

Estimation of biogas Potential in different district of Chhattisgarh, India

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Abstract

Total eighteen districts of CG were taken namely Raipur, Mahasamund, Dhamtri, Durg, Rajnandgaon, Kawarda, Bastar, Nararayanpur, Kanker, Daniewada, Bijapur, Bilaspur, Janjgir-champa, Koraba, Surguja, Koriya, Raigarh and Jashpur during the years 2006-07 and 2007-08 for dung availability on the basis of animal category, total dung availability from Cow and buffalo family, and total gas generation on the basis of total dung availability. Total dung availability from cow family and buffalo family are found 65804112kg/day and 21556310 kg/day respectively. Total biogas generation is found 2649173 m³/day.

Keywords: Biogas, Buffalo, Cow, CG, Dung availability

Introduction:

Biogas is the alternative source of energy which is very essential due to crisis of fossil fuels. Biogas is produced from mainly dung local name *gobar* gas. This study is carried out during the years 2006-07 to 2007-08 in Chhattisgarh keeping in mind how much availability of dung in different districts of Chhattisgarh (CG) and how much gas is produced from this available dung. Biogas is a sustainable source of energy by virtue of its production from waste, and available cattle dung. The biogas substitutes both fuel and fertilizer, the plant gives gas and at the same time enhances the fertilizer value of dung. It is estimated that out of the total dung available, 69 % is used as manure, 29 % as cakes for fuel and remaining 2 % is used for other purposes (Nesmith, 1991).

Biogas is a type of renewable energy resource. The main component of biogas is methane which can be combusted to release energy. This energy release allows biogas to be used as a fuel. Biogas and its derivatives are used for multiple purposes including heat for cooking, electricity generation, and as a vehicle fuel. At a high level, biogas is a carbon-neutral fuel in so far as emissions of carbon dioxide from its combustion are matched by carbon dioxide pulled from the atmosphere to produce biomass in practice, the carbon intensity of biogas can vary depending on emissions from the production of biomass, and the processes used to produce and upgrade biogas. In some applications, the capturing of biogas can avoid emissions of methane reducing overall emissions.

The increased utilization of fuel wood has caused problem of ecological deterioration and reduction of forest cover. Direct burning of biomass not only results in poor salvation of heat energy but also causes pollution problem. The smoke of wood and coal produces several diseases of eyes and lung. Thus, renewable energy resources like biogas was found suitable and can play an important role in present day of fuel and fertilizer crises in the country like India. (Kumar Shailendra, 2008)

Biogas technology has been introduced in the country in 1930 and in the CG 1975 (Kumar *et. al.*, -2013). The biogas technology had established itself as a technology with great potential, which could have considered in calculating the energy scene in rural areas. It had not made any real impact on the total energy scenario despite

the presence of about 1.8 million biogas digesters. Due to failure of the some of the digester, one of its serious limitations was the availability of feedstock followed by defects in construction, and microbiological failure. They further reported that a long list of alternate feedstock and its potential were found for biogas production. They suggested that now it is the time that substrate-specific biocatalysts are made available to reduce the lag period of the bio-methanization during the start-up. Regular supply of inoculums and quality control of the available inoculums will result in regulating the plant failures. They further reported that design suited to microbial catalysts have been discussed for long, but have to be realized. This indicates that the technology transfer is not complete. It requires coordinated efforts of scientists and engineers to overcome these limitations in order to translate this “high potential” technology to “high performing” technology. (Nagmani and Ramasami, 2008)

Bhatiya (1990) carried a case study on biogas engines. He expressed that biogas engines can be popularized, but Govt. policy of giving subsidy in electricity, kerosene, and diesel etc. makes farmer's mind to prefer these sources of energy and hence they dislike adopting non-conventional sources (biogas engines).

Method and materials:

Observations on dung availability (6pm-7am) gm / day were taken from different district of CG and data are shown in Table 1. Minimum 100 Animal are selected from each category of animals and five replications are taken. The mean of each category of animals are given in Table 1

The data were collected from the office of CREDA, and personally visiting the biogas plants with the help of questionnaire. The theoretical gas generation was worked out 0.04-m³ gas per kg fresh dung per day (Rai, 1997). Burner diameter, dung fed in kg and gas consumption time are noted at the site of plants.

Therefore, theoretical gas produced was calculated by multiplying dung fed with 0.04. Therefore plant use or presently working efficiency was calculated as below.

$$\text{Gas generation efficiency} = \frac{\text{Actual gas consum.}}{\text{Theo. gas generation efficiency}} \times 100$$

Result:

Observations on dung availability per day of each category of animals are given in Table1. Table1 revealed that the maximum Dung availability from He-buffalo (9 kg) followed by she- buffalo (8.75kg). The minimum dung availability per day were found Calf (age Less than one year) followed by Calf (age 1 -1.25 Year).

Total eighteen districts of CG were taken namely Raipur, Mahasamund, Dhamtri, Durg, Rajnandgaon, Kawrda, Bastar, Narayanpur, Kanker, Daniewada, Bijapur, Bilaspur, janjgir-champa, Koraba, Surguja,. Koriya, Raigarh and Jashpur. The total cow dung collected from different districts are given in Table 2 (Cow Family) and the total buffalo dung collected from different districts are given in Table 3 (Buffalo Family). The maximum Cow dung was found in district Surguja fallowed by Raipur. The minimum cow dung was found in district Narayanpur followed by Bijapur.

The maximum buffalo dung was found in district Surguja fallowed by Raipur. The minimum buffalo dung was found in district Narayanpur followed by Bijapur.

The maximum buffalo dung was found in district Raipur fallowed by Bilaspur. The minimum buffalo dung was found in district Bijapur followed by Jajgir-Champa.

Total gas generation theoretically calculated and given in Table4. Table revealed that the total biogas generate per day in different districts of Chhattisgarh was found 2649173 m³/ day. This is huge amount of gas. Maximum Biogas was found in district Surguja fallowed by Raipur. The minimum biogas generation was found in district Narayanpur followed by Bijapur.

Table 1 Observations on dung availability (6pm-7am) gm / day

Animal category	Age (yr)	Quantity of dung (gm) / day at each time				Total dung gm / day	
		I	II	III	IV	V	
1-Calf/ Heifer							
I	<1 year	120	110	130	120		480
Ii	1-1.5 year	450	400	460	430	410	2150
Iii	1.5-2 year	600	500	550	510		2160
Iv	2-2.25year	700	750	650	500		2600
V	2.25-2.5 year	750	800	700	700	550	3500
Vi	2.5-3 year	700	825	800	700	975	4000
2-Cow							
I	4-6 year	1200	1000	1100	1200	1000	5500
Ii	6-8 year	1400	1500	2000	1550		6450
Iii	8-10 year	1500	1600	1800	1100		6000
Iv	>10year	2150	1600	1250	1300		6300
3-Bullock							
I	7-8 year	1600	1400	1950	1825		6775
Ii	8-10 year	2000	1500	1800	1700		7000
4-She Buffallow							
I	5-6 Year						
Iii	7-8 year	3000	2500	2800			8300
Iv	8-10 year	2500	1650	2200	2400		8750
5-He Buffallow							
I	5-7 year	3300	2700	3000			9000
Ii	7-8 year	3500	3300	3200			10000

Table 2 Animal population and district wise available dung from cow family

S.N.	District	Bullock Nos.	Cow Nos.	Calf / Heifer Nos.	Total dung kg / day
1	Raipur	307179	342556	365364	7888052
2	Mahasamund	164715	74651	106800	3000988
3	Dhamtari	86007	79431	87511	2017576
4	Durg	252039	291504	315997	6620488
5	Rajnandgaon	229050	181522	178871	4916260
6	Kawarda	74992	86066	83294	1921608
7	Baster	236614	108911	114878	4170168
8	Narayanpur	18224	9357	14361	350988
9	Kanker	139376	82614	89603	2691836
10	Daniewada	118432	115414	124505	2842516
11	Bijapur	63235	54696	55905	1420008

12	Bilaspur	202230	248188	235128	5352776
13	Jajgir-Champa	105514	140766	181470	3118176
14	Koraba	95782	78771	87746	2130536
15	Surguja	467713	208905	240779	8246912
16	Koriya	102924	70830	77184	2110464
17	Raigarh	164056	120157	129073	3446220
18	Jashpur	209156	81982	98203	3558540
	Total	3037238	2376321	2586672	65804112

Table 3 Animal population and district wise available dung from buffallow family

S.N.	District	He buff allow nos.	She buffallow, nos.	Calf nos.	Total dung kg /day
1	Raipur	129603	54887	68518	2876761
2	Mahasamund	46544	13982	17637	936492
3	Dhamtari	29478	17040	21660	733290
4	Durg	96288	50522	57562	2280832
5	Rajnandgaon	63296	21192	25211	1304588
6	Kawarda	44714	11300	14175	863010
7	Baster	71945	13101	16531	1302511
8	Narayanpur	7218	1537	2157	135342
9	Kanker	34976	6573	11262	648564
10	Daniewada	16084	7756	9928	374044
11	Bijapur	5555	4805	5869	164461
12	Bilaspur	119844	39631	41368	2438704
13	Jajgir-Champa	118845	7623	12945	1925931
14	Koraba	49387	11509	16008	942945
15	Surguja	93177	50162	58537	2233747
16	Koriya	25316	16606	20445	660792
17	Raigarh	67682	9776	12875	1184042
18	Jashpur	24990	10445	12516	550254
	Total	1044942	348447	425204	21556310

Table 4 Estimation of total biogas generation (m³/day)

S.N.	District	Total dung kg/day (Cow Family)	Total dung kg/day buffallow,.	Total dung kg/day	Total Gas generation m ³ /day
1	Raipur	7888052	2876761	7956570	318262.8
2	Mahasamund	3000988	936492	3018625	120745
3	Dhamtari	2017576	733290	2039236	81569.44
4	Durg	6620488	2280832	6678050	267122
5	Rajnandgaon	4916260	1304588	4941471	197658.8
6	Kawarda	1921608	863010	1935783	77431.32
7	Baster	4170168	1302511	4186699	167468
8	Narayanpur	350988	135342	353145	14125.8
9	Kanker	2691836	648564	2703098	108123.9
10	Daniewada	2842516	374044	2852444	114097.8
11	Bijapur	1420008	164461	1425877	57035.08
12	Bilaspur	5352776	2438704	5394144	215765.8
13	Jajgir-Champa	3118176	1925931	3131121	125244.8
14	Koraba	2130536	942945	2146544	85861.76
15	Surguja	8246912	2233747	8305449	332218
16	Koriya	2110464	660792	2130909	85236.36
17	Raigarh	3446220	1184042	3459095	138363.8
18	Jashpur	3558540	550254	3571056	142842.2
	Total	65804112	21556310	66229316	2649173

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