The Pharma Innovation Journal 2022; SP-11(2): 1074-1077

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(2): 1074-1077

www.thepharmajournal.com
Received: 05-12-2021
Accepted: 09-01-2022

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Feasibility of biogas plant in Sikar district Rajasthan

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DOI: https://doi.org/10.22271/tpi.2022.v11.i2So.10882

Abstract
A study was conducted to evaluate performance of biogas plant in Sikar district of Rajasthan (India). Existing biogas plant constructed and commissioned to Biogas Development and Training Center, Udaipur in District Sikar were considered for the study. Out of total 1383 biogas plant constructed in District Sikar 60 biogas plants were selected on random basis. A questionnaire was prepared for the study. Out of selected 60 biogas plants, 54 plants were found operational or 6 plants were found non-operational due to migration of cattle. The bio-slurry is collected in a pit and used as manure once or twice in a year. Mostly Deenbandhu type biogas plants are installed.

Keywords: Deenbandhu biogas plant, survey, performance, manure, Rajasthan, BDTC, NBMMP

Introduction
Biogas is a well-established, renewable sources and widely popular source of energy globally by virtue of its production from waste, and available cattle dung. The biogas substitutes both fuel and fertilizer. The plant gives gas as well as give the fertilizer to enhance the productivity of land. It is estimated that out of total dung available, 69% is used as manure, 29% is used as cakes for fuel and remaining 2% is used for others purpose. (Nesmith, 1991) [5]

In 2021 India produce a total capacity of 10170 MW has been installed in Biomass power and cogeneration sector. The ample potential of setting up biogas plant considering the livestock population 512.06 million. The livestock sector contributes about significantly to India's GDP and will continue to increase. Biogas contains about 55-65 % of methane, 35- 44 % of carbon dioxide and traces of other gases, such as Hydrogen Sulphide, Nitrogen and Ammonia. Biogas, in its raw form, that is without any purification, can be used as clean cooking fuel like LPG, lighting, motive power and generation of electricity. It can be used in diesel engines to substitute diesel up to 80% and up to 100% replacement of diesel by using 100% Biogas Engines. Further, Biogas can be purified and upgraded up to 98% purity of methane content to make it suitable to be used as a green and clean fuel for transportation or filling in cylinders at high pressure of 250 bar or so and called as Compressed Bio-Gas (CBG) (Gautam, 2009) [4].

India is primarily an agricultural country with about 1.27 billion human population out of which 70 per cent population resides in the rural area and 65 per cent people are highly dependent on agriculture. Fuel wood has been and still is the major source of fuel daily use by rural masses in India. This total dependence on fuel wood as the source of energy for cooking has resulted in deterioration of the quality and quantity of forests and has posed a serious threat in maintaining ecological balance, thereby manifesting various problems like deforestation, flood, Global warming, soil erosion, landslides and climate change etc. The pressure on forest resources for energy fulfillment is considerably increasing due to high population growth in rural areas causing scarcity of fuel wood for cooking. As a consequence, many people in the rural areas are burning livestock dung and other agricultural residues. This has been one of the factors in the deterioration of the environment and soil fertility in the country (Devkota, 2001) [3]. Kerosene and other oil-based sources of fuel are scarce and costly to be easily available for small marginal and medium farmers residing in rural areas. Furthermore, frequent alarming hikes in prices of imported oil and chemical fertilizers have serious economic threats to the rural poor. In this context, to reach self-sufficiency in energy and fertilizer and to minimize the pressure on traditional biomass fuel, biogas technology has been the best alternative energy solution (Sharma et al. 2018) [6].

According to data obtained from the Biogas Development and Training Center, Udaipur, a total of 1383 biogas plants have been constructed during 2009-10 to 2016-17 under national level scheme of National Biogas and Manure Management Programme supported by Ministry of New and Renewable Energy (MNRE), Government of India. In order to assess the scheme's

performance, implementation method, and impact at the ground level, an assessment study at local level is required. The study may recommend changes to the scheme's design and implementation that could lead to better performance of scheme at ground level. Findings of this study could also aid in identifying areas of strength and weakness.

Material and methodology

In the Sikar district, a survey was performed to gather input from the owners. Out of total 1383 biogas plant constructed in District Sikar 60 biogas plants were selected on random basis. By reviewing various research papers, a questionnaire was prepared for this study wherein beneficiary details, biogas plant history and its socio economics factors were mentioned. Door to door survey was conducted as shown in plate.1. The primary objectives of biogas plants are to optimize plant performance by increasing gas generating efficiency, uniformity in application, and maintaining input raw materials. Collection of important data outlined as follows is a prerequisite for establishing the viability, feasibility of selected biogas plants is operational or not, repair and maintenance for each and every randomly selected plant. The following aspects should be taken into consideration-

- Collection of data by biogas plant owner satisfactory or not?
- Problem faced by owner

The purpose of this study was to determine the current state of rural household energy use and to identify factors influencing household acceptance of biogas technologies. It was necessary to investigate the relationship between several parameters affecting household adoption of biogas technology (Bhatia, 1990) [2]. The following factors were discovered as a result of the literature review. Various socioeconomic, demographic, and institutional factors, as well as technology awareness, have influenced rural household adoption of biogas technology.

Result and Conclusion

Biogas installation pattern

Out of the sixty biogas plants, a total of 40 biogas plants were found of 2 cubic meter capacity with an average of 6 family members and average 6 livestock. This information indicates that their daily biogas generation meets their daily energy needs for cooking. A total of 12 biogas plants with a capacity of 3 cubic meters were found with an average of 8 family members and average of 9 cattle. Six beneficiaries have biogas units with a capacity of four cubic meters with an average 11 number of family members and cattle. Two biogas plants with a capacity of 6 cubic meters were found. Owners of these biogas plants have an average of 13 family members and 23 animals and the beneficiary was a dairy owner (Fig.1.). These plants are rarely erected.

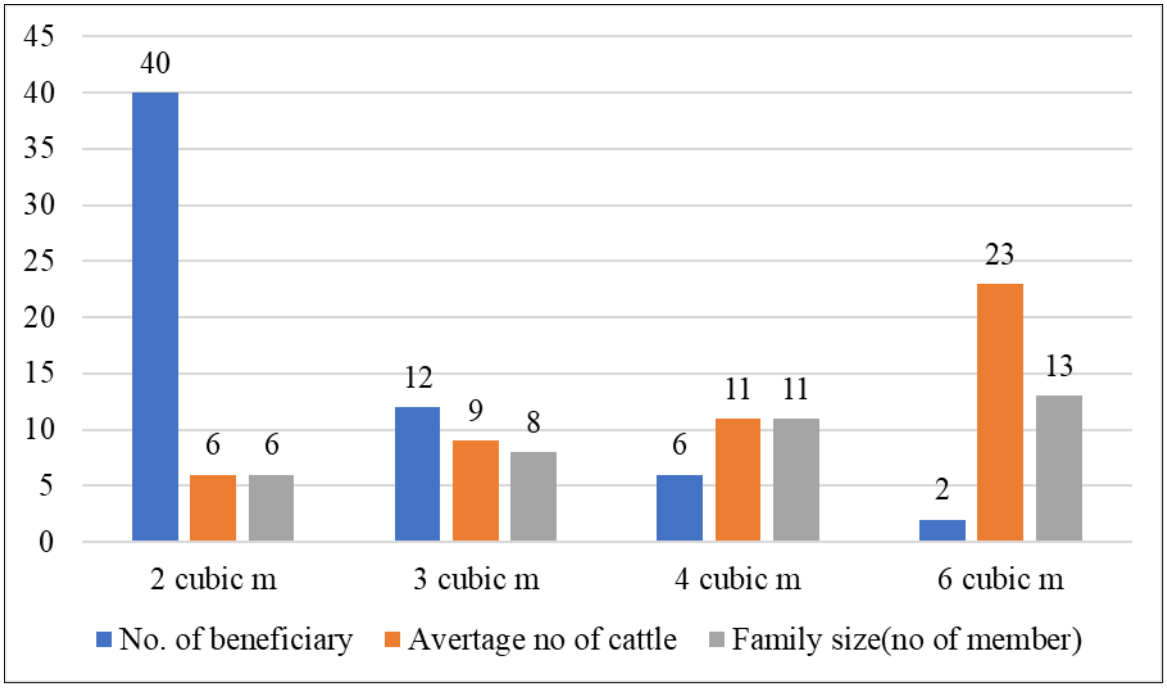

Fig 1: Availability of cattle

Source of information about biogas plant:

Farmers got information about biogas technology mainly by the BDTC or NGO working in their respective areas as shown in Table 1. According to their information, the Biogas Development and Training Centre Udaipur regularly were conducting programmes for awareness creation about biogas technology. It is observed that once a biogas plant is established in a community, neighbors were quick to adopt the technology after seeing the benefits of the plant in terms of fuel savings, time savings, and improved health.

Biogas is used solely for cooking and the production of organic manure by each biogas beneficiary as shown in Table 2. Sometimes it is used for heating the water for domestic application. On average, biogas is used for cooking for roughly 4 hours each day, though this varies from 2 to 5 hours depending on the family. Only double burner biogas stove is used by the beneficiaries. As per the survey, total 93% beneficiaries were satisfied with the technology as cooking fuel is available at free of cost and 7% beneficiaries are disappointed with the technology as labour work to mix cattle dung with water is associated (Fig.2.).

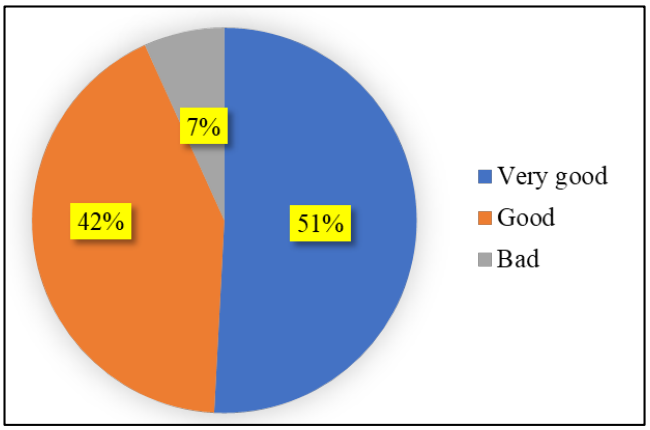

Fig 2: Satisfaction level of beneficiary

Table 1: Information about biogas technology

Size of Biogas Plant (in Cubic meter)	Neighbors	News Paper	Friends & Relatives	BDTC/ NGO	Total
2	10	-	12	18	40
3	2	-	5	5	12
4	3	-	1	2	6
6	-	-	-	2	2

Table 2: Applications of biogas

Purpose of install Biogas plant	Capacity of biogas plant (m^3)				Total
	2	3	4	6	
a) For cooking	40	12	6	2	60
b) For organic manure	40	12	6	2	60
c) For lightening	-	-	-	-	-
d) increase social prestige	-	-	-	-	-
e) As a hobby	-	-	-	-	-

Non-functional biogas plant

Out of 60 plants 6 plants wore found non functional. There are four common reasons which are describes below and shown in fig.3.-

A. Lack of dung: Dung is required for the operation of a biogas plant. For a biogas plant to work smoothly, a specific daily rate of dung is required. The amount of dung required is determined by the size of the biogas plant. For a biogas plant with a capacity of 1 cubic metre, approximately 25 kg of dung is sufficient. Output from biogas plant will be negatively impacted if the dung requirement is not met. A number of biogas plants have been inoperable due to cattle migration in rural areas. Due to a shortage of cattle manure, two biogas plants were found nonoperational.

B. Lack of water: Rajasthan is a dry state where lack of water is a common problem. Due to requirement of water in bulk volume and area required for drying, the technology has not penetrated into water scare region. Besides, a number of working plants become nonfunctional every year mainly because feeding is discontinued during summer season due to scarcity of water. A total of 1 biogas plants were not functioning due to disinterest of beneficiary due to availability of water. Conditions were met at the time of construction of biogas plant but in present they do not have sufficient water.

C. Technical issue: Biogas beneficiaries are not well aware technically about biogas plants or other related accessories like biogas Challahs. So, when any technical problems occur in biogas plants and related accessories, they simply stop it. There is total 2 plants were not working due to this problem.

D. Structural failure: Due to any incident the structural failure leads to stop production of biogas plant. A biogas plant was found with structure issue

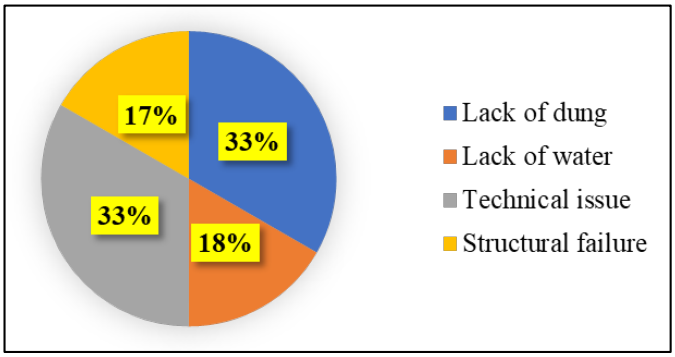

Fig 3: Reason for non-functional of biogas plant

Water feeding in inlet of biogas plant

Cooking By biogas

Plate 1: Door to door survey of biogas plant in District Sikar (Rajasthan).

Conclusion

In this study, it was aimed to analyze the consent of biogas plant owner through randomly selected biogas plant in Sikar district. Only Deenbandhhu biogas plant was found during survey. The study focused on evaluating the performance of biogas plant among the district of Rajasthan state. Data from existing biogas plant located in Sikar district, was used for the operational performance of randomly selected biogas plant. Out of 60 biogas plants 54 biogas plants were operational and 6 plants were found nonoperational. Reason found behind non-functional plant is mainly lack of dung, lack of water, technical issue and structural failure. As per the survey, it is concluded that the technology is more beneficial for the farmers and might be helpful to double the farmer's income (Bajgain, 2005) [1]. Subsidy on the biogas plant can also be raised so more biogas plants can be constructed (Devkota, 2001) [3].

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