ESTIMATED POTENTIAL FOR INSTALLATION OF FAMILY-SIZE BIO-GAS PLANTS IN BODOLAND TERRITORIAL AREA DISTRICTS, ASSAM

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ABSTRACT

As on date, India is the second most populous country in the world and is poised to outnumber China by 2050. It is therefore destined to face growing energy need and soil fertility improvement challenges. Resource augmentation and growth in energy supply have not been able to keep pace with ever increasing demands and thus the country faces a demand supply gap of about 11% energy shortage and 14% peak power shortage. Efficient utilization of India's renewable energy sources for on and off-grid application through Renewable Energy Technologies (RETs) like biomass gasifiers, solar photo voltaic, micro hydro projects, biogas etc can play a significant role on India's energy security. It can be agreed to the fact that a significant role can be played by biogas plants, because of their large-scale feasibility and cost effectiveness compared to other RETs and the multiple benefits the technology can offer. The biogas plant is also a viable answer to the new global outlook in converting bio-waste into a wealth of high end useable commodity in addition to meeting the growing rural and urban energy needs and in addressing deforestation and climate change issues. Use of biogas energy can at least partially, solve the most serious problem of energy security in rural areas of Bodoland Territorial Area Districts, Assam, where people traditionally forage for fuel wood in forest.

1. Introduction

It can be agreed to the fact that a significant role can be played by biogas plants in meeting energy requirements of rural areas, because of their large-scale feasibility and cost effectiveness compared to other RETs and the multiple benefits the technology can offer. The biogas plant is also a viable answer to the new global outlook in converting bio-waste into a wealth of high end useable commodity in addition to meeting the growing rural and urban energy needs and in addressing deforestation and climate change issues. Use of biogas energy can at least partially, solve the most serious problem of energy security in rural areas of Bodoland Territorial Area Districts, Assam, where people traditionally forage for fuel wood in forest.

Biogas is a clean, non-polluting and low cost fuel. The gas is highly flammable and is very useful as a fuel. It contains 55% of methane, 35% of carbon dioxide, 7.4% of hydrogen, 2.6% of nitrogen and water in traces. Its calorific value is 21.5 kg/ ltr.

Biogas plant is a system which produces a gaseous product obtained by anaerobic (in the absence of air) fermentation of organic materials that can be used for domestic purposes viz. cooking and lighting.

The present project was conceived with a view to addressing issues like energy security at domestic level, economic growth and environment protection pertaining to the rural areas of the project districts of Kokrajhar, Chirang, Baksa and Udalguri.

2. The Project Area

Bodoland is the gateway to the North Eastern Region of India that was created by curving out areas of Kokrajhar, Dhubri, Bongaigaon, Barpeta, Nalbari, Kamrup, Darang and Sonitpur districts of Assam. The Bodoland Territorial Area Districts (BTAD) also known as BTC (Bodoland Territorial Council) is an autonomous administrative unit constituted under the 6th Schedule of the Constitution of India and Kokrajhar town is the headquarters of this area. The council area encompasses the districts of Kokrajhar, Chirang, Baksa and Udalguri as shown here.

BTC is bounded by Bhutan and Arunachal Pradesh in the north, Sonitpur district in the east, Bongaigaon, Dhubri, Barpeta, Nalbari, Kamrup and Darrang districts in the south and the state of West Bengal in the west. Total geographical area of the council is about 8,970 sq. km, while the population (As per Census 2001) is about 26.32 lakh meaning that population density is about 293 persons per sq. km compared to 340 for Assam.

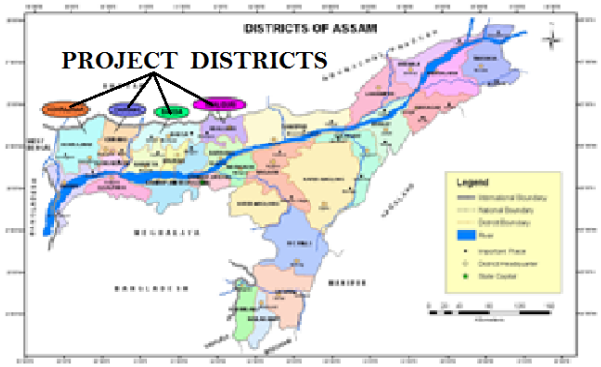

Fig.-1: The project districts

Sl. No.	New District	Old District	Total Population
1	Kokrajhar	Kokrajhar (Pt)	768363
		Dhubri (Pt)	130630
		Total	898993
2	Chirang	Bongaigaon (Pt)	343626
		Kokrajhar (Pt)	NA
		Total	343626
3	Baksa	Barpeta (Pt)	279345
		Nalbari (Pt.)	351089
		Kamrup (Pt)	88208
		Total	718642
4	Udalguri	Darrang (Pt)	660956
		Sonitpur (Pt)	10054
		Total	671010
		GRAND TOTAL	2632271

3. Energy Use and Landuse

The major energy sources within the districts are given below. However, dependence on forest resources still dominates the scenario.

Cooking : Wood/bamboo/kerosene/LPG
Lighting : Electricity and Kerosene
Agriculture : Diesel
Others : Wood/bamboo/Coal

Forest area depletion is a major development and environmental issue as is evident from the table below.

Landuse/ Landcover (%)	District			
	Kokrajhar	Chirang	Baksa	Udalguri
Dense Forest	27.92	26.28	3.32	3.38
Grassland	6.00	13.41	10.19	10.08
Degraded Forest	14.16	15.64	33.37	19.64
Non-Forest	46.62	40.70	47.49	61.50
Water Bodies	1.30	0.17	1.43	1.24
Sand Beds	4.00	3.80	4.20	4.16
Total	100.00	100.00	100.00	100.00

Note: All these areas were once covered with dense forest

4. Bio-gas & Its Benefits

Some of the major benefits of bio-gas are as follows:

- ✓ No need of firewood- Trees are saved
- ✓ No smoke- health of woman/children are protected
- ✓ Produces organic manure for needed for agriculture
- ✓ Good alternative energy- saves fossil fuels

5. Programme of GoI

The National Biogas & Manure Management Programme (NBMMP) of the MNRE has been in operation since 1981-82. The idea is to provide clean alternate fuel to rural masses & enriched organic manure for agriculture. The programme envisages setting up of biogas plants in rural India, the estimated current potential of which stands at 12 million.

As far as Assam is concerned, the estimated potential stands at 3,07,000 nos. (Source: MNRE), while for BTAD no realistic data exists. It is reported that about 1.14 lakh plants have already been installed in various districts of Assam. Field survey conducted during 2010 revealed that >50,000 rural families of BTAD would be interested in setting up 1-2 m^3 size biogas plants. The Survey Team however, put the above figure of 50,000 at 27,500 duly considering operational difficulties and inadequate capacity building measures undertaken by the State Nodal Agency. The estimated break-up is as follows:

- ➢ Kokrajhar : 7,000
- ➢ Chirang : 6,500
- ➢ Baksa : 8,500
- ➢ Udalguri : 5,500

Total : 27,500

6. Types of Biomass Feedstock

Field survey conducted revealed that the following types of feedstock are available in BTAD.

- ❑ Cattle dung
- ❑ Poultry litter
- ❑ Pig droppings
- ❑ Kitchen waste
- ❑ Vegetable waste
- ❑ Goat droppings
- ❑ Rice straw

7. Substrates and their Characteristics

The following table provides necessary details.

Substrate	HRT* (days)	Solid Concen-tration (%)	Tempe-rature (°C)	Biogas Yield added (m^3/kg VS)	Methane (%)
Cattle Dung	30	10.00	35	0.30	58
Poultry Litter	15	6.00	35	0.50	69
Pig Droppings	20	6.50	35	0.43	69
Kitchen Waste	20	10.00	30	0.60	50

8. Selection of Biogas Model

In the context of BTAD, the recommended type was Deenbandhu in-situ model with ferro-cement (capacity=1 to 6m^3). The reasons for selection of this type of biogas plant are, (i) the cost of Deenbandhu is less than the KVIC model (ii) its O & M cost is negligible (iii) it is durable and reliable and (iv) above all, local mason can construct as well as repair it easily. The conceptual diagram is shown below.

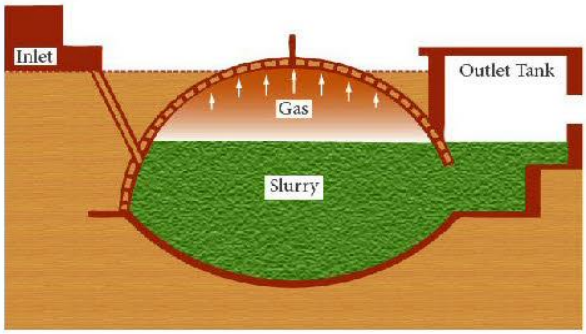

Fig.-2: Conceptual diagram of Deenbandhu in-situ model

Fig.-3: Deenbandhu in-situ model under construction

9. Plant Size & Requirement of Cattle Dung

The following table provides information on sizes of biogas plants vis-à-vis cattle dung requirement per day for the purpose of assessment/calculation of inputs.

Size of Plant (m^3)	Cattle Dung Required/day (kg)	Cattle Heads Required (nos.)
1	25	2-3
2	50	4-6
3	75	7-9
4	100	10-12

10. Assessment of Availability of Biomass

Information on availability of biomass as input to the proposed biogas plant (s) for a family is as follows.

Assumptions:

- Every family has at least 1 cow
- Every family has 3 pigs
- Every family discharges 1.50 kg of kitchen waste/day
- Every family rears about five (5) poultry bird

Total Production:

- Cattle Dung : 5.00 kg/animal/dayx1 animal = 05.00 kg
- Poultry Litter : Negligible
- Piggery Waste : 3.50 kg/animal/dayx3 animals =10.5kg
- Kitchen Waste : 1.50 kg/day = 01.50 kg
- **Total = 17.00 kg**

11. Bio-gas generation potential

(for a typical family in BTAD)

The following table provides information on bio-gas generation potential of a typical family in BTAD. It can be seen that a Biogas Plant of 1-2 m^3 would be best suited for an average family.

Substrate	Biomass Available (kg/day/family)	Total Solids		Volatile Solids	
		(%)	(kg)	(% of TS)	(kg)
a	b	c	d	e	f
Cattle Dung	1x5.00= 5.00	20	1.00	70	0.70
Piggery Waste	3x3.50= 10.50	20	2.10	90	1.89
Kitchen Waste	1x1.50= 1.50	16	0.24	86	0.21
Poultry Litter	0.00= 0.00	-	-	-	-
Total	**17.00 kg**				

Biogas yield added (m^3/kg of VS)	Total Biogas Yield Added (m^3)	Methane Content (%)
g	h	i
0.30	0.21	58
0.43	0.81	69
0.60	0.12	50
0.50	0.06 (LS)	69
-	**1.20**	-

12. Estimated Fund Requirement

As part of the proposed intervention, it was incumbent on the part of the author to estimate the total project cost and phase the investment over a period of five years ranging from 2012-13 to 2016-17 (i.e. during the 12th 5-Year Plan period). The total project cost for BTAD for the period is presented here.

Total Project Cost	
Investment Head	**Amount (Lakh Rs.)**
Plant Installation	3066.25
Training	13.65
Communication And Publicity	6.10
Grand Total	**3086.00**

13. Expected Outcome

The project intervention were planned and aimed at addressing the following issues.

- Better socio-economic condition
- Saving in cost of cooking fuels
- Saving in cost of chemical fertilizers
- Environmental (forest) protection/conservation
- Saving in the cooking time
- Saving in time to clean kitchen/utensils/cooking vessel
- Saving in time on collection/processing of fuel
- Reduction in the drudgery of women/children

14. The Challenges before MNRE, GoI

The following issues have been identified in the context of BTAD, Assam and need to be addressed at the right earnest.

- ✓ Generating awareness of benefits of the technology
- ✓ Reviving the non-functional biogas units
- ✓ Making biogas plants accessible to people having requisite bio-feed resource but lack access to technology
- ✓ Generate awareness to have biogas plants using human waste (non-existent in Assam) to augment capacity

15. Failure of Biogas Unit

The following causes have been identified to contribute to failure of biogas plants in general.

- ✓ Mostly due to planning mistakes. The consequences of such mistakes may be immediately evident or may only become apparent after several years. Thorough and careful planning is, therefore a MUST.
- ✓ Defect in construction
- ✓ Improper maintenance of biogas units

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