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Design and Development of the Biogas Plant in Pati Village of Valsad District

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Abstract:- *Village households mainly depend on wood & cow dung and other bio mass sources to meet their energy requirements. Use of other bio mass sources for heating in a primitive way pose a great thrue to environment as well as on the generally health of the rural people. Government in the developing & under developed countries are trying hard to tackle these important issue that there is a need arise for the development of community based bio gas plant. From research & design a family with between 5 to10 cows can produce a minimum 2.5m^3 of gas which is adequate for lighting and cooking for an average rural house holder of six people. In this research attempts were made to collect land detail, house holders, cattle detail and need assessment with population growth for human being with the help of local people and techno economic survey of Pati-village was carried out. After that planning, design & cost estimation of most need based eco friendly bio gas plant was prepared.*

Key Words: *bio mass, cows, household, rural house*

I. INTRODUCTION

Mahatma Gandhi, in his vision for India, envisaged a system of devolved, self-sufficient communities, sustaining their needs from the local environment, and organizing income generating ventures around co-operative structures. Sixty years on, and Gandhiji's vision of *Swadeshi*(self-sufficiency) for India is perhaps more urgent than ever. Diminishing forestsand a burgeoning, mainly rural biomass-dependent population of around 70% of the total population necessitates a co-ordinated effort of rural India to supply itself with a dependable and sustained source of energy. Biomass alone currently meets almost half of the national energy demand, yet is rarely featured in any 'official' statistics of energy use, given perhaps its scattered nature, and its low status as fuel. Fuel wood is the primary source of biomass, derived from natural forests, plantations, woodlots and trees around the homestead. Alarm regarding the state of India's forests has kick started an intense afforestation and forest regeneration scheme that attempts to share management of forest resources between the forest department and local user communities.
India's overall energy production is considerably less than its overall energy consumption. India's energy demand is increasing, and its inability to step up production to meet demand, has increased India's reliance on costly imports, the gap between consumption and production projected to widen into the next century, as demand for energy is projected to grow at an annual rate of around 5% - one of the highest in the world. Energy for developing industries, transport, and a drive towards the electrification of India over the last three decades has contributed to the energy production deficit.

In an attempt to stem the projected deficit between production and consumption, particularly for the expanding rural sector, the government is pursuing alternative measures of energy provision. Renewable energy potential is high on the subcontinent. Table 1, below, lists the estimated potential of various renewable energy sources. Energy from solar, wind, hydro and ocean all have a significant future potential to play in a mixed energy production scenario. However, of particular interest here, in the context of providing a devolved, sustainable energy supply for the burgeoning rural sector in India, is the potential of biogas; the gas created as a product of anaerobic digestion of organic materials.

Source	Approx potential (mws)
Biomass Energy	19500
Solar Energy	20000
Wind Energy	47000
Small Hydropower	15000
Ocean Energy	50000

Table 1: Estimated Potential of Rural Energy Sources in India (Source: MNRE, 2008)

The government views biogas technology as a vehicle to reduce rural poverty, and as a tool in part of a wider drive for rural development. To promote and disseminate information about biogas technology specifically, the government has organized the National Project on Biogas Development nation-wide, and several NGO's have been active in implementing the program on the ground. Currently, there are thought to be about 2.5 million (Dutta et al., 2007) household and community biogas plants installed around India.

II. STUDY AREA

Pati is located almost on the Gujrat-Maharashtra border, very close to the town of Navapur in Maharashtra. Pati is a village in pardi taluka in valsad district of Gujarat state, India. it is located 27.7 km towards south from district head quarter valsad, 368 km from Gandhinagar capital of Gujarat. National highways No.-8 as well as the state highway No.-6 are passing through this village. The village consists around 225 families (Population- around 1126), all of which are milk suppliers to the nearby Surat District Co-operative Milk Producer„s Union Ltd (Vasudhara). Majority of these 225-odd households are closely spaced in the heart of the village; the rest being considerably far and scattered. The Nearer Village of Pati are Dhgadmal (1km), Samarpada (2km), Goima (2km), Daheli (3km) and panchlai (3km). Pati is surrounded by kapradataluka towards east ,dadranagarhavelitaluka west, parditaluka towards west , vapitaluka towards west. The Nearer City of Pati are Dharampur, Amli, Silvassa and Pardi. This place is in the border of the valsad district and diu district. diu district is west towards this place. also it is in border of the district daman.it is near to the daman &diu state border. it is near to Arabian sea. there is a chance of humidity in the weather. The approximate area of Pati village is 204.3 ha.as per the record of grampanchayat of Pati village.The44.29% area falls under residence and rest 55.71% under the forest, The current population of Pati village is 1126.

Fig 1: Study area of Valsad district

The overall objective of research work is to develop biogas plant in a Pati Village. However some specific objectives of the Research were as follows:

- Deliver cooking gas each and every household
- Provide proper dung disposal system to village.
- Provide cheap and fertile fertilizers to farmers for their farms.

III. METHOD AND MATERIALS

In this research, initially the primary survey of Pati village was done for finding out the problems of the village. After that secondary survey was carried out to collect data like population of village of 2011, no of pucca house, no of government schemes running in village & for the base map of pati village. After that Various data collected by team members from the various agencies like Gram Panchayat office, Mamlatdar Office, Pardi G.W.S.S.B and Valsad R & B division. After enlisting all the problems, these were categorized into four main groups namely, problem of Inadequate dung disposal systems, Trouble for getting L.P.G gas, Trouble in collection of fual woods and Insufficient fund for development of project.

The methodology adopted in this project has been shown below through the flowchart.

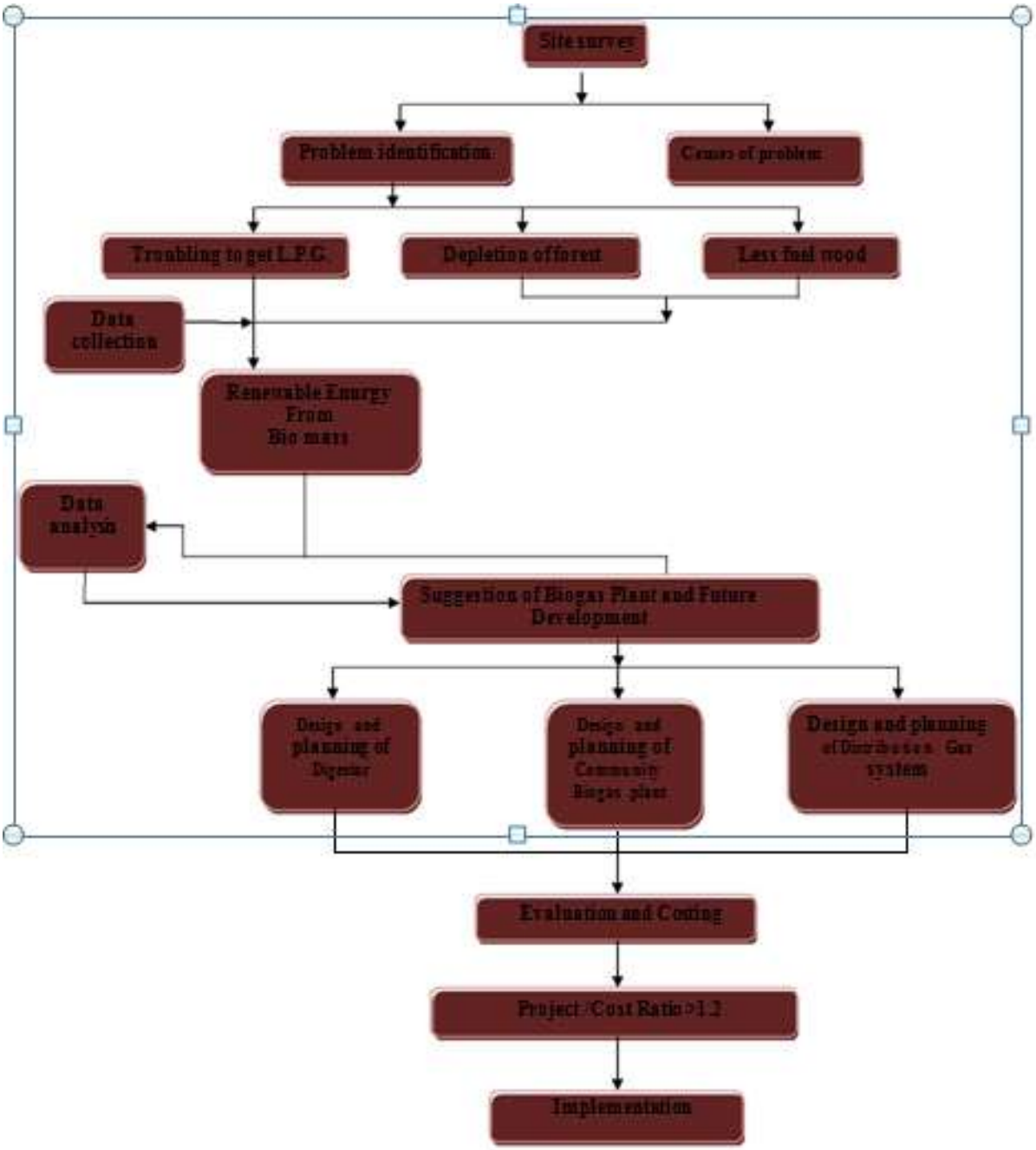

Fig 2: Flowchart of Methodology adopted

IV. RESULTS AND DISCUSSION

Design of Biogas plant:

After collection of all data related to problem of village, Design of Community based Biogas plant was done. The design of other important component of Community based Biogas plant were like mixing tank, Digester chamber, Expansion chamber, pressure regulation tank and Vermicompost sheds also done. The Design of Community based Biogas plant was done by keeping the village population by the year 2040. So the village population by the year 2040 was forecasted using incremental-increase method. For this entire plant measurement sheets were prepared and after that abstract sheet were also prepared. After that total amount for construction of Community based Biogas plant were calculated.

Preliminary Economic Analysis:

This section presents the preliminary economic analysis of the Community based Biogas plant. As visualized from the following tables, the economic feasibility of this model was entirely attributed to the vermicompost production. The base parameters used in the calculations are listed below:

1. Number of beneficiaries: 150
2. Cow dung at each beneficiary : 30 kg per day
3. Total cow dung input using design data: 4.5 tons per day
4. Total cow dung input using actual operations data: 2.7 tons per day
5. Rate of cow dung: Rs. 0.35 per kg
6. Cost of gas supply: Rs. 150 per month per beneficiary
7. Vermicompost production using design data: 49 tons per month if entire slurry is converted to vermicompost
8. Vermicompost produced using actual operations data : 20-35 tons per month
9. Rate of vermicompost: Rs. 3 per kg
10. Other expenses for the plant: Supervisor salary= Rs. 2500 p.m.

Worker salary= 4* Rs. 1000 p.m. Laborer daily wages= Rs. 50 per day
Electricity and maintenance= Rs. 8000 p.a.

Table 2: Initial cost of Community Biogas Plant (One Time)

Sr No	Particulars	Amount
1	124 Cu.Mt. two Digesters	Rs. 12,00,000
2	Bio Gas distribution pipelines	Rs. 4,45,000
3	Bio Gas collection Tank, Blowers, PRESSURE REGULATION SYSTEM	Rs. 3,55,000
4	Vermicompost Unit	Rs. 1,50,000
	Total Cost	**Rs. 21,50,000**

Table 3: Operational Cost of the Plant Yearly

Sr No	Particulars	Amount
1	Daily 4.5 MT Dung x 365 Days = 1643 MT 1643 MT X Rs. 250/MT	Rs. 410750
2	Labor Cost 5 Employees	Rs. 273750
3	Maintenance (Gas Tank, diesel etc)	Rs. 11670
	Total Operational Cost	**Rs. 696170**

Table 4: Revenue of the CBP Yearly

Sr. No.	Particulars	Amount
1	Bio Gas Distribution 150 Connection X Rs.150 X 12 Month	Rs. 27,0000
2	Vermicompost from Slurry Input dung-1643 MT yearly from which 60 % obtained as Dry Slurry 986 i.e. 986 MT which produces 592 MT vermicompost which is sold @ rate of Rs. 3000 /MT yearly.	Rs. 1776000
	Total Revenue Yearly	**Rs. 2046000**

Table 5: Net Profit from Community Biogas Plant

Sr. No.	Particulars	Amount
1	Operational Cost Yearly	Rs. 696170
2	Total Revenue Generation Yearly	Rs. 2046000
	Net Profit from CBP Yearly	**Rs. 1349830**

Table 6: Other benefits in the terms of rupees

Sr. No.	Particulars	Amount
1	Fuel saving 150 Family X 6 Person = 750 X 5 Kg of Woods for Cooking @ 2 Rs. Of Kg X 365 Days	Rs.2737500
2	After using vermicompost 25 % more income from Crops due to improved Quality and Production i.e. 150 Families get Rs. 20000.00 more per Annum.	Rs. 24,20,000
3	Revenue Generation from Carbon Credit Yearly Rs. (Expected)	Rs. 2,66,076
	Total Other benefits in the terms of rupees	**Rs. 5423576**

V. CONCLUSION

From all above survey and design , it was concluded that the village was also as important as urban areas. It must also get all those facilities and importance which urban peoples. By providing "Design and Delivery system of bio-gas" which was solution for development of villages in Rurban‟ areas. The developmental work in villages that could undertaken as per the need of the village in particular includes community bio-gas plant as renewable energy for Sustainable development. This enhance facilities in village to increase the life style of people with the rural soul.

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