	730	76.1%	999	100.0%	197	95.2%	10	4.8%	207	100.0%

respondents said that the time gap was 4-6 months. While 30.7% Janata respondents said the time gap was 1-3 months 48.3% KVIC respondents said the time gap was 1-3 months.

6.1.2 46.6% of all Janata respondents said that the time gap between starting construction and commissioning was between 1-3 months, while 43.8% said the time gap was between 4-6 months. 64.3% respondents of KVIC plants said the time gap was 1-3 months while 32.4% said the time gap was between 4 - 6 months.

6.2 Time taken in getting subsidy

6.2.1 Table 12 shows the percentage of plants and the time taken in getting subsidy. The total Janata plants showed that 41.3% of the respondents said the time taken in getting subsidy was 1-3 months. 56.1% of all KVIC respondents said the time taken in getting subsidy was 1-3 months.

6.2.2 37.3% of all Janata respondents and 36.8% of all KVIC respondents said the time taken in getting subsidy was 4-6 months. Only 1.3% of Janata respondents said the time taken was more than one year.

7. OPERATING PROBLEMS IN PLANT FUNCTIONING

The causes for malfunctioning of plants mentioned here was not based on any thorough technical inspection of biogas plants but it mainly reflects the conclusions of the field investigators discussion with the biogas plant owners. There are various reasons for plants malfunctioning. A glance at table 13 gives a list of several reasons which are attributed to the non-functioning of plants.

TABLE 12

TIME TAKEN IN GETTING SUBSIDY

	JANATA						KVIC					
Months	1984-1985	%	1985-1986	%	TOTAL PLANTS	%	1984-1985	%	1985-1986	%	TOTAL PLANTS	%
>1	7	2.2%	15	1.5%	22	1.6%	-	-	-	-	-	-
1-3	136	42.2%	421	41.0%	557	41.3%	156	54.4%	24	70.6%	180	56.1%
4-6	113	35.1%	390	37.9%	503	37.3%	109	38.0%	9	26.5%	118	36.8%
7-12	58	18.0%	192	18.7%	250	18.5%	22	7.7%	1	2.9%	23	7.2%
>12	8	2.5%	10	1.0%	18	1.3%	-	-	-	-	-	-
TOTAL	322	23.9%	1028	76.1%	1350	100.0%	287	89.4%	34	10.6%	321	100.0%

TABLE 13

NUMBERS & PERCENTAGE OF REASONS ATTRIBUTED TO NON-FUNCTIONING OF BIOGAS PLANTS *

. REASONS	JANATA	%	KVIC	%	TOTAL	%
1 STRUCTURAL [1]	224	40.0%	55	45.5%	279	41.0%
2 LEAKAGE [2]	45	8.0%	6	5.0%	51	7.5%
3 LESS GAS PROD.	4	0.7%	3	2.5%	7	1.0%
4 CLOGGING OF GAS PIPE	39	7.0%	7	5.8%	46	6.8%
5 DOME CRACKING (JANATA)	7	1.3%	-	-	7	1.0%
6 HOLES IN GAS HOLDER (KVIC)	-	-	3	2.5%	3	0.4%
7 CRACKS IN DIGESTER	-	-	-	-	-	-
8 LESS THAN REQD.AMT. OF FEEDING	50	8.9%	9	7.4%	59	8.7%
9 IRREGULAR FEEDING	119	21.3%	22	18.2%	141	20.7%
10 WRONG MIXTURE OF DUNG & WATER	51	9.1%	13	10.7%	64	9.4%
11 CRACKS IN INLET & OUTLET	21	3.8%	3	2.5%	24	3.5%
12 OTHERS	-	-	-	-	-	-
TOTAL	560	100.0%	121	100.0%	681	100.0%

* The data are based on multiple -respoanses and therefore do not correspond with the actual total of non - functioning plants.

1 Leakage problem in KVIC plants reported seem to be due to use of thinner gauge steel than recommended.

2 This reason is related to the functioning plants operating at less than rated capacity or partially functioning.

7.1 40% of Janata and 45.5% of KVIC plant owners list structural reasons for non functioning of plants. Irregular plant feeding comes a close second with 21.3% of Janata and 18.2% of KVIC respondents stating it to be the reason for plants not functioning.

8. PATTERN OF DISPLAY OF SLURRY DISPOSAL

8.1 The used slurry which comes out from the biogas plant is ric in manure. In terms of NPK (Nitrogen Phosphorous and Potash) it is found that this slurry is superior to farm yard manure. The best method to use this slurry is by mixing it with irrigation water when it is still wet, as the dried slurry loses part of nitrogen content.

8.2 Table 14 shows the percentage of plants in relation to type of slurry used. Janata 1984-85 plants used 10.4% of liquid slurry which was the highest among all plant owners, while KVIC 1985-86 plant owners used 20% of compost slurry which was also the highest among all plants owners. The maximum utilization of dry slurry was done by Janata 1984-85 which was 92.2% and KVIC 1984-85 used 88.8% of dry slurry.

8.2 Efficacy of Slurry on Crop Production

8.2.1 Table 15 shows the districtwise percentge of efficacy of slurry on crop production. 53% of respondents said that there was an increase in crop production due to slurry utilization while 47% said that the crop production remained the same.

9. IMPACT ON FUEL CONSUMPTION

It was seen that usually the farmers use either Firewood Kerosene, Cowdung for their energy requirements. Biogas was

TABLE 14

NUMBERS & PERCENTAGE OF PLANTS ACCORDING TO PATTERN OF SLURRY USE

	JANATA						KVIC					
	1984-1985		1985-1896				1984-1985		1985-1896			
SLURRY WISE	FUN	%	FUN.	%	TOTAL	%	FUN	%	FUN	%	TOTAL	%
LIQUID SL.	23	10.4%	22	3.7%	45	5.5%	13	16.6%	-	-	13	6.3%
COMPOST SL.	8	3.6%	6	1.0%	14	1.7%	8	4.1%	2	20.0%	10	4.8%
COMPOST SL. +WASTES	2	0.9%	19	3.2%	21	2.6%	1	0.5%	4	40.0%	5	2.4%
DRY SLURRY	188	85.1%	554	92.2%	742	90.3%	175	88.8%	4	40.0%	179	86.5%
TOTAL	221	100.0%	601	100.0%	822	100.0%	197	100.0%	10	100.0%	207	100.0%

TABLE 15

EFFICACY OF SLURRY ON CROP PRODUCTION:NO. OF RESPONDENTS
& PERCENTAGE

DISTRICT	CROP PROD INCREASE	%	CROP PROD SAME	%	TOTAL
1 GAYA	67	42.1%	92	57.9%	159
2 GIRIDIH	26	45.6%	31	54.4%	57
3 BEGUSARAI	24	55.8%	19	44.2%	43
4 PURNEA	24	54.5%	20	45.5%	44
5 BHAGALPUR	53	48.6%	56	51.4%	109
6 SAMASTIPUR	72	49.7%	73	50.3%	145
7 ROHTAS	45	91.8%	4	8.2%	49
8 PATNA	24	45.3%	29	54.7%	53
9 HAZARIBAGH	40	71.4%	16	28.6%	56
10 RANCHI	16	55.2%	13	44.8%	29
11 MADHUBANI	21	45.7%	25	54.3%	46
12 NALANDA	41	56.2%	32	43.8%	73
13 NAVADA	16	44.4%	20	55.6%	36
14 LOHARDAGA	7	58.3%	5	41.7%	12
15 GUMLA	26	53.1%	23	46.9%	49
16 MONGHYR	16	61.5%	10	38.5%	26
17 KHAGARIA	10	52.6%	9	47.4%	19
18 MUZAFFARPUR	28	52.8%	25	47.2%	53
19 VAISHALI	30	45.5%	36	54.5%	66
20 BHOJPUR	32	53.3%	28	46.7%	60
21 SINGHBHUM	11	50.0%	11	50.0%	22
G.TOTAL	629		577		1206
%		53.0%		47.0%	

used as an additional fuel apart from these three fuels.

9.1 Impact of biogas plants in monthly consumption of firewood.

9.1.1 In Table 16 percentage of total Janata plants shows that saving of firewood in 21-30 Kgs. category was 31.8% while saving for more than 30 kgs. was 43.9%. The saving of firewood for 21-30 kgs. for total KVIC plants was 37 % while that for more than 30 kgs was 44%.

9.1.2 The savings in 1-10 Kgs. for the Janata plants was 5.2% whie for KVIC plants it was 5%. Savings for 11-20 Kgs. category was 13.1% for Janata and 10.5% for KVIC plants.

9.1.3 5.9% of total Janata owners said the savings remained same while 3.5% of total KVIC owners said the savings remained unchanged.

9.2 Impact of biogas plants in monthly consumption of kerosene.

9.2.1 Table 17 showed that for total Janata plants ie. 83.9% the fuel used remained the same; while 73.5% of KVIC plant owners said there was no difference in saving.

9.2.2 14.5% of Janata users and 26.5% of KVIC users said there was saving of 1-10 litres. Only 1.6% of Janata usres said there was a saving of 11-20 litres.

9.3 Impact of biogas plants in monthly consumption of Cowdung Cakes.

9.3.1 In Table 18, 45.8% of savings in cowdung cakes (more than 300 category) was found in the total Janata plants while only 12.1% of savings for more than 300 cakes was found in KVIC

TABLE 16

IMPACT OF BIOGAS PLANTS IN MONTHLY CONSUMPTION OF FIREWOOD

	JANATA						KVIC					
	1984-1985		1985-1986				1984-1985		1985-1986			
SAVING (kgs.)	FUN	%	FUN	%	TOTAL	%	FUN	%	FUN	%	TOTAL	%
SAME	21	9.4%	28	4.7%	49	5.9%	7	3.7%	-	-	7	3.5%
1-10	21	9.4%	22	3.7%	43	5.2%	7	3.7%	3	30.0%	10	5.0%
11-20	34	15.2%	74	12.3%	108	13.1%	18	9.5%	3	30.0%	21	10.5%
21-30	70	31.4%	192	31.9%	262	31.8%	71	37.4%	3	30.0%	74	37.0%
>30	77	34.5%	285	47.4%	362	43.9%	87	45.8%	1	10.0%	88	44.0%
TOTAL	223	100.0%	601	100.0%	824	100.0%	190	100.0%	10	100.0%	200	100.0%

TABLE 17

IMPACT OF BIOGAS PLANTS IN MONTHLY CONSUMPTION OF KEROSENE

	JANATA						KVIC					
	1984-1985		1985-1986				1984-1985		1985-1986			
SAVING (litres)	FUN.	%	FUN.	%	TOTAL	%	FUN	%	FUN	%	TOTAL	%
SAME	146	65.5%	543	90.3%	689	83.9%	142	74.7%	5	50.0%	147	73.5%
1-10	64	28.7%	57	9.5%	121	14.5%	48	25.3%	5	50.0%	53	26.5%
11-20	13	5.8%	1	0.2%	14	1.6%	-	-	-	-	-	-
TOTAL	223	100.0%	601	100.0%	824	100.0%	190	100.0%	10	100.0%	200	100.0%

plants.

9.3.2 39.1% of cowdung cakes saving in the 101-200 and 201-300 category was found in the total KVIC plants, while 6.9% and 32.3% of savings was found in 101-200 and 201-300 in the Janata plants respectively.

9.3.3 The table shows that the saving of cowdung cakes is not more than 50% in any plant. There was a.42.2% saving in the greater than 300 category for Janata 1984-85 while in the same category for Janata 1985-86 it was 47.1%. For KVIC 1984-85 the savings was 40.1% in the 201-300 category while for KVIC 1985-86 it was 40% in the 101-200 category.

9.4 Seasonal use of Biogas.

9.4.1 Seasonal variation was observed in the consumption of biogas - both for cooking and lighting purposes. In Table 19 in Summer for cooking 55% of households used biogas for 2-3 hours, 27.8% for less than 2 and only 13.5% households used biogas for 4-5 hours and a negligible percentage ie. 3.7% used biogas for more than 5 hours. On the other hand the consumption of biogas decreased during the Winter season.79% of the total households reported that they used biogas for less than 2 hours for cooking purposes, while 18% of them used biogas for 2-3 hours and only 3% used it for 4-5 hours.

9.4.2 The seasonal variation of biogas consumption for lighting purposes was not large.While 92.5% of households used biogas for less than 2 hours in Summer, 95% of households used biogas for less than 2 hours in Winter. 7.5% of households used biogas for lighting for 2-3 hours in summer , while 5% used it

TABLE 18

IMPACT OF BIOGAS PLANTS IN MONTHLY CONSUMPTION OF COW DUNG CAKES

SAVING (nos.)	JANATA 1984-1985 FUN	%	1984-1985 FUN.	%	TOTAL	%	KVIC 1984-1985 FUN	%	1984-1985 FUN	%	TOTAL	%
SAME	13	5.8%	28	4.7%	41	5.0%	-	-	3	30.0%	3	1.4%
1-100	24	10.8%	59	9.8%	83	10.1%	14	8.1%	1	10.0%	17	8.2%
101-200	21	9.4%	36	6.0%	57	6.9%	72	39.1%	4	40.0%	81	39.1%
201-300	71	31.8%	195	32.4%	266	32.3%	79	40.1%	2	20.0%	81	39.1%
>300	94	42.2%	283	47.1%	377	45.8%	25	12.7%	-	-	25	12.1%
TOTAL	223	100.0%	601	100.0%	824	100.0%	190	100.0%	10	100.0%	200	100.0%

TABLE 19

SEASONAL USE OF BIOGAS

	SUMMER <2 hrs.	%	2-3 hrs.	%	4-5 hrs.	%	>5 hrs.	%	WINTER <2 hrs.	%	2-3 hrs.	%	4-5 hrs.	%	>5 hrs.	%
Cooking	414	27.8%	820	55%	200	13.5%	55	3.7%	1175	79%	269	18%	46	3%	-	-
Lighting	1377	92.5%	112	7.5%	-	-	-	-	1408	95%	81	5%	-	-	-	-

for 2-3 hours in winter.

10. BENEFITS OF BIOGAS

There are various benefits from biogas usage. These benefits were divided according to their type and then reported in tables.

10.1 Impact of biogas plants on use of fertilizer and soil condition.

10.1.1 Table 20 gives an insight about the impact of biogas plants on fertilizer use. 57% of respondents felt that fertilizer use had neither increased nor decreased but remained the same after using biogas.

10.1.2 Table 20 also shows the impact of biogas plants on soil condition. 54% of total respondents said the condition ofthe soil had improved while 46% said the condition had not improved.

10.2 Impact of biogas plants on Utensils/ Kitchen

10.2.1 Table 21 shows the biogas plants impact on kitchen and Utensils. 50.1% of all respondents said that there was less blackening of utensils after using biogas, while 49.9% of all respondents said that the kitchen remained cleaner after using biogas.

10.3 Impact of biogas plant on Cooking Conditions

10.4.1 Table 22 shows the impact of biogas plants on cooking conditions 29.0% of total respondents said that they needed less time for cooking food while 35.0% said that cooking had become easy after installing of biogas plants. 14.8% of respondents

TABLE 20

IMPACT OF BIOGAS PLANTS ON FERTILISER USE, SOIL CONDITIONON :NO. OF RESPONDENTNTS & PERCENTAGE

DISTRICT	FERTILISER					SOIL CONDITION				
	DEC.	%	SAME	%	Total	Improved	%	Not Improved	%	Total
1 GAYA	54	34.0%	105	66.0%	159	84	52.8%	75	47.2%	159
2 GIRIDIH	28	48.7%	29	50.4%	57	29	50.9%	28	49.1%	57
3 BEGUSARAI	21	48.3%	22	50.6%	43	20	46.0%	23	52.9%	43
4 PURNEA	20	45.0%	24	54.0%	44	40	90.9%	4	9.1%	44
5 BHAGALPUR	52	47.5%	57	52.1%	109	50	45.7%	59	53.9%	109
6 SAMASTIPUR	72	49.5%	73	50.2%	145	72	49.5%	73	50.2%	145
7 ROHTAS	11	22.3%	38	77.2%	49	38	77.6%	11	22.4%	49
8 PATNA	25	46.8%	28	52.4%	53	26	48.6%	27	50.5%	53
9 HAZARIBAGH	33	58.3%	23	40.6%	57	40	70.5%	16	28.2%	57
10 RANCHI	13	44.2%	16	54.3%	29	16	55.2%	13	44.8%	29
11 MADHUBANI	21	45.7%	25	54.3%	46	22	47.3%	24	51.6%	46
12 NALANDA	25	34.1%	48	65.4%	73	32	43.6%	41	55.8%	73
13 NAVADA	11	30.3%	25	68.9%	36	20	55.6%	16	44.4%	36
14 LOHARDAGA	3	24.5%	9	73.5%	12	9	75.0%	3	25.0%	12
15 GUMLA	20	40.5%	29	58.7%	49	29	59.2%	20	40.8%	49
16 MONGHYR	6	22.9%	20	76.3%	26	13	49.1%	13	49.1%	26
17 KHAGARIA	8	41.2%	11	56.7%	19	10	52.6%	9	47.4%	19
18 MUZAFFRPUR	26	48.6%	27	50.5%	53	27	50.9%	26	49.1%	53
19 VAISHALI	29	43.7%	37	55.7%	66	35	53.0%	31	47.0%	66
20 BHOJPUR	27	44.7%	33	54.6%	60	34	56.7%	26	43.3%	60
21 SINGHBHUM	10	44.6%	12	53.5%	22	10	44.6%	12	53.5%	22
G. TOTAL	515		691		1206	656		550		1206
%		43.0%		57.0%			54.0%		46.0%	

TABLE 21

IMPACT OF BIOGAS PLANTS ON UTENSILS/KITCHEN

	DISTRICT	LESS BLACK-ENING OF UTENSILS	%	CLEAN KITCHEN	%	TOTAL
1	GAYA	84	48.6%	89	51.4%	173
2	GIRIDIH	36	48.0%	39	52.0%	75
3	BEGUSARAI	26	49.1%	27	50.9%	53
4	PURNEA	36	54.5%	30	45.5%	66
5	BHAGALPUR	75	51.0%	72	49.0%	147
6	SAMASTIPUR	107	52.2%	98	47.8%	205
7	ROHTAS	43	42.6%	58	57.4%	101
8	PATNA	42	51.2%	40	48.8%	82
9	HAZARIBAGH	48	46.6%	55	53.4%	103
10	RANCHI	20	52.6%	18	47.4%	38
11	MADHUBANI	27	52.9%	24	47.1%	51
12	NALANDA	68	52.3%	62	47.7%	130
13	NAVADA	20	44.4%	25	55.6%	45
14	LOHARDAGA	9	50.0%	9	50.0%	18
15	GUMLA	26	46.4%	30	53.6%	56
16	MONGHYR	16	45.7%	19	54.3%	35
17	KHAGARIA	13	48.1%	14	51.9%	27
18	MUZAFFARPUR	33	56.9%	25	43.1%	58
19	VAISHALI	26	55.3%	21	44.7%	47
20	BHOJPUR	33	50.8%	32	49.2%	65
21	SINGHBHUM	12	54.5%	10	45.5%	22
	G.TOTAL	800		797		1597
	%		50.1%		49.9%	

TABLE 22

IMPACT OF BIOGAS PLANT ON COOKING CONDITIONS

DISTRICT	LESS TIME	%	EASY	%	LESS SMOKE	%	HYGENIC	%	TOTAL
1 GAYA	67	36.8%	63	34.6%	42	23.1%	10	5.5%	182
2 GIRIDIH	24	33.8%	29	40.8%	12	16.9%	6	8.5%	71
3 BEGUSARAI	14	32.6%	16	37.2%	7	16.3%	6	14.0%	43
4 PURNEA	20	33.3%	22	36.7%	10	16.7%	6	10.0%	60
5 BHAGALPUR	54	36.0%	42	28.0%	30	20.0%	24	16.0%	150
6 SAMASTIPUR	48	23.0%	77	36.8%	46	22.0%	38	18.2%	209
7 ROHTAS	39	31.5%	33	26.6%	38	30.6%	14	11.3%	124
8 PATNA	12	19.4%	18	29.0%	22	35.5%	10	16.1%	62
9 HAZARIBAGH	16	25.4%	26	41.3%	10	15.9%	11	17.5%	63
10 RANCHI	11	28.9%	17	44.7%	6	15.8%	4	10.5%	38
11 MADHUBANI	16	21.9%	28	38.4%	14	19.2%	15	20.5%	73
12 NALANDA	29	27.4%	30	28.3%	22	20.8%	25	23.6%	106
13 NAVADA	10	25.0%	14	35.0%	8	20.0%	8	20.0%	40
14 LOHARDAGA	2	9.5%	10	47.6%	4	19.0%	5	23.8%	21
15 GUMLA	18	29.0%	25	40.3%	10	16.1%	9	14.5%	62
16 MONGHYR	12	38.7%	9	29.0%	6	19.4%	4	12.9%	31
17 KHAGARIA	10	27.8%	12	33.3%	6	16.7%	8	22.2%	36
18 MUZAFFARPUR	25	37.9%	15	22.7%	17	25.8%	9	13.6%	66
19 VAISHALI	18	25.4%	35	49.3%	8	11.3%	10	14.1%	71
20 BHOJPUR	15	20.3%	30	40.5%	16	21.6%	13	17.6%	74
21 SINGHBHUM	6	21.4%	12	42.9%	7	25.0%	3	10.7%	28
G.TOTAL	466		563		341		238		1608
%		29.0%		35.0%		21.2%		14.8%	

felt that it was more hygenic and 21.2% of them said that by using biogas less smoke was produced while cooking. On an average , 1 -2 hours were reported to be saved by the respondents. This 1-2 hour time saving included activities like dung. cake making,dung/firewood collection apart from actual cooking(time saved for actual cooking was about 30-40 minutes).

11. FOLLOW - UP

11.1 Frequency of visits by implementing agency during first year of commencement.

11.1.1 Table 23 shows the frequency of implementing agency's visits. Madhubani tops the list in all districts whose respondents said that there have been no visits which was 65.2%. Lohardaga was second with a percentage of 58.3%. Nalanda had the highest percent where the frequency of visit was one i.e. 28.8% and Muzzaffarpur had 28.3%.

11.1.2 Samastipur had the highest percent when the visiting frequency was two with 20% , Hazaribagh was next with 19.6% . When the frequency of visits was three or more than three, Giridih had the highest with 12.3% and Ranchi had 10.3%.

11.1.3The overall percentage of all districts was 55.4% where there had been no visits, 25.4% where the frequency of visits was one. 16.2% for two visits and 3 % where the frequency of visits were three or more than three.

11.2 Frequency of visits by implementing agency after one year of commencement and their response to complaints.

11.2.1Table 24 shows the frequency of visits after one year. and

TABLE 23

FREQUENCY OF VISITS BY IMPLEMENTING AGENCY :DURING FIRST YEAR OF COMMENCEMENT

DISTRICT	NEVER	%	ONCE	%	TWICE	%	>=3	%	TOTAL
1 GAYA	88	55.3%	40	25.2%	22	13.8%	9	5.7%	159
2 GIRIDIH	31	54.4%	14	24.6%	5	8.8%	7	12.3%	57
3 BEGUSARAI	24	55.8%	11	25.6%	8	18.6%	-	-	43
4 PURNEA	24	54.5%	11	25.0%	7	15.9%	2	4.5%	44
5 BHAGALPUR	60	55.0%	27	24.8%	20	18.3%	2	1.8%	109
6 SAMASTIPUR	80	55.2%	36	24.8%	29	20.0%	-	-	145
7 ROHTAS	27	55.1%	12	24.5%	8	16.3%	2	4.1%	49
8 PATNA	29	54.7%	13	24.5%	10	18.9%	1	1.9%	53
9 HAZARIBAGH	31	55.4%	14	25.0%	11	19.6%	-	-	56
10 RANCHI	16	55.2%	7	24.1%	3	10.3%	3	10.3%	29
11 MADHUBANI	30	65.2%	11	23.9%	5	10.9%	-	-	46
12 NALANDA	40	54.8%	21	28.8%	12	16.4%	-	-	73
13 NAVADA	20	55.6%	9	25.0%	7	19.4%	-	-	36
14 LOHARDAGA	7	58.3%	3	25.0%	2	16.7%	-	-	12
15 GUMLA	27	55.1%	12	24.5%	5	10.2%	5	10.2%	49
16 MONGHYR	14	53.8%	7	26.9%	5	19.2%	-	-	26
17 KHAGARIA	10	52.6%	5	26.3%	3	15.8%	1	5.3%	19
18 MUZAFFARPUR	29	54.7%	15	28.3%	9	17.0%	-	-	53
19 VAISHALI	36	54.5%	16	24.2%	10	15.2%	4	6.1%	66
20 BHOJPUR	33	55.0%	16	26.7%	11	18.3%	-	-	60
21 SINGHBHUM	12	54.5%	6	27.3%	3	13.6%	1	4.5%	22
G.TOTAL	668		306		195		37		1206
%		55.4%		25.4%		16.2%		3.0%	

TABLE 24

FREQUENCY OF VISITS BY IMPLEMENTING AGENCY :AFTER 1 YR OF COMMENCEMENT, RESPONSE TO COMPLAINTS

DISTRICT	FREQUENCY OF VISITS: SUBSEQUENTLY Regular	%	SUBSEQUENTLY Irregular	%	TOTAL	RESPONSE TO COMPLAINTS: FAST	%	SLOW	%	NEVER	%	TOTAL
1 GAYA	-	-	159	100.0%	159	3	1.9%	15	9.4%	141	88.7%	159
2 GIRIDIH	-	-	57	100.0%	57	5	8.8%	25	43.9%	27	17.0%	57
3 BEGUSARIA	1	2.3%	42	97.7%	43	7	16.3%	31	72.1%	5	11.6%	43
4 PURNEA	-	-	44	100.0%	44	1	2.3%	5	11.4%	38	23.9%	44
5 BHAGALPUR	1	0.9%	108	99.1%	109	4	3.7%	17	15.6%	88	80.7%	109
6 SAMASTIPUR	5	3.4%	140	96.6%	145	6	4.1%	21	14.5%	118	74.2%	145
7 ROHTAS	2	4.1%	47	95.9%	49	1	2.0%	35	71.4%	13	8.2%	49
8 PATNA	-	-	53	100.0%	53	3	5.7%	12	22.6%	38	23.9%	53
9 HAZARIBAGH	-	-	56	100.0%	56	1	1.8%	6	10.7%	49	87.5%	56
10 RANCHI	-	-	29	100.0%	29	2	6.9%	3	10.3%	24	42.9%	29
11 MADHUBANI	2	4.3%	44	95.7%	46	1	2.2%	8	17.4%	37	66.1%	46
12 NALANDA	2	2.7%	71	97.3%	73	1	1.4%	5	10.9%	67	91.8%	73
13 NAVADA	1	2.8%	35	97.2%	36	1	2.8%	2	5.6%	33	91.7%	36
14 LOHARDAGA	-	-	12	100.0%	12	2	16.7%	5	41.7%	5	41.7%	12
15 GUMLA	-	-	49	100.0%	49	3	6.1%	7	14.3%	39	79.6%	49
16 MONGHYR	-	-	26	100.0%	26	-	-	6	23.1%	20	76.9%	26
17 KHAGARIA	-	-	19	100.0%	19	-	-	8	42.1%	11	57.9%	19
18 MUZAFFARPUR	3	5.7%	50	94.3%	53	1	2.0%	7	13.2%	45	84.9%	53
19 VAISHALI	-	-	66	100.0%	66	1	1.5%	15	22.7%	50	75.8%	66
20 BHOJPUR	-	-	60	100.0%	60	-	-	18	30.0%	42	70.0%	60
21 SINGHBHUM	1	4.5%	21	95.5%	22	-	-	2	9.1%	20	90.9%	22
G.TOTAL	18		1188		1206	43		253		910		1206
%		3.0%		97.0%			3.6%		21.0%		75.5%	

their response to complaints. Most of the respondents said that the frequency of visits was irregular. Muzzaffarpur respondents i.e. 5.7% of them said that the visits were regular and 4.5% Singhbhum respondents said the frequency was regular. Gaya, Giridih, Purnia, Patna, Hazaribagh, Ranchi, Lohardaga, Gumla, Mungar, Khagaria, Vaishali, and Bhojpur respondents said that the visiting frequency was irregular i.e. (100%).The overall percentage showed that 97% of the respondents said the visits were irregular.

11.2.2Table 24 also shows the implementing agency's response plant owners'complaints. 16.3% of Begusarai respondents and 16.7% of Lohardaga respondents said that response to complaints was fast. On the other hand, 72.1% of Begusaria respondents and 71.4% of Rohtas respondents said that response to complaints was slow.

11.2.3 Nalanda and Navada district respondents with a percentage of 91.8%, 91.7% respectively said that there was no response to their complaints.The overall percentage of all districts show that 75.5% respondents have said there was no response to complaints while 21% said the response was slow while only 3.5% said the response of the implementing agency to the complaints was fast.

12. CONCLUSIONS AND RECOMMENDATIONS

Some of the important weaknesses and shortcomings are discussed below and remedial measures are suggested in order to overcome the deficiencies.

12.1. Organisational Issues

It became quite obvious that the biogas programme in Bihar had been suffering seriously the organisational inadequacies both in terms of functions, responsibilities and identity. The biogas cell at the Department of Energy seemed to be blissfully unaware of its basic responsibilities towards planning, monitoring and coordinating the programme .The cell at the State level was found to be acting merely as a post-box for allocating and disbursing funds to the districts and blocks. It rarely took any active role and responsibility in the implementation process.This was clearly indicated by almost non-existent or utterly incomplete and unorganized information and data system about the progress of the programme available at the State level nodal cell at the time of investigation.In the middle of our survey, Bihar government had created a special nodal agency for renewable energy programme named Bihar Renewable Energy Development Authority (BREDA). Creating BREDA did not help the programme organisationally either. Although BREDA became formally and officially the nodal agency for planning, monitoring and coordinating the biogas programme. its activities were largely and effectively dependent on its Chairman's (the Secretary, Energy Department) whims, interests and commitments. BREDA was not equipped with sufficient technical staff and freedom to assume the role of a nodal agency.

12.1.1. The nature of the organizational weakness described above indicates the following immediate remedial measures :

- It is imperative to create a corporate State-level organizational infrastructure with clear responsibilities and role towards the programme. It should necessarily be armed with sufficient technical and non-technical manpower and other infrastructural facilities, a definite chain of command and authority over the district and block level functionaries and a largely autonomous decision making authority. Given the decentralized character of the programme, its size and complexity, a fairly exclusive organisational identity at the State level was felt necessary. The most feasible, viable and effective alternative, is to continue the rural energy cell in the department of Agriculture or Rural Development, headed by a senior IAS officer as Special Secretary with independent charge of the programme.
- As per the roles and responsibilities of the suggested alternative organization, the following minimum should be adhered to :
    - Planning the programme i.e., target fixation (beneficiarywise, yearwise, district/block-wise), delineation of responsibilities and roles; identification and activation of official and non-official organizations, financial allocations and plan for masons training programme etc.
    - Monitoring the programme i.e. collection of regular data on a pre planned management information system, follow-up field visits and plan for mid-course corrections etc.

Coordination of the programme i.e., regular periodical meetings with district and block level officials for stock-taking, exchange of views and experiences etc.

12.2. Commitment to Biogas Programme

There was a pervasive lack of commitment and enthusiasm among the implementing officials at the district and block levels. The biogas programme implementation was largely left to the normal bureaucratic process at the hands of district and block development authorities without effective continous monitoring and follow-up from the State level. The overwhelming attitude at the district and block levels was to treat the biogas programme as a mere addition to the list of their activities, often looked upon as a necessary evil and a cause for extra botherations

12.2.2 The remedial measures for such a state of affairs should necessarily be one of organisational interventions at the State level. The innovative approaches of some of the district and block level should be properly publicized and recognized and could be integrated as regular institutional processes.

12.3 Peoples' Participation and Role of NGOs

Except a few Khadi-institutions implementing KVIC model only, there was hardly any involvement of NGOs either in inplementing the programme or in training activities (for masons particularly) As a remedy, the State level and district level organization should necessarily make earnest effort to ensure active participation of the NGOs. In this regard, it would be worth to identity all the NGOs in Bihar and publicly invite them along with the District Officials in a conference and exchange views

in order to work out the modalities of their active participation in the programme.

12.4. Management Information System

Effective monitoring depends on a regular flow of minimum information to institute adequate follow-up operations and mid-course corrections. The biogas programme in Bihar was found to suffer seriously from lack of appropriate monitoring both at district and state level. Not only the information collected for monitoring were extremely irregular in its flow, but also were not adequate for proper monitoring and follow up action.

12.4.1. The above situation can be remedied by instituting appropriate management information system (MIS) and ensuring regular (monthly) flow of these information from the district to the state level organization.

12.5. Training of Masons

One of the major weaknesses of the biogas programme in Bihar has been the non-availability of properly trained masons. Number of training programmes organized in Bihar had been abysmally less than required. The few training programmes organised at the block level were reported to be, mostly ineffective. The scope of mason training programme in Bihar has to be enlarged with more financial allocations. In stead of organizing the training programme at the Block level , it should be organized at the district level under the District Officers' supervisons. More careful attention should be given in selecting the trainees.

12.6. Bank Loan Facilities

It was surprising to note that in Bihar none of our sample households was reported to avail of the bank loan facilities. On inquiry it was reported by the officials of the Energy Department that the bank loan facilities for biogas programme was neither publicized nor seriously followed up. The beneficiaries were also unaware of the existence of such facilities. As a remedy, immediate action shuld be taken by the state agency to publicize the bank loan facilities in collaboration with the relevant banks in the state.

12.7. Selection of Target Beneficiaries

In many cases the non - functioning of biogas plants was purely due to wrong selection of the beneficiary possibly due to the urge and pressure to complete the allotted target and/or to collect the motivator-incentive fees. Very often the beneficiaries were selected without minimum required resources as per the criteria with the result that the plants remained uncommissioned or temporarily commissioned or run intermittently and inefficiently or completely were abandoned. Still in many cases the beneficiaries were never informed ahead about the requirement of large amount of dung for initial feeding. This not only delayed commissioning, but often the beneficials felt helpless loosing interest and ultimately abandoned the plant altogether. Feasibility criteria should be strictly followed in selecting the beneficiaries. Also, immediately after the selection of beneficiaries, they should be informed about the daily requirement of dung and water including the dung requirement for initial charging. It

would be administratively and cost-wise easier to follow proper methods of beneficiary selection if 'cluster' approach as emphasized by DNES are followed.

12.8. Effective Delivery System

During the survey it was often reported that the delay in construction and commissioning was due to delay and irregular supply of raw materials as well as delay in payment of subsidies and supervision charges. The only way to remedy the situation is to streamline the administration and adopt simple and quicker methods for disbursement of payment by the district authority.

12.9. Regular Follow-up

One of the major lacuna in Bihar had been a near absence of effective follow-up as mentioned earlier. It was surprising to see villages with 5-6 functional plants running for 3-4 years without any demonstration effect to create effective demand. On the other hand, often the beneficiaries had to wait inordinately after making complaints about some defects in the plant before they were attended to. Sometimes, the beneficiaries did not even know where to direct their complaints.

A large part of this problem could be solved by having regular flow of management information system (MIS).