

Market potential for domestic biogas digesters in Muzaffarpur district of Bihar

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Abstract- The 'National Biogas and Manure Management Program' gets implemented with physical targets of biogas plants. Annual physical targets for the installation of biogas plants are fixed in accordance with the demand and performance of various states nodal departments, implementing agencies and other eligible organizations. Setting up targets, allocating them to state nodal agencies, and assuring necessary efforts to achieve the set targets plays a very important role in the promotion of biogas technology under Government national scheme. In Bihar, against the target of 4500 domestic biogas digester units for the year 2017-20, the target achievement is only 0.91%. The study is focused on identifying the market potential for domestic biogas digesters based on bovine population and universe interest for biogas digester installation in Muzaffarpur district and rural Muzaffarpur separately. A minimum and maximum number of biogas digesters market potential has been estimated.

Keywords – Biogas, Potential, Target, Scheme, Digester

I. INTRODUCTION

The National Biogas and Manure Management Program (NBMMP) which had been under implementation since 1981-82 as a Central government scheme mainly catered to setting up of family type biogas plants. The scheme provided a central subsidy in fixed amounts. Along with subsidy, this scheme provides funds for five year maintenance warranty, repair of old non-functional plants, training of users and technicians and promotional activities to state nodal agencies and departments. Central financial assistance (CFA) is available for different sizes and models of domestic biogas digesters and also for institutional cattle dung based power generation plants etc. (MNRE, 2014).

The program gets implemented with physical targets of biogas plants. Annual physical targets for a particular year for the installation of biogas plants are fixed according to the demand of biogas digester units, also the performance of various states nodal departments, other implementing agencies and other eligible organizations are kept into consideration.

MNRE keeps the parental regulator over the scheme and sets state/union territory-wise and agency-wise physical targets for the installation of biogas plants. The allocations of physical targets are then assigned to relevant functioning departments. State nodal agencies (SNAs)/State nodal departments(SNDs) issue suitable instructions to District Nodal Officers for implementation and control over the scheme yearly while assigning the district-wise targets.

As per the Ministry of new and renewable energy (MNRE) guidelines, Banks may be asked to put block / district-wise targets reflected in the service area plans prepared by them for the purpose of target achievements under New National Biogas & Organic Manure Program(NNBOMP) scheme. The Bank-wise targets are also used for micro-level (states/districts/block) scheme monitoring purposes.

The rate of administrative charges for SNDs / SNAs and KVIC, BDTCs, etc. is decided by MNRE. The state's main executing agencies are linked with their physical target range and actual achievements. There exists a minimum target achievement of 100 for disbursement of administrative charges to states agencies and departments by MNRE.

The manpower involved by SNDs / SNAs, KVIC and BDTCs and by any other implementing agencies for NNBOMP execution and deployment are on contractual and/or project basis.

Setting up targets, allocating them to SNAs/SNAs, and assuring necessary efforts to achieve the set targets plays a very important role in the promotion of biogas digester under Government National scheme.

For the year 2017-20, biogas deployment operations for Bihar has been handed over from BREDA to 'Panchayat Raj Department' with a target of 4500 domestic units (MNRE, 2018), whereas, the achievement of the year 2017-20 up to 31.01.20 is 41 units (MNRE, 2019). The target achievement is only 0.91% and there exists a huge gap between the target assigned and the actual achievement.

II. OBJECTIVE OF THE STUDY

- To understand Government National scheme for biogas technology promotion and deployment in India.
- To analyze the installation targets and achievements under NBMMP and NNBMMP for Bihar and Muzaffarpur district.
- To identify market potential for domestic biogas digesters in Muzaffarpur district and rural Muzaffarpur separately.

III. RESEARCH METHODOLOGY

A detailed field survey of potential customers of biogas technology was made. The respondents were interviewed using a structured and unstructured questionnaire. Also, an observation method was used wherever conditions were favorable for the same.

Secondary data were obtained from the published reports, internet, libraries, journals/magazines, and reports of certain government agencies.

BEREDA has been taken into consideration for understanding the development and deployment process of biogas technology in Bihar.

Sampling: Multi-stage sampling method is used for the household survey of potential consumers. Simple random sampling method is followed to select villages and households from each block.

The study demanded a universe consisting of rural households of Muzaffarpur districts with at least one bovine as livestock.

Sample size: A maximum of 300027 households (Households with cattle + Households with buffalos) of rural Muzaffarpur have at least one cattle or bovine livestock (refer to table no. T1). We have considered the same as our universe for the study.

At a 95% confidence level and a 3% margin of error, a sample of 1064 households (www.checkmarket.com/, 2020) of potential consumers have been surveyed.

The number of samples for each block (all the blocks of Muzaffarpur district have been considered) has been decided as per households in the block as a percentage of total rural households of Muzaffarpur district (refer to table no. T2).

Village selection from each block has been done using a random sampling technique. And sample households have been selected from the identified village as per convenience. The surveyed consumers often located near the existing consumers (if any) of the identified village.

Table T1- Livestock data of Bihar and, Domestic biogas digester market potential for as per MNRE.

	Potential units based on cattle population.	Livestock cattle [#]	Livestock buffalos [#]	Livestock bovines [#] (cattle +buffalo)	Households with cattle [#]	Households with buffalos [#]
Bihar	733000*	12231523	7567233	19798756	5568111	3554058
Muzaffarpur		343789	278127	621916	159252	140775
Muzaffarpur (Rural)	-	-	-	612611 ^{##}	-	

Source- * (MNRE, 2019), [#] (Dept. of Animal Husbandry, Dairying & Fisheries, 2012), ^{##} Calculated

Table T2- Number of samples selected on the basis of households in the block as a percentage of total rural households of Muzaffarpur district.

Blocks	Total number of rural households*	Households in the block as a percentage of total rural households of Muzaffarpur district	Distribution of the sample among different blocks	Number of samples selected (Next round figure)
001 - Sahebganj	42556	4.856100536	51.66890971	52
002 - Baruraj Motipur	73766	8.417499581	89.56219554	90
003 - Paroo	60979	6.958364381	74.03699701	75
004 - Saraiya	60488	6.902335963	73.44085464	74
005 - Marwan	30154	3.440898007	36.61115479	37

006 - Kanti	48990	5.590289625	59.48068161	60
007 - Minapur	75435	8.607950558	91.58859394	92
008 - Bochaha	51308	5.854798532	62.29505638	63
009 - Aurai	62727	7.157830114	76.15931241	77
010 - Katra	54801	6.253387665	66.53604476	67
011 - Gaighat	56754	6.476246119	68.9072587	69
012 - Bandra	29753	3.395139563	36.12428495	37
013 - Dholi Moraul	19278	2.199828606	23.40617636	24
014 - Musahri	64256	7.332305575	78.01573132	79
015 - Kurhani	81660	9.318290483	99.14661074	100
016 - Sakra	63436	7.238734693	77.02013714	78
District Total	876341	100	1064	1074
<i>Source – * (Ministry of home affairs, 2011)</i>				

IV. GOVERNMENT NATIONAL SCHEME FOR DOMESTIC BIOGAS PROMOTION AND DEPLOYMENT IN INDIA

In May 2018, the Biogas Technology Development Group of MNRE has introduced a new scheme in the name of New National Biogas and Organic Manure Program. NNBOMP replaced NBMMP, and initially, the NNBOMP is in working for 2017 to 2020, which ends in March 2020 (MNRE, 2018) .

4.1 New National Biogas and Organic Manure Program-

The program is being implemented by SNDs/SNAs, Khadi and Village Industries Commission(KVIC), Biogas development and training center (BDTC), and other state Government agencies/organizations/departments, etc. However, within the state, the program implementing SNDs/SNAs and KVIC, BDTC, etc. could also take help from other skilled organizations that would function within their overall control. However, in one state there could not be more than two agencies excluding KVIC. The implementing agencies within a state works with proper coordination and share all the information with each other.

Identification of potential beneficiaries are done by Panchayat raj department and various district and block level officers and Kissan Vikas Kendras, the identified potential beneficiaries are finally approved by SNDs/SNAs.

The financial tasks and objectives of the scheme are achieved by participation of Indian Renewable Energy Development Agency Limited (IREDA), National Bank for Agriculture and Rural Development (NABARD), scheduled banks through their regional rural development banks / Grameen and Prathama banks, and other financial institutions. SNDs /SNAs and KVIC as well as BDTCs confirms the involvement of associated financial institution. (MNRE, 2018)

The major objective of NOBMMP is not limited only to provide clean biogas fuel for cooking purposes for reducing use of LPG and other conventional fuels, but also to improve sanitation in villages by linking sanitary toilets with biogas plants. Along with this the scheme also focuses on providing bio-fertilizer/organic manure to promote organic farming. Preventing black carbon and methane emission by promoting green and clean cooking fuel is one of the objectives of this program. The scheme moves towards meeting 'life line energy' need for cooking envisaged in 'Integrated Energy Policy'.

4.2 State nodal agencies/State nodal departments of MNRE in Bihar-

4.2(a) Bihar Renewable Energy Development Agency (BREDA):

BREDA has been implementing various central and state govt. schemes focused on the development, deployment, and promotion of different renewable energy sources. NBOMMP, Solar photovoltaic (SPV) systems of lanterns/home lighting systems, street lighting systems, and windmills are the major ones. BREDA is also involved in the Border Area Development Program. BREDA works towards providing energy alternatives to the people of Bihar for a sustainable tomorrow.

Besides working on unconventional and renewable power resources for free energy and energy independence, BREDA has been contributory to envisioning the policy designing and planning for the implementation of renewable energy schemes and formulates innovative policies. (BREDA, n.d.)

4.2(b) Khadi and Village Industries Commission (KVIC):

KVIC is a statutory body and it works under the Ministry of Micro, Small and Medium Enterprises, Govt. of India. KVIC is involved in the planning and implementation of various programs for the overall development of Khadi and other village industries. KVIC coordinates with other state-level agencies engaged in rural development and takes the help of these agencies for organisation, promotion, and deployment of various Govt. schemes. District and block-level earmarking of scheme implementations are done by mutual consultation between SNAs and KVIC at the beginning of the financial year.

KVIC has an active participation in the deployment of NBOMMP at village level. Also, KVIC assigns tasks to the micro-level organization/NGOs/self-help groups for implementation of the scheme. Although, one agency or organization must be allowed to operate in an identified area. KVIC along with all other implementing agencies shares the list of beneficiaries to concerned nodal departments/agencies at the appropriate level. Checking with the lists of nodal departments/agencies done by concerned state and district authorities and get it cleared within a maximum period of 45 days before disbursing subsidy to the genuine beneficiaries. (KVIC, n.d.)

4.2(c) Panchayat raj department Bihar:

The organizational structure of Panchayat raj department consists of gram panchayat at the village level, panchayat samiti at the block level and zila parishad at district level. Currently, under the Panchayat raj department of Bihar there are 8386 gram panchayat, 534 panchayat samitis and 38 zila parishads are functioning. Gram panchayat further divided into ward. At present, there are approximately 1.15 lacs wards established in Bihar (Panchayat Raj Department, Govt. of Bihar, n.d.).

Panchayats at the different levels have been entrusted with the responsibility of carrying out significant functions and duties with regard to 29 subjects described in the Eleventh Schedule of the Constitution (Panchayat Raj Department, Govt. of Bihar, n.d.). For smooth functioning Panchayat raj department issues advisory and necessary direction to panchayat. Standard operating procedures are guided by Govt. of Bihar to all panchayats.

Panchayat raj department puts monitoring and controls over the functioning of panchayats for devolution of funds provided by central and state governments and the overall development of villages. The panchayat raj department also monitors the if any misuse of power assigned to panchayats. The department keeps a close watch on the regular maintenance of accounts and conducts audits to evaluate the optimum and genuine use of funds.

The Deputy Development Commissioner/ District Panchayat Raj Officer at the district level and the Block Panchayat Raj Officer/ Junior Engineer/ Executive Assistants/Panchayat Secretary and employees of different departments working at the panchayat level render necessary assistance and guide to the Panchayats subject to directions of the department. (Panchayat Raj Department, Govt. of Bihar, n.d.)

V. MARKET POTENTIAL, INSTALLATION TARGETS, AND ACHIEVEMENTS' OF BIOGAS DIGESTERS UNDER NATIONAL SCHEMES FOR BIHAR

As per MNRE the total estimated potential for installing biogas digester in India is 1,23,39,000 units and the potential of Bihar is estimated 733000 family type biogas plants based on estimated availability of cattle dung in the country. As of 31/03/2019, cumulative achievement for India is 5028347 units and cumulative achievement for Bihar up to 129905 units. (MNRE, 2020)

In the 11th Five Year Plan (2007-12) of MNRE, the target of SNA for biogas digesters installation in Bihar was 300 units (MNRE, 2009), and the target was successfully achieved (Energetica India, 2016).

Despite this success and huge potential, there was no target to SNAs of Bihar for biogas digesters installation in the 12th Five Year Plan (2012-2017) of MNRE (MNRE, 2014). It means that the government had shifted its focus from biogas to other renewables in Bihar. From the year 2012-2016 (as on 31/01/2016) no installation of biogas digesters has been done in Bihar (Energetica India, 2016).

For the year 2017-20, biogas deployment operations for Bihar have been handed over from BREDA to 'Panchayat Raj Department' with a target of 4500 domestic units (MNRE, 2018), whereas, the achievement of the year 2017-20 up to 31.01.20 is 41 units (MNRE, 2019). The target achievement is only 0.91%.

As of 31/12/19, the National achievement against the target of 2019-20 is 15.81%, whereas for Bihar it is 0%. (MNRE, 2020)

In Muzaffarpur district, no installation was done during the period of 2007-14 (Pandey, 2017). The last installation of 188 units domestic biogas digesters was done during the period of year 1990-1995 in Muzaffarpur district (Paroo prakhand samagra vikas pariyojana vs The state of Bihar, 2005).

For marketing of any product, it is very important to do the segmentation, targeting, and positing (STP) at the very first stage of the marketing plan. The installations target for biogas digester in Bihar has not been identified as district-wise market potential. The current achievements data of Bihar states that the achievement of the given target for the year 2017-20 seems impossible to be achieved by 31/03/2020. Hence, it became very important to identify district wise market potential for biogas digester, so that the promotion and deployment of the biogas technology could be done in a more systematic pattern. Setting up a realistic target and proper control over marketing activities can assure the target achievements.

The installation history clearly states that since 1995, no installation has been done in Muzaffarpur district. It became very important to identify the market potential of Muzaffarpur district for installation of biogas digesters' so that adequate deployment strategies could be made and implemented as per the district's market potential for biogas digesters.

VI. MARKET POTENTIAL FOR DOMESTIC BIOGAS DIGESTER IN MUZAFFARPUR

Even if biogas has huge potential, it will be of no use if people are not willing to use and adapt this technology. It is necessary to calculate the market potential for biogas in Muzaffarpur district. Biogas digesters need to be installed on domestic levels to generate the identified potential volume of biogas. Three different approaches are used to identify the number of potential customers in Muzaffarpur district.

6.1 Method 1; Market potential calculation for biogas digester as per MNRE potential calculation methodology (based on estimated availability of cattle dung)-

As manure, sewage sludge, municipal solid waste, biodegradable waste, energy crops, or any other biodegradable feedstock can be used for biogas production through anaerobic digestion.

In method 1, we considered MNRE identified market potential, and the livestock of Bihar, for identifying the market potential of biogas digesters. As Bihar potential has been already identified by MNRE, we calculated the potential of 'Muzaffarpur district' and 'rural Muzaffarpur' with the same approach of calculation.

The potential of Bihar is about 733000 family type biogas plants based on the estimated availability of cattle dung in the country (MNRE, 2019).

6.1(a) Muzaffarpur district potential:

Muzaffarpur district potential based on bovines population (refer to table no. T1 for livestock data):-

(Bihar biogas digester potential / Bihar bovine population) x Muzaffarpur bovine population.

i.e. $(733000/19798756) \times 621916 = 23024$ units (decimal not considered).

6.1(b) Rural Muzaffarpur potential:

Rural Muzaffarpur potential based on the bovine population (refer to table no. T1 for livestock data):-

Bihar biogas digester potential/Bihar cattle population x Muzaffarpur rural bovine population.

i.e. $(733000/19798756) \times 612611 = 22680$ units (decimal not considered).

From Method 1, it can be easily derived that Muzaffarpur district's potential of biogas digester based on bovines' population is 23024 units. Whereas, Muzaffarpur district's rural potential of biogas digester based on bovines' population is 22680 units.

6.2 Method 2; Market potential calculation for biogas digester is done based on the number of households having at least one bovines as livestock-

In this method of identifying the market potential for biogas digesters, we considered the livestock of Muzaffarpur district and the number of households owning at least one bovine livestock to feed a biogas digester. And on the assumption that there exists a potential for one biogas digester for each household having at least one bovine as livestock.

6.2(a) Muzaffarpur District:

In Muzaffarpur district, there are 159252 households owning cattle (cows/ bulls/oxen) and 140775 owning buffalos (Dept. of Animal Husbandry, Dairying & Fisheries, 2012). So, for biogas digester, there is a minimum of 159252 household those have at least one cattle or buffalo to feed a biogas digester in Muzaffarpur district. So there exists a potential of 159252 digesters in Muzaffarpur district.

6.2(b) Rural Muzaffarpur:

No data is available on the total number of 'rural households' in Muzaffarpur district owning at least one bovine as livestock. So, to identify the same, we segregated the 'total number of household in Muzaffarpur district owning bovine', according to the ratio of 'urban-rural' bovine population.

Muzaffarpur's total bovines (Rural + Urban): Rural bovines' population = 621916: 612611 (Dept. of Animal Husbandry, Dairying & Fisheries, 2012).

- Taking the same ratio for rural-urban households with bovines as livestock:-
Muzaffarpur district HH with bovines: Muzaffarpur rural HH with bovines = 159252: 156869 (refer to table no.T3). We found that for biogas digester there were a minimum of 156869 household those have at least one cattle /buffalo to feed a biogas digester in 'rural Muzaffarpur' district.

Table T3- Domestic Biogas digester potential, as per minimum number of households owning at least one bovines.

Market	Potential (Household Units)
Muzaffarpur District*	159252
Muzaffarpur Rural [#]	156869
<i>Source- *(Dept. of Animal Husbandry, Dairying & Fisheries, 2012), #Calculated.</i>	

From Method 2, it can be easily derived that Muzaffarpur district's potential of biogas digester units based on the number of households owning at least one bovine is 159252 units. Whereas, there exists a potential of 156869 biogas digesters units in 'rural Muzaffarpur' district.

6.3 Method 3; Market potential calculation for biogas digester, as per theoretical definitions and primary data-

Philip Kotler says "A market consists of all the potential customers sharing a particular need or want who might be willing and able to engage in exchange to satisfy that need or want".

As per Primary Data collected and analyzed from potential customers of Muzaffarpur district's rural households (refer to table no.T4), the findings reveal that:

- 95%, of the population, is interested in installing biogas digester.
- 3.4% shows no interest in installing biogas digester.
- 1.6 % was not sure about their decision.

Table T4- Responses to the question, "Are you interested in installing a biogas digester"

	Frequency	Percent
Can't say	17	1.6
No	37	3.4
Yes	1020	95.0
Total	1074	100.0
<i>Source- Primary data.</i>		

6.3(a) Muzaffarpur District:

Data reveals, 95% of this population is interested in biogas installation. And on the assumption that there exists a potential for one biogas digester for each household having at least one bovine as livestock. So, Muzaffarpur district potential will be 95% of 159252 digesters, i.e. 151289 digesters.

6.3(b) Rural Muzaffarpur:

Market potential for rural Muzaffarpur will be 95% of 156869 digesters, i.e. 149025 digester units.

VII. CONCLUSION

Based on the bovine population in Muzaffarpur district and interest for digester installation, the estimated market potential for biogas digesters in Muzaffarpur district is a minimum of 23024 to a maximum of 151289 biogas digester units. The estimated market potential for biogas digesters in rural Muzaffarpur is a minimum of 22680 to a maximum of 149025 biogas digester units. The target allocation, budgets, and marketing efforts should be taken accordingly for maximum achievement of allocated targets.

Despite such a good number of market potential biogas has not yet made an optimum market capture. District-wise target allocation and systematic marketing plans implementation can help the achievement of set targets in the coming years. A further study identifying problems in the marketing of biogas technology will light up new paths for policymakers.

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