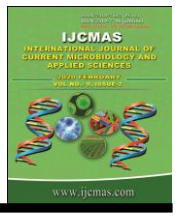
Int.J.Curr.Microbiol.App.Sci (2020) *9*(2): 185-193

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 9 Number 2 (2020)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2020.902.023

Survey Report: Performance Evaluation of Deenbandhu Biogas plants Installed in Various Regions of Punjab, India

Deepinder Singh Aulakh, Jasvarinder Chalotra* and S. S. Sooch

Department of Renewable Energy Engineering, COAE&T, PAU, India

**Corresponding author*

Keywords

Organic waste, Survey & Inspection, Deenbandhu biogas model, Analysis Report

Article Info

Accepted:
05 January 2020
Available Online:
10 February 2020

A B S T R A C T

Greenhouse gas emission is the biggest challenge to the society and responsible for major climatic changes these days. The non-renewable sources are responsible for this and should be replaced by the renewable once. Biogas is one of the most reliable and efficient renewable resource. Various organic wastes such as cattle dung, crop residues, human excreta, kitchen waste etc. are available in nature and can be easily used for biogas production. In this study, the survey was conducted by the engineers deputed by department of civil engineering, Punjab Agricultural University, Ludhiana, Punjab. The main objective of this survey was to evaluate the performance of family size biogas plant (Deenbandu model) already installed in the various regions of Punjab and to promote the use of biogas plant instead of LPG cylinders. 100 plants were randomly selected from various regions and on the basis of user experience and data collected a report was prepared.

Introduction

Energy is a vital input for economic growth in agricultural and industrial field. The depletion of fossil fuels (non-renewable energy)is at alarming rate and the cost of environment protection is also increasing. Renewable resources technology is of utmost importance for balance and healthier environment for living. The renewable resources such as sun, wind, biomass, geothermal and tidal energy are abundant resources of energy provided by nature. Biomass refers to the solid carbonaceous material derived from plants and animals. Biomass does not add CO_2 to the atmosphere as it absorbs the same amount of carbon in growing plants as it releases when consumed as fuel. Biomass fuel is used maximum in rural households and little bit in urban dwellings[1].

Biogas from biomass is one of the most sustainable and effective source of energy which endures for a long time. Biogas is

derived by anaerobic digestion of organic wastes such as cattle dung, crop residues, human excreta, kitchen waste etc[1]. Anaerobic digestion not only provides valuable fuel but also enhances the fertilizer value of residue. It also provides environment friendly, safe, conventional and economical disposal method of waste. This process gives better results as compared to other waste treatment processes. Developing the technology for biogas production is subjected to well proven technique and economical aspects of the country. Biogas has both social and industrial advantages as it is safe fuel for cooking, lighting and engine running. The left over digested slurry is enriched manure, which can be used in agricultural land. Biogas consists of methane (CH_4), carbon dioxide (CO_2) and traces of other gases such as H_2, CO, N_2 and H_2S[2].Methane is the main component of biogas which is used for purposes as it has same thermal efficiency compared to LPG (butane gas). Table 1 shows the thermal efficiency of various fuels with calorific values[2]. For the production of biogas, different models are developed such as KVIC, Janta and Deenbandu model. Out of these, Deenbandhu modelis the most economical and smallest family size plant.

Aim of the study was to conduct the survey over selected installed biogas plants in the region of Punjab so as to know the working condition, problem faced and awareness among the people.

Materials and Methods

Survey Performa:- Initially, the perform a including various points such as name and address of beneficiary, no. of cattle owned, capacity, installation year, operational and structural problems of the plant for data collection was prepared.

Location selection:-The selection of location, installation and provision of after service is done with the help of the masons and self-employed workers (SEWs) trained by the department. Based upon the information provided by the masons and SEWs, survey was conducted. In this process, engineers visit the selected spot and conduct the survey in contact mode with every individual person holding plant.

Deenbandhu biogas plant design: Figure 1 represents Deenabndhu biogas plant design model[2]. This is the most popular and successful type of family size plant the in the region of Punjab. It is very economical and requires least space among the other designs. The major factors affecting the production of biogas are the temperature and pH. The temperature is required to be in the range of 35^oC - 45^oC but unfortunately, the process retards below 10^oC. On the other hand, pH factor should be in between 6.5 to 7.5 inside the digester[3]. For biogas generation, daily 25kg per m^3 of cow dung is required. The cow dung and water is mixed in the ratio 1:1 and added to the digester. These plants are installed in various sizes $1m^3$, $2m^3$, $3m^3$, $4m^3$ and $6m^3$ depending upon the number of members and animals present in the house. Mostly, $4m^3$ and $6m^3$ are more popular size of plants which are sufficient for 8-12 members of the family[2]. The government also provides subsidy on these sizes of plants.

Analysis:- After collection of data provided by the owner of plant from various regions. Excel sheet was prepared for the analysis.

Results and Discussion

Survey over 100 installed biogas plants are conducted and reported in the table 2.

It has been observed from the survey that most of the people prefer $6m^3$ of biogas plant over other sizes due to high number of family members and secondly, keeping in mind consistent progression in the family members.

Another noticeable factor from the survey was that with the advancement in the time and a building sense of awareness among the people there has been a tremendous increase in the installation of biogas plant. The yearly growth of biogas plants installed is shown in Fig. 2.

Table.1 Comparison of calorific value and thermal efficiency of various fuels are

Sr. No.	Name of fuel	Thermal Efficiency (KCal)	Calorific value (KCal)
1	Biogas (m^3)	60	4713
2	Fire Wood (kg)	17.3	4708
3	Cow dung cake (kg)	17.3	2092
4	LPG(Butane gas) (kg)	60	10662
5	Charcoal (kg)	28	6930

Table.2 Survey data of biogas plants

Sr. No.	Name & Village	District	No. of Cattle owned	Capacity of plant (m^3)	Year of installation	Status of plant		
						Working satisfactorily / Partially	Not working due to	
							Structural problem	Operational problem
1.	Lekh Singh Vill:Charik	Moga	7	6	2015	Satisfactorily	--	--
2.	Gurbachan Singh Vill:Charik	Moga	8	6	2015	Satisfactorily	--	--
3.	Gurnek Singh Vill:Charik	Moga	4	6	2014	Satisfactorily	--	--
4.	Hardev Singh Vill:Charik	Moga	15	6	2015	Satisfactorily	--	--
5.	Baljinder Singh Vill:Charik	Moga	6	6	2016	Satisfactorily	--	--
6.	Sarabjit Singh Vill:khai	Moga	5	6	2013	Satisfactorily	--	--
7.	Jagdev Singh Vill:Khai	Moga	6	6	2014	Satisfactorily	--	--
8.	Karam Singh Vill:Khai	Moga	10	6	2016	Satisfactorily	--	--
9.	Kirandeep Kaur Vill:Kha	Moga	4	6	2016	Satisfactorily	--	--
10.	Baljit Kaur Vill: Khai	Moga	10	6	2015	Satisfactorily	--	--
11.	Avtar Singh Vill:Daburji	Moga	5	6	2015	Satisfactorily	--	--
12.	Suksar Singh Vill:Daburji	Moga	7	6	2009	Satisfactorily	--	--

13.	Pehal Singh Vill:Daburji	Moga	8	6	2011	Satisfactorily	--	--
14.	Labh Singh Vill:Daburji	Moga	6	6	2012	Satisfactorily	--	--
15.	Jagtar Singh Vill:Korewala	Moga	7	6	2016	Satisfactorily	--	--
16.	Malkit Singh Vill:Korewala	Moga	6	6	2011	Satisfactorily	--	--
17.	Harnam Singh Vill:Korewala	Moga	8	6	2008	Satisfactorily	--	--
18.	Nirmal Singh Vill:Korewala	Moga	40	6	2008	Satisfactorily	--	--
19.	Paramjit Singh Vill:Korewala	Moga	10	6	2007	Satisfactorily	--	--
20.	Kulwant Singh Vill:Korewala	Moga	9	6	2008	Satisfactorily	--	--
21.	Sukha Singh Vill:Korewala	Moga	4	6	2007	Satisfactorily	--	--
22.	Darshan Singh Vill: Kaulgarh	Fatehgarh Sahib	18-20	6	1996	Satisfactorily	--	--
23.	Nichatar Singh Vill:Kaulgarh	Fatehgarh Sahib	4	6	1991	Satisfactorily	--	--
24.	Hardeep Singh Vill:Kaulgarh	Fatehgarh Sahib	10-12	8	1985	Satisfactorily	--	--
25.	Jatinder Singh Vill:Kaulgarh	Fatehgarh Sahib	10-11	6	1990	Satisfactorily	--	--
26.	Baljeet Singh Vill:Kaulgarh	Fatehgarh Sahib	4	6	2009	Satisfactorily	--	--
27.	Saudagar Singh Vill:Kaulgarh	Fatehgarh Sahib	12	6	1995	Satisfactorily	--	--
28.	Achhra Singh Vill:Kaulgarh	Fatehgarh Sahib	15-16	6	1993	Satisfactorily	--	--
29.	Amolak Singh Vill:Kaulgarh	Fatehgarh Sahib	10—12	6	1994	Satisfactorily	--	--
30.	Karmolak Singh Vill:Kaulgarh	Fatehgarh Sahib	20-22	6	1994	Satisfactorily	--	--
31.	Sandeep Singh Vill: Kaulgarh	Fatehgarh Sahib	7	6	1991	Uncommisioned	--	--
32.	Amrik Singh Vill:Kaulgarh	Fatehgarh Sahib	11-12	6	1992	Satisfactorily	--	--
33.	Baljinder Singh Vill:Kaulgarh	Fatehgarh Sahib	3-4	6	2012	Satisfactorily	--	--
34.	Kamaljeet Singh Vill:Kaulgarh	Fatehgarh Sahib	15	6	2005	Satisfactorily	--	--
35.	Sant Ram Vill:Ajroar	Patiala	10-11	6	2009	Satisfactorily	--	--
36.	Gurcharan Singh Vill: Ajroar	Patiala	5-7	6	2012	Satisfactorily	--	--
37.	Kartar Singh Vill: Nathu Manjra	Patiala	5	6	2012	Satisfactorily	--	--
38.	Jarnail Singh Vill: Ajroar	Patiala	8	6	2009	Partially	--	Under Feeding

39.	Gurtej Singh Vill: Ajrawar	Patiala	4	6	2012	Satisfactorily	--	--
40.	Tara Singh Vill: Mandli	Patiala	3	6	2011	Satisfactorily	--	--
41.	Harbans Singh Vill: Mandli	Patiala	4	6	2011	Satisfactorily	--	--
42.	Gurmukh Singh Vill: Mehma	Patiala	20	6	2014	Satisfactorily	--	--
43.	Jaswant Singh Vill: KehriGandiya	Patiala	4	6	2013	Satisfactorily	--	--
44.	Balvir Singh Vill: KehriGandiya	Patiala	5-7	6	2013	Satisfactorily	--	--
45.	Surinder Singh Vill: Mehma	Patiala	7-8	6	2014	Satisfactorily	--	--
46.	Pritpal SinghVill: KehriGandiya	Patiala	10	6	2013	Satisfactorily	--	--
47.	Des Raj Vill: Lochma	Patiala	9-10	6	2015	Satisfactorily	--	--
48.	Sawarn Singh Vill: KherpurJatta	Patiala	35	6	2013	Satisfactorily	--	--
49.	Shiv Ram Vill:KherpurJatta	Patiala	6-7	6	2009	Satisfactorily	--	--
50.	Jawar Singh Vill:Mehma	Patiala	15-16	6	2011	Satisfactorily	--	--
51.	JasdevSinghVill: Saunti	Fatehgarh Sahib	3-5	6	2012	Satisfactorily	--	--
52.	Gurcharan Singh Vill: Saunti	Fatehgarh Sahib	2-4	4	2011	Satisfactorily	--	--
53.	Rashvinder Singh Vill: Saunti	Fatehgarh Sahib	10-11	6	2000	Satisfactorily	--	--
54.	Nibah Singh Vill: Saunti	Fatehgarh Sahib	6	6	2008	Satisfactorily	--	--
55.	Jasvinder Singh Vill: Saunti	Fatehgarh Sahib	2-4	6	2015	Satisfactorily	--	--
56.	Harvinder Singh Vill: MajriKishniwala	Fatehgarh Sahib	6-7	6	1998	Partially	--	Under Feeding
57.	Hardam Singh Vill: MajriKishniwala	Fatehgarh Sahib	4	6	1998	Partially	--	Under Feeding
58.	Harvinder Singh Vill: MajriKishniwala	Fatehgarh Sahib	10-11	6	2004	Satisfactorily	--	--
59.	Jagtar Singh Vill: MajriKishniwala	Fatehgarh Sahib	20-22	6	2014	Satisfactorily	--	--
60.	Avtar Singh Vill: Pola	Fatehgarh Sahib	5	4	2007	Satisfactorily	--	--

61.	Major Singh Vill: PunjoliKhurd	Fatehgarh Sahib	15	20	1997	Satisfactorily	--	--
62.	Jasvant Singh Vill: PunjoliKhurd	Fatehgarh Sahib	11	10	2011	Satisfactorily	--	--
63.	Gurmeet Singh Vill: PunjoliKhurd	Fatehgarh Sahib	6	4	2011	Partially	--	Under Feeding
64.	Joginder Singh Vill: PunjoliKhurd	Fatehgarh Sahib	5	4	2011	Partially	Doom Crack	--
65.	Kulwant Singh Vill: Panjoli Kalan	Fatehgarh Sahib	10	4	1998	Satisfactorily	--	--
66.	Jarnail Singh Vill:Diala	Ludhiana	7	6	2010	Satisfactorily	--	--
67.	Harpreet Singh Vill:Diwala	Ludhiana	8	6	2007	Satisfactorily	--	--
68.	Narinder Singh Vill:Diwala	Ludhiana	4	6	2014	Satisfactorily	--	--
69.	Kashmir Singh Vill:Diwala	Ludhiana	15	6	2012201	Satisfactorily	--	--
70.	Kuldeep Singh Vill:Gharkhana	Ludhiana	8	6	2006	Satisfactorily	--	--
71.	Santokh Singh Vill:Gharkhana	Ludhiana	2	6	1999	Satisfactorily	--	--
72.	SukhwinderSingh Vill:Gharkhana	Ludhiana	15	6	2011	Satisfactorily	--	--
73.	Jaspal Singh Vill:Gharkhana	Ludhiana	5	6	2015	Satisfactorily	--	--
74.	Harwinder Singh Vill:Gharkhana	Ludhiana	11	6	2014	Satisfactorily	--	--
75.	Teja Singh Vill:Gharkhana	Ludhiana	11	6	1996	Satisfactorily	--	--
76.	Khushwinder Singh Vill:Gharkhana	Ludhiana	10	6	2000	Satisfactorily	--	--
77.	Gurdeep Singh Vill:Gharkhana	Ludhiana	4	6	2016	Satisfactorily	--	--
78.	Gursewak Singh Vill:Gharkhana	Ludhiana	10	6	2000	Satisfactorily	--	--
79.	Ujagar Singh Vill:Gharkhana	Ludhiana	8	6	1996	Satisfactorily	--	--
80.	Chand Singh Vill:Gharkhana	Ludhiana	6	6	2000	Satisfactorily	--	--
81.	Kesar Singh Vill:Gosalan	Ludhiana	8	6	1997	Satisfactorily	--	--
82.	Darshan Singh Vill:Gosalan	Ludhiana	10	6	2012	Satisfactorily	--	--

83.	Dev Singh Vill:Gosalan	Ludhiana	6	6	1992	Satisfactorily	--	--
84.	Swaran Singh Vill:Gosalan	Ludhiana	7	6	2009	Satisfactorily	--	--
85.	Mnapreet Singh Vill:Gosalan	Ludhiana	6	6	2011	Satisfactorily	--	--
86.	Balwinder Singh Vill:Gosalan	Ludhiana	8	6	2010	Satisfactorily	--	--
87.	Manjeet Singh Vill:Bhagwanpura	Ludhiana	30	6	2011	Satisfactorily	--	--
88.	Malkeet Singh Vill:Bhagwanpura	Ludhiana	10	6	2006	Satisfactorily	--	--
89.	Gulzar Singh Vill:Bhagwanpura	Ludhiana	20	6	2009	Satisfactorily	--	--
90.	Vikramjit Singh Vill:Dalla	Jalandhar	2	6	2013	Satisfactorily	--	--
91.	Kuldeep Singh Vill:Dalla	Jalandhar	6	6	2008	Satisfactorily	--	--
92.	Makhan Singh Vill:Dalla	Jalandhar	5	6	2001	Satisfactorily	--	--
93.	Harbhajan Singh Vill:Kaimwala	Jalandhar	4	6	2012	Satisfactorily	--	--
94.	Soocha Singh Vill:Kaimwala	Jalandhar	12	6	2000	Satisfactorily	--	--
95.	BalkarSingh Vill:Kaimwala	Jalandhar	8	6	2008	Satisfactorily	--	--
96.	Balwinder Singh Vill:Kaimwala	Jalandhar	2	6	2013	Satisfactorily	--	--
97.	Jasbir Singh Vill:Kaimwala	Jalandhar	2	6	2013	Satisfactorily	--	--
98.	Samund Singh Vill:Kaimwala	Jalandhar	6	6	2003	Partially	--	Under Feeding
99.	Kulbiir Singh Vill:Kaimwala	Jalandhar	8	6	2012	Satisfactorily	--	--
100.	Darshan Singh Vill:Mehsampur	Jalandhar	3	6	1990	Satisfactorily	--	--

Fig.1 Deenbandhu Biogas plant design

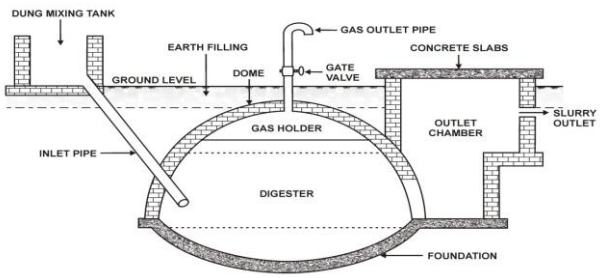
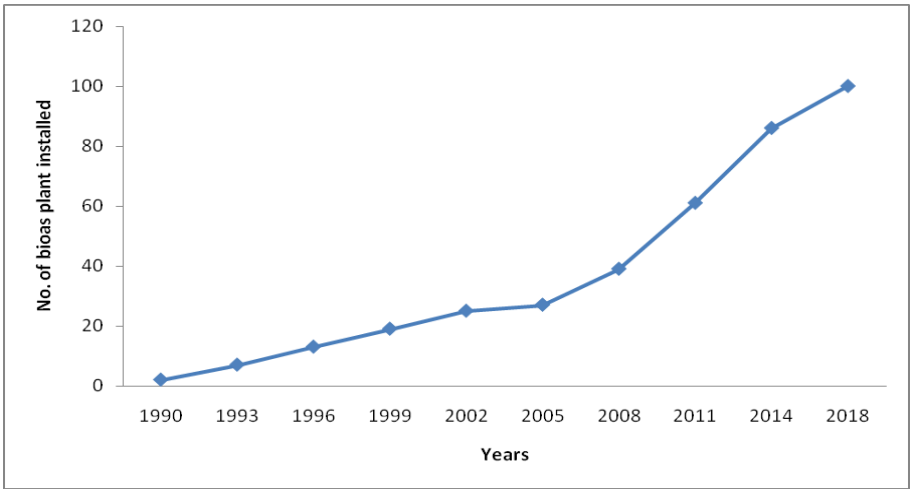


Fig.2 No. of biogas plant installed every year



In order to overcome the problems posed by increasing energy demands and diminishing resources, it is necessary to switch to new alternate energy sources (environment friendly), so that the future generations can be prevented from facing various environment related issues like global warming, pollution, health hazards etc. Biogas has emerged out to be one of the most convenient and reliable energy resources. On the bases of survey, Deenbandhu biogas plants model is best for family and industry purposes as it can made upto any required size to meet the need.

Future scope

This is the largest alternative of LPG cylinder.

These models consume the harmful gases produces and convert into methane gas which is useful for cooking.

By increasing the size, the capacity of biogas generation increases and can be used for lighting lamps and power generation.

Acknowledgement

Authors would like to express their deepest gratitude to all the staff members and colleagues for their consistent support during the survey. One of the authors, Deepinder Singh would like to thank Dr. Mandeep Kaur (Asst. Professor, Baba Banda Singh Bahadur Engineering College, Fatehgarh Sahib) for her valuable suggestions during the work.

References

1. Kothari D P, Singal K C and Rajan R (2009) Renewable energy sources and emerging technologies, New Delhi, PHI Learning Pvt. Ltd..
2. Sooch S S (2018) important information on biogas technology, Ludhina, PAU.
3. Sooch S S and Gautam A (2013) Present status of renewable energy sources in Punjab. *International Journal of Agriculture, Environment & Technology* 6(2): 317-33.
4. S S Sooch and Bhati J S (2016) Biogas plants for cooking and power generation. *Dairy India* 7: 263-66.

How to cite this article:

Deepinder Singh Aulakh, JasvarinderChalotra and Sooch, S. S. 2020. Survey Report: Performance Evaluation of Deenbandhu Biogas Plants Installed in Various Regions of Punjab, India. *Int.J.Curr.Microbiol.App.Sci.* 9(02): 185-193.
doi: https://doi.org/10.20546/ijcmas.2020.902.023