REPORT OF THE

INTER-INSTITUTIONAL GROUP

ON FINANCING GOBAR

GAS PLANTS BY BANKS

1976

RESERVE BANK OF INDIA
CREDIT PLANNING CELL,
Central Office,
BOMBAY-400 001.

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CONVERSION TABLE FOR WEIGHTS AND MEASURES USED

BRITISH SYSTEM		METRIC SYSTEM
Linear Measurements		
1 inch	=	2.54 centimetres
1 foot (12 inches)	=	30.48 centimetres
Area		
1 square inch	=	6.45 square centimetres
1 square foot (144 square inches)	=	0.09 square metre
Volume		
1 cubic foot	=	0.03 cubic metre
1 Imperial gallon (4 quarts) (0.16 cubic foot)	=	4.55 litres
Weight		
1 ounce	=	28.35 grams
1 pound	=	0.45 kilogram
1 hundredweight (112 pounds)	=	50.85 kilograms
1 ton	=	1016 kilograms
1 British thermal unit (mean BTU)	=	0.2598 kilogram - calorie

LIST OF ABBREVIATIONS USED

A.C.	--	Asbestos cement
c.ft.	—	Cubic foot
c.mt./M^3	—	Cubic metre
CO_2	—	Carbon dioxide
CPHERI/ NEERI	—	Central Public Health Engineering Research Institute (now) National Environmental Engineering Research Institute
DIR	—	Differential interest rate
ESCAP	--	Economic and Social Commission for Asia and the Pacific
FYM	—	Farm yard manure
G.I.	—	Galvanised iron
H.P.	--	Horse power
H_2S.	—	Hydrogen sulphide
IARI	—	Indian Agricultural Research Institute
IIMA	—	Indian Institute of Management, Ahmedabad
Kg.	—	Kilogram
KVIB	—	State Khadi and Village Industries Board
KVIC	—	Khadi and Village Industries Commission
MFAL	—	Marginal Farmers & Agricultural Labourers Agency
M.S.	—	Mild steel
NCST	—	National Committee on Science and Technology
NPK	—	Nitrogen, phosphorus and potassium
PARI	—	Planning, Action and Research Institute
PWD	--	Public Works Department
R.C.C.	--	Reinforced cement concrete
rft.	—	Running foot
SFDA	—	Small Farmers Development Agency
U.P.	—	Uttar Pradesh
W.I.	—	Wrought iron

CHAPTER I

INTRODUCTORY

Genesis of the Group

1.1 Cattle dung as an indigenous source of either fuel or farm yard manure is known to Indian farmers for ages. But the utilization of this material for producing both fuel and manure through a gas plant started in this country only since early fifties. The KVIC has since then been propagating the use of gobar gas plants in the countryside as part of its rural development programme.

1.2 The recent oil crisis and the consequent steep rise in prices of imported crude and chemical fertilisers created a situation which called for urgent action for finding alternative source of fuel and fertiliser by utilising the locally available materials. In this context, the installation of gobar gas plants for the purpose on a large scale was considered necessary. The Government of India set a target for installation of one lakh plants during the Fifth Five Year Plan. The execution of a programme of this size would involve capital investment of the order of about Rs. 30 crores at an average estimated cost of Rs. 3,000 per plant. Although the banks have been financing the setting up of gobar gas plants during the last two years or so, their experience in this field is limited. With a view to accelerating the progress under the programme, it was considered necessary that a study should be carried out covering all aspects of financing this activity. Accordingly, the Reserve Bank of India constituted in July 1975, an Informal Inter-Institutional Group to undertake the study with the following terms of reference :

(i) Review the present situation with regard to financing of gobar gas plants by commercial and co-operative banks and identify problems and difficulties.

(ii) Review the scheme as prepared by the Khadi & Village Industries Commission and other agencies.

(iii) Suggest suitable modifications in the techno-economic feasibility of the scheme based on an assessment of the actual working of the scheme.

(iv) Suggest possible lines of action for providing larger credit support to the scheme by the banks.

1.3 The members of the Group and institutions they represent are as under:

Shri S. N. De — Chairman
Senior Director,
Agricultural Refinance &
Development Corporation,
Bombay.

Kum. I. T. Vaz — Member
Deputy Chief Officer,
Agricultural Credit Department,
Reserve Bank of India,
Central Office,
Bombay.

Shri R. R. Rayarikar — Member
Project Officer,
Agricultural Finance Corporation Ltd.,
Bombay.

Shri P. E. John — Member
Asst. Chief Officer,
Department of Banking Operations &
Development,
Reserve Bank of India,
Central Office,
Bombay.

Shri D. T. Punwaney
Asst. Chief Officer,
Credit Planning Cell,
Reserve Bank of India,
Central Office,
Bombay.

1.4 The Group met immediately after its formation and felt that having regard to the terms of reference, information will have to be collected from several sources. The major sources were the KVIC, KVIBs, commercial and co-operative banks besides certain other agencies like research institutions, agricultural universities, etc. The Group decided to seek information and views from these bodies through questionnaires. A copy each of the questionnaires issued to commercial banks and the KVIC is given in Annexures 1 and 2 respectively.

1.5 As part of the study, the Group visited a few States viz. Assam, Bihar, Gujarat, Maharashtra, Orissa, Tamil Nadu, West Bengal and the Union Territory of Pondicherry for an on-the-spot study of the problems and discussions with the various parties involved in the implementation of the programme. During the course of the field visits, the Group also met and interviewed a few farmers and others who had installed gas plants.

Acknowledgements

1.6 The Group is thankful to the KVIC, commercial and co-operative banks and other institutions for having sent detailed replies to its questionnaires. The Group places on record the valuable assistance given by Shri H. R. Srinivasan, Assistant Director, KVIC. The Group is also grateful to the representatives of the State Governments, KVIC, KVIBs, banks and other non-officials in the States visited for their active participation in the meetings and offering valuable suggestions which facilitated the work of the Group. The Group expresses its thanks to Shri D. T. Punwaney for his assistance in the Group's work.

CHAPTER II

BRIEF REVIEW OF THE POSITION

Historical background

2.1 The commissioning of the sewage purification station at Dadar, Bombay in 1937 provided an opportunity to certain visiting scientists of the IARI to observe the process of anaerobic fermentation of sewage. Some of the scientists felt that the process had a great future in India which had a large cattle population. One of these scientists, Dr. S. V. Desai, designed an experimental gas plant in 1940 mainly to study the process of cattle dung fermentation. Later in 1946 the prototype of a cattle dung digester was built and patented by Prof. N. V. Joshi (a retired scientist from IARI) who made it available for public use. The work of these scientists showed the way for the increased use of cattle dung for purposes of fuel and manure. The breakthrough in cattle dung fermentation, however, came with the designing and patenting in 1951 of the "Gramalaxmi Gas Plant" by Shri Jashbhai J. Patel of the KVIC. With continued research by the scientists of the IARI and the keen interest taken by some others notably Swami Vishwakarmanand of Belur Math and Shri Satish Chandra Das Gupta of Khadi Pratishthan, Calcutta, the Gramalaxmi Gas Plant underwent substantial modifications first in 1952 and later on in 1954 when it was named "Gramalaxmi III". The KVIC has adopted this model and has been popularising its use through a nation-wide programme since 1962. In the meantime, experiments and research for the development of a cheap and efficacious model have been going on in several institutions like IARI and PARI.

Present position

2.2 The following table shows the statewise position of gobar gas plants completed and in operation in the country and the amounts disbursed as loans for the purpose upto the end of June 1975.

TABLE 1

(Rs. lakhs)

Sr. No.	State/Union Territory	No. of plants completed*	Amount of loans disbursed
State			
1	Andhra Pradesh	816	16.53
2	Assam	25	0.90
3	Bihar	251	3.86
4	Gujarat	3,657	49.22
5	Haryana	3,235	148.72
6	Himachal Pradesh	9	0.14
7	Jammu & Kashmir	5	—
8	Karnataka	1,067	23.95
9	Madhya Pradesh	796	4.80
10	Kerala	265	2.98
11	Maharashtra	2,449	62.99
12	Manipur	5	0.24
13	Orissa	48	0.93
14	Punjab	112	50.49
15	Rajasthan	121	1.66
16	Tamil Nadu	679	6.71
17	Uttar Pradesh	787	20.01
18	West Bengal	71	0.17
Union Territory			
1	Chandigarh	26	0.69
2	Delhi	11	0.04
3	Goa	7	—
4	Pondicherry	11	0.23
5	Dadra & Nagar Haveli	1	—
	Total :	14,454	395.26

* These figures do not take into account the number of plants under construction for which loans have been disbursed.

Source: *KVIC Statistics*

That the progress has not been evenly spread all over the country will be seen from the fact that of the 23 States and Union Territories in which all the gobar gas plants are set up, seven States viz. Gujarat (25%), Haryana (22%), Maharashtra ((17%), Karnataka (7%), Andhra Pradesh (6%), Madhya Pradesh (6%) and Uttar Pradesh (5%) together account for 88% of the total number of gas plants installed in the country. From the point of view of loans disbursed also, seven States viz. Haryana (38%), Maharashtra (16%), Punjab (13%), Gujarat (12%), Karnataka (6%), Uttar Pradesh (5%) and Andhra Pradesh (4%) together account for as much as 94% of the total loans disbursel. Although the increase of over 7,000 gas plants recorded during 1974-75 was due mainly to the entry of the commercial banks for financing the plants, it was nonetheless also on account of the active interest evinced by some State Governments of which particular mention may be made of Haryana and Punjab where the number of gas plants completed and under construction rose from 180 and 98 till 1973-74 to 5,000 and 2,006 respectively during 1974-75.

The table also shows that the programme is spreading to most of the States except Jammu & Kashmir and Himachal Pradesh which have cold climate for most part of the year and are mountainous and the smaller States in North Eastern region.

The break-up of the number of plants installed in rural and urban centres is not separately available.

2.3 Table 2 on page 7 shows the year-wise break-up of loans and subsidy disbursed for the installation of gobar gas plants till 30 June 1975. It may be mentioned that since the introduction of the scheme in 1962-63, the KVIC was providing financial assistance for the construction of the plants both in the form of subsidy as also loans. It was later in 1974-75 that the commercial banks commenced financing the plants when the loan assistance from the KVIC was discontinued.

TABLE 2

(Rs. lakhs)

Year	Disbursement		
	Subsidy	Loans	Total
1962-63	0.87	1.27	2.14
1963-64	1.21	1.79	3.00
1964-65	0.75	1.10	1.85
1965-66	2.03	2.96	4.99
1966-67	1.54	3.38	4.92
1967-68	2.74	5.64	8.38
1968-69	4.31	15.45	19.76
1969-70	5.20	29.93	35.13
1970-71	8.88	29.92	38.80
1971-72	6.25	32.32	38.57
1972-73	8.25	31.20	39.45
1973-74	5.15	23.37	28.52
1974-75	91.12	216.93	308.05
	138.30	395.26	533.56

Source: *KVIC Statistics*

It will be seen that while the programme started picking up gradually from the year 1968-69, the progress in the disbursement of loans and subsidy was the maximum during 1974-75. The total amount of subsidy disbursed increased from Rs. 0.87 lakh in 1962-63 to Rs. 91.12 lakhs in 1974-75, while the loans disbursed during the same period increased from Rs. 1.27 lakhs to Rs. 216.93 lakhs. The sudden increase in both subsidy and loans in 1974-75 can be attributed to the fact that the commercial banks entered the field for the first time and started financing plants.

2.4 Table 3 on page 8 indicates yearwise progress in the installation of gas plants since 1962-63 and their installed capacity to produce gas and manure by value.

TABLE 3

Year	No. of gas plants	Value of production (Rs. lakhs)		
		Gas	Manure	Total
1962-63	315	1.29	0.86	2.15
1963-64	203	2.13	1.42	3.55
1964-65	230	3.09	2.06	5.15
1965-66	204	3.93	2.62	6.55
1966-67	313	5.35	3.30	8.65
1967-68	436	6.95	4.24	11.19
1968-69	664	9.48	5.84	15.32
1969-70	720	13.17	7.86	21.03
1970-71	811	15.97	9.75	25.72
1971-72	1,041	21.25	18.21	39.46
1972-73	1,065	26.61	22.70	49.31
1973-74	856	30.82	26.28	57.10
1974-75	7,818*	197.21	138.70	335.91
	14,676			

* 222 plants not completed during 1974-75

Source : *KVIC Statistics and "Bio-Gas—Achievement and Challenges" by M.A. Sathianathan.*

During 1974-75, the production capacity of gas (Rs. 197.21 lakhs) and manure (Rs. 138.70 lakhs) aggregated Rs. 335.91 lakhs. Information regarding the extent of utilisation of gas and manure produced in these plants is not available.

2.5 Till the advent of the oil crisis in 1973, considerable stress was being laid on the rural electrification programme and the building up of increased capacity for the production of chemical fertilisers in the country. The programme for the installation of gobar gas plants had not received adequate attention and support from the concerned authorities. The Fuel Policy Committee reviewed the fuel situation in the country and recommended the popularisation of gobar gas plants as an alternative source of energy and fertiliser. Accordingly, the Government of India have

decided to go ahead with a programme for installation of one lakh gas plants during the Fifth Five Year Plan i.e. 20,000 plants per year.

2.6 Following the above decision, the Fertiliser Commissioner, Ministry of Agriculture, Government of India convened in November 1973 a meeting in Bombay of the representatives of the nationalised banks, Agricultural Finance Corporation, Reserve Bank of India and other interested bodies to consider the steps needed for the implementation of the programme. It was agreed in that meeting that all the banks would participate in the programme to provide financial assistance with the KVIC providing the necessary information and guidance for installation, maintenance and service facilities.

Potential for development

2.7 The Group is not aware of any systematic study having been carried out for precisely quantifying the benefits likely to accrue as a result of large scale utilisation of the available cattle dung in the country. However, certain organisations like KVIC have estimated that the fermentation of 75% of the dung collected from the country's 226 million cattle (1961 Livestock Census) will yield about 195 megawatts of energy per year (which is equivalent to about 24 billion litres of kerosene) and at the same time lead to the production of 236 million tons of manure. The nitrogen content of this manure will be about 3.5 million tons which is more than the nitrogen fertiliser capacity established in the country so far. The naphtha required to achieve this nitrogen content would be about 1.7 million tons.* In view of the country's large cattle population, the increasing utilisation of dung through gas plants is expected to provide an alternative source of fuel and fertiliser for use of the rural population.

* Pages 1347-48 of Economic & Political Weekly—Special Number, 1974.

CHAPTER III

TECHNICAL ASPECTS

Gobar gas plant

3.1 The gobar gas plant operates on the principle that the anaerobic fermentation (i.e. fermentation in the absence of air) of cellulose containing organic materials such as cattle dung, other animal and human excreta, agricultural wastes like straw, plant leaves, paddy husks, groundnut shell, water weeds, algae etc. leads to the production of a combustible mixture of gases viz., methane, carbon dioxide, hydrogen and nitrogen, the predominant among them being methane (about 55% to 60%). The main emphasis in India has been on the use of 'gobar' (cattle dung) as the fermentable material; hence the popular name, gobar gas plant. Such plant consists of two main components (i) a digester (or fermentation tank) with an inlet into which the fermentable mixture is poured in the form of liquid slurry and (ii) a gas holder to collect the gas. In the design of Gramalaxmi III, which is now widely in vogue the gas holder floats like a bell on the fermentation mix and serves, not only to collect gas, but also to cut off air to the digester. In addition, the gas holder is provided with a gas outlet, and the digester with an overflow pipe to lead out the sludge which is what the digested slurry is often called. Since the sludge retains 1.5% nitrogen as against 1% or less in undigested farm yard manure and also phosphorus and potassium of the organic material, it can be used as manure to improve the physical condition of the soil.

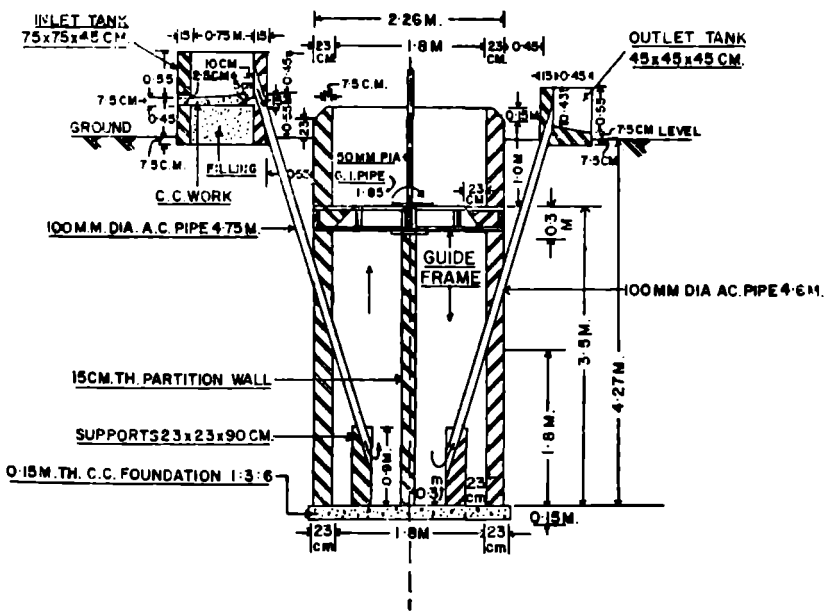
Designs

3.2 Several institutions and individuals have been involved in the development of the gobar gas plant. Consequently a number of designs have been developed over the years by different scientists. While the search for a simple plant, easy to install and operate with minimum of cost both for installation and maintenance is still on, it may be worthwhile to consider here the salient features of a few designs developed by institutions like KVIC, IARI and CPHERI (NEERI).

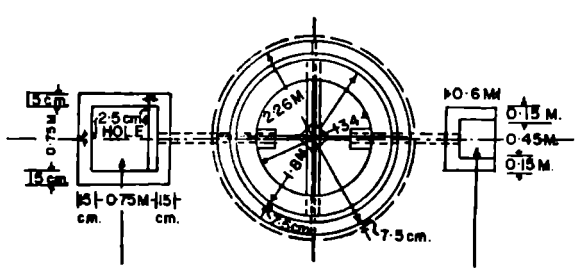
(i) *KVIC Plant*

The current model of this plant called Gramalaxmi III is an improvement of the design originally evolved by Shri Jashbhai J. Patel in 1951. The main feature of this plant is that the digester and the gas holder are in one unit. A diagram of the plant is given below. In this plant, the digester is built below the

KVIC PLANT



CROSS SECTIONAL ELEVATION



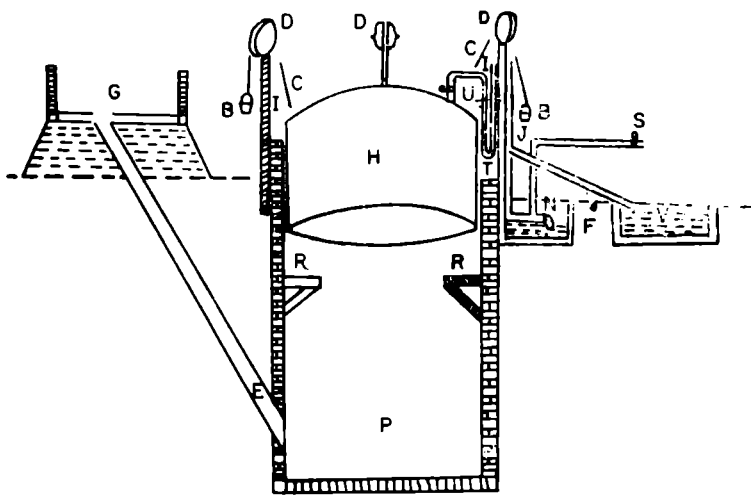
ground level and is connected to a mixing tank by means of a slanting cement pipe. The digester is divided into two semi-circular compartments by a partition wall. In very small plants such a partition wall is not considered necessary. Fresh dung mixed with water in the mixing tank is fed into the digester through the slanting pipe. The plant provides for a continuous digestion system in as much as when fresh slurry is fed into the plant, an equal volume of digested slurry gets ejected through an outlet pipe similar to the inlet slanting pipe, thus maintaining the level of slurry in the digester unchanged. The system envisages a digestion period of about 50 days.

(ii) *IARI Plant*

A diagram of the IARI plant is given on page 13. This plant, like the KVIC plant has an underground digester without a partition wall. In this plant an attempt has been made to economise the cost by using cheaper materials such as low quality bricks and thinner gauge of M.S. plates for the gas holder. Quantity of cement used is also less. The main variation from the KVIC plant is that the gas holder is held suspended by three iron pipes erected outside the digester tank by means of pullies and twisted wire rope or iron chain, one end of which is tied to a bucket. About 80 bricks are kept in the three buckets to serve as counter weight or negative pressure. When the gas is required to be used each time, these bricks are shifted and placed on the top of the gas holder to increase the pressure. While about 10% more gas can be obtained by keeping the gas holder at a negative pressure, there is always a possibility of leakage either in the holder or in the gas pipe or at any other point. Also some air could enter into the gas holder and there might be an explosion. In this type of plants, production of gas normally starts within a week of their construction and a

continuous production of gas is maintained by daily feeding of dung mixture.

IARI PLANT

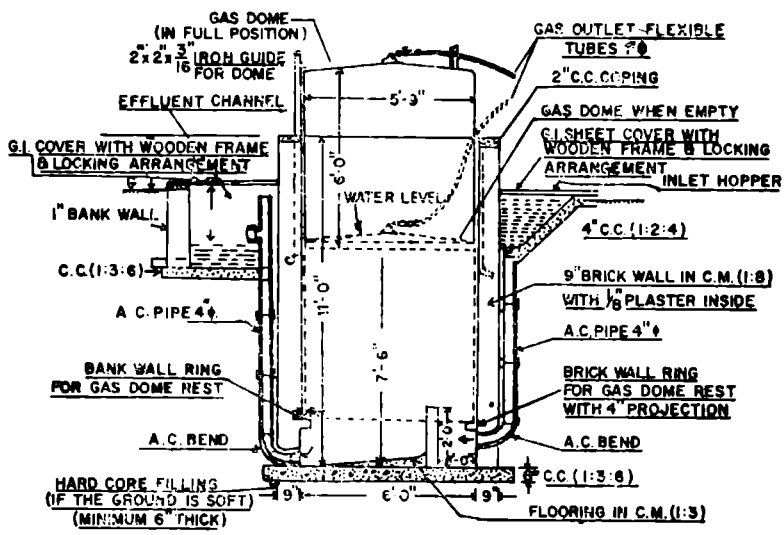


B.	COUNTER POISE BUCKET	J.	G I. PIPE
C.	SUPPORTING WIRE	N.	CONDENSED WATER TRAP PIT
D.	IRON PULLEYS	P.	FERMENTATION WELL
E.	FEEDING PIPE	R.	LEDGE
F.	OVERFLOW CHANNEL	S.	WHEEL COCK
G.	FEEDING TUNNEL	T.	G.I. BEND WITH WHEEL COCK
H.	GAS HOLDER	U.	HOSE PIPE
I.	SUPPORTING PIPES	V.	SPENT SUPPLY RECEIVING PIT

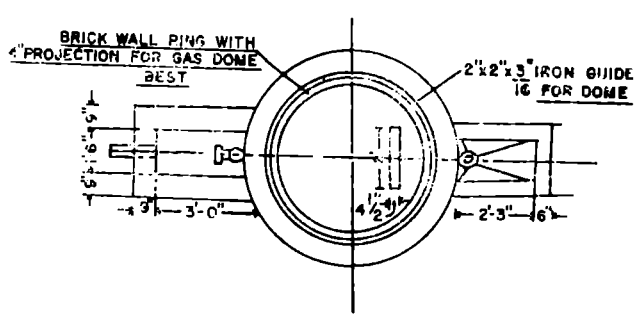
(iii) *CPHERI Plant*

CPHERI (now NEERI) has after considerable research on the optimum design and operation of gobar gas plants developed a design as given below. While the KVIC and IARI

CPHERI (NEERI) PLANT



SECTION ON C.D.



plants are primarily designed for digestion of cattle dung, the NEERI plant has been built for the digestion of both cattle dung and night soil. For this plant, the slurry is prepared in the proportion of 1 part of gobar with 1.5 parts of water. In order to accelerate the production of gas slaked lime can be added initially.

3.3 Besides the designs illustrated in paragraph 3.2, the PARI through the Gobar Gas Research Centre at Etawah, U.P. has developed certain plants which could be used without any significant variations in the output of gas under different climatic conditions. These plants designed by Shri Ram Bux Singh provide for stirring and heating arrangements so that a constant supply of gas is maintained even under climatic conditions where the temperature falls below the optimum required for proper digestion.

Components

3.4 All gas plants have the undernoted main components :

(i) Digester
(ii) Gas holder
(iii) Pipeline and pipe fittings
(iv) Mixing tank
(v) Gas stove, burner, etc.

(i) *Digester*

The digester is a well or underground circular tank built of brick and cement with the top portion showing above the ground level. It is divided into two compartments with a partition wall upto about 2/3rd of its depth at which level there is a ledge constructed inside the wall for resting the gas holder. A central guide pipe fitted in a frame is also fixed in the masonry work. There is no need to have a partition wall for small digester upto a capacity of 3 cubic metres. For filling the digester an inlet pipe is connected to the mixing tank in such a way that its lower end opens out between one foot and two feet above the bottom of the

digester at the centre of the compartment or the digester, as the case may be. Similarly, another pipe is provided in a slanting position on the other side and is connected to the outlet tank for the discharge of slurry.

(ii) *Gas holder*

The gas holder is a cylindrical drum fabricated out of M.S. sheet and is so placed that it rests on the ledge in an inverted position on the digester tank. This not only serves as a cover for the digester tank but also holds the gas produced in it under certain pressure. The mouth of the holder dips in the slurry and the holder rises when there is an accumulation of gas and goes down with the depletion of the gas. The holder is kept in position by the central guide pipe as and when it moves up and down. The gas flows out through a pipe provided at the top of the holder and can be led to the kitchen or other points of use.

(iii) *Pipeline and pipe fittings*

Gas is transported from the gas holder to the points of use by pipes which may be made of either G.I. pipes or polythene. Other items required are socket, bend, valve, nipple, flexible hose pipe with clip, drain pipe, plug, etc.

(iv) *Mixing tank*

A small tank is built with brick and cement above the ground level for mixing cattle dung with water.

(v) *Gas stove, burner, etc.*

Gobar gas can be used for cooking, lighting and for running engines. At present the gas is used mainly for cooking and lighting purposes only. Methane can be used for all the purposes for which natural gas or fuel in a gassified form is used but its fuel value is low compared with other gases. However, when compared with solid and liquid fuels it can be considered more efficient. Stoves used for natural gas, coal gas or liquefied petroleum gas (LPG) cannot be used for burning gobar gas as its

flame speed factor is slow compared to that of the former. In view of this, special types of burners and stoves have been devised for using gobar gas.

Any gas lamp with a mantle can be used for lighting by gobar gas. However, as small plants generate gas only at a pressure of 1" to 1½" the light cannot be very bright.

Materials required for construction of gas plant

3.5 Estimates of the materials required for the construction of gas plants of various sizes have been made by the KVIC. One such estimate for a 3 cubic metre plant is given in Annexure 3.

Process

3.6 Cattle dung is mixed with equal quantity of water in the mixing tank and is fed into the digester. While mixing, gravel and other hard substances should be removed to prevent the inlet from getting choked up. After the digester gets full for the first time, it is allowed to remain for about 50 days for digestion of the dung. If the necessary conditions are present for the anaerobic fermentation of the dung and there is no leakage in the gas holder, it will get filled with gas by the end of this period and will rise up. When the gas is used up the gas holder goes down. A regular supply of gas can thereafter be ensured only if fresh cattle dung mixture is fed into the digester daily. As and when fresh dung is fed into the digester, digested dung gets ejected in the form of slurry through the outlet pipe and the tank remains full. Fully digested slurry is odourless. There are two alternatives for handling the slurry which comes out from the digester. One is to spread the slurry as it comes out, in thin layers and dry it in the sun. The dried slurry properly powdered can be applied to the land like any other organic manure. The other alternative is to let the slurry flow out along with irrigation water directly into the field. In the process of dung fermentation temperature plays an important part and maintaining optimum temperature at 30°-35°C is essential.

Technical feasibility

3.7 We have so far indicated the salient features of the gobar gas plant, its components and the processes involved in the production of gas. It would now be necessary to identify the technical criteria for installation and successful operation of such a plant. The technical feasibility for the installation of a gobar gas plant is discussed under the two broad heads viz. (a) the factors which determine the installation of a plant and (b) factors which determine the size of a plant.

(a) The factors which determine the installation of a plant include soil condition, water table, availability of water, adequacy of land for plant, pits, etc., nearness to the points of use, availability of cattle etc. These are examined below:

(i) *Suitability of soil*

It is necessary to have information about the sub-soil up to a depth of 16 feet. The level and depth of the murrain layer and the rock layer and the depth at which water is struck have relevance to the cost and type of the plant to be constructed. For instance, in soft rock area, plastering upto $\frac{1}{2}''$ to $\frac{1}{4}''$ of the excavated pits has worked without any trouble for at least 5 years. Burnt and unburnt bricks, stone masonry rings from 1:2:4 cement concrete or from clay are also known to have been successfully used. In some areas, split bamboo has also been used with some success. In sandy sub-soils, digesters have to be built with care on firm foundation. In areas where hard rocks form the sub-soil, even plastering becomes unnecessary. In heavy rainfall areas and places where water is struck within a few feet, it may be necessary to build the plant above ground. This would naturally affect the cost estimates because of the varying requirements of the materials to be used. Further, a pumping system will have to be provided for the feeding into the digester. So also in extremely cold climate regions or in snow clad regions, it may be rather difficult or uneconomical to maintain a gobar gas plant under the present level of technology.

(ii) *Adequacy of land for plant, pits, etc.*

The availability of land for the construction of the masonry work for the digester and the digging of manure pits would be one of the factors to determine the size of the plant. Normally more than one pit will be required for drying up the liquid slurry before it can be used as manure. If, however, the field of the farmer is located nearby, there may not be much difficulty in utilising the liquid slurry direct in the field.

(iii) *Nearness to the point of use*

It is necessary that a gobar gas plant should be located near to the kitchen and other points of use. If gas is to be led through pipes at long distances, the cost of pipe would add to the total cost of installation besides increasing the chances of leakage of gas and reduction in its efficiency due to fall in pressure.

(iv) *Distance from well*

The plant should not be located within say a radius of 50 feet of drinking water well since there are chances of the slurry percolating into the well.

(v) *Availability of water*

It should be ensured that adequate water is available for mixing cattle dung with it in the required proportion for use in the digester.

(vi) *Climatic conditions*

The micro organisms which take part in methane formation have the optimum activity at 30°-35°C. The rate of gas production per lb. of dung added daily varies from 1.4 c.ft in summer months to about 0.6 c.ft in winter months (mean temperature 15°C), that is to say, it drops to about one third. In regions where the winter lasts longer the installation of gobar gas plants may not bring the assumed extent of benefits. In such conditions suitable devices will have to be provided for main-

taining the required temperature for continuous operation of the plant throughout the year.

(vii) *Nearness to cattle sheds*

Usually the cattle shed is found very close to the farm house where the plant is to be installed and in such cases there is no difficulty in collecting the dung and feeding it into the digester. However, if the cattle shed is located at a distance from the plant site, it would involve extra labour and expenditure for carrying the dung for feeding the plant.

(b) The factors which determine the size of the plant include the raw materials available for digestion and the quantity of gas required. In other words, cattle dung is the raw material required for the production of gobar gas and its availability in right quantity would be the main factor for deciding upon the size of the digester. Prima facie, the number of cattle with a farmer would give an indication of the likely supply of dung. However, reliance on the number of cattle alone could be misleading as other considerations such as the type and size of the cattle, the quality of the feed given and the period of the day for which they are stable-bound are all equally important and relevant. The size of the family, the way of living and the possible uses to which the gas is expected to be put are considerations from the supply side which go to determine the size of the gas plant. The availability of dung in abundance alone should not determine the size of the gas plant if the gas and manure produced cannot be fully utilised.

Importance of technical norms

3.8 It is needless to emphasise here the importance of strict adherence to the technical norms as spelt out above, before any proposal for setting up of gobar gas plants is considerd for sanction. Any relaxation in these norms is likely to lead to the construction of plants which may prove to be defective or troublesome at a later stage and create wrong impression in the minds of other farmers who would like to construct such plants, thereby affecting the programme.

CHAPTER IV

ECONOMIC AND FINANCIAL ASPECTS

Benefits of a gobar gas plant

4.1 The various benefits derived from a gobar gas plant could be grouped into two broad heads viz. (a) economic and (b) social. These are discussed below:

(a) *Economic benefits*

Cattle dung passed through a gobar gas plant produces two-fold advantages. They are (i) production of gas and (ii) residual manure. In the absence of a gas plant, a cultivator can obtain only one of the benefits by converting dung into dung cakes for fuel or farm yard manure. It is further seen that by passing cattle dung through a gas plant, not only the fuel factor of the gas produced becomes far higher than that of the dung but also the quality of the manure obtained in addition to gas is better than that of farm yard manure that may be obtained outside the gas plant. On the basis of the estimates given by the KVIC, in the generation of gas, about one-fourth of dung is consumed but the useful heat of the gas is about 20% higher than the useful heat obtained by burning the entire amount of dung. This is mainly due to the very high thermal efficiency (60%) of the gas as against the poor efficiency (11%) of the dung cakes. Similarly, the dung yields 43% more manure when it is passed through the gas plant than when it is converted into farm yard manure This is perhaps because the decomposition in gas digester is selective, while in the open manure pit, it is more rigorous.

(i) Uses of gas

The gobar gas can be used for heating (cooking) or lighting or for motive power. Since the composition of this gas is different from that of the coal gas or petroleum based gas, the appliances like burners or lamps for using it have to be of special design and specification. The gas consumption for cooking is estimated at 8 c.ft. per day per person, while that for light it is 4.5 c.ft.

per lamp of 100 watts per hour. As regards the use of gobar gas for motive power e.g. running oil engines, the quantity of gas available must be sufficiently large. On an average, 425 litres (15 c.ft.) of gas are required per H.P. per hour. Water pump generator can be connected to the engines. If a 5 H.P. engine is to be used for say 8 hours per day, at least 18 c.mts. of gas would be required per day. That means at least 30 to 35 cattle will be required for this purpose. For converting internal combustion engines of diesel/petrol/kerosene type to gas engines, a special attachment needs to be fixed up. The special attachment has also been developed and is available in the market.

(ii) Use of manure

The manure produced by the plant (digested slurry) is rich in nitrogen and humus. It also contains phosphates, potash and a number of essential micro nutrients like zinc, sulphur, iron, etc. The dried gobar gas manure can also be used as filler in the manufacture of fertiliser mixtures. The regular use of organic manure every year improves the fertility status of the soil. It does not impoverish the soil, as may perhaps happen due to the excessive use of straight fertilisers over a period of time.

According to the KVIC estimates, 45 kgs. of cattle dung droppings per day of 5 cattle will give the plant owner either of the following products in a year. These products have been valued at June 1974 market prices.

TABLE 4

Method of utilisation of fuel	Quantity of fuel	Effective heat value	Quantity of manure	Net value Rs.
Composted in manure pit outside gas plant	Nil	Nil	7 cart loads	105
Converted to cakes for fuel outside gas plant	3.65 tons	1.55 million kilo calories	Nil	197
Digested in gobar gas plant	620 c.mts.	1.87 million kilo calories	10 cart loads	303

It may perhaps not be out of place to make a passing mention here of the controversy in regard to the fertility value of the manure produced by the gas plant. One view is that the dung after its fermentation 'loses a good deal of of its fertility and the products left or formed after consumption of gobar as in burning certainly possesses much less fertility value than gobar.' It is further contended that with the application of NPK there is decrease in crop yield over time, whilst farm yard manure plus lime or gobar appreciably increase the annual crop production year after year. Farm yard manure or cow dung or straw or leaves and other organic substances when ploughed on the land, fix atmospheric nitrogen in the soil itself and make the land rich in nitrogenous compounds. That the repeated indiscriminate applications to the soil of chemical fertilisers result in diminishing crop yields in succeeding years is not disputed. However, the application of fresh cattle dung to soil is possible only when the land is ready to receive it which is not always so. If the dung is kept stored before the land is ready for such application i.e. for about 3 to 4 months, it will ferment and lose as much as 50% of dry organic matter. Temperate climatic soils become acidic and require liming. In almost all parts of India, on the other hand, the concentration of alkali in soil is low. Addition of lime cannot, therefore, be suggested. If anything, it should be acid releasing substances like gypsum. Cattle dung is normally used to increase humus. In humid regions, addition of dung does help in increasing humus content in the soil over a period of time. But this does not happen in tropical areas since the organic matter gets burnt up because of high temperature. Thus the use of cattle dung in tropical areas like India does not contribute significantly to humus accumulation or moisture retention and also in building up or improving the soil structure and texture unless it is applied regularly every year in adequate quantities. By getting bio-gas from cattle dung, what is lost is carbon which produces methane gas. A small fraction of nitrogen might also get lost but most of the nitrogen, phosphorus and potash is retained in the slurry. Dr. Ghosh of IARI is reported to have found that repeated application of slurry from gobar gas plants year after year consistently improved the soil better than with similar application of dung.

(b) *Social Benefits*

Besides monetary benefits, certain social benefits also flow from the use of gas plants, the money value of which cannot be easily quantified. Not only the environmental pollution is eliminated by the use of gas plant but it helps to solve the problem of fertiliser shortage, prevent indiscriminate felling of trees or deforestation, improve the health of the farmer's family, save medical expenses, provide more leisure or time for remunerative work to improve the farmer's economic condition or for attending literary classes by women, increase the durability of family clothes and utensils, add to the aesthetic appearance of the house and surroundings with brighter and smoke-free homes and neat and clean yards.

Initial capital investment

4.2 The initial capital required to be invested by an individual for the installation of a gas plant, besides the portion of land in his backyard where the plant is to be constructed would primarily depend upon the size of the plant to be set up. The components-wise break-up of the investment on the basis of the estimates made by KVIC is given in table 5 for various sizes of the plants which are now in operation in different parts of the country.

TABLE 5

Size of the plant (c.mt.)	Cost of the gas holder	Cost of civil construction	Cost of pipeline and appliances	Total initial cost
	Rs.	Rs.	Rs.	Rs.
2	933	1143	256	2332
3	1207	1478	331	3016
4	1344	1646	370	3360
6	1670	2055	450	4175
8	2000	2450	550	5000
10	2440	2989	671	6100
15	3400	4165	935	8500
35	7395	9016	1989	18400

4.3 The above estimates are based on the 1975 prices and there may be slight variation from place to place depending upon the incidence of local taxes and transportation charges. It will be seen that broadly, 50% of the cost of the plant is on account of the civil works for construction of digester, 40% for the gas holder and the remaining about 10% for pipeline and appliances. At present most gas holders are made of 10 to 12 gauge M.S. or G.I. sheets. This material has two serious drawbacks. Firstly, iron being a good conductor dissipates natural heat during winter. Conversely, it gains heat in summer months. This creates problems especially in areas having wide temperature range between day and night and summer and winter. Secondly, iron is also subject to corrosion. Experiments are being conducted to replace the M.S. or G.I. sheets in the fabrication of gas plants with spun concrete, reinforced concrete moulding or plastic material.

For reduction in the initial cost of civil works for construction, the use of cheap materials locally available should be considered.

Characteristic feature of the investment in a gas plant

4.4 Although basically the gobar gas plants need investment of a capital nature in the same way as other schemes for agricultural development like minor irrigation, dairy, poultry, etc., there is a characteristic difference between the two. The investment in latter types of schemes directly generates cash inflow, whereas that in installing gobar gas plants does not generate visible income. In the case of gobar gas plants the return to the owner accrues in the form of savings he will make in the expenditure on fuels like kerosene, charcoal, wood, etc. as also the increase in crop yield due to application of improved variety of manure from the gas plant. The return in this case, therefore, cannot be precisely quantified as in the case of other schemes of agricultural development, as referred to above, and has to be estimated carefully taking into account the actual expenditure which the plant owner would have incurred but for the availability of gas and manure through the plant.

Gobar gas plant as an independent investment

4.5 For the purpose of appraising the economic feasibility of a gobar gas plant proposed to be installed by an individual, the plant may be treated either as an independent item or as forming part of the scheme of agricultural development like minor irrigation, dairy farming and the like. In case the plant is treated as an independent investment, the economic feasibility will have to be determined on the basis of the return from the gas plant, which cannot be precisely quantified, as mentioned in paragraph 4.4, and the ability of the plant owner to repay the bank loan, if taken, is determined having regard to his overall financial position. In the other case i.e. of an integrated project, the feasibility could be dovetailed, if necessary, into the overall feasibility of the scheme for agricultural development. In case of an independent investment in the installation of a plant, the repayment of the loan may have to come out of the general resources or income of the individual since it will be hazardous to quantify the savings effected by him as a result of setting up the gas plant.

Economic and financial feasibility of a gobar gas plant

4.6 The soundness of an investment in any project including a gobar gas plant, from the economic and financial point of view, must be judged on the basis of the return on the capital sunk by the individual. In other words, the investment in the gobar gas plant should be a paying proposition.

4.7 The KVIC has worked out the cost-benefit analysis of gas plants of different sizes. According to it, gas plants of all sizes are beneficial to farmers. On the basis of the analysis furnished in the KVIC publication 'Gobar Gas Plants — Why and How', we have worked out the economics of gobar gas plants of each of the sizes of 2, 3, 4, 6 and 8 cubic metres which constitute the bulk of the gas plants in operation at present. We have also worked out the economics of two larger sized gas plants of 25 and 85 cubic metres for the purpose of comparison with the economics of smaller sized gas plants. The economics are given respectively in statements 1A and 1B to 7A and 7B in the following pages.

STATEMENT 1A

Economics of 2M³ per day gobar gas plant

(Annual expenditure, income, surplus)

(See paragraph 4.7)

	Previous use of cattle dung as FYM Rs.	Previous use of cattle dung as fuel Rs.
A. Annual Expenditure		
(a) Cost of painting gas holder (once a year)	50	50
(b) Cost of maintenance	50	50
(c) Cost of cattle dung as Farm Yard Manure — 4.677 tons @ Rs. 40 per ton	187	—
(d) Previous use of cattle dung as fuel in terms of equivalent kerosene (@ Rs. 1.09 per litre) $\frac{18.71 \times 0.25}{19.83}$ = 226 litres x Rs. 1.09	—	246
Total :	287	346
B. Annual Income		
(a) Manure — 7.02 tons @ Rs. 50 per ton	350	350
(b) Gobar gas per year 730 cu. metres at the rate comparable to kerosene equivalent of useful heat 730 x 0.62 = 452 litres x Rs. 1.09	492	492
Total :	842	842
Less annual expenditure (A)	287	346
C. Gross Annual Surplus	555	496

STATEMENT 1B

Economics of 2M³ per day gobar gas plant

(Capital cost, loan, instalments, etc.)

(See paragraph 4.7)

Capital Investment

	Rs.
Cost of gas holder	932
Cost of pipeline and appliances	257
Cost of civil construction	1,143
Total :	2,332
Subsidy @ 25%	583
Bank Loan	1,749

Year	Loan received during the year Rs.	Loan outstanding at the end of the year Rs.	Gross surplus as per statement 1A Rs.	Payment of interest @ 14% Rs.	Repayment of principal Rs.	Total outgoings Rs.	Net surplus Rs.
1	1,749	1,685	555	245	64	309	246
2	—	1,612	555	236	73	309	246
3	—	1,529	555	226	83	309	246
4	—	1,434	555	214	95	309	246
5	—	1,326	555	201	108	309	246
6	—	1,203	555	186	123	309	246
7	—	1,062	555	168	141	309	246
8	—	902	555	149	160	309	246
9	—	719	555	126	183	309	246
10	—	511	555	101	208	309	246
11	—	274	555	72	237	309	246
12	—	—	555	38	274	312	243
				1,962	1,749		

STATEMENT 2A

Economics of 3M³ per day gobar gas plant

(Annual expenditure, income, surplus)

(See paragraph 4.7)

	Previous use of cattle dung as FYM Rs.	Previous use of cattle dung as fuel Rs.
A. Annual Expenditure		
(a) Cost of painting gas holder (once a year)	50	50
(b) Cost of maintenance	50	50
(c) Cost of cattle dung as Farm Yard Manure — 7.391 tons @ Rs. 40 per ton	296	—
(d) Previous use of cattle dung as fuel in terms of equivalent kerosene (@ Rs. 1.09 per litre) $\frac{7956 \text{ kgs.}}{19.83} = 401.2$ litres x Rs. 1.09	—	437
Total :	396	537
B. Annual Income		
(a) Manure — 11.09 tons @ Rs. 50 per ton	554	554
(b) Gobar gas per year 1,095 cu. metres at the rate comparable to kerosene equivalent of useful heat 678.9 litres x Rs. 1.09	740	740
Total :	1,294	1,294
Less annual expenditure (A)	396	537
C. Gross Annual Surplus	898	757

STATEMENT 2B

Economics of 3M³ per day gobar gas plant

(Capital cost, loan, instalments, etc.)

(See paragraph 4.7)

Capital Investment

	Rs.
Cost of gas holder	1,207
Cost of pipeline and appliances	331
Cost of civil construction	1,478
Total :	3,016
Subsidy @ 25%	754
Bank Loan	2,262

Year	Loan received during the year Rs.	Loan outstanding at the end of the year Rs.	Gross surplus as per statement 2A Rs.	Payment of interest @ 14% Rs.	Repayment of principal Rs.	Total outgoings Rs.	Net surplus Rs.
1	2,262	2,145	898	317	117	434	464
2	—	2,011	898	300	134	434	464
3	—	1,859	898	282	152	434	464
4	—	1,685	898	260	174	434	464
5	—	1,487	898	236	198	434	464
6	—	1.261	898	208	226	434	464
7	—	1,004	898	177	257	434	464
8	—	711	898	141	293	434	464
9	—	377	898	100	334	434	464
10	—	—	898	53	377	430	468
				2,074	2 262		

STATEMENT 3A

Economics of 4M³ per day gobar gas plant

(Annual expenditure, income, surplus)

(See paragraph 4.7)

	Previous use of cattle dung as FYM Rs.	Previous use of cattle dung as fuel Rs.
A. **Annual Expenditure**		
(a) Cost of painting gas holder (once a year)	50	50
(b) Cost of maintenance	50	50
(c) Cost of cattle dung as Farm Yard Manure — 9.826 tons @ Rs. 40 per ton	393	—
(d) Previous use of cattle dung as fuel in terms of equivalent kerosene (@ Rs. 1.09 per litre) 9.434 tons / 19.83 = 475.74 litres x Rs. 1.09	—	518
Total :	493	618
B. **Annual Income**		
(a) Manure — 14.74 tons @ Rs. 50 per ton	737	737
(b) Gobar gas per year 1,460 cu. metres at the rate comparable to kerosene equivalent useful heat 905.2 litres x Rs. 1.09	986	986
Total :	1,723	1,723
Less annual expenditure (A)	493	618
C. **Gross Annual Surplus**	1,230	1,105

STATEMENT 3B

Economics of 4M³ per day gobar gas plant

(Capital cost, loan, instalments, etc.)

(See paragraph 4.7)

Capital Investment

	Rs.
Cost of gas holder	1,344
Cost of pipeline and appliances	370
Cost of civil construction	1,646
Total :	3,360
Subsidy @ 25%	840
Bank Loan	2.420

Year	Loan received during the year Rs.	Loan outstanding at the end of the year Rs.	Gross surplus as per statement 3A Rs.	Payment of interest @ 14% Rs.	Repayment of principal Rs.	Total outgoings Rs.	Net surplus Rs.
1	2,420	2,194	1,230	338	226	564	666
2	—	1,937	1,230	307	257	564	666
3	—	1.644	1,230	271	293	564	666
4	—	1,310	1,230	230	334	564	666
5	—	929	1,230	183	381	564	666
6	—	495	1,230	130	434	564	666
7	—	—	1.230	69	495	564	666
				1,528	2,420		

STATEMENT 4A

Economics of 6M³ per day gobar gas plant

(Annual expenditure, income, surplus)

(See paragraph 4.7)

	Previous use of cattle dung as FYM Rs.	Previous use of cattle dung as fuel Rs.
A. **Annual Expenditure**		
(a) Cost of painting gas holder (once a year)	50	50
(b) Cost of maintenance	50	50
(c) Cost of cattle dung as Farm Yard Manure — 14.8 tons	682	—
(d) Previous use of cattle dung as fuel in terms of equivalent kerosene (@ Rs. 1.09 per litre) 14.15 tons / 19.83 = 713 litres x Rs. 1.09	—	778
Total :	782	878
B. **Annual Income**		
(a) Manure — 22.174 tons @ Rs. 50 per ton	1,109	1,109
(b) Gobar gas per year 2,190 cu. metres at the rate comparable to kerosene of equivalent useful heat 1,357.8 litres x Rs. 1.09	1,480	1,480
Total :	2 589	2 589
Less annual expenditure (A)	782	878
C. **Gross Annual Surplus**	1,807	1,711

STATEMENT 4B

Economics of 6M³ per day gobar gas plant

(Capital cost, loan, instalments, etc.)

(See paragraph 4.7)

Capital Investment

	Rs.
Cost of gas holder	1,670
Cost of pipeline and appliances	450
Cost of civil construction	2,055
Total :	4,175
Subsidy @ 25%	1,043
Bank Loan	3,132

Year	Loan received during the year Rs.	Loan outstanding at the end of the year Rs.	Gross surplus as per statement 4A Rs.	Payment of interest @ 14% Rs.	Repayment of principal Rs.	Total outgoings Rs.	Net surplus Rs.
1	3,132	2,765	1,807	438	367	805	1,002
2	—	2,347	1,807	387	418	805	1,002
3	—	1,870	1,807	328	477	805	1,002
4	—	1,326	1,807	261	544	805	1,002
5	—	707	1,807	186	619	805	1,002
6	—	—	1,807	98	707	805	1,002
				1,698	3,132		

STATEMENT 5A

Economics of 8M³ per day gobar gas plant

(Annual expenditure, income, surplus)

(See paragraph 4.7)

	Previous use of cattle dung as FYM Rs.	Previous use of cattle dung as fuel Rs.
A. **Annual Expenditure**		
(a) Cost of painting gas holder (once a year)	50	50
(b) Cost of maintenance	50	50
(c) Cost of cattle dung as Farm Yard Manure — 19.65 tons @ Rs. 40 per ton	786	—
(d) Previous use of cattle dung as fuel in terms of equivalent kerosene (@ Rs. 1.09 per litre) 18.868 tons / 19.83 = 951.47 litres x Rs. 1.09	—	1,037
Total :	886	1,137
B. **Annual Income**		
(a) Manure — 29.48 tons @ Rs. 50 per ton	1,474	1,474
(b) Gobar gas per year 2,920 cu. metres at the rate comparable to kerosene equivalent of useful heat 1,810.4 litres x Rs. 1.09	1,973	1,973
Total :	3,447	3,447
Less annual expenditure (A)	886	1,137
C. **Gross Annual Surplus**	2,561	2,310

STATEMENT 5B

Economics of 8M³ per day gobar gas plant

(Capital cost, loan, instalments, etc.)

(See paragraph 4.7)

Capital Investment

	Rs.
Cost of gas holder	2,080
Cost of pipeline and appliances	450
Cost of civil construction	2,470
Total :	5 000
Subsidy @ 25%	1,250
Bank Loan	3,750

Year	Loan received during the year Rs.	Loan outstanding at the end of the year Rs.	Gross surplus as per statement 5A Rs.	Payment of interest @ 14% Rs.	Repayment of principal Rs.	Total outgoings Rs.	Net surplus Rs.
1	3,750	3,183	2,561	525	567	1,092	1,469
2	—	2,536	2,561	445	647	1,092	1 469
3	—	1,799	2 561	355	737	1.092	1 469
4	—	958	2,561	251	841	1,092	1 469
5	—	—	2,561	134	958	1.092	1.469
				1,710	3,750		

STATEMENT 6A

Economics of 25M³ per day gobar gas plant

(Annual expenditure, income, surplus)

(See paragraph 4.7)

	Previous use of cattle dung as FYM Rs.	Previous use of cattle dung as fuel Rs.
Annual Expenditure		
(a) Cost of painting gas holder (once a year)	50	50
(b) Cost of maintenance	50	50
(c) Cost of cattle dung as Farm Yard Manure — 61.41 tons @ Rs. 40 per ton	2,456	—
(d) Previous use of cattle dung as fuel in terms of equivalent kerosene (@ Rs. 1.09 per litre) 58.95 tons / 19.83 = 2,973 litres x Rs. 1.09	—	3,240
Total :	2,556	3,340
Annual Income		
(a) Manure — 92.12 tons @ Rs. 50 per ton	4,606	4,606
(b) Gobar gas per year 9,125 cu. metres at the rate comparable to kerosene equivalent of useful heat 5,657.5 litres x Rs. 1.09	6,166	6,166
Total :	10,772	10,772
Less annual expenditure (A)	2,556	3,340
Gross Annual Surplus	8,216	7,432

STATEMENT 6B

Economics of 25M³ per day gobar gas plant

(Capital cost, loan, instalments, etc.)

(See paragraph 4.7)

Capital Investment

	Rs.
Cost of gas holder	5,307
Cost of pipeline and appliances	740
Cost of civil construction	6,753
Total :	12,800
Subsidy @ 25%	3,200
Bank Loan	9,600

Year	Loan received during the year Rs.	Loan outstanding at the end of the year Rs.	Gross surplus as per statement 8A Rs.	Payment of interest @ 14% Rs.	Repayment of principal Rs.	Total outgoings Rs.	Net surplus Rs.
1	9,600	7,649	8,216	1,344	1,951	3,295	4,921
2	—	5,425	8,216	1,071	2,224	3,295	4,921
3	—	2,890	8,216	760	2 535	3,295	4,921
4	—	—	8,216	405	2,890	3,295	4,921
				3,580	9,600		

STATEMENT 7A

Economics of 85M³ per day gobar gas plant

(Annual expenditure income, surplus)

(See paragraph 4.7)

	Previous use of cattle dung as FYM Rs.	Previous use of cattle dung as fuel Rs.
A. **Annual Expenditure**		
(a) Cost of painting gas holder (once a year)	100	100
(b) Cost of maintenance	100	100
(c) Cost of cattle dung as Farm Yard Manure — 210.79 tons @ Rs. 40 per ton	8,431	—
(d) Previous use of cattle dung as fuel in terms of equivalent kerosene (@ Rs. 1.09 per litre) 202.356 tons / 19.83 = 10,204 litres x Rs. 1.09	—	11,122
Total :	8,631	11,322
B. **Annual Income**		
(a) Manure — 316.18 tons @ Rs. 50 per ton	15,809	15,809
(b) Gobar gas per year 31,025 cu. metres at the rate comparable to kerosene equivalent of useful heat 19,235 litres x Rs. 1.09	20,966	20,966
Total :	36,775	36,775
Less annual expenditure (A)	8,631	11,322
C. **Gross Annual Surplus**	28,144	25,453

STATEMENT 7B

Economics of 85M³ per day gobar gas plant

(Capital cost, loan, instalments, etc.)

(See paragraph 4.7)

Capital Investment

	Rs.
Cost of gas holder	16,523
Cost of pipeline and appliances	5,582
Cost of civil construction	16,695
Total :	38,800
Subsidy @ 25%	9,700
Bank Loan	29,100

Year	Loan received during the year Rs.	Loan outstanding at the end of the year Rs.	Gross surplus as per statement 7A Rs.	Payment of interest @ 14% Rs.	Repayment of principal Rs.	Total outgoings Rs.	Net surplus Rs.
1	29,100	20,640	28,144	4,074	8,460	12,534	15,610
2	—	10,995	28,144	2,889	9,645	12,534	15,610
3	—	—	28,144	1,539	10,995	12,534	15,610
				8,502	29,100		

The economics have been worked out both on the basis that the farmer uses the cattle dung exclusively as farm yard manure and also where he uses it exclusively as dung cake for fuel. The statements for each plant size are divided into two parts, Part A and Part B. Part A of each statement shows the annual expenditure, income and gross surplus from the plant of each size, while the details about the capital cost, repayment of annual instalment and the net surplus are given in Part B for each plant size. Table 6 below gives a summary of the annual expenditure, income and gross surplus for plants of different sizes, as furnished in statements 1A to 7A referred to above.

TABLE 6

Plant size (c.mts.)	Minimum number of cattle required	Annual expenditure when cattle dung is used as		Annual income by way of gobar gas and gobar gas manure	Gross annual surplus when dung is used as	
		FYM	Fuel		FYM	Fuel
		Rs.	Rs.	Rs.	Rs.	Rs.
2	3	287	346	843	555	497
3	4	396	537	1294	898	757
4	6	493	618	1723	1230	1105
6	10	782	878	2589	1897	1711
8	15	886	1137	3447	2561	2310
25	45	2556	3340	10772	8216	7432
85	140	8631	11322	36775	28114	25453

The various items of the summary Table 6 are briefly discussed below:

(a) *Annual expenditure*

Unlike capital investment in other schemes for agricultural development, the operating cost for running a gas plant is the minimum and comprises (i) the cost of painting, (ii) maintenance cost, (iii) cost of cattle dung as farm yard manure and (iv) cost of cattle dung as fuel.

(i) Cost of painting

The cost of painting the gas holder once a year has been taken at an average rate of Rs. 50 per year for all sizes of plants.

(ii) Maintenance cost

A flat rate of Rs. 50 per annum has been taken for all sizes of plants as the cost of replacement of valves, appliances, hose-pipes, cleaning, etc.

(iii) Cost of cattle dung as farm yard manure

The input cost of cattle dung as farm yard manure has been computed at Rs. 40 per ton as the market rate. The market rate may, however, vary from place to place depending upon the demand for farm yard manure in different parts of the country. Therefore, while computing the value of this input, the rate at which the farm yard manure is locally available should be taken into account.

(iv) Cost of cattle dung as fuel

The cost of cattle dung has been computed on the basis of previous use of cattle dung as fuel in terms of equivalent kerosene at the controlled rate.

(b) *Annual income*

The income derived by operating a gobar gas plant arises from two sources viz. (i) gobar gas manure and (ii) gobar gas.

(i) Income from gobar gas manure

The KVIC has valued the gobar gas manure at the rate of Rs. 50 per ton. This rate is based on the market rate. The Group observed in the course of its visits that the rate varies widely from State to State and within a State from place to place depending upon the demand in surrounding area. While working out the income from this source, the rate prevailing in the locality will have to be taken into account in each case. Further, the gas and manure production estimates by the KVIC may have been over estimates because no allowance has been made for periods during which the plants remain inoperative during maintenance.

(ii) Income from gobar gas

Similarly, income from use of gas has been taken by the KVIC on the basis of the gas production per plant at full rated capacity at a price comparable to kerosene of equivalent useful heat. Here also, the income actually derived will very much depend on the farmer's ability to utilise the gas (it may not be possible for all households to use up all the gas every day all the year round), facility to transport the gas, etc. Further, many farmers do not perceive the advantage of gas in terms of saving in kerosene. They often use agricultural wastes and fuel wood available cheaply or free, from the nearby forest. It would, therefore, be difficult in such cases to attribute a price to these. Also the quantity of gas produced varies seasonally. Thus the use of kerosene cost in valuing gas production will not always be realistic. Therefore, while computing the income from this source, account will have to be taken of the above factors.

(c) *Gross annual surplus*

The gross annual surplus represents the excess of annual income over the annual expenditure for each size of plant. The Group would like to stress that the gross surplus in respect of all sizes of plants particularly larger ones though very comfortable, does not, however, represent actual cash inflow but an estimated income unlike in the case of cash income generating investments like those in milch cattle, poultry, minor irrigation, etc. This aspect should be kept in view while considering the repaying capacity of a borrower in respect of a gas plant. In the case of financing milch cattle, poultry, minor irrigation, etc. it is generally the practice of the financing banks to permit retention of about one third of the gross annual surprlus for the betterment of the borrowers and utilise the remaining two thirds for repayment of loan instalments. However, in the case of gobar gas plants, the Group is of the view that it will be necessary to permit retention of about half of the gross annual surplus for use of the borrower instead of the customary one third. The balance may be utilised towards repayment of the loan instalments. This view has been taken for the following reasons:

(i) The gross annual surplus is merely an estimated income and does not place liquid cash in the hands of the borrower.

(ii) The borrower will have to arrange for repayment of the loan from his general funds and may find it difficult to meet his commitment towards repayment of the loan instalment.

(iii) The investment in gas plant is not based on the borrower's felt need as is in the case of his other development investments in agriculture.

(iv) The programme of installation of gobar gas plants is yet to pick up. Keeping in view the national objective of increasing the alternate source of fuel and fertiliser, if a take-off stage is to be reached soon, a positive incentive by way of permitting the retention of more than the usual part of the gross annual surplus would be necessary.

In view of the foregoing considerations, the Group feels that while working out the repayment schedule of the borrowers, the financing banks should take into account only about half of the gross annual surplus as worked out on the basis of the economics.

4.8 Table 7 gives a summary of the details of capital cost, repayment of annual instalments and the net surplus that will be available to the borrowers for different sizes of plants, as furnished in statements 1B to 7B referred to in paragraph 4.7.

TABLE 7

Plant size (c.mts.)	Capital investment Rs.	Bank loan Rs.	Period of repayment (years)	Annual equated instalment Rs.	Net surplus Rs.
2	2332	1749	12	309	246
3	3016	2262	10	434	464
4	3360	2420	7	564	666
6	4175	3132	6	805	1002
8	5000	3750	5	1092	1469
25	12800	9600	4	3205	4921
85	38800	29100	3	12534	15610

(i) Capital Investment

The components of the capital investment required by the farmer comprise cost of gas holder, pipeline and appliances and cost of civil construction (digester). The KVIC estimates for different sizes of gas plants are based on the Central P.W.D. rates. On the basis of the available reports (confirmed by plant owners during the Group's field visits), the rates adopted by the KVIC are considerably lower than the prevailing rates at which the various components of the investment could be purchased or constructed. While estimating the amount of capital outlay for this investment, the prevailing market or controlled rates for various components should be taken into account. In other words, the cost of a gas plant should be determined on the basis of the actual cost estimate prevailing in the area.

(Ii) Bank loan

Every person constructing a gobar gas plant gets 25% of cost as subsidy, helping him to reduce his capital outlay to that extent. Besides the amount of subsidy, we have not taken any further amount by way of borrower's down payment (margin money) in arriving at the amount of bank loan. The reasons why this has not been done are discussed in chapter VII. In arriving at the amount of bank loan required for a gas plant, therefore, the amount of subsidy should be deducted from the total outlay.

(iii) Interest rate

Interest on bank loan has been calculated at 14% per annum on the basis of the average of the rates charged by commercial banks which have financed the installation of gobar gas plants. The rates of interest at present charged by the commercial banks vary between 10.5% and 17%. If, as recommended by us in chapter VII, all banks treat the financing of gobar gas plants as

priority sector advances and charge concessional rate of interest, the annual loan instalment of the borrowers will be reduced to the extent of reduction in the interest rate and the period of repayment of loans will also be reduced accordingly.

(iv) Period of repayment

On the basis that 50% of the gross annual surplus from the plant will be utilised for repayment of loan instalments as discussed earlier, the repayment period of the entire loan in the case of gas plants with sizes varying between 2 and 6 cubic metres (which constitute the bulk of the plants at present in use), will extend beyond 5 years, while in the case of plants of larger sizes the loans can be repaid within 3 years and less.

As mentioned in the preceding paragraph, if the banks charge concessional rate of interest on loans for gobar gas plants, the period of repayment of loans could be less than that worked out by us.

Parameters used

4.9 Various parameters used in working out the expenditure and income as per statements 1A to 7A on pages 27 to 39 are given in Annexure 4. The parameters have been worked out by the KVIC.

4.10 The Group has not attempted to work out the internal rate of return on investment in gobar gas plants of various sizes in view of the difficulty in realistically quantifying the savings actually made by plant owners. Recently the Indian Institute of Management, Ahmedabad has carried out a study on gobar gas plants in Gujarat. The study has brought out the internal rate of return on investment for plants of various sizes. It will be useful to show the results in the following table 8.

TABLE 8

Size of the plant (c.mt.)	Economic analysis (percentage)		Financial analysis (percentage)	
	Using KVIC estimates	Using sample data of the study	Using KVIC estimates (with 25% subsidy on initial cost)	Using sample data of the study (with 25% subsidy on initial cost)
2	19.99	13.53	23.23	19.04
3	26.39	21.45	35.57	29.35
4	38.23	33.34	51.15	44.95
6	41.65	37.53	55.63	50.44
7	46.04	40.53	61.43	54.38
8	53.80	50.90	71.67	68.04
10	51.66	45.66	68.85	61.12
15	53.97	52.15	71.93	69.71
35	63.94	58.97	85.18	78.73

The analysis shows that the average earning on the investment increases with an increase in the size of the plants (with the exception of 10 cubic metre plants). The Institute's study has also brought out the cost-benefit ratio of plants of various sizes. The analysis shows that the benefit-cost ratio was positive in the case of plants of all sizes with 10% and 13% rate of discount. The benefit-cost ratio increased with an increase in plant size.

Operation of plants on co-operative basis

4.11 The economics worked out by us show that a large sized gas plant is more economical than a small sized one. With a view to availing of the economies of size and ensuring fuller utilisation of gas and manure, some people have suggested installation of large-sized gas plants and their operation through cooperative societies covering groups of farmers. They have also indicated that the formation of cooperative societies specially for the purpose may solve many of the organisational and technical problems,

besides increasing the coverage of beneficiaries particularly the small farmers, under the programme. The Group is of the view that before a co-operative organisation is considered for the purpose, it will be necessary to satisfactorily resolve certain problems, mainly organisational and managerial, associated with the co-operatives. The major management problem in a cooperative society will be the manner of distribution of gas and fixation of its price. The society could cover a limited number of households which are clustered in a village; otherwise booster pumps will be needed to reinforce the pressure sufficiently to cover a large area. Having ensured a regular supply of gas, it will be necessary to regulate the consumption of gas by each household for accounting; this will be possible by installing not more than requisite number of points with specific discharge capacity, in each household. Arrangements will also have to be made for receipt of fresh dung from members and distribution of digested slurry among them. Since this will be a new type of cooperative venture, further details will need to be worked out for the day to day operation by members themselves.

CHAPTER V

OPERATIONAL PROBLEMS

5.1 Till the end of June 1975, a little over 14,000 gobar gas plants of different sizes were in operation in various parts of the country. Information regarding the operational efficiency of these plants was not available. However, quite a few problems particularly of a technical and organisational nature have been experienced by the plant owners. While the technical faults could be attended to promptly by a proper follow-up service, other organisational problems have also been reported which are obstructing the demand for large scale installation of plants in the rural areas. These operational problems need to be tackled effectively and urgently if the pace of the programme has to be accelerated during the next few years as envisaged under the Fifth Five Year Plan.

To facilitate analysis, the operational problems reported to and observed by the Group in the course of its field visits may broadly be grouped under three categories—technical, socio-economic and organisational.

Technical problems

5.2 The gobar gas plant in use in the country is of recent origin and, as mentioned earlier, until recently not many plants were in existence. There are a number of technical defects or shortcomings which need constant research work for their removal. Some of these problems are persisting like rapid corrosion of the gas holder, wide seasonal variation in gas production, non-availability of components, cracking or bursting of digester, etc. We have highlighted some of these defects in the following paragraphs in the hope that research will soon find solutions to these problems.

(i) *Corrosion of gas holder and pipeline*

A major technical problem relates to the fast corrosion of gas holder and pipeline due to rusting. The rusting and

the corrosion cause perforations in the gas holder, making the plant inoperative. This problem is more acute in coastal areas due to greater salinity. To prevent or minimise rusting, suggestions have been made in various quarters. The gas holder may at frequent intervals be cleaned and painted with tar or a mixture of gobar and oil or wax or cement and covered with a gunny bag. This adds to the maintenance cost which many farmers may not be able to bear. It has also been suggested that the gas holder be manufactured with such materials as thick iron sheets, alkathene, polythene, plastic, R.C.C. or galvanised sheets. In other words, the present gas holder may be replaced by some non-corrosive or rust proof and more durable one. It is even suggested that a fibreglass cover be fixed around the holder. This problem requires thorough investigation through research.

(ii) *Seasonal variation in gas production*

There is a definite drop in gas production by as much as two thirds of the normal in winter season. The gas production also drops to a certain extent during monsoon. The problem is being tackled in two ways, viz. (a) physical and (b) chemical means.

(a) The physical means suggested are insulation by covering the whole plant with alkathene or by providing a double wall in the digester and filling the inner space with insulating material; heating the slurry by using hot water to mix the cattle dung. For the latter, a suitable solar heater has to be developed; heating the digester by incorporating coils in the design within the digester or along the wall, through which hot water or steam is circulated. According to Shri Ram Bux Singh of the Gobar Gas Research Station, Ajitmal, Etawah, U.P. though both the heating and the agitating of the slurry 'appear beyond the means of a small rural plant owner', it is possible to do both by making use of 'the feedback principle' according to which a part of the gas produced is mixed up for heating the slurry and another part is used for providing power required for pumping the slurry. The resulting enormously increased rate of generation of gas more than compensates for the gas thus used up.

(b) The chemical means suggested are the addition of cattle urine, chopped up straw, finely powdered bajra and leaves and one per cent urea in the cattle dung being fed into the digester.

These devices work well where the winter is not severe but are not so successful when the temperature drops very low. Finding a solution to this problem is most vital for the future development of bio-gas production in the colder regions.

(iii) *Durability of various components of gas plants*

There have been reports of frequent breakdown of various components of gas plants. The breakdown of the central guide pipe and the bursting of the hose pipe have been more common. The possible solution is the replacement of the components but this increases the recurring expenditure. It may be worthwhile to devise a model which is free from this problem. This also falls within the area of research.

(iv) *Problem with the digester*

It has been reported that the digester wall cracks sometimes due to either hollow space inside, or more pressure of the gas than the wall can withstand. As a preventive measure, special bricks of cement, sand and iron rods are used while constructing the walls. This does, however, increase the cost of construction.

(v) *Well mixed slurry*

For efficient generation of gas it is absolutely essential that the slurry in the digester should be well mixed. The formation of scum obstructs the release of gas from the slurry and causes blistering of the surface of the gas holder thereby reducing its life. This can be prevented by occasional stirring of the slurry in the digester necessary to clear the scum. This occasional stirring is done at present by a stick or an iron rod or by simply rotating the holder by hand. These are, however, not very efficient and clean methods. A suitable device should be found out to prevent the formation of scum.

(vi) *Inlet and outlet of gas plant*

The inlet and outlet for slurry often get choked or blocked disturbing the fermentation process. The inlet and outlet pipes therefore need to be checked regularly and cleared by a stick or a rod and a flush of water in the slurry. The use of polythene instead of asbestos for making the inlet and outlet pipes may be a solution. But this adds to the cost of the plants.

(vii) *Accumulation of water in the pipeline*

Along with the gas, steam also gets generated. This causes water accumulation in the gas pipe. To solve the problem, it has been suggested that an extra tap should be provided at the end of the burner; this tap would help remove the water from the pipe. Alternately the pipe conveying the gas and attached immediately to the holder should be fixed at a slight angle rising above the holder. This would drain back the collected water to the plant itself. The fixing of the additional tap would, however, add to the cost of the plant.

(viii) *Gas burner*

When the gas burns, carbon is formed and deposited on the inner surface of the nozzle of the burner. If an arrangement could be devised by which the upper part of the burner is eliminated, the nozzle could be cleaned of carbon deposit whenever required.

(ix) *Gas distribution and supply*

Methane gas does not have enough pressure to be transported by pipe over long distances. This limitation makes the widespread use of gas difficult. Research needs to be carried out to devise means for carrying the gas to longer distances including by liquefying it and transporting it in cylinders.

(x) *Engineering technology*

For construction of plants, strategic materials like cement and steel are required. Besides being costly, these materials are often in short supply and not available at controlled rates. Research will have to be carried out to evolve new plant designs and

find out substitute materials locally available or prefabricated for construction of plants at low costs.

Socio-economic problems

5.3 Like technical problems, the handicaps of a socio-economic nature also have resulted in a slow progress of the programme. The handicaps are briefly discussed below.

(i) *Low priced durable gas plants*

At the present cost, it is difficult for the majority of the farmers to go in for gas plants. To cover a wider section of the farmers, the initial cost of installing the plants has to be brought down substantially. For this purpose, suggestion made earlier for evolving new designs and utilisation of substitute materials locally available for the construction of gas plants may have to be considered.

(ii) *Availability of land for installation of plants*

It is observed that in certain parts of the country, village houses are often clustered with no suitable land in the backyard of the homesteads of the farmers for installing gas plants. This will exclude a large number of farmers from the benefits of gas plants. In this context, it may perhaps be necessary to consider setting up gas plants on a cooperative basis to which reference has been made in paragraph 4.11.

(iii) *Collection of dung*

Since cattle graze in the open rather than in fenced areas or pens during large part of the day, dung collection is a laborious and, therefore, costly process. Quite often sufficient dung is not collected and fed into the digester causing insufficient production of gas. This should lead the researchers to find out other agricultural wastes which could be used additionally to produce gas.

(iv) *Lack of felt need for gas plants*

The basic problem relating to the popularisation of the programme seems to be the lack of felt need among the farmers. There is no popular demand for these plants. On their own very few farmers opt for gas plants and whenever they agree to set up a plant, it is because of the persuasion and also the lure of subsidy and loan facilities. From the farmer's point of view, there is no immediate need for a gas plant because the traditional alternative source of energy (atleast for cooking) is available to him and the gas plant does not generate any direct cash income. It will therefore be the job of the extension staff to convince the farmers about the benefits of gas plants so that a demand for these could be created among them.

(v) *Criteria for determining the plant size*

One of the factors in determining the size of a gas plant for loan and subsidy is the number of cattle heads possessed by a farmer. A suggestion has been made that other factors like family size, socio-economic status, ability to buy dung, etc. should also be considered.

Organisational problems

5.4 On the basis of the reports available and during the course of the field visits the Group has come across organisational/technical problems in the construction and operation of the gas plants installed in different parts of the country. These problems may not by and large arise if there is proper organisational support. These problems are mentioned below in brief and have also been dealt with in greater detail in the subsequent chapter on organisational set-up.

(i) *Lack of awareness*

There is general lack of awareness on the part of the various agencies involved in the implementation of the programme in some States — KVIBs, financing banks, and State Governments. Although the KVIBs in a few States have been

actively involved in the programme with the backing of the State Governments and the financing banks, the staff available with these Boards are not exclusively attached to the gobar gas work and are very much limited for the task. The KVIBs being the counterparts of the KVIC in the States should be entrusted with the programme in all the States. Suggestions have been made in a subsequent chapter for the proper strengthening of the staff of the KVIBs for the purpose. It was observed that although the branches of the commercial banks had generally been authorised by their head offices to go ahead with the financing of the plants, a number of branch officials did not view the programme with a sense of urgency it deserved. Many of the branch officials of the banks had not even seen a plant. Except in a few States, the Government officials in the Departments of Industries and Agriculture did not also seem to be conscious of the importance of the programme. The extension staff of the Departments of Industries and Agriculture were also not involved in popularising the programme.

(ii) *Lack of follow-up service*

There have been several complaints of a lack of post construction follow-up service for proper maintenance and repair of plants. The Group noticed that at many centres the complaints for minor repairs had not been attended to causing stoppage of operation of the plants for long periods.

(iii) *Lack of availability of technical guidance and help*

In view of the limited staff of the KVIC and KVIBs, the required technical guidance for the installation of the plants in certain cases was not forthcoming to the farmers and the financing banks.

(iv) *Supply of raw materials and plant components*

The Group observed that in certain places, materials like cement, steel and component parts for construction of plants were not easily available through a single agency. The farmers had

to spend considerable time and money to secure all the requisite items. This lack of regular supply of materials and plant components was responsible for the slow progress of the programme. Detailed suggestions have been made to overcome this problem in the next chapter on organisational set-up.

(v) *Prompt sanction and disbursement of loans*

Delay has been reported in the sanction of loans by the financing banks and the consequent delay in the installation of gas plants. During the field visits the Group discussed the matter with the concerned banks and was given to understand that in a majority of cases the KVIC/KVIBs sent to banks merely a list of the proposed borrowers instead of their applications. In certain other cases, concerned district officers of the KVIBs had not forwarded the applications and even where the applications had been sent, the requisite technical certificates had not been forwarded. Consequently there was delay in the sanction of loans.

(vi) *Lack of co-ordination among the various agencies*

One of the major problems noticed was the lack of co-ordination among the various agencies involved in the implementation of the programme. As a result, the progress was slow. This aspect has been discussed in detail in the next chapter on organisational set-up.

Concerted efforts needed

5.5 The various operational problems — technical and others — noticed at present in the working of the gas plants, as discussed in the preceding paragraphs, bring to focus the deficiencies which are impeding the spread of a larger number of plants all over the country. They do highlight the need for concerted efforts in the immediate future on the part of all the concerned agencies to rectify the deficiencies. We have highlighted the problems particularly for the reason that it will be extremely difficult to attract

investment in gobar gas plants except by offering inducements to the farmers. The best inducement that can be offered is a plant which gives complete satisfaction to the farmer at all stages. Of the problems discussed, the technical ones need to be tackled by different research bodies urgently. Other operational problems — organisational, socio-economic, etc. will, however, have to be resolved by a greater effort by the agencies like KVIC, KVIBs, financing banks, State Agriculture and Industries Departments, etc. through proper co-ordination.

CHAPTER VI

ORGANISATIONAL SET UP

Need for an integrated structure

6.1 For effective and expeditious implementation of the programme fixed by the Government of India for installation of gobar gas plants in the country, an integrated infrastructure capable of providing all support needed for its execution is a necessary pre-requisite. Such an integrated infrastructure has necessarily to involve various agencies for (a) providing technical expertise and follow-up service, (b) supplying materials and components required for installation of the plants, (c) rendering extension service, and (d) providing financial support.

Existing infrastructure

6.2 The programme is being implemented at present with the assistance of the following infrastructure.

Agency	Nature of support
(i) KVIC	Technical guidance and help before, during and after the installation of plants
(ii) KVIBs	Propaganda, publicity and extension work, training, research and development
(iii) Commercial banks	Provision of financial assistance by way of loans
(iv) Service agencies — Agro Industries Corporations, Agro service centres, private entrepreneurs, institutions	Supply of raw materials and plant components, fabrication of gas holders, civil construction work

(v) Extension Agencies — concerned departments of State Governments—Agriculture, Industries and Development	Publicity, propaganda, canvassing for popularisation of the programme among the farmers

The services rendered by the different agencies and the constraints they are subjected to are briefly discussed in the following paragraphs.

KVIC

6.3 The KVIC is a national level statutory organisation with headquarters at Bombay. It is principally devoted to the growth and development of khadi and village industries. In view of its national character and involvement in the rural areas, the Planning Commission has entrusted the scheme for development of gobar gas plants to the KVIC as part of its rural development programme.

A chart showing the organisational set up of the KVIC in relation to the gobar gas programme is given in Annexure 5.

The KVIC functions on a national level. It organises and participates in exhibitions, seminars, meetings, fairs, etc. It also brings out publicity material/literature, films, etc. to propagate the benefits of gobar gas plants to as large a number of rural people as possible.

In regard to the provision of technical assistance and guidance, the KVIC has accepted an overall responsibility to render such assistance/guidance for construction of individual plants of any size in any part of the country. For this purpose the KVIC has established a directorate of gobar gas scheme under the Deputy Chief Executive Officer (Village Industries) with two Assistant Directors in charge of development and research respectively. The development work is further distributed among 4 development officers, one at headquarters and 3 in each of the States of Andhra Pradesh, Maharashtra

and Madhya Pradesh. In all major States the KVIC has posted technical staff, the strength of which varies in relation to the availability of potential for work as well as the work on hand. The staff include assistant development officers, foremen, biochemists, draughtsmen and mechanics. Besides providing technical guidance and supervision over construction of plants, the KVIC has also undertaken the responsibility of providing training facilities for personnel who could supervise the construction work. The KVIC also prepares candidates to work independently as supervisors and guides them to look after the construction of plants on payment of specified fees. Currently, about 150 such non-employee supervisors are working for the KVIC as against its own technical staff of 70.

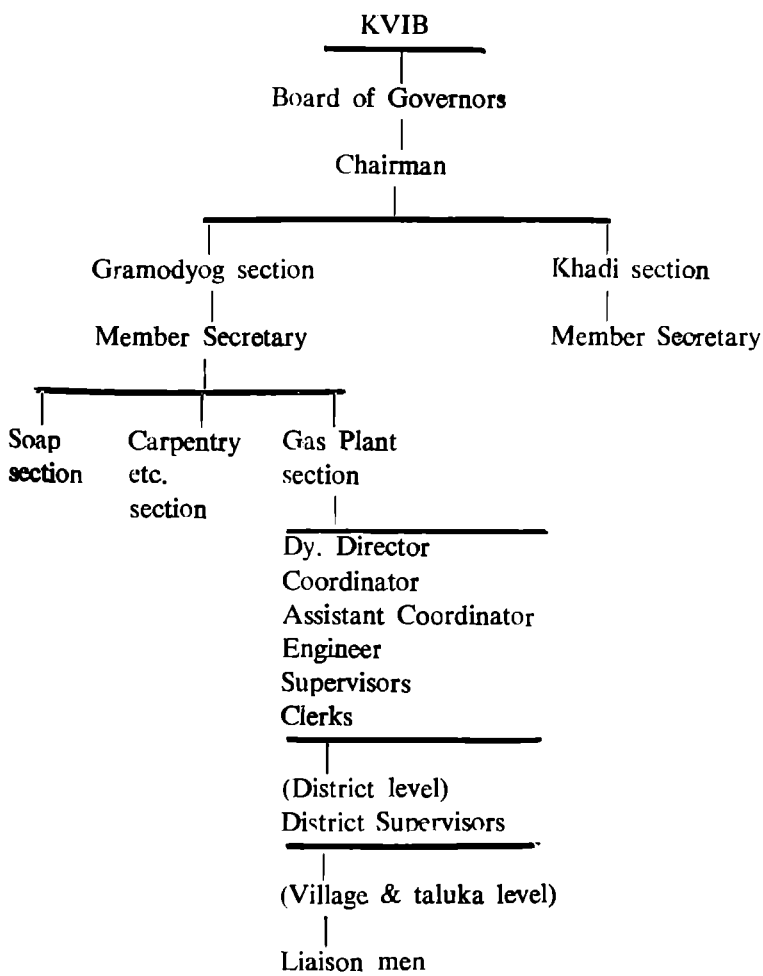
The technical assistance and guidance expected from the KVIC take the form of providing feasibility reports for the financing banks, supervising the construction of the gas plants at various stages, furnishing completion certificates to the financing banks to claim subsidy, providing post installation service in cases where plants go out of order, contacting the borrowers at periodical intervals for providing technical assistance and also providing training to personnel of various agencies involved in the implementation of the scheme. With the limited technical staff available with it, the KVIC has not been able to post adequate hands in the various States to render the necessary technical assistance and guidance which is its primary responsibility under the programme. If the KVIC must discharge adequately the responsibility entrusted to it under the programme, it will need not only to review its requirements of technical staff, State-wise, on a realistic basis and strengthen the staff suitably, but also to reorganise on a sound footing the entire extension service it is expected to provide throughout the country under the programme.

KVIBs

6.4 The counterparts of the KVIC at state level are the 22 KVIBs which are also statutory bodies created by the State Governments for promotion and development of khadi and village industries. Some of the Boards have been additionally entrusted with the task of promoting the gobar gas scheme. It is reported

that in certain States like Haryana, Gujarat and Maharashtra, the Boards are actively working in close collaboration with the KVIC and performing a good deal of extension and other work in connexion with the gobar gas scheme.

The organisational pattern of the KVIBs in the various States is shown in the following diagram:



The organisational set up of the KVIB of each and every State was not available with us. The above diagram gives only a broad indication of the organisational pattern in a developed

State. In course of the discussions during the Group's field visits to some of the States, we were given to understand that quite a number of the Boards are yet to create separate divisions for the gobar gas work. Further, there was no separate supervisor for each district in some of the States. The available district supervisor attends to the entire work relating to 22 village industries including gobar gas plants, under his charge. Our field visits amply demonstrated that the extremely limited staff of the KVIBs in most of the States will not be in a position to provide technical support for different aspects of the plants before, during and after their installation. Presently, the financing banks have entirely to depend on the KVIC/KVIB staff for the technical expertise. In view of the importance attached to the gobar gas programme, it would be necessary for each State Government to take stock of the situation in regard to the ability of the KVIB in providing technical assistance and guidance and also imparting training for building up personnel for various other agencies. If necessary, the State Governments should suitably strengthen the staff of the KVIBs as early as possible taking into account the potential demand. Unless the KVIBs are actively involved in the programme in each State and separate divisions exclusively for gobar gas work created with suitably augmented staff, it will not be possible for them to meet the demand under the programme for technical assistance and guidance and function as complementary to the KVIC. In fact, the KVIB in each State should be made primarily responsible under the programme for rendering technical assistance and guidance.

Financing institutions

6.5 Financial institutions providing assistance by way of loans comprise broadly (a) commercial banks and (b) cooperative banks consisting of (i) state and central cooperative banks and primary credit societies and (ii) land development banks.

(a) *Commercial banks*

Institutional finance for setting up of gobar gas plants in the country is at present largely provided by the commercial banks. The commercial banks commenced financing the gas plants from

the end of 1973 and in one and half years ended June 1975 they have financed over 7,800 plants involving loans aggregating Rs. 2.17 crores. The head offices of many commercial banks have framed certain terms and conditions for financing gobar gas plants and have instructed their branches to go ahead with the financing of such schemes. Since the entry of commercial banks in the field of agricultural financing in 1968-69, most of the banks have built up their technical staff and have now agricultural officers for their branches in the rural areas. As at the end of June 1975 the total number of rural branches of commercial banks was 6,806 forming about 36% of the total number of branches at 18,730. If the number of semi-urban branches (which also undertake business of agricultural financing) at 5,569 is also taken into account, the two categories would account for about 66% of the total branches. The commercial banks make direct advances for agricultural development. These advances include crop loans, marketing finance, term lending for minor irrigation, land development, land reclamation, farm mechanisation, horticulture, etc. Most of the branch managers have adequate discretionary powers to grant all types of agricultural advances. The banks have also built up working procedures for agricultural lending. In view of the growing involvement of commercial banks in agricultural finance it will not pose any problems to them to extend larger support to the gobar gas programme. In this task, however, the banks will have to depend heavily, at least in the initial stages, on the technical guidance and assistance of the staff of the KVIC/KVIBs till such time as they build up the technical expertise on gobar gas plants of their own. The Group does not suggest augmentation of staff of the commercial banks at branch level, as it considers that the present staff available for agricultural financing will be able to handle the financing of gobar gas plants as well.

During the course of our field studies/visits, we noticed in certain States that some of the rural and semi-urban branch managers had no occasion to see a gobar gas plant. Further, there were certain branches in the rural and semi-urban areas where this item of activity did not receive due importance as a result of which very little interest was shown by them in financing the plants.

(b) *Co-operative banks*

(i) State and central co-operative banks and primary credit societies

The existing cooperative banking structure in the country has a vast net work of organisation for providing financial assistance by way of loans to meet the credit needs of the cultivators. The short and medium term cooperative credit structure as on 30 June 1974 comprised 26 state cooperative banks, 341 central cooperative banks with 4,832 branches and 1,53,808 primary agricultural credit societies. These cooperative institutions provide loans to farmers to meet their short and medium term credit needs for agricultural development. These institutions have built-in machinery for extension work, canvassing for loans, collection of loan applications, disbursement of loans and their recovery. They have built up over the years a system of supervision and follow-up. Lending procedures have also been established. It will not be difficult for the cooperative institutions to implement the programme as part of their normal agricultural financing.

The cooperative banks were advised by the Reserve Bank of India in the middle of 1975 to finance the gobar gas plants as medium-term lending. However, the Group did not have information about their financing the programme.

(ii) Land development banks

The organisational structure of land development banks as on 30 June 1974 comprised 19 state land development banks, 857 primary land development banks/1211 branches of state primary land development banks spread over the whole country. These banks provide long-term credit to farmers for agricultural development. They possess, by and large, technical expertise for term lending for agricultural development schemes. Lending procedures have been established over the years. The banks have also built up machinery for extension work, canvassing for loans, collecting loan applications, disbursement of loans, their recovery, supervision and follow up. However, these

banks have not so far made any advances for gobar gas plants as the Reserve Bank of India have advised them that no long term credit need flow for financing the plants. If on the basis of the Group's findings, these banks are also required to take up the financing of gas plants, the present organisation will be adequate for the purpose.

Service agencies

6.6 For an effective support to the programme, it will be necessary to ensure availability of services, all over the country, for regular supply of materials like bricks and cement for the construction of the digesters, steel sheets for fabrication of gas holders, gas pipes and other appliances at controlled rates, their transportation to the plant sites, and arrangements for the construction work. Locationally, these services will necessarily have to be as near to the villages as possible but not in any case beyond the taluka/district level. In the past whenever strategic materials like cement and steel sheets had become scarce, the KVIC/KVIBs made arrangements with the concerned departments of the State Governments for allotment of adequate quotas. In the course of our field visits, we have seen that these services are being provided by private individuals/firms, State agro industries corporations/institutions, and various agro service centres run by unemployed technicians. The Group also observed that in some States, there was a tie-up between the KVIBs and these service agencies in regard to the supply of gas holders and other appliances, construction of plants and provision of post-installation services. The Group, however, noticed that in most of the States, the arrangements for post-installation services were practically absent, as a result of which the farmers were not getting full benefit of the gas plants. It is in this context that suggestions were made in certain quarters that, for ensuring regular supply of materials at fair prices for new plants and for making available the component parts for follow-up services, it may be worthwhile to identify a single agency for an area, which could supply materials, manufacture standardised components/ parts and also provide technical services. Such an organisation could be the State agro industries corporations which have now been set up in all the States. Such corporations are already

undertaking manufacture and supply of various agricultural machineries and implements and providing, through a number of centres, follow-up services, and maintenance facilities in connexion with the execution of schemes of agricultural development. We suggest that for the implementation of the gobar gas programme, the facilities available from these corporations should be made use of.

Extension agency

6.7 One of the reasons for the tardy progress in the spread of the gobar gas scheme in the rural areas, in the Group's view, is inadequate publicity campaign about the programme. In fact, in some of the States visited, it was noticed that a number of farmers were not even aware of the existence of plants and their benefits. Besides providing the important input by way of technical guidance and assistance, the KVIC is mainly responsible for the extension work. With the increasing demand on the KVIC for technical assistance, it has not been possible for it and the KVIBs, with their limited staff, to intensify the extension work. In view of the importance of the programme and the failure of the KVIC to fulfil its responsibility for extension work, it will be necessary at this stage to entrust the extension work for the programme to an additional agency. In this task the agency has necessarily to be such as has already roots and organisational set-up in villages. We recommend that the services of the extension staff of the agriculture departments of the State Governments at the block level would be useful for the purpose. As part of their overall extension work, the extension staff will propagate the need for gobar gas plants for the benefit of the farmers, canvass loan applications and ensure that these applications together with feasibility reports are submitted to the nearest branch of a bank.

Co-ordination among various agencies

6.8 Till now the promotion and implementation of the programme has by and large been the responsibility of the KVIC. The field visits and the discussions held by the Group demonstrated that in the wake of the spurt received by the programme during the last two years following the entry of the commercial banks in this field, the staff available with the KVIC/KVIBs

were wholly inadequate to attend to a variety of their responsibilities. If the programme has to be pushed forward a number of agencies will have to work along with the KVIC and the activities of all these agencies will have to be properly co-ordinated. The ability of the banks to disburse loans increasingly under the programme will largely depend directly on the capacity of the KVIC and other agencies to provide the necessary technical support. Similarly, the installation of an increasing number of gas plants will depend upon the ability of the service agencies to provide materials, gas holders, construction and post-installation service and supply spare parts. Also, acceleration of the programme can be achieved with the publicity work of the extension staff of the State Governments. Currently, a co-ordinated approach to the whole programme could nowhere be seen in some of the States visited by the Group. At present Co-ordination Committees for the agricultural development programmes are already functioning in each State at block, district and State levels. These Co-ordination Committees should at their periodical meetings review the progress made under the gobar gas scheme in the respective areas, discuss the various technical and operational problems faced in its implementation and offer solutions to overcome the problems.

Suggestions for strengthening the existing infrastructure

6.9 On the basis of the observations made in the foregoing paragraphs, we are making the following suggestions with a view to improving and strengthening the existing infrastructure for achieving the desired results under the programme. While the Group considers that the existing organisational set-up in the various States will generally be adequate for implementing the programme, it will be necessary to fill up certain gaps to enable the existing set-up to function as an integrated structure.

(a) *Technical services*

(i) KVIC

It would be necessary for the KVIC to continue to be the apex body at the national level and look after the promotion, development and implementation of the programme. It should

primarily be responsible to provide technical know-how and guidance as at present, carry on propaganda and promotional work, undertake research and development work in bio gas technology and provide the training facilities. For effectively discharging these responsibilities, the technical staff at present available with the KVIC including the independent supervisors trained by the KVIC and working on a fee basis would not be adequate to the task. It is, therefore, suggested that the KVIC should review its existing technical staff strength including non-employee supervisors and take steps to augment it in a phased manner. For this purpose, the KVIC may approach the Government of India, if necessary, for financial assistance.

(ii) KVIBs

Our field visits have revealed that in many States, the weakest link in the organisational set up is the KVIB of the State. Many of the Boards have not yet earmarked staff specially for this work and even where they have so done, the available staff is wholly inadequate to the task. In view of this, the Group suggests that all State Governments should assess the capability of the Boards in the light of the potential for immediate and future needs of the programme and augment technical staff strength of the Boards in a phased manner, exclusively for the gobar gas work. For this purpose, the State Governments will have to make additional financial allocation.

(b) *Financing agencies*

The existing structure of the commercial banks will be able to provide financial support to the programme of gobar gas plants. It will, however, be necessary for all banks to treat this activity on the same priority basis as other agricultural advances.

The cooperative banks will also be able to provide necessary financial support to the programme. The programme can initially be taken up in areas where the cooperatives are functioning satisfactorily. In other areas necessary steps are being taken by the State Governments and the concerned institutions for the rehabilitation and reorganisation of the cooperative credit structure.

(c) *Service agencies*

The Group suggests that the possibility of utilising the agro-industries corporation in each State should be examined to serve as a central agency to supply materials and components for construction, provide technical know-how and service facilities and even to construct plants on a turn key basis. The present arrangements with the private entrepreneurs for manufacture of gas holders, agro service centres run by unemployed technicians for providing post-construction service, and private institutions for construction work as are available in some of the States may be allowed to continue.

(d) *Extension agencies*

The main responsibility for popularising the programme among the farmers would devolve on the extension staff of the agriculture departments of the State Governments. The extension staff should propagate and convince the farmers of the utility of the gas plants, canvass loan applications and ensure their submission to the nearest offices of banks for financial assistance. The State Governments should utilise their publicity departments for popularising the scheme on the same lines as is being done for other schemes like family planning. When the extension work is taken over by the State Government staff, the burden on the KVIC/KVIBs/financing agencies will be lightened and these agencies will be able to devote themselves largely in providing technical/financial assistance and performing other functions assigned to them. These agencies will, of course, continue to lend a helping hand to the extension staff during their field visits.

(e) *Co-ordination*

The effective and speedy implementation of the scheme would depend upon the co-ordination and co-operation among the various agencies involved in the programme. For ensuring maximum co-ordination and co-operation, the various co-ordination committees functioning at present for the agricultural

development schemes in each State should, in their periodical meetings, review the progress of the gobar gas scheme, discuss the connected problems and suggest the steps necessary to overcome the problems. In these committees the representatives of the KVIC/KVIBs should also be included at all levels for participation in the meetings. In view of the importance of the programme, the Agricultural Production Commissioners of the States who already head the State level co-ordination committees may take personal interest in the programme. Further, at the state level the Secretary, Agriculture Department and the collector at the district level should be appointed as the Project Co-ordinators.

CHAPTER VII

FINANCING OF GOBAR GAS PLANTS

Need for institutional finance

7.1 Institutional finance is at present available to the farmers for meeting their short, medium and long term credit requirements for agricultural purposes. It is provided by the commercial and cooperative banking structure, as discussed in chapter VI. While the commercial banks' direct finance to agriculture aggregated Rs. 543 crores as at the end of March 1975, the advances made by co-operative banks, on an average, exceed Rs. 700 crores a year for short and medium term loans and those of land development banks exceed Rs. 150 crores every year. These loans and advances cover wide range of agricultural activities viz. crop raising, marketing produce, minor irrigation, land development, farm mechanisation, fishery, poultry, dairy, plantation, horticulture, etc. In view of this magnitude of banks' involvement in agricultural finance, it will not be difficult for the banks to provide financial assistance to the farmers for installation of gobar gas plants, which should form an integral part of agricultural activities.

7.2 Till the end of March 1974, the Government of India, through the KVIC, provided financial assistance by way of long term interest free loans and subsidy to individuals and institutions for installation of gas plants. As mentioned earlier, despite this financial assistance, the KVIC could succeed in installation of 6,858 gas plants during a period of one decade ended 1973-74. The loans and subsidy amounted to Rs. 178.33 lakhs and Rs. 47.18 lakhs respectively. The progress thus made was limited in the context of the urgent need for speedier implementation of the programme. The Government of India has, however, discontinued loan assistance to individuals since 1973-74. Since then, the financial needs for installation of gas

plants of individual farmers is being met through institutional channel.

Existing arrangements for financial assistance

7.3 Financial assistance for installation of gobar gas plants is provided by the following agencies:

(a) KVIC
(b) Commercial banks
(c) Cooperative banks

The terms and conditions of the financial assistance provided by each type of agency are discussed below.

(a) *KVIC*

As mentioned in preceding paragraph, financial assistance till 1973-74, was provided by Government of India through the KVIC to individuals and institutions for setting up gas plants. The quantum of financial assistance was equal to the cost estimates prepared by the KVIC. For plants of all sizes installed by individuals, a subsidy of Rs. 300 was given. The balance was treated as interest free loan. The loan component was repayable in 10 years in 9 equal annual instalments. If the individual constructed lavatory attached to the plant, a further loan of Rs. 400 was made available to him. If the individual wanted to run an engine with gas from large plant, an additional interest free loan of Rs. 1,200 per H. P. was sanctioned. Such a loan was repayable in 5 years in 4 equal annual instalments. Since 1974 interest is being charged at 4½% per annum on the outstanding balances of loans already advanced. At present the KVIC grants a subsidy @ 25% of the estimated cost of a gas plant to the individuals instead of a flat rate of subsidy.

An attempt was made by us to study the recovery performance in respect of the KVIC loans. However, information regarding yearwise overdue loan instalments in relation to demand was not available. The particulars received from the KVIC regarding the total amount of default in relation to total loans disbursed

showed that as on 31 March 1975, the total amount of instalments defaulted stood at Rs. 4.48 lakhs out of Rs. 179.05 lakhs disbursed till that date, forming 2.5% of total disbursements. State-wise break up of the instalments in default is given in Annexure 6. The reasons for default and the action taken to recover the defaulted amount could not be ascertained.

(b) *Commercial banks*

As mentioned in paragraph 2.6 of chapter II, it was at the meeting convened by the Government of India in Bombay in November 1973 that the commercial banks agreed to extend financial support to the programme of installation of gobar gas plants. This support was to be extended initially in 8 States on the basis of certain targets fixed by the Ministry of Agriculture, Government of India. During one and half years ended 30 June 1975, since the commercial banks commenced financing the gas plants in a number of States, the number of gas plants financed by them has exceeded 7,800. This exceeds the number of plants at 6,858 achieved by the KVIC during a full decade and the amount advanced by banks stood at Rs. 2.17 crores as against Rs. 1.78 crores advanced by the KVIC till 1973-74. The commercial banks have laid down certain procedures for lending under the scheme. On the basis of the replies to the questionnaire issued by the Group soliciting information from the commercial banks on various aspects of the schemes framed and implemented by them, we have tabulated (Annexure 7) the salient features of the schemes of 20 banks. Although replies were received from almost all the banks to whom the questionnaire was sent, we have selected for this purpose 20 banks which have done some work in this behalf. The more important features of the scheme are mentioned below.

(i) Introduction of the scheme : Most of the banks have by and large introduced the scheme as from the beginning of 1974. Only two banks entered the field earlier towards the end of 1973.

(ii) Issue of instructions to branches : While most of the banks have given discretion to all their branches to provide financial

assistance for setting up of gobar gas plants, two banks have been somewhat selective.

(iii) Basis for determining eligibility for loan:

Minimum land holding: Only one bank has reported that for being eligible for bank loan, a farmer should hold a minimum of 5 acres of cultivated land. Other banks have not laid down land holding as criterion for eligibility for loan.

Minimum cattle holding: All banks have stipulated minimum cattle holding as a condition for loan eligibility.

(iv) Basis for determining economic feasibilty: Most banks have adopted the basis for economic viability as laid down by the KVIC. Only one bank has reported that the economic feasibility of a proposal should be worked out by the bank's staff. Five banks have, however, mentioned that in addition to the criteria laid down by the KVIC, they check up the feasibility by independently working out the economics.

(v) Size of the gas plants: The size of the plants financed by the banks varies between 2 and 6 cubic metres. Nineteen banks have financed plants upto the size of 4 cubic metres. Only one bank has financed plants upto 6 cubic metres.

(vi) Down payment: A majority of the banks has reported that the subsidy of 25% provided by the KVIC under the scheme is treated as margin for the loan. No additional margin is insisted upon. Five banks have reported that they have stipulated a margin requirement varying between 10% and 25% but have not indicated whether the same is being collected in cash or is being adjusted against the subsidy. Two banks take margin money in cash but it is not known how the subsidy received by them is adjusted.

(vii) Service charges: Twelve banks recover inspection/service charges varying between Rs. 3 and Rs. 5 per month from the borrowers. Among them, some banks waive the charges if the loan amount is small. No charge is recovered by other banks.

(viii) Rate of interest: Eighteen banks charge interest at rates varying between 12.5% and 15%. As from January 1976 the State Bank of India has reduced its interest rate from 15.5% to 1.5% below State Bank of India advance rate with a minimum of 12.5%. One bank charges 10.5% while another bank charges 17%.

(ix) Security: Most banks take as security for advances for gobar gas plants hypothecation of gas holders, gas pipes and other appliances plus third party/group guarantee and mortgage of land, where available. The State Bank of India grants such loans to borrowers who have already borrowed or intend to borrow from the bank for other agricultural purposes. Further, in States in which legislation on the lines suggested by the Talwar Committee has not been passed, mortgage charge on land is taken in the case of loans for amounts above Rs. 3,500.

(x) Repayment period: All banks are following the repayment period varying between 3 and 5 years.

(xi) Refinance facilities: All banks have indicated that refinance assistance should be provided to them by the Agricultural Refinance & Development Corporation for financing the gobar gas plants, which is an agricultural activity.

(c) *Cooperative banks*

The replies to the Group's questionnaire received from some of the state and central cooperative banks and state land development banks show that none of them has commenced financing gobar gas plants. The state land development banks of Haryana and Gujarat started making loans for gas plants sometime back but they discontinued such financing since April 1975 following the advice of the Reserve Bank of India contained in its Circular No ACD-LDB.1360/D1-74/5 dated 24 March 1975 to the effect that long term loans for such financing need not flow from the land development banks. Subsequently, however, the Reserve Bank of India has recognised the financing of gobar gas plants as an approved medium-term purpose

for refinance under section 17(4AA) read with section 46A(2)(b) of the Reserve Bank of India Act, 1934 by its circular No. ACD Plan. 3889/PR 34-74/5 dated 9 June 1975 and has indicated the various terms and conditions on which such advances could be made by state and central co-operative banks as medium term loans. The more important terms and conditions are briefly mentioned below.

(i) The agriculturist (both land owner and tenant cultivator) proposing to set up a gobar gas plant must have a sufficient number of cattle as the plant is run with the use of cattle dung. The cattle preferably should be stable bound.

(ii) The precise number of cattle required for working the different sizes of plants and the size of the land holding required to support the requisite number of cattle cannot be specified on account of several variable factors such as type and size of cattle, whether they are stable bound or free grazing type, quality and quantity of feed and fodder given to them resulting in variations in daily droppings. However, as a very rough indication about 5 cattle and a land holding of 5 acres would be required to qualify for a loan for a 2 cubic metre plant. For a 3 cubic metre plant, the number should be 8 cattle with a land holding of 8 acres. The number of animals and land holding required for larger size plants will have to be proportionately higher. This has to be worked out by the financing banks taking the possible variables into account. A minimum land holding needs to be prescribed as the farm yard manure produced in the plant is normally to be used on the land ploughed by the agriculturist. This is also necessary as the agriculturist should ordinarily be in a position to grow fodder for feeding the animals on the land cultivated by him.

(iii) The overall margin to be provided by the agriculturist going in for gobar gas plant from his own resources or from the subsidy that may be available to him from the Government should be prescribed at 25% excluding the usual investment in share capital i.e. 5% in one lump sum in the case of small, marginal and economically weak farmers and 10% in lump sum in the case of other farmers.

(iv) The loan should normally be for a period of 3 years. The loan may also be advanced for a period upto 5 years in case the repaying capacity of the borrower warranted such a period.

(v) For the purpose of security, the gas holder and frame, pipelines, other appliances and cattle maintained by the agriculturist should be hypothecated in favour of the lending bank.

Operational procedures

7.4 On the basis of the Group's field visits and the replies to the questionnaire, the operational procedures of the financing banks are discussed below.

(a) *Commercial banks*

(i) Canvassing for loans

In most States the canvassing for the installation of gas plants is done by the KVIC. In some States, the KVIC is assisted by the extension staff of the State Governments. The applications for loans obtained by the KVIC and the extension staff are forwarded to the nearest offices of banks. The Group also came across instances of financing banks approaching the farmers to avail of bank loans.

(ii) Identification of borrowers

The identification of farmers who are likely to install gobar gas plants is primarily done by the KVIC. In certain States like Haryana and Gujarat, the block staff of the State Governments also help in the identification of farmers.

(iii) Technical feasibility and recommendation for bank loans

After collecting the loan applications in prescribed forms, the staff of the KVIC and in certain cases KVIBs carry out the technical feasibility of the proposals and forward the applications for loans with their recommendations to the nearest branches of the financing banks.

(iv) Processing of the loan applications

On receipt of the loan applications with the technical feasibility reports and the recommendations of the KVIC/KVIB, the financing banks process the applications to appraise the economic viability of the proposals, if necessary by site visits. No difficulty was being experienced by the banks in processing the applications as most of them have adopted the criteria indicated by the KVIC for financing the gobar gas plants.

(v) Delay in forwarding the loan applications to the financing banks

Delay in forwarding the loan applications by the KVIC/KVIBs to the financing banks and the consequent delay in sanctioning the loans were reported from several States. This was due mainly on account of the limited staff of the KVIC/KVIBs for this work. Generally no delay was reported in the processing of loan applications and sanctioning of the loans, as the branches had been given adequate discretionary powers to sanction such loans.

(vi) Repaying capacity of the borrowers

As the installation of a gas plant does not generate direct cash income to the farmer, the banks take into account the overall financial position of the borrowers in determining their repaying capacity.

(vii) Disbursement of loans

Loans are disbursed by the banks in 2 or 3 instalments depending upon the progress of construction work. The payments for gas holders and other appliances are made direct to the suppliers.

(viii) Post installation service

The staff of the KVIC/KVIBs are at present responsible for post installation service to the plant owners which includes technical guidance and also arrangements for repairs, if required.

The financing banks do not generally attend to such work.

(ix) Recovery of loan instalments

Since the banks have started financing the plants as recently as in 1974, their recovery experience in respect of these loans was not available.

(b) *Co-operative banks*

(i) Land Development banks

As mentioned earlier, the Reserve Bank of India has advised the land development banks in the country that they need not grant long term loans for financing the gobar gas plants. In view of this, land development banks, with the exception of a very few, prior to the Reserve Bank's advice, have not financed gas plants under the scheme. However, if on the basis of the recommendations of the Group, the Reserve Bank considers that financing of the gobar gas plants also attracts long term flow of funds, these institutions will have to frame appropriate lending procedure keeping in view the various criteria mentioned in this Report for financing gobar gas plants.

(ii) State and central cooperative banks

In the case of these banks, as indicated earlier, the Reserve Bank of India advised them in June 1975 that financing gobar gas plants was recognised as an approved agricultural purpose for which medium-term loans could be granted. No cooperative banks have, however, reported having made such loans, possibly because the Reserve Bank's advice was sent to them in the middle of last year. When the cooperative banks start making loans, they will have to follow the procedure laid down by the Reserve Bank, keeping, however, in view the various criteria mentioned in this Report for financing gobar gas plants.

Criteria for financing gobar gas plants

7.5 The Group has examined the various aspects of financing gobar gas plants by banks and makes the following recommendations.

(i) *Area approach*

For effective implementation and supervision of the scheme, it will be desirable for banks to take up financing the programme on an area basis, instead of scattered lending covering the entire State, particularly those States where the programme is yet to pick up. This is considered necessary because of the various limitations, discussed elsewhere, on the infrastructural facilities available at present for taking up the programme immediately on a large scale, that is to say, availability of technical know-how, arrangements for supply of materials, gas holders and components and provision of post installation service, etc. For this purpose, the areas in each State which offer potential for development, keeping in view the various technical considerations for setting up of gas plants, could be initially identified and area schemes prepared and taken up for financing. The identification of such areas in a State is not likely to present much difficulty, as the banks are already financing area schemes for agricultural development over the past few years and the financing of the gobar gas plants will be only an extension of the agricultural development schemes. As the programme intensifies, more and more areas could be taken up for financing, for which preparatory work has already been done by the extension staff for popularising the scheme. The scheme to be financed may be either for independent investment in a gas plant or may form part of agricultural development scheme viz., a scheme covering the installation of a gobar gas plant along with dairy development, etc.

(ii) *Eligibility*

To be eligible for financial assistance for setting up a gobar gas plant, the primary consideration is that the applicant has a regular source of fresh cattle dung, that is, he maintains a minimum number of cattle. This will be the prime determining

factor also for the size of the plant that will be recommended for him. Minimum cattle holding should be the main eligibility criterion. The installation of a gobar gas plant by a farmer has been recognised by the Reserve Bank of India as an approved agricultural activity for the purpose of financing. The Reserve Bank of India has, however, laid down that to be eligible for loan, a farmer should, besides holding the minimum number of cattle, hold as owner or tenant certain acreage of cultivated land (varying with plant size) for utilising the gobar gas manure and for growing fodder to maintain his cattle. The Group has examined this aspect of eligibility viz. the minimum acreage holding and is of the view that the eligibility for loan need not be linked to the minimum land holding. A dairy farmer who satisfies the minimum cattle criterion but who does not hold any cultivated land need not be prevented from securing financial assistance for setting up a gas plant for improving his economic/social condition by utilising the gobar gas for cooking and selling the manure. In the absence of any cultivated land, he might already be selling the dung as farm yard manure or burning it as fuel. He might also be maintaining his cattle by buying fodder from the market. Similarly, a cultivator is likely to utilise the gas manure partly on his land which may be less than the minimum holding as required by the Reserve Bank of India and partly by selling it in the market. The safeguard which should be taken before financing the plants in such cases is to ensure that the income of the cultivator/dairy farmer from other sources is adequate enough to enable him to conveniently repay the instalments. The Group, therefore, considers it desirable that eligibility for loans for installation of gas plants need not be linked to the farmers' holdings of cultivated land.

In case where the financing for construction of gobar gas plants is to be made to persons other than farmers, the advances need not be treated, for purpose of eligibility, as agricultural advances.

(iii) *Technical feasibility*

Each proposal for setting up a gas plant to be eligible for finance should strictly satisfy the technical feasibility criteria

which cover a number of factors viz. suitability of soil on which plant is to be constructed, climatic conditions, adequacy of land for plant and pits, nearness of plant site to the point of use of gas, safe distance from a well, availability of water, nearness to cattle shed, etc. as discussed in chapter III. At present the services of the KVIC/KVIBs are available for the technical appraisal of the proposals but in due course the agricultural officers of the financing banks should build up technical expertise to carry out the technical feasibility of the individual proposals.

(iv) *Financial viability*

After the proposal satisfies the criteria for technical feasibility, its economic and financial viability will have to be appraised. On the basis of the economics for various sizes of the gas plants worked out by us, it is seen that all sizes of plants would be beneficial to the farmers. However, the benefits accruing from gas plants cannot be quantified precisely like those from other schemes of agricultural development like minor irrigation, poultry, dairy, fisheries, etc. which generate cash incomes. The KVIC has made estimates of cost-benefit in investment in installation of gobar gas plants of various sizes but the assumptions on which these estimates are based are necessarily subject to various limitations as discussed in chapter IV. For working out the economics, therefore, the Group has considered it advisable to leave out one half of the gross surplus arising out of the investment and calculate the repaying capacity of the farmer on the balance 50% of the gross surplus. This is unlike other investments in agricultural development in respect of which it is customary to allow one third of the gross surplus for the improvement of the economic condition of the farmer. As the various assumptions made in working out the economics of gas plants will vary from State to State and also within a State, it will be necessary for the financing banks to work out the economics of each individual proposal taking into consideration the conditions prevailing in the area, that is to say, expenditure on fuel and fertilisers, utilisation of gas and manure, possibility of sale of gas and manure, etc.

(v) *Identification of borrowers*

For financing gobar gas plants, the identification of farmers should be made with proper care. This is because the repayment of the bank loans will have to come from out of their general resources. The identification of borrowers may not present serious difficulty as for the initial programme the identification may be made generally from among the existing borrowers of the financing banks.

(vi) *Quantum of loan*

The quantum of loan to be made by a financing bank in each case will depend upon the cost of investment in the installation of a gas plant, as estimated on the basis of local conditions and the amount of subsidy available. Since the amount of subsidy is made available to a borrower on the basis of the completion certificate, the financing bank should invariably provide loan to the full extent of actual investment outlay, pending adjustment of subsidy when received.

(vii) *Disbursement of loan*

At present the banks disburse the loan amounts in 2 or 3 instalments after satisfying themselves of the utilisation of the previous instalments on the basis of the progress in construction work. Payments for the gas holder and other appliances are made direct to the suppliers. The Group recommends that the present procedure regarding the disbursement of loan amounts in instalments should be continued.

(viii) *Down payment*

For financing term investment in agricultural development schemes, it is customary for banks to insist on receiving by way of down payment, a certain percentage of the outlay from the farmer as his involvement. The Group has examined this question from the point of view of the investment in a gas plant and is of the view that no down payment or margin money need be insisted upon in financing the gas plants for the following reasons:

(a) The Government of India is currently providing a subsidy at the rate of 25% of the capital cost as estimated by the KVIC with a view to popularising the programme on a national scale. This amount should be treated as contribution of the farmer by way of margin.

(b) The investment in gas plant does not at any time generate cash inflow. In other words, there is no felt need among the farmers, at least for the present, for investment in gas plants as in other farm investments. If down payment is insisted upon, the farmers may be discouraged to go in for gas plants.

(c) When the subsidy is withdrawn by the Government in course of time and the farmers are fully convinced about the benefits of gas plants and a felt demand for plants is created, the requirement of margin money may be considered at that stage.

(ix) *Rate of interest*

Suggestions were made to the Group during its field visits that, if the gobar gas programme has to be implemented on a sizeable scale, a package of concessions will have to be offered. One of these concessions having immediate monetary value is that the loans granted by banks for gas plants should be at rates of interest lower than normal rates charged by the banks on other advances. Further, it has also been suggested that the scheme of differential interest rate (DIR) should be made applicable to such advances. The Group has considered the various aspects of these suggestions and has the following views to offer. Most of the banks have treated the financing of gas plants as agricultural loans falling under the category of priority sector advances and are consequently charging concessional rates of interest, applicable to such advances. Further, as a special incentive for popularising the scheme, the Government of India have been giving subsidy at the rate of 25% of the capital cost as estimated by the KVIC. As the banks are already charging concessional rate of interest on loans for gas plants and a sizeable amount of subsidy is available which could perhaps take care of the entire interest element there is no case for further lowering of the interest rates. The Group, however, is of the view that the banks

which have not already fallen in line with other banks in charging concessional rates of interest on loans for gas plants, should forthwith do so. Since the quantum of loan required for the smallest economic size gas plant and the estimated income of the beneficiary from such a plant both exceed the criteria laid down under the DIR scheme, the loans for gas plants cannot be covered thereunder.

It has also been suggested to us that a uniform rate of interest should be charged on bank loans for gas plants. The Group has examined this aspect although the rationale for a demand like this is not clear. It may be mentioned that even in the case of agricultural loans which fall under the priority sector advances and on which concessional rates of interest are charged, there is no such uniformity. This is perhaps for the reason that the cost of funds varies from bank to bank. The Group is, therefore, of the view that there is no case nor need for uniformity in the rates of interest.

The rate of interest which is charged by the cooperative banks on other agricultural advances will also apply to the loans for financing the gobar gas plants.

(x) *Security*

The Group has examined the various aspects connected with the security that may be obtained by banks for financing the gas plants. The Group considers that the existing security requirements of banks will not come in the way of larger number of farmers seeking bank loans under the programme. The banks generally obtain hypothecation of gas holders and other appliances and/or a third party guarantee. Wherever available, the banks also additionally obtain hypothecation of cattle. They do not as a rule insist on mortgage of land as security for such advances. In this context, it is observed that the quantum of loan for the more popular plant sizes upto 8 cubic metres is below Rs. 4,000 and should not normally attract land mortgage as security. We, therefore, recommend that the existing stipulation of obtaining hypothecation/third party guarantee and hypothecation of cattle, where available, should be

adequate for purpose of security for loans for gas plants. For plants of larger sizes, say, above 8 cubic metres, the banks may, at their discretion, obtain mortgage security.

(xi) *Repaying capacity of the borrowers*

As the investment in gas plants does not generate cash income the repaying capacity of the borrowers will have to be estimated on the basis of their general financial condition.

(xii) *Repayment period*

On the economics worked out by us for gas plants of various sizes, the extent of surplus that will be available with the owners of plants of the sizes upto 6 cubic metres will enable them to repay their loans in not less than 5 years. In the case of plants of sizes exceeding 6 cubic metres, the surplus will be sufficient for loans to be repaid between 3 and 5 years. The repayment period, however, needs to be worked out by banks in each case having regard to the various variables applicable in different cases.

(xiii) *Documentation*

The Group suggests that the banks may continue the documentation procedure presently followed by them in the case of similar loans for agricultural development.

Supervision and follow-up

7.6 For effective and speedy implementation of the programme it will be necessary for the banks to exercise close supervision and follow-up after the installation of the plants. If there is any difficulty in the operation of a plant, the borrower is likely to suffer and it may ultimately affect his capacity to repay his loan. The banks may follow up with the KVIC/KVIBs for any technical defects noticed in the working of the plants.

Subsidy

7.7 With a view to popularising the scheme, the Government of India have been providing subsidy through the KVIC initially at a flat rate of Rs. 300 for each plant irrespective of its size. Since 1974-75 the subsidy is being given at 25% of the cost as estimated by KVIC. Keeping in view the potential for utilising large quantities of available cattle dung for producing useful gas and manure with the help of gas plants for supplementing and contributing towards satisfying the country's need for fertilisers and fuel, the subsidy was offered as an incentive to install the plants, the investment in which does not generate cash incomes Besides the subsidy given by the Government of India, some State Governments also provide additional subsidy to further help intensify the implementation of the programme.

The procedure for grant of subsidy as laid down by the Ministry of Agriculture, Government of India is indicated below:

(a) The subsidy will be released only after the plants have actually been completed and not in advance.

(b) Certificates in respect of completion of plants should be signed by the Block Development Officers besides the representatives of the implementing agency, viz. KVIB/State Agro Industries Corporation, etc. In respect of plants set up in urban areas where there are no Block Development Officers, the completion certificates should be countersigned by any officer of the State Agriculture/Development/Cottage and Small Scale Industries Department. (It is understood that the insistence on the certificates of the Block Development Officers has since been discontinued.)

(c) Sanction for release of subsidy will be issued to the State Government and/or the KVIC from time to time on receipt of districtwise information regarding the number of plants certified to have been completed, total cost involved and the amount of subsidy payable. The State Government and/or the KVIC will in turn reimburse the subsidy to the banks to be adjusted against the loans advanced to the beneficiaries.

(d) Pending release of subsidy from the Government of India, the State Government/KVIC may, if considered necessary, arrange to place the funds at the disposal of the banks, equivalent to the amount of subsidy involved, in advance or immediately after completion of the plants.

(e) Farmers/other individuals, who would not wish to take loans will also be eligible to get the permissible subsidy which will be routed through the State Government and/or KVIC.

(f) The quantum of subsidy will be 25% of the actual cost or the cost estimated by the KVIC whichever is less.

In course of the Group's field visits, it was represented that there was undue delay in actual settlement of subsidy claims and consequently the farmers had to suffer by paying additional interest pending adjustment of subsidy to the loan accounts. To avoid delay and consequent interest burden on the borrowers, the KVIC may consider releasing subsidy as provided for in sub-para (d) above.

Credit Guarantee Scheme

7.8 It has been suggested to the Group by banks during its field visits and also in the replies to the questionnaire that it will be helpful if the advances for gobar gas plants are covered by the guarantee of the Credit Guarantee Corporation of India. It may be mentioned that cover under the Credit Guarantee Scheme for Small-scale Industries is already available in the case of loans made to small scale industrial units for setting up gobar gas plants. This, however, excludes loans granted to farmers and other individuals in rural areas for the same purpose from being covered under the scheme. We have considered the suggestion of banks in this light and recommend that credit facilities granted by banks to farmers and other individuals be treated as agricultural advances and like other agricultural advances should be covered under the guarantee scheme of the Credit Guarantee Corporation of India on usual terms and conditions.

Refinance facilities from higher financing agency

7.9 Banks have indicated in their replies to questionnaire that refinance facilities from the higher financing agency i.e. Agricultural Refinance and Development Corporation may be extended in the case of loans granted by them for setting up gobar gas plants on the lines of those available for other schemes for agricultural development financed by them. The Reserve Bank of India has recognised the financing of gobar gas plants as one of the approved agricultural purposes and has agreed to provide refinance facilities to cooperative banks. We also consider that the financing of gobar gas plants by commercial banks should be eligible for refinance from the Agricultural Refinance & Development Corporation.

CHAPTER VIII

TRAINING OF PERSONNEL

Need for trained personnel

8.1 One of the reasons for lack of desired progress in the programme of gobar gas plants is the paucity of trained technical and other personnel with the concerned implementing agencies — KVIC, KVIBs, financing institutions, extension staff of the State Governments and service agencies. Trained personnel are needed to attend to the various aspects of the programme e.g. preparation of feasibility reports in respect of proposed plants, supervision and guidance during their construction, provision of post installation service, carrying out intensive publicity and propaganda among the farmers and convincing them about the benefits of the gas plants, etc. If the programme in different States in the country is to get impetus, it will be necessary to make adequate arrangements for training of personnel for these tasks. The arrangements as envisaged by us should cover both immediate and future needs of trained staff for the various agencies involved in implementing the programme.

Existing training arrangements

KVIC

8.2 At present the KVIC provides technical guidance and assistance connected with the installation and operation of gobar gas plants in the country. The guidance provided covers various aspects like preparing technical feasibility reports on the basis of the various criteria mentioned in chapter III, scrutinising the proposals and according approval for subsidy, supervising the construction of plants and ensuring their satisfactory operation and providing post installation service, as and when required. For providing such technical guidance, the Gobar Gas Directorate of the KVIC has posted technical staff in different States

who alone carry out these duties. With the rapid increase in the number of gas plants installed since the last two years, it is becoming difficult for the limited technical staff of the KVIC to cope with the work of providing such services. The KVIC has therefore, introduced a scheme called Supervision Charge Scheme under which local educated persons including unemployed technicians who volunteer their services are trained to supervise the installation work. They receive remuneration on per plant basis from the KVIC. Since it is in the interest of such workers to supervise the installation of as many new plants as possible, they voluntarily do extension work and canvass for plants among farmers. The KVIC organises training of candidates at places where clusters of gas plants are under construction. This enables the trainees to have intimate understanding and practical knowledge of all stages of construction. Alongside the practical training, lectures covering theory are also given. These lectures cover all aspects of gobar gas technology viz. fermentation, plant sizes, construction details, etc. It is understood that the KVIC has 400 training centres under its Training Directorate in various States in the country. These centres are intended to impart training to candidates in all the 22 khadi and village industries of which gobar gas is one. However, most of these centres are reported to be not active in view of non-availability of trainers.

KVIBs

8.3 The KVIBs are functioning in 20 States and 3 Union Territories. Although their objectives, like those of the KVIC, also cover the promotion of khadi and other specified village industries including gobar gas plants, actual active work in so far as gobar gas plants are concerned is being done only in a few States like Gujarat, Maharashtra, Haryana, Tamil Nadu and Andhra Pradesh. In these States too the trained personnel available for the job are very limited. It will, therefore, be necessary for the KVIBs in all States to train up specially recruited staff for looking after the gobar gas work in the light of the growing requirements. The KVIBs also conduct training courses of varying duration of a fortnight to 2 months for promotion and development of village and small industries. We suggest that the KVIBs may consider

including in their training programme, courses for equipping educated unemployed persons in villages for undertaking supervision of installation of gobar gas plants on the pattern of the KVIC's Supervision Charge Scheme. This will help relieve the KVIC of the heavy pressure and also build up a wide based cadre of technicians to attend to the increasing needs of implementing a larger programme.

Financial agencies

8.4 At present arrangements do not exist for the commercial banks which finance the construction of the gobar gas plants and cooperative banks which are expected to commence this type of financing, for getting their staff trained in technical and other basic aspects of gobar gas scheme. The banks have been entirely depending upon the technical guidance and assistance provided by the KVIC and/or KVIBs for the appraisal of proposals for installation of gas plants. Such guidance as already indicated consists of providing technical feasibility reports, supervision of the installation of the plants and issuance of certificates for completion of work for the purpose of claiming subsidy. Due to paucity of staff, the KVIC/KVIBs are generally not able to attend to all work expeditiously. Thus total dependence of banks on KVIC/KVIBs has been a major cause of delay in the construction work in many States. On the basis of the replies received from the commercial banks to the Group's questionnaire, it is observed that some of the banks are attempting to build up technical expertise of their own in this field but by and large banks have not succeeded and continue to depend on the KVIC/KVIBs for provision of technical guidance. We consider that it would be necessary for all banks to give a special, may be short, training course to all their agricultural officers and staff handling proposals for agricultural finance in due course of time. For this purpose, it would be necessary for the KVIC/KVIBs to plan and make available training facilities to all banks.

Types of training needed

8.5 Having regard to the need for financing the gobar gas plants on a priority basis under the programme and keeping in view the long-term objective of bringing about a rapid increase in the

number of gas plants for maximum utilisation of the vast quantities of available cattle dung and other agricultural wastes for creating a supplementary source to meet the country's requirements of fertiliser and fuel, two types of training are called for; one, a brief training course and the other a full course as part of the normal training programme on agricultural finance which is now conducted in various national/state institutions and institutions of financing agencies for training of staff. Besides the training programme for the officials of the banks, separately for branch managers and agricultural field staff, there is need for training the staff of the concerned departments of the State Governments, engaged in the extension work for popularising the gobar gas scheme. In addition to the scheme for training the staff of banks/State Governments as mentioned above, the normal training programmes of the KVIC/KVIBs under their own schemes will have to be multiplied.

Categories of trainees

8.6 The staff of various agencies involved in the programme needing training will fall into two categories, one to be trained in brief course for immediate requirements and the other for full course for future needs, as mentioned in the preceding paragraph. For this purpose, the KVIC/KVIBs will have to assess the requirement of teaching staff needed. In respect of each State, it should be the responsibility of the KVIB to assess the number of persons to be trained for each agency in consultation with the concerned agencies like financing banks, State Governments, etc. The assessment with regard to the number of staff to be trained will depend upon (a) the number of officers of commercial banks in rural/semi urban areas in the States handling gobar gas advances, (b) the supervisors and other higher level staff of the apex/central cooperative banks and apex (including branch)/primary land development banks, (c) the extension staff and higher level staff in the agriculture department of the State Government, the staff of the State agro industries corporation and other supply agencies (private entrepreneurs and unemployed technical persons), etc. On the basis of the assessment of the requirement, the training programmes may be organised on the lines discussed later.

Duration of training

Brief course

8.7 For the immediate need of the field officers of the commercial and cooperative banks and the extension staff of the State Governments, a brief training for a week in various aspects of gobar gas plants including visits to sites where the plants are under construction may be considered adequate.

Full course

8.8 (i) For the training of the staff of agro industries corporations and training under Supervision Charge Scheme, etc. the usual training programme of 3 weeks to one month's duration at present conducted by KVIC/KVIBs is considered adequate.

(ii) As part of their training in agricultural finance, the officials of the financing banks, State Governments and other agencies who undergo training in institutions like College of Agricultural Banking (Reserve Bank of India), training institutes of the various commercial banks, co-operative training institutes in the States run by the National Co-operative Union, Vaikunth Mehta National Institute of Co-operative Management, Pune and similar other institutions, will receive the usual training which will include aspects on gobar gas plants.

Content of the training courses

Brief course

8.9 A week's training for branch managers and extension staff will cover broad aspects of gobar gas plants, namely, fermentation process, plant sizes, construction details, economics, social impact, statistical data, financial assistance from banks, etc. Actual field visits to see the construction of plants at various stages will also form part of the course. The course content for this brief training may be drawn up by the KVIC for each State.

Full course

8.10 The courses which are at present conducted by the various institutions mentioned in paragraph 8.8 (ii) may include talks on important aspects of gas plants. To produce demonstrative effect on trainees, the KVIC should arrange to construct for these institutions in their campuses model gobar gas plants.

Organisation of training courses

For officers of commercial banks

8.11 One of the lead banks in each State should undertake the responsibility of organising the courses at the State headquarters in collaboration with the KVIC/KVIB. By way of illustration, some of the banks which could organise the courses in different States are indicated below.

State	Lead Bank
Andhra Pradesh	Andhra Bank Ltd.
Assam	United Commercial Bank
Bihar	Bank of India
Gujarat	Bank of Baroda
Haryana	Punjab National Bank
Kerala	Canara Bank
Karnataka	Syndicate Bank
Maharashtra	Bank of Maharashtra
Madhya Pradesh	Central Bank of India
Orissa	State Bank of India
Punjab	State Bank of Patiala
Rajasthan	State Bank of Bikaner and Jaipur
Tamil Nadu	Indian Overseas Bank
Uttar Pradesh	Union Bank of India
West Bengal	United Bank of India

The number of courses to be organised by a lead bank will depend upon the response of the branches of other com-

mercial banks functioning in the State and the potential for gobar gas plant financing in rural areas. The programmes will be organised, conducted and supervised by the Head offices of the concerned lead banks.

For staff of apex/central cooperative banks

8.12 The state cooperative bank in each State should organise, in collaboration with the KVIC/KVIB, the programme at its training institute or the institute of the State Co-operative Union (if it has no institute of its own) for its officers and the officers/supervisors of the central cooperative banks.

For staff of the apex/primary land development banks

8.13 The state land development bank in each State may, in collaboration with the KVIC/KVIB, organise the training programme for its officers and the staff of the primary land development banks. The programme may be organised at the bank's own training institute at State headquarters or at the institute of the State Co-operative Union at State headquarters, if the bank has no institute of its own.

For extension staff of the State Governments

8.14 Each State Government in collaboration with the KVIC may organise a study course for the extension staff of its Agriculture Department at the State Co-operative Training Institute at State headquarters. Since the number of extension staff will be fairly large, it is suggested that the course to be organised by the State Government at the State headquarters should be attended only by the concerned district/block development officers. On return from the course, the concerned district/block development officers will organise similar courses in collaboration with the KVIC, district officers/KVIBs for the extension staff of the concerned districts.

Full course

8.15 For full training course, the present arrangement for imparting training in agricultural banking at various levels at

other training institutes viz. College of Agricultural Banking, Reserve Bank of India, Pune, Vaikunth Mehta National Institute of Co-operative Management, Pune, the various training institutes of commercial banks, cooperative banks, State Co-operative Union's training institutes, etc. will continue to impart training to staff of the concerned institutions. The appropriate course content of these institutes should hereafter provide for training on important aspects of gobar gas plants.

8.16 The KVIC/KVIBs will continue the present arrangements for training under the various schemes of training organised by them.

Training materials

8.17 For effective implementation of various training programmes under the gobar gas scheme, the KVIC will take steps to build up suitable training materials in the form of audio-visual aids, film strips, etc. for use by various institutions concerned with the training programmes.

CHAPTER IX

RESEARCH AND DEVELOPMENT

Need for research

9.1 The present high cost of investment in installing a gobar gas plant and the various technical problems connected with its operation as discussed in chapter V emphasize the urgent need for undertaking research projects by the various institutions and individuals engaged in research work relating to bio-gas technology and developing a low priced durable and trouble-free plant for use of the farmers in rural areas. An early action in this regard is considered necessary for achieving rapid progress under the programme. Such research work assumes particular importance as the capital investment for the installation of a gas plant does not generate cash inflow like other investments of a farmer for agricultural development.

Areas to be covered

9.2 The research projects should cover both fundamental and applied aspects of the bio-gas technology. The fundamental aspects relate to the anaerobic fermentation of cattle dung and other organic wastes, physical properties and the chemical aspects of bio-gas including methane. The fundamental research may not have an immediate impact on the methane producing process and plants but will provide such knowledge as would be useful to evolve better processes of biological fermentation of organic wastes and also to help in finding new and more efficient use of the gas. The applied aspects of the research would be of immediate importance in the context of the need for a rapid increase in the number of gas plants in the country under specific programmes. The applied aspects of the research would cover very large and wide areas like fermentation research, engineering technology, corrosion control of steel gas holder, auxiliary system, gas distribution/supply, diverse uses

of gas, manure utilisation, use of slurry for production of algae, weed and insect control, etc. the need for which has been mentioned in chapter V.

Agencies to be involved

9.3 At present various agencies, institutions and individuals are engaged in research work relating to bio-gas technology in the country on their own without a central agency guiding and coordinating their activities. There is thus no effective co-ordination of the efforts between the various agencies, which could prevent avoidable overlapping of efforts and the consequent inability to produce a package of results intended to provide maximum benefit out of the investment made by a farmer. The research organisations engaged at present in the work include IARI, PARI, KVIC, NEERI and various agricultural universities, besides a number of individuals. If an integrated bio-gas plant is to be evolved for the use of the farmer, it will be necessary for each of the existing research organisations to undertake research on specific aspects of the technology, some of which were mentioned in the preceding paragraph, for achieving maximum results.

Co-ordination of work of research agencies

9.4 At the apex level, there should be a central agency for co-ordinating the efforts of the various agencies already engaged in the research work in bio-gas technology. The Government of India have recently taken steps to co-ordinate the research and development of bio-gas technology and accordingly the Department of Science and Technology of the National Committee of Science and Technology (NCST) was appointed as the co-ordinating body for all-India research and development on bio-gas technology. The Economic and Social Council of Asia and Pacific (ESCAP) held in New Delhi a workshop last year in co-operation with the NCST to recommend organisation of short and long-term research programmes on bio-gas at the national level. On the basis of the recommendations, the NCST is reported to have drawn up an all India project on bio-gas plants. The recommendations of the workshop are given

in Annexure 8. Following these recommendations, the NCST has finalised specific project proposals to be carried out by various research organisations in the country. The project proposals which are given in Annexure 9 cover almost all important aspects of the technological developments. The Group recommends that research on these project proposals be carried out expeditiously and a low priced and trouble-free plant developed and adopted which would help the farmers to increase agricultural production and also improve their standard of living.

Cost of research

9.5 The agencies conducting research on bio-gas technology are already in existence and no new agency for the purpose need be established. The specified project proposals, as mentioned in the preceding paragraph, to be undertaken by different organisations are not likely to involve any extra cost since these organisations will carry on such research as part of their normal research activities.

CHAPTER X

SUMMARY AND CONCLUSIONS

Introductory

10.1 The introductory chapter deals with the genesis of the Informal Inter-Institutional Group on financing of gobar gas plants by banks constituted by the Reserve Bank, the terms of reference and the modus operandi of the Group's working. With a view to eliciting information on the various aspects relating to the terms of reference, the Group issued questionnaires to the concerned agencies involved in the work relating to gobar gas plants, visited a few States and held discussions and interviews with connected officials, non-officials and farmers and also utilised the available material on the subject.

Brief review of the position

10.2 The Group has briefly reviewed the historical background leading to the development of gobar gas plants in India. A prototype of a cattle dung digester was built and patented by a scientist of the IARI in 1946. But bigger breakthrough came with the designing and patenting in 1951 of a gas plant by the KVIC. Several modifications have since been made in the designs through research. Most of the gas plants in use in the country since 1954 are based on the model designed by the KVIC. The designs made by other agencies include those of IARI, NEERI, etc. but these models are not widely in use.

With the financial assistance made available by the Government of India channelled through the KVIC, the programme made limited progress during the period 1962-63 to 1973-74 when in mid 1974, the total number of gas plants installed in the country stood at 6,858. The amount of loans and subsidy provided by the Government of India for the purpose till then was Rs. 47.18 lakhs under subsidy and Rs. 178.33 lakhs under loans. With the entry of the commercial banks in the field of financing gobar gas

plants since 1974-75, the number of plants installed in 1974-75 was 7,818 and the subsidy and bank loans aggregated Rs. 91.12 lakhs and Rs. 216.93 lakhs respectively. By mid 1975, the total number of gas plants completed increased to 14,454, while the total number of plants for which finance was provided was 14,676. The total amount of subsidy and finance extended till mid 1975 rose to Rs. 138.30 lakhs under subsidy and Rs. 395.26 lakhs under loans. The progress made by the programme of gas plants has not been uniform in all States. Out of the 23 States (including 5 Union Territories) in which all the gas plants in the country are spread, seven States viz. Gujarat, Haryana, Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh and Uttar Pradesh together accounted for as much as 88% of the number of these plants, and seven States viz., Gujarat, Haryana, Maharashtra, Karnataka, Andhra Pradesh, Uttar Pradesh and Punjab accounted for about 94% of the total loans disbursed. The capacity value of gas and manure from the plants installed during 1974-75 was Rs. 197.21 lakhs and Rs. 138.70 lakhs respectively. However, the extent of utilisation of these products by the plant owners is not known. It is understood that the bulk of the financial assistance was utilised for installing plants upto the size of $6M^3$, although no precise information in this regard is available.

The Group is not aware of any study having been made for quantifying the aggregate benefits likely to accrue from large scale utilisation of the available cattle dung in the country. However, on the basis of the estimates made by some of the organisations like KVIC, the potential of the gas plants in providing an alternate source of fertiliser and fuel from the country's indigenous materials like cattle dung and organic wastes would appear to be encouraging.

Technical aspects

10.3 Gobar gas plants operate on the principle that the anaerobic fermentation of cellulose and other organic materials like dung leads to the production of combustible gases including methane. Such a plant consists of two main parts: a digester (fermentation tank) with an inlet into which cattle dung mixed with water is poured and a gas holder. An outlet is provided for the discharge of the digested slurry which is connected to an outlet

tank. Besides the digester and the gas holder, other equipment consists of gas pipeline, gas stove, burners, etc. and a mixing tank. The digester is a sort of well about 3 to 4 metres deep, built with bricks and cement. The depth varies with the size of the plant depending upon its gas producing capacity. The gas holder is a cylindrical container made of M. S. or G. I. sheet and is placed in an inverted bell like position on the digester resting on the ledge. It serves as a cover shutting out air from the digester and also holds under pressure the gas produced in it. At its top, the gas holder is fitted with a pipe through which gas is led to the desired points of use. Dung takes about 50 days to ferment fully. The gas can, therefore, start flowing initially after 50 days of first filling the digester. Thereafter a continuous supply of gas can be ensured if fresh dung is fed into the digester daily. As and when fresh dung is fed into the digester, the digested dung gets ejected by overflow through the outlet, in the form of slurry. The operation of a gas plant does not involve any complicated mechanical process and with a little understanding it can be operated by any plant owner.

The installation of a gas plant, however, requires satisfaction of certain technical criteria. The technical feasibility would broadly determine (a) whether the plant can be installed or not; and if so, (b) what should be the size of the plant. The former will take account of soil and climatic conditions, water table, availability of water for use in the gas plant, adequacy of land for plant and pits, nearness to the point of use of gas and manure, availability of cattle, nearness to cattle sheds, etc. The factors which determine the size of the plant include raw material — dung, etc. available for digestion and the quantity of gas and manure required.

Before a proposal for financing a gas plant can be considered, it is imperative to ensure its technical feasibility by strictly adhering to the various norms mentioned above. Any relaxation of these norms will lead to the construction of defective plants causing a set-back to the programme.

Economic and financial aspects

10.4 Two main economic benefits flow from gobar gas plants — gas and manure. Besides, certain social benefits also accrue

like elimination of environmental pollution, prevention of indiscriminate deforestation, creation of healthy conditions in the farmer's house and improvement in his economic conditions by providing more leisure for part-time employment, etc., the money value of which cannot be easily quantified.

The investment in a gas plant differs from that in other schemes for agricultural development like minor irrigation, dairy, poultry, etc. inasmuch as it does not generate direct cash inflow but yields other benefits which have to be computed in terms of savings on fuel, increase in crop yield by use of improved manure, etc. The quantification of this estimated income is hard to make in general terms. Consequently, the repayment of loan for this investment has to come from out of the general resources of the borrower and the loan cannot be said to be self liquidating in the ordinary sense of the expression.

The investment in a gas plant may be made either independently or as an integral part of investment in dairy farming or other schemes of agricultural development. The Group has examined the economic feasibility and the financial viability of gas plants on the basis of the estimates of cost made by the KVIC for plants of different sizes presently in use in the country. According to the KVIC calculations, all plants are beneficial to the farmers. After examining the various assumptions made by the KVIC and the limitations in their universal applicability, the Group has come to the conclusion that investment in a gas plant is economically feasible and financially viable, subject to the satisfaction of the technical criteria mentioned in chapter III. It may be mentioned that in working out the economics of other schemes for agricultural development, normally it is the practice to allow about one third of the gross surplus from the investment to be retained by the borrower for improving his living standard depending upon his present economic and financial condition. In regard to the gross surplus from investment in gobar gas plants, however, the Group has considered it desirable to take into account only about half of the estimated gross annual surplus worked out on the basis of economics of the plants of varying sizes for the purpose of repayment of bank loan. This liberal

allowance to the borrower is considered necessary for the following reasons:

(a) The investment in gas plant is not impelled by the felt need of the farmer as in the case of investment in other schemes for agricultural development.

(b) The investment does not generate direct cash income and benefits accruing from the investment cannot be quantified in precise monetary terms.

(c) The monetary value of dung as an input for feeding the gas plant in substitution of its previous use as farm yard manure or as fuel may vary sharply from area to area and will have to be calculated in relation to the conditions prevailing in different areas.

(d) The monetary value of gas and manure produced in a gas plant mentioned in the economics is the optimum but in actual practice, the whole benefit as calculated by us may not accrue to the farmer as the quantum of gas/manure produced daily may not be actually needed or used by him and it may be difficult for the borrower to get money value by sale of gas due to transport difficulty or lack of demand for manure in a particular area.

The economics worked out for plants of a few sizes show that the larger sized plants have greater economic value and consequently are more beneficial than the smaller sized plants.

The internal rate of return from investment in gobar gas plants on the basis of economic and financial analysis justifies the investment. The financial rate of return for investment in plants of different sizes is found to exceed 19 per cent.

The economics worked out by us further show that the smaller the size of the plant installed, the lesser will be the disposable surplus from it and, therefore, the longer will be the period of repayment of the loan. While the loan for a plant of the size of $85M^3$ could be amortised in 3 years, that for $2M^3$ gas plant will take not less than 12 years to repay.

Keeping in view the benefit-cost ratio, the investment in the installation of a gas plant may be considered as a bankable proposition provided, of course, certain safeguards are taken to ensure the technical and financial feasibility of each proposal.

With a view to deriving economies of large sized gas plants and ensuring optimum utility of gas and manure produced, the installation of bigger sized plants which may be operated on co-operative basis, covering groups of farmers, may be considered. The operation of plants on cooperative basis may solve many of the operational problems mentioned in chapter V and increase the coverage of beneficiaries who may not otherwise be in a position individually to satisfy strictly the technical and financial criteria for such investment. Before, however, such societies are formed, various connected organisational issues and management problems e.g. the distribution of gas and manure, fixation of their prices, etc. will need to be sorted out.

Operational problems

10.5 A few operational problems in the working of gobar gas plants in the country have been reported through different sources and during the field visits of the Group. While some problems, particulary technical, noticed in the day to day operations of the plants could be taken care of merely by an efficient follow-up service a few other problems are impeding the popularisation of the programme. These problems demand speedy solution for an accelerated progress in the next few years.

The operational problems reported and noticed by the Group can broadly be categorised as technical, socio-economic and organisational.

Technical problems relate to different aspects of the functioning of the plants and may be attributed to specific causes, the more important of which are —

(a) Rapid corrosion of the gas holder and pipeline.

(b) Seasonal fluctuation in gas production.

(c) Frequent breakdown of various components of the plants, such as, central guide pipe, hose pipe, etc.

(d) Cracking of the digester wall due to hollow space between the wall and the earth and more pressure of the gas than the wall can withstand.

(e) Formation of scum in the mixed slurry which hinders the release of gas from the slurry and causes the blistering of the surface and reduction in the life of the holder.

(f) The choking of the inlet and outlet pipes of the gas plant disturbing the flow of gas.

(g) Accumulation of water as a result of generation of steam along with gas. This results in choking of the burner obstructing the flow of gas.

(h) Lack of efficient generation of gas when water and dung are not mixed in the prescribed proportion.

(i) Formation and deposit of carbon during use of gas on the inner surface of the nozzle in the types of gas burners currently in use. The nozzle cannot be cleaned of the carbon deposit as the upper part of the burner cannot be removed.

(j) Limitation on transportation of gas in the currently used plants. The limitation on the distance renders the optimum use of gas difficult.

(k) Occasional difficulty in the availability of materials like cement and steel sheets for installation of gas plants. Substitute materials locally available have yet to be found.

The socio-economic problems arise due to various factors, like the price element, making it difficult to cover a wide section of medium and small farmers, non-availability of the backyard in the farmer's homestead or sufficient space therein for installation of plants. For farmers whose cattle graze in the open, dung

gathering becomes a laborious task, making collection of minimum quantity of dung for continuous production of gas difficult.

The organisational problems prop up due to factors like lack of awareness about the programme by certain agencies in some States — KVIBs, financing banks and State Governments—deficiency in follow-up service, frequent cases of non-availability of technical help and guidance at different stages of construction/ operation of the plants, occasional short supply of materials and components needed for construction of plants, delay in sanction and disbursement of loans and above all the lack of co-ordination among the concerned agencies.

The various operational problems—technical and others—noticed at present in the working of the gas plants bring to focus the deficiencies which are impeding the spread of a large number of plants all over the country. They also highlight the need for concerted efforts in the immediate future on the part of all the concerned agencies to rectify the deficiencies. While the technical problems need to be tackled by different research bodies, other operational problems—organisational, socio-economic, etc. will have to be resolved by a greater effort by the agencies like KVIC, KVIBs, financing banks, State Agriculture & Industries Departments, etc. through proper co-ordination.

Organisational set-up

10.6 For promotion, development and implementation of the programme, an integrated infrastructure capable of providing the necessary support is required. Such a structure should cover (a) technical expertise for pre and post construction and follow up service, (b) supply of materials and various components required for installation (c) extension service and (d) financial support.

The existing organisational set-up in each State comprises the KVIC/KVIB for technical guidance and help at all stages of construction of plants, private entrepreneurs and institutions, unemployed trained technicians, agro service centres and in some States, agro industries corporations for supply of materials, gas holders, components and post installation repairs service, financing banks for providing loan assistance and in some States, departmental staff for extension work.

The Group noticed many gaps and inadequacies in the existing structure. In view of the limited technical staff of the KVIC, it was becoming increasingly difficult for that organisation to render the required technical assistance which is its primary responsibility. For the same reason, the KVIC is not able to organise training programmes for personnel required for various jobs.

The KVIBs in most States are the weakest link in the whole structure. Many States have not set up separate cells for gobar gas work in the KVIBs. Where the Boards have taken up the work of gobar gas plants, the technical staff attending to other industries also look after the gas plant work as an additional item. In most States, the KVIBs do not organise training programmes, which responsibility also they should take up.

The commercial banks which have started financing the plants have yet to train up their agricultural officers in the technical aspects of the plants. These banks at present largely depend on the KVIC/KVIBs for guidance. The state and central cooperative banks have been permitted by the Reserve Bank of India to take up the financing of gas plants by granting medium-term loans.

In most States, the tie-up is lacking between the supply/service agencies and the programme execution. Similarly, there is totally inadequate post installation service in most States.

The extension staff of the State Agriculture Departments have not been fully involved in publicity work which was found to be wholly wanting in some States. In some of the States, little publicity was given to this programme through the States' Publicity Departments.

Subject to reorganisation and strengthening, the existing organisational structure in the various States is capable of giving the necessary support to the programme. The Group suggests the following measures:

(a) The KVIC should remain the apex body at the national level to look after the promotion, development and implementation of the scheme. It should primarily be responsible to provide technical know-how and guidance in all States as at present,

carry out research and development work in bio-gas technology along with other research bodies already engaged in such work and undertake the training programme of the personnel all over the country. If the KVIC must discharge adequately the responsibility entrusted to it under the programme, it will need not only to review its requirements of technical staff, Statewise, on a realistic basis and strengthen the staff suitably but also to reorganise the entire extension service throughout the country for the spread of the programme. The Government of India may have to provide necessary financial assistance to the KVIC towards fulfilment of the foregoing objective.

(b) Each State should build up a separate cell in the KVIB which should be provided with technical staff for rendering technical guidance and assistance and also for carrying out the training programme for various personnel entrusted with this work in the State. For this purpose, the State Government will have to provide necessary financial assistance.

(c) The financing banks, mostly the commercial banks, will have to treat this programme on par with other agricultural development schemes which are in the priority sector and train their agricultural staff in the job in collaboration with the KVIC/KVIBs.

The co-operative banks will also have to train up their staff for financing the plants in conformity with the guidelines provided by the Reserve Bank of India.

(d) For effective implementation of the programme, a tie-up between the programme and the various supply and service agencies is vital. For this purpose, the state agro-industries corporation may be considered as a central agency for the supply of materials, manufacture of standardised gas holders of different sizes, components, etc. and provision of post installation service through its skilled staff at its net-work of service centres. However, to meet the increasing demand, the existing arrangements with private entrepreneurs, unemployed technical personnel, institutions and agro service centres should continue.

(e) The extension staff of the agriculture departments of the State Governments should get fully involved in carrying out the extension work which is at present sadly lacking in most of the States. This will relieve the KVIC/KVIBs of the burden of extension work and enable them to devote greater attention to technical work and training programmes. The extension staff should be suitably trained in the programme.

(f) For effective implementation of the programme, close co-ordination among the various agencies is vital. At present such co-ordination is lacking in most of the States. Co-ordination committees existing at present for agricultural development programmes at block/district/State levels should include this programme in their regular agenda. At the State level, the Secretary, Agriculture Department of the State Government and at the district level, the Collector should be the programme co-ordinators. The Agricultural Production Commissioner who already heads the state level Co-ordination Committee for agricultural development schemes should take personal interest in the programme.

Financing of gobar gas plants

10.7 For implementing a sizeable programme of installation of gobar gas plants, institutional finance would be necessary and the existing financing institutions already providing support to other agricultural development programmes will be able to finance this programme also.

The commercial banks have already entered the field of financing the gas plants. During the last two years, since their entry, the total number of plants financed by them has exceeded the number of plants constructed in the previous ten years with the financial assistance from the Government of India through the KVIC. The banks have adopted suitable procedures and laid down terms and conditions for financing the programme. Since this is a new type of activity, they have generally adopted the KVIC guidelines for appraising the loan proposals. Till the time the banks build up their own technical expertise, they will have to depend largely on the technical assistance of the KVIC/KVIBs. The head offices of banks have authorised their branches to finance the gas plants. Their instructions include

those for determining loan eligibility, financial viability, rate of interest, margins, security, repayment period, etc. For cooperative banks, the Reserve Bank of India has recently issued suitable guidelines in terms of which they can commence financing gas plants. The Reserve Bank of India has advised the land development banks that long term loans need not be made for financing the plants.

The commercial banks are at present following the same lending procedures which they generally follow for financing other agricultural development programmes.

The Group has laid down suitable criteria for banks for financing the programme of gobar gas plants on a regular basis. The criteria, briefly indicated below, cover various aspects of financing the programme :

(i) For effective implementation and supervision of the programme, the banks should draw up schemes on area basis. For this purpose, suitable potential areas (may be districts) in each State could be identified. The proposal to be financed may be either for independent investment in a gas plant or may form part of an agricultural development scheme e.g. a scheme covering the installation of a gas plant along with dairy development programme of a farmer.

(ii) The main consideration for eligibility for bank loan should be the holding of a minimum number of cattle corresponding to the size of the plant proposed to be installed. The eligibility for bank loan need not be linked to the holding of a specified acreage of land as stipulated by the Reserve Bank of India in its circular No. ACD. Plan. 3889/PR 34-74/5 dated 9 June 1975.

(iii) A proposal to be eligible for finance should satisfy the various technical criteria mentioned in chapter III.

(iv) The proposal should be economically feasible and financially viable. For this purpose, it will be necessary for the banks to work out the economics in each case, keeping in view the local conditions.

(v) The quantum of loan will depend upon the estimated capital cost of the plant according to the size proposed and the amount of subsidy available under the scheme.

(vi) For various reasons mentioned in paragraph 7.5 (viii) of chapter VII, the Group has not suggested any down payment from the borrowers as long as subsidy is available under the scheme.

(vii) The banks may charge interest on loans for gas plants at rates which they are currently charging on loans which come under the priority sector advances. The cooperative banks may charge the same rates of interest as they are currently charging on term loans for other agricultural development schemes.

(viii) As regards security for loans for plants, the existing stipulation of banks for obtaining hypothecation of gas holder/appliances/third party guarantee and/or hypothecation of cattle, where available, should be adequate. For plants of larger sizes, the banks may at their discretion obtain mortgage security. The land development banks should obtain such security as is stipulated under their bye-laws/Cooperative Societies Act/Rules.

(ix) As the investment in gas plants does not generate cash incomes, the banks will have to take into account the general financial position of the borrowers while calculating their repaying capacity.

(x) The repayment period of the loans will have to be calculated taking into account the repaying capacity of the borrowers, on the basis of their general financial position, as mentioned in (ix) above.

(xi) There is no need to prescribe a uniform loan application form for all banks as the existing forms currently in use in different banks will serve the purpose.

(xii) Loan is to be disbursed in parts as the work progresses. Payments for gas holders/appliances should be made direct to the suppliers.

(xiii) The banks may follow the same documentation procedure as they are currently following in respect of loans for other agricultural purposes.

(xiv) For effective and speedy implementation of the programme, it will be necessary for the banks to exercise close supervision and follow-up after the installation of the plants.

The Reserve Bank of India has recognised the financing of gobar gas plants as one of the approved agricultural purposes and has agreed to provide refinance facilities to co-operative banks. In view of the likely long periods of loans for plants of sizes generally in use, refinance facilities from higher financing agency should be extended to commercial banks and land development banks.

As the loans for gobar gas plants fall in the category of priority sector advances, such loans should be eligible for guarantee under the scheme of the Credit Guarantee Corporation of India.

Training of personnel

10.8 One of the reasons for the tardy progress in the implementation of the programme is the paucity of adequate trained personnel at all levels. Trained personnel are needed to attend to the various aspects of the programme e.g. technical guidance and help, construction of plants, supply of components, provision of other services, financial assistance and extension service.

The KVIC and KVIBs are the only organisations available at present for organising training facilities for various agencies involved in implementing the programme. They have different schemes for training of personnel to provide technical know-how, construct plants and supply components, etc., apart from their own trained staff to attend to the different aspects of the programme. With the impetus provided to the programme by the entry of the commercial banks for financing the gas plants during the past two years the

trained staff available with the KVIC/KVIBs are proving inadequate to cope with the growing demands under the programme. It is, therefore, imperative that arrangements should be made on an urgent basis for training of personnel at different levels, if a larger programme under the scheme is to be implemented.

The Group has suggested training for (a) the additional staff of KVIC/KVIBs required for augmenting their teaching faculty, (b) agricultural officers and branch executives of commercial banks dealing in agricultural finance, (c) supervisors and higher level staff of cooperative banks and (d) extension staff of the State Governments.

For training of staff of the financing banks and the extension staff, two types of training have been suggested; one, a brief course and the other a full course.

The duration of the brief course will be about a week while that for the full course, about 3 weeks.

The contents of the brief course should be decided by the KVIC in collaboration with the agencies concerned, while for the full course, the normal course for training of staff, as at present being conducted by the financing institutions, should provide for one or two talks on bio-gas technology.

The brief course may be organised at State headquarters in collaboration with the KVIC/KVIBs, while the normal course may continue according to the present arrangements for training of staff of financing banks and State Government Departments, in agricultural financing.

To facilitate the suggested training programmes, the KVIC may build up suitable training material in the form of audio-visual aids, film strips, etc. The KVIC should also place at the disposal of the various training institutions, model gobar gas plants for demonstration purposes.

Research and development

10.9 The present high cost of investment for the installation of gobar gas plants and the various technical problems connected with their operation emphasise the urgent need for undertaking co-ordinated research projects by various research organisations engaged in bio-gas technology for developing a low priced, durable and trouble-free plant.

The research projects should cover both fundamental and applied aspects of bio-gas technology. The fundamental research relates to the anaerobic fermentation of cattle dung and other organic wastes, physical properties of bio-gas including methane, and the chemical aspects. The applied research relates to large and wide areas like fermentation research, engineering technology, corrosion control of steel gas holder, auxiliary system, gas distribution/supply, manure utilisation, etc. and is of immediate importance in the context of the need for installation of larger number of plants in the next few years.

Already various research bodies like IARI, PARI, KVIC, NEERI and agricultural universities and individuals are engaged, on their own, in research work relating to bio-gas technology without a central organisation guiding and coordinating their activities. In the absence of such an agency, a package of results based on the individual research work is not available for commercial use.

Considering the need for a co-ordinating agency, the Department of Science and Technology of the National Committee of Science and Technology (NCST) was appointed by the Government of India as the co-ordinating body for all India research and development on bio-gas technology.

Recently, the NCST has, on the basis of the recommendations of the Economic and Social Council of Asia and Pacific (ESCAP) Workshop held in India, finalised specific project proposals to be carried out by various research organisations. These proposals cover almost all important aspects of the

technological development connected with the gobar gas plants. The Group suggests that research on these project proposals be carried out expeditiously and the research results utilised for developing low-priced and trouble-free plant.

The research programmes as finalised by the NCST would not involve additional cost to the various research bodies as they are already engaged in research work in bio-gas technology.

ANNEXURE 1

QUESTIONNAIRE ISSUED TO COMMERCIAL BANKS

(Paragraph 1.4)

Notes : (1) In this questionnaire —

(a) the term "plant" has been used to mean gobar gas plant;

(b) the Khadi & Village Industries Commission and State Khadi & Village Industries Boards have been referred to as "Commission" and "Boards" respectively.

(2) Please indicate the statistical position as on 30th June 1975.

General

1.1 Name of the bank

1.2 Statewise number of offices of the bank at rural/semi-urban centres (i.e. places having a population upto 1 lakh) in India :

State	*No. of Offices*

(Please attach sheet, if necessary)

1.3 Has the bank commenced granting advances for the installation of plants?

1.4 If so, has any scheme been formulated?

Please give particulars of the scheme and the date of its introduction or implementation.

1.5 Have all branches of the bank been authorised to grant advances for installation of plants?

If not, please state the reasons for differentiation?

Economics

2.1 Has the bank worked out the economics of the different types/sizes of the plants?

If so, please furnish full details for each type/size separately, giving the basis on which the economics has been worked out. (Kindly attach work sheets in respect of each type/size of plant financed by the bank).

2.2 Has the bank any suggestions to offer for revising the economics of the plants as a result of recent studies/experience/research in the field?

Eligibility

3.1 What are the eligibility norms prescribed by the bank for sanction of advances? Is the eligibility being related to ownership of minimum acreage or number of cattle head?

3.2 If the eligibility is being related largely to the ownership of the number of cattle head, does the bank require that the cattle be stablebound?

If not, how does the bank ensure that the plants will get adequate supply of dung for continuous use?

3.3 Does the bank stipulate a condition to the effect that the financial assistance for installation of plants will be made available by it only to such farmers who get all their credit needs from your bank?

3.4 Does the bank grant advances for installation of plants to non-agriculturists also? If yes, whether separate economics

has been worked out for such borrowers, taking into account particularly, how the manure produced by the plants is used by them?

3.5 Has the bank prescribed maximum distance stipulation for the location of the plants from the concerned branch?

3.6 Does the bank relax the maximum distance stipulation when clusters of plants are proposed in a village? If yes, what minimum number the bank would consider for a cluster of plants?

3.7 Are any special concessions given to farmers covered by SFDA/MFAL, etc. agencies in the matter of granting accommodation for construction of plants? If yes, please give details.

Technical feasibility

4.1 How does the bank satisfy itself of the technical feasibility in respect of setting up of the plant of each individual applicant?

4.2 Does the bank solely rely on the technical feasibility report of the Commission/Board?

4.3 Does the bank solely rely on the technical assistance of the Commission/Board for the construction of the plant?

4.4 Does the bank get necessary technical assistance in respect of items 4.2 and 4.3 from the Commission/Board without delay?

4.5 Does the bank consider it possible that an alternative source of the technical services provided by the Commission/Boards could be developed by private parties or banks, keeping in view the possibility of a large increase in the number of applications in the near future?

4.6 Will it help in expediting processing of applications and sanctioning the assistance if the bank builds up its own technical expertise?

4.7 If the bank has in view any alternative means of securing technical services, please give details.

4.8 Has the bank developed its own technical services? If not, will the bank be prepared to train one or two persons from each rural branch in case the Commission/Boards provide training facility concerning various aspects as to installation and running of the plants?

Terms of lending

5.1 Has the bank laid down any specified quantum of loan/finance for each size of the plant? If not, how is the amount of finance determined in the case of each individual applicant?

5.2 Does the quantum of loan/finance take into account the element of margin? If yes, the usual percentage rate of margin on the cost of the plant may please be indicated.

5.3 Is the availability of cash subsidy from the Government and/or technical assistance from the Commission/Boards made a necessary condition for the grant of loan?

5.4 At what stage of installation of the plant is the subsidy usually received from Government/Commission/Boards and adjusted to the loan accounts? Are there any delays in the receipt of the subsidy? In the case of delay, does the bank make available to the borrower entire cost of the plant?

5.5 In case the Government/Commission/Boards decide to withdraw or stop giving subsidy, will the bank be prepared to continue to go ahead with the scheme or will it stop or go slow with the scheme?

5.6 What is the usual rate of interest charged on loans? Does the rate of interest vary —

(a) from borrower to borrower;

(b) from centre to centre; or

(c) from size to size of the plant.

5.7 Is there an element of concession in the bank's rate of interest on account of the loan being treated as agricultural finance?

5.8 If the loans for plants are not treated as agricultural advances, under what category are these classified?

5.9 Are there any agencies in any States, like Panchayat Samiti, Zilla Parishad, etc. which offer subsidy either in the capital cost or in the rate of interest?

(Please indicate the position statewise).

If so, has such subsidy helped in the speedy implementation of the scheme and increase in the number of applications?

5.10 What is the usual period for repayment of the loan stipulated by the bank?

5.11 From the bank's study of techno-economic feasibility of the scheme do you consider it would be desirable to vary loan repayment period?

If so, please give details and reasons.

5.12 Does the bank stipulate different loan repayment schedules for different plant sizes/borrowers? If so, please indicate the basis for such variations.

5.13 Does the bank charge the borrowers any service charge, inspection fee or any other levy/out-of-pocket expense, etc. in addition to the interest? If so, please furnish details.

5.14 What is the type of security the bank obtains for granting loans for setting up the plants, both for agriculturists and non-agriculturists?

5.15 Does the bank insist on obtaining mortgage of the borrowers' land/other immovable property as security for loans? Please furnish details.

5.16 What documents does the bank get executed by the borrowers?

5.17 Does the bank insist, for operational or other reasons, on providing finance in a specified area only if a minimum number of plant borrowers are available?

5.18 What is the usual time-lag between the receipt of loan application and setting up of the plant?

Performance appraisal/evaluation

6.1 Does the bank fix periodical targets for financing the plants? If so, are these targets related to the amount financed or the number of plants financed?

6.2 Are the targets fixed for the bank as a whole or separate targets are fixed for individual branches/States/areas?

6.3 What targets were fixed for the years 1973, 1974 and 1975? Kindly give State-wise performance of the bank against the targets fixed for these years, in the proforma in Appendix I.

6.4 Kindly give the names of the branches, Statewise, which have financed 25 or more plants in any one calendar year.

6.5 Kindly indicate the bank's recovery performance in respect of loans for plants, in the proforma in Appendix II. In case of defaults please indicate the reasons therefor.

6.6 What is the nature of post-disbursement supervision exercised by the bank over the functioning of the plants financed by it? Please give details.

6.7 Have any plants, whether financed by the bank or not, gone out of commission due to technical defects/faults? If so, what remedial measures are taken to put back the plants in working condition?

6.8 Do you consider that it will be helpful if the loans for construction of plants are covered by the guarantee scheme for small loans of the Credit Guarantee Corporation of India Ltd.?

6.9 Do you consider that refinance support is necessary from a higher financing agency without which the plans/targets will be affected? If yes, please indicate the nature and extent of such refinance facilities sought.

General

7.1 It has been reported that lack of timely availability of the loans, besides the materials like gas holders, bricks, cement, etc. required for the construction of gas plants has stood in the way of implementation of the scheme. Please suggest ways to overcome these in order to enable the bank to fulfil the targets.

7.2 Are any difficulties, such as lack of co-ordination among the concerned agencies, inadequacy of extension services, etc. being faced by the bank's branches in financing/implementing the scheme? Please give details.

7.3 Are there any agencies, besides the Commission/Boards which have prepared the schemes for installation of gobar gas plants? If so, please furnish the details.

7.4 What is the size of the plant generally preferred by and is popular among the farmers and other individuals?

7.5 Kindly enclose a copy each of the circulars/instructions/ brochures/material issued by the bank concerning gobar gas plants.

7.6 Please give any other suggestion which in the opinion of the bank, if implemented, will give a fillip to the scheme and help reaching the target set by the Government of India.

APPENDIX I

(Kindly see item 6.3 of the questionnaire)

Statement giving the performance of the bank in the implementation of the gobar gas scheme

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Name of the bank

State	1973							
	Target		Applications received		Applications sanctioned		Plants financed and completed	
	No.	Amt.	No.	Amt.	No.	Amt.	Size	No.

State	1974							
	Target		Applications received		Applications sanctioned		Plants financed and completed	
	No.	Amt.	No.	Amt.	No.	Amt.	Size	No.

State	1975 (upto end September)							
	Target		Applications received		Applications sanctioned		Plants financed and completed	
	No.	Amt.	No.	Amt.	No.	Amt.	Size	No.

APPENDIX II

(Kindly see item 6.5 of the questionnaire)

Statement showing the recovery performance of the bank in respect of advances for setting up gobar gas plants

Name of the bank

State	30-6-1973			
	Outstandings		Overdues for over 6 months	
	No. of plants	Amount	No. of plants	Amount

State	30-6-1974			
	Outstandings		Overdues for over 6 months	
	No. of plants	Amount	No. of plants	Amount

State	30-6-1975			
	Outstandings		Overdues for over 6 months	
	No. of plants	Amount	No. of p'ants	Amount

ANNEXURE 2

QUESTIONNAIRE ISSUED TO KVIC

(Paragraph 1.4)

Note : In this questionnaire, "gobar gas plants" have been referred to as "plants".

General

1.1 Kindly mention, in brief, the history of the discovery and evolution, etc. of the plants and the circumstances leading to their development in the present form, whether in India or elsewhere.

(Please attach notes, papers, etc. if any available on the subject).

1.2 Can you describe the plant as at present evolved, its technique, technical efficiency, suitability in Indian climatic conditions and other features. (The details may please be supported, where necessary, by sketches, drawings, etc.)

1.3 What priority is accorded to the plants by the Planning Commission and the Government of India in their programmes for rural economic/social development?

1.4 Will the extensive use of plants benefit the farmers economically and socially and also help the country tangibly? Please give details.

1.5 What are the social benefits of the plants individually to their owners and collectively to the community at large? Is it possible to quantify such benefits? If so please indicate such quantifications.

1.6 Can you indicate the steps which have been taken by the Commission to popularise the plants among the

farmers in every part of the country? Is the programme adequate or does the Commission consider that due to limitation of staff or other constraints it has not been as intensive as it should have been?

1.7 Can you mention the circumstances in which the Commission was called upon to introduce and develop the plants?

1.8 Is the Commission aware of the existence of any other body/agency including private company/firm which has also devised/developed/introduced/marketed plants in any form in India?

1.9 It is understood that the Commission has undertaken/completed certain studies — technical and economic — concerning plants. If study reports are available, can the Commission furnish the same for perusal (and return, if necessary).

1.10 More plants have come up in certain States/areas than others. Can the Commission give any reasons for lack of uniform growth of plants throughout the country?

1.11 Has the Commission studied the feasibility of establishing community plants in villages? If so, what are the details of the study? (Kindly mention the economics and proposed arrangements for finance including bank finance, if any, distribution of gas and selling of manure, etc.)

1.12 Has the Commission set any State-wise/year-wise targets for installation of plants during the Fifth Five Year Plan? Please give details.

1.13 It has been observed that as the installation of plants in villages involves a number of agencies — Commission, State Boards, State Government Agriculture/Industries Departments, zilla parishads, panchayats, banks, etc. considerable co-ordination is necessary to avoid delays. The Commission may kindly indicate the manner in which

co-ordination between the concerned agencies is being or can be achieved for cutting down delays.

1.14 The plants are required to be constructed in remote villages where the necessary materials like cement, bricks, gas holders, stoves, pipes, etc. are not locally available. Nor are the communications always good for transportation of materials to the fields. What arrangements have the Commission visualised for supply/delivery of materials at sites? Can the arrangements be decentralised and the task entrusted to agencies like agro-industries corporations, small scale/cottage industrial units, agro-service centres run by unemployed technical people?

Technical aspects of the scheme

2.1 The plants can be installed in different sizes. Kindly indicate the different sizes being recommended by the Commission?

2.2 What are the considerations for recommending different sizes of plants?

2.3 The Commission offers free technical assistance/guidance for the construction of the plants. What are different forms in which this assistance/guidance is provided?

2.4 Please give details of the existing arrangements made by the Commission for training of technical personnel for the supervision/installation/maintenance of the plants in different States.

2.5 Will it be possible for the Commission to continue to provide technical assistance/guidance for the construction of the plants when banks start financing these in large numbers?

2.6 Has the Commission considered the question of engaging adequate number of technically qualified personnel to be

in a position to provide technical assistance and guidance when the demand for construction of the plants picks up in the near future.

2.7 Banks have commenced financing the plants. In view of the subsidy, banks insist on specifications prescribed and completion certificates given by the Commission. This requirement is likely to result in delay in the completion of formalities for grant of loans. Will it be possible for the Commission to agree to release subsidy on the banks' own certificates to the effect that the plants have been constructed as per Commission's specifications? Can the Commission suggest/arrange for an alternate agency or arrangement for providing technical assistance/guidance?

2.8 Is it possible for a large number of persons including bank officials to get trained in the technical aspects of the plants in a short time and start providing technical assistance/guidance? If so, will the Commission be in a position to impart such training or provide training facilities? Will such a course help in expeditiously meeting the demand for construction of a large number of plants?

2.9 It has been contended by certain soil scientists that cow dung when passed through the plant to produce gas manure loses a part of its fertilising value. If, on the other hand, dung is ploughed direct in the land, it fixes atmospheric nitrogen in the soil itself and makes the land rich in nitrogenous compounds, which is lost when passed through the plant. Can the Commission support this view? If not, please mention reasons giving supporting technical data, if necessary.

2.10 Is the Commission carrying out any research programme for improvement in the design, efficiency, and other technical aspects of the functioning of the plants? If so, kindly give details. The aspects in which improvements could be effected mainly relate to enhancement in the value of manure, reduction in the cost of plant (gas holder, digester, pipes, etc.) increasing and maintaining the gas production during cold season, etc.

Economic feasibility

3.1 The cost of installation of plants varies having regard to the size, place, and cost of materials, quality of terrain, etc. Has the Commission worked out economics or cost-benefit ratio of each plant having different cost factor? If so, kindly indicate broadly whether the plants are considered universally a viable proposition.

Financial support

4.1 What is the quantum and form of subsidy the Commission offers to those who install the plants? On what basis the amount of subsidy is computed? How long will the grant of subsidy be continued?

4.2 What is the procedure for sanction of subsidy? How long does it take for the applicant to get the subsidy after his application? At what stage of completion of the plant is subsidy actually paid?

4.3 Does the Commission grant subsidy to all persons who construct the plants or only to agriculturists?

4.4 Please furnish State-wise/year-wise break-up of the amount of subsidy disbursed by the Commission and the grants received from the Government till 30.6.1975.

4.5 The Commission had in initial stages of the introduction of the plants offered to provide loans to farmers to the full extent of the cost of the plants. Kindly indicate the terms on which this financial assistance was provided. Please also indicate the percentage of arrears, if any, in the repayment of such loans.

4.6 The Commission is aware of the terms on which the banks grant loans for the construction of the plants. Does the Commission consider whether the terms need any liberalisation? If so, please specify the areas in which such liberalisation is desirable.

4.7 The term of commercial bank loans for construction of plants is usually 3-5 years, whereas the Commission had granted loans upto 10 years. In the light of economics of the plants worked out by the Commission which period will be justified for repayment of bank loans — both from the point of view of the farmers as well as of banks?

Statistical data

5.1 Please furnish in the following proforma the details of the gobar gas plants, State-wise and year-wise, installed with (a) loan assistance by the Commission and (b) loan assistance by banks:

(i) Financed by Commission

State	Year	Plants financed		
		Size	Number	Amount (Rs. lakhs)

(ii) Financed by banks

State	Year	Plants financed		
		Size	Number	Amount (Rs. lakhs)

5.2 Please furnish details about recovery of loans financed with loan assistance by the Commission in the following proforma :

(Position as on 30.6.1975 — Amounts in lakhs of rupees)

State	Year of installation	Loans					
		Plants financed		Dues as prescribed		Dues realised	
		No.	Amt.	No.	Amt.	No.	Amt.

Overdues							
Less than 6 months		Between 6 months and 1 year		Between 1 and 2 years		Over 2 years	
No.	Amt.	No.	Amt.	No.	Amt.	No.	Amt.

N.B. Reasons for overdues and the legal/other action taken/proposed to be taken may please be indicated.

ANNEXURE 3

ESTIMATES OF MATERIALS REQUIRED FOR 3M³ GAS PLANT

(Paragraph 3.5)

I. *Materials required for construction of digester*

		Vertical type	*Horizontal type*
(i)	Bricks	2900 Nos.	2800 Nos.
(ii)	Sand	100 c.ft.	100 c.ft.
(iii)	Stone chips	¾" 25 c.ft.	¾" 25 c.ft. ½" 10 c.ft.
(iv)	Cement	15 bags	20 bags
(v)	A.C. pipe 4" diameter	19 rft	20 rft
(vi)	M.S. rods ½" diameter (for horizontal gas plants)	—	120 rft
	M.S. rods 3/8" (for horizontal gas plants)	—	80 rft

II. *Materials required for central guide frame*

(i)	1¼" × 1¼" × ¼" angle iron	39 rft
(ii)	2" diameter G.I. or M.S. pipe	6 rft
(iii)	9" × 9" and ¼" thick plates	2 Nos.
(iv)	½" diameter 1¼" long bolts with nuts	16 Nos.

III. *Materials required for gas holder*

(i)	1" × 1¼" × ¼" angle iron	65 rft
(ii)	M.S. or G.I. or W.I. Pipe 3" diameter	3 1/6"

(iii)	9″ diameter 1¼″ thick flange plates	9 Nos.
(iv)	Flats 1½″ and ¼″	12 rft
(v)	Gas outlet pipe flange 1″ diameter	1 No.
(vi)	G.I. Bend 1″ diameter	1 No.
(vii)	Heavy duty gate valve 1″ diameter	1 No.
(viii)	Nipple 1″ diameter	1 No.
(ix)	Coping or socket 1″ diameter	1 No.
(x)	3 metre 1″ reinforced rubber pipe with 1″ adapters and rubber washer at both ends	1 No.
(xi)	12 gauge M.S. sheets (3′ × 6′)	3 Nos.

Notes : 1. Items Nos. II and III, (gas holder and central guide and frame) must be entrusted to a local workshop for fabrication.

2. 10% of the cost of all the above items will cover up the gas pipe. the diameter and the length of which will depend upon the consumer's number of bends and elbows used, flow of gas in c.ft. per hour, etc,

3. In case of horizontal gas plant, the estimated cost may go up by 10%.

ANNEXURE 4

PARAMETERS USED IN WORKING OUT EXPENDITURE AND INCOME IN STATEMENTS 1A TO 7A

(Paragraph 4.9)

1. On an average an animal (stable bound) yields 10 kgs. of dung per day. The variation may be between 7 and 15 kgs. per day depending upon the size of the animal, feed, etc.

2. From 1 kg. of dung, 37.5 litres or 1.3 c.ft. of gas is obtained. This varies between 1 c.ft. and 2 c.ft. depending upon the composition of the dung and ambient temperature.

3. One kg. of cattle dung, if converted into FYM in manure pit will produce 0.25 kg of FYM.

4. One kg. of cattle dung passed through gobar gas plant produces 0.375 kg. of gobar gas manure.

5. The cost of gobar gas on the basis of kerosene replaoement comes to 68 paise per M^3 of gas.

6. The cost of gobar gas manure as ascertained from the farmers will be Rs. 50 per ton, while that of FYM would be Rs. 40 per ton.

7. One kg of cattle dung produces 0.24 kg. of dried cattle dung cakes.

8. About 20 kgs. of cattle dung cakes are equivalent to 1 litre of kerosene in utilisable heat value.

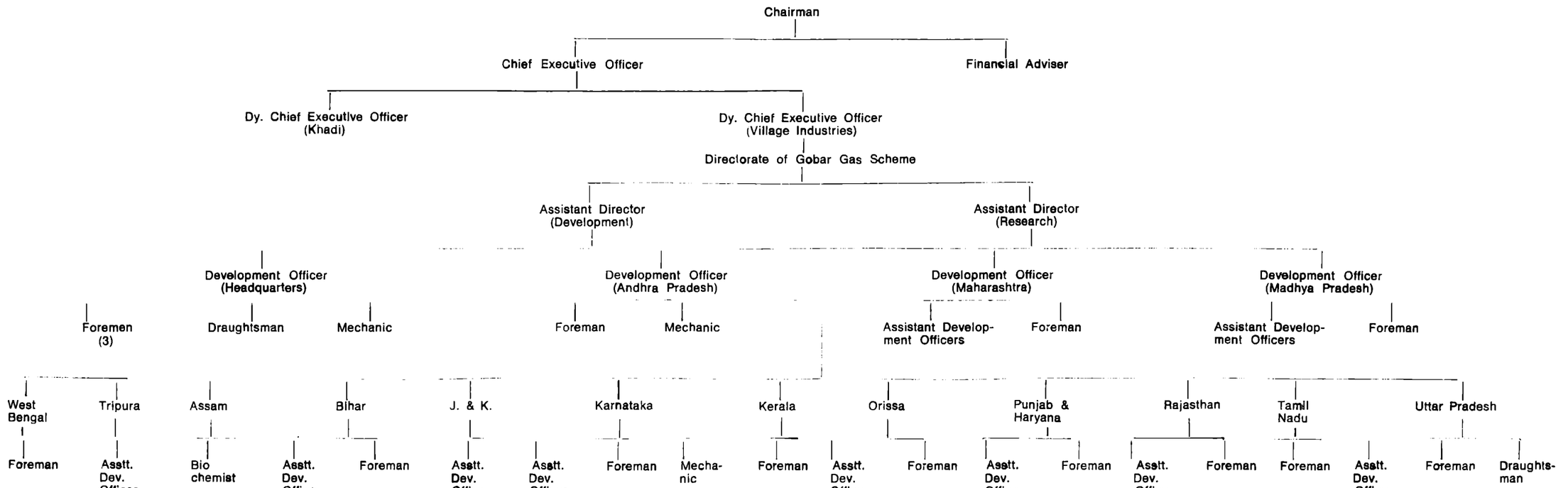
Data furnished by KVIC.

ANNEXURE 5

ORGANISATIONAL SET-UP OF KHADI & VILLAGE INDUSTRIES COMMISSION

(Relating to gobar gas plants)

(Paragraph 6.3)



ANNEXURE 6

STATEMENT SHOWING INSTALMENTS OF LOANS DEFAULTED UNDER KVIC LOANS

(as on 31.3.1975)

(Paragraph 7.3)

State	Amount of default Rs. P.
Andhra Pradesh	1,10,382.77
Assam	8,061.05
Bihar	48,992.62
Delhi	977.53
Haryana	5,434.43
Himachal Pradesh	349.20
Karnataka	35,035.14
Kerala	7,399.94
Madhya Pradesh	36,204.78
Maharashtra	39,816.32
Orissa	3,122.26
Punjab	10,821.42
Rajasthan	10,241.25
Tamil Nadu	7,785.62
Uttar Pradesh	1,22,605.47
West Bengal	958.26
Total :	4,48,188.06

ANNEXURE 7

SALIENT FEATURES RELATING TO FINANCING OF GOBAR GAS PLANTS BY COMMERCIAL BANKS

(Paragraph 7.3)

Sr. No.	Name of the bank	Date of introduction of scheme for financing gobar gas plants	Whether all branches are authorised to grant loans under the scheme	Basis of determination of eligibility for loan		Basis of determination of economic feasibility		Margin stipulated for the loan	Rate of interest	Service charges if any, recovered	Repayment period of the loan	Nature of security	Usual sizes of plants for which loans have been granted	Remarks
				Minimum land holding	Minimum number of cattle head	As worked out by KVIC	Worked out by the bank itself							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A.	**State Bank Group**													
1	State Bank of India	March, 1974	yes	—	yes	yes	Bank has also worked out — generally based on KVIC economics.	25% — relaxable in deserving cases.	15.5% (since reduced to 12.5% from 1-1-1976)	Nil (inspection charge of Rs. 3 per visit is charged)	Upto 5 years	In States where legislation on the lines suggested by the Talwar Committee has not been passed, for small loans upto Rs. 3,500 hypothecation of the plant and group guarantee. Mortgage/charge on land is taken in other cases.	100 c.ft.	Only the farmers assisted by the bank or those who intend to avail of the assistance for agricultural operations are being financed for setting up gas plants.
2	State Bank of Bikaner & Jaipur	March, 1974	yes	—	yes	yes	—	20% to 25% i.e. equivalent to subsidy.	16%	Inspection charge not exceeding Rs. 5 per quarter	Upto 5 years	Third party guarantee or group guarantee or mortgage where available.	105 to 210 c.ft.	
3	State Bank of Indore	—	yes	—	yes	yes	yes	25% — available as government subsidy.	15.5%	Inspection charge Rs. 3 per quarter	3 to 5 years	Hypothecation of plant and third party guarantee. In case the borrower is having less than 10 acres of land, mortgage of land is insisted upon as stamp duty and registration charges are remitted by the State Government on such land.	150 c.ft.	
B.	**Nationalised banks**													
4	Allahabad Bank	February, 1975	yes (other than branches located in city and metropolitan areas)	—	yes	yes	—	10%	On a sliding scale depending upon the amount (treated as agricultural advances)	No charge upto Rs. 2,500. Service charge from Rs. 3 to Rs. 50 per year charged for amounts in excess of Rs. 2,500 up to Rs. 25,000	2 to 3 years	Guarantee of two persons and hypothecation of plants for loans upto Rs. 5 000. For loans above this amount, registered/equitable mortgage of land is additionally obtained.	100 to 200 c.ft.	After disbursement of the loan amount, claim for 25% subsidy is being made.
5	Bank of Baroda	October, 1974	yes (initially extended to selected branches)	—	yes	yes	Worked out on the basis of KVIC economics	25% — available as government subsidy.	11% for loans upto Rs. 10,000. For loans above this amount but below Rs. 50,000, 13.5%	NIL	3 to 5 years	Hypothecation of plant and appliances, one good surety and, if possible, hypothecation of cattle.	60 to 100 c.ft.	
6	Bank of India	February, 1974	yes	—	yes	yes	To be amended according to local conditions.	10%	10.5% for loans upto Rs. 2 500 and 12% for loans above that amount	In case of farmers other than small and marginal farmers actual inspection charges levied on pro rata basis	3 to 5 years	Hypothecation of gas holder, frame, pipeline and stoves and where available, livestock. Mortgage of land is taken as collateral wherever it is available and does not unduly add to the cost of borrowing.	70 to 140 c.ft.	
7	Bank of Maharashtra	January, 1974	yes	—	yes	yes	—	25% — available as government subsidy.	Linked to land holding. Where the borrower does not hold any land it is linked to the amount sanctioned (treated as agricultural advances)	NIL	Upto 5 years	Hypothecation of materials, third party guarantee and mortgage of agricultural land.	250 c.ft.	The bank generally follows the principle of one borrower one bank.

1	2	3	4	5	6	7	6	7	8	9	10	11	12	13	14	15
8	Canara Bank	November, 1973	yes	—	yes	yes	yes	yes	—	25% — wherever subsidy is not available.	12.5% for loans upto Rs. 10,000	Inspection charges varying from Rs. 2 to Rs. 20 per inspection depending upon the amount of loan	3 to 5 years	Hypothecation of plant and milch cattle and mortgage of land for loans over Rs. 5 000 (which is being enhanced to Rs. 10,000).	100 to 150 c.ft.	
9	Central Bank of India	February, 1974	Branches in Punjab and Haryana have been authorised.	—	yes	yes	yes	yes	Branches asked to work out representative economics in consultation with KVIB.	25% — available as government subsidy.	Varies between 10.5% and 16% depending upon the size of the plant	For loans between Rs. 2,500 and Rs. 5,000 service charges at Rs. 7.50 per half year	3 to 5 years	Hypothecation of plant and, if available, cattle and one or two guarantors.	Medium size	
10	Dena Bank	January, 1974	yes (initially introduced in lead districts in Gujarat)	yes (5 acres cultivated land)	yes	yes	yes	yes	Bank also appraises.	25% — available as government subsidy.	13%. Concessions offered to small/marginal farmers	Supervision / inspection charges varying from Rs. 5 to Rs. 100 per year	3 years	Hypothecation of animals.	150 to 200 c.ft.	
11	Indian Bank	April, 1974	yes	—	yes	yes	yes	yes	—	10% cash margin	15%	NIL	3 years	Hypothecation of plant	100 to 150 c.ft.	It is generally insisted on the borrowers to confine their dealings to one institution.
12	Indian Overseas Bank	September, 1975	yes	—	yes	yes	yes	yes	—	25%	15.5% with 0.5% rebate for prompt repayment	Inspection charges pro-rata)	3 to 5 years	Hypothecation of plants and animals and one good guarantor.	70 to 105 c.ft.	
13	Punjab National Bank	March, 1974	yes	—	yes	yes	yes	yes	—	25% — available as government subsidy.	12.5%	Inspection charge varying from Rs. 5 to Rs. 50 per year for loans exceeding Rs. 2,500	Upto 5 years	Loans upto Rs. 5,000 by hypothecation of plants and one guarantor. Loans above that amount secured by mortgage of land worth atleast 200% of the amount in addition to hypothecation of plant.	100 to 150 c.ft	It is insisted that borrowers should also avail of other loan facilities from the bank.
14	Syndicate Bank	October, 1973	yes	—	yes	yes	yes	yes	—	25%	13.5%	No service charge if loan is less than Rs. 5,000	Upto 5 years	Clean. Collateral security is insisted if the loan amount exceeds Rs. 5,000.	100 to 250 c.ft.	
15	Union Bank of India	December, 1973	yes	—	yes	yes	yes	yes	—	15% exclusive of subsidy. In some cases the margin is waived.	13%	NIL	3 to 5 years	Hypothecation of plant and accessories. Mortgage of land in cases where farmers are not indebted to the bank.	No information	All farmers who have not borrowed from any other financing agency are eligible.
16	United Bank of India	Recently introduced	No only to selected branches	—	yes	yes	yes	yes	—	25% — available as government subsidy.	12.5%	NIL	Not mentioned.	Hypothecation of plant and 2 guarantors.	100 c.ft.	Introduced the scheme at a few selected branches where programme for animal husbandry has also been taken in an integrated way.
17	United Commercial Bank	March, 1974	yes	—	yes	yes	yes	yes	—	25% available as government subsidy.	13% to 15% (as for agricultural advances)	For loans exceeding Rs. 2,500 service charges varying from Rs. 5 to Rs. 50 per year.	3 to 5 years	Hypothecation of plant and accessories and animals and at least one acceptable guarantor.	Upto 260 c.ft.	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C.	**Other commercial banks**													
18	Bank of Rajasthan Ltd.	June, 1975	yes	—	yes	yes	—	Rs. 300 minimum from borrower's own resources plus subsidy.	15%	NIL	3 to 5 years	Hypothecation of plants and animals and a guarantor.	150 c.ft.	The branches can grant loans after obtaining sanction from central office.
19	Karnataka Bank Ltd.	April, 1975	yes	—	yes	yes	—	25%	17%	Service charges at 1% of the loan amount and quarterly incidental charges at 6% of the interest.	3 to 5 years	Hypothecation of the plant and a co-obligant.	Not mentioned	The interest rate includes an element of concession at 2% p.a.
20	Oriental Bank of Commerce Ltd.	February, 1974	yes	—	yes	yes	—	No margin will be required where animals are hypothecated to the bank but 25% cash margin shall be insisted where animals are already hypothecated.	15%	NIL	3 to 5 years	Hypothecation of plant. Hypothecation of animals in lieu of cash margin of 25%. Third party guarantee.	150 c.ft.	The amount of subsidy to be credited to the borrower's loan account when received.

ANNEXURE 8

SUMMARY RECOMMENDATIONS* OF THE WORKSHOP HELD BY ESCAP IN NEW DELHI IN JULY-AUGUST 1975

(Paragraph 9.4)

1. To formulate a programme on the utilisation and promotion of bio-gas as part of an integrated rural development programme.

2. To consider setting up of a national co-ordinating body to ensure the co-operation of all the departments and to plan and review the programmes and to identify an agency for the implementation of the programme.

3. To arrange for the provision of adequate financial assistance and incentives for the programmes while ensuring peoples' involvement in them.

4. To formulate package programme of extension and training consisting of the publication of newsletters, bulletins, manuals, etc. in local languages, to set up mobile exhibition units for demonstration, and to develop scientific demonstration kits for schools and colleges as well as conduct periodical meetings/ symposia, workshops, etc.

5. To provide adequate facilities and assistance for designing, fabricating, constructing and operating plants with reliance on self-help and local materials to the maximum possible extent, as also adequate maintenance and servicing facilities.

6. To promote activity for improving the productivity and economics of bio-gas plants.

7. To initiate action for the standardisation of the technical terminologies involved in the bio-gas field as also to define the

* *Source*: *CMA Monograph No. 59 of IIM, Ahmedabad.*

parameters of the designs and the specifications of the plant and accessories.

8. To undertake research and development work in relation to the physical, chemical and biological aspects and the engineering parameters relating to the production and use of bio-gas and other associated products.

9 To undertake the experimental construction of bio-gas plants on a prototype scale by using the results of research.

10. To identify institutions for undertaking in-depth studies of problems relating to the social acceptability of bio-gas, to survey social reactions, inhibitions, and other factors peculiar to certain areas and people in respect of adopting bio-gas projects, and to study the cost aspects of the plant and suggested cost reduction alternatives.

11. To undertake a study to establish an integrated programme for the bio-gas system in the development of fuel, fertiliser and food.

12. To collect existing and available information on technologies and arrange for their dissemination in specified areas in collaboration with the training and extension fields.

ANNEXURE 9

SUMMARY PROJECT PROPOSALS* FINALISED BY NCST

(Paragraph 9.4)

(Action : IARI)

1. To study the corrosion aspect of the gas holder, develop commercial burners, and improve domestic burners, fermentation kinetics, environment, etc.

2. To transmit the improvements obtained from the various institutions to the plants at the farmer's level.

3. To reduce the cost of the plant by optimizing the design and evolving cheaper alternative materials of construction.

4. To carry out trials of an integrated farming system with a bio-gas plant being one unit of the system.

(Action : PARI)

1. To carry out insulation studies like having a second wall outside the dig well, etc. for gas generation.

2. To study the feedback principle in the gas plant, i.e. the economics of using a part of the gas generated for raising the temperature of the digester to increase gas production.

3. To develop gadgets such as plastic moulding machines, lathes, fans and ovens to run on gas so as to widen the scope of the use of gas for cottage industries.

(Action : NEERI)

1. To study bio-gas production from cow dung, and its acceleration or increase through additives.

2. To standardise methods for the removal of H_2S from bio-gas.

* *Source: CMA Monograph No. 59 of IIM, Ahmedabad.*

3. To study methods to prevent corrosion in gas holders.

(Action : NSI)

1. To produce bio-gas and bio-manure from agricultural wastes.

(Action : IARI)

1. To conduct chemical and micro-biological studies for the stimulation of gas production round the year with particular reference to low temperature situations, for the installation of alternative materials for gas production; for the removal of carbon-dioxide; for the storage and processing of slurry for manure, and the trapping H_2S and other odonorious from human sanitation plants.

2. To conduct engineering studies relating to the design and fabrication of optimum community plants, cheaper and more efficient plants suitable for using different raw materials, suitable design incorporating methods of the removal of CO_2 and generation of pure methane, determination of engineering parameters for utilisation of gas for the operation of farm machineries and the corrosion aspects.

3. To conduct extension studies relating to the socio-economic aspects of introducing individual and community plants, transfer of technical know-how of the bio-gas plants to the rural population, demonstration of the utility of the gas plant in rural development, sanitation, water supply and home management.