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Biogas Power from Organic Wastes – A Case Study of Rashtrothana Goshala, Karnataka

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Abstract: *The performance and impact of a decentralized biogas based power generation system in Rashtrothana Goshala was village are presented. The present Biogas plant generates about 200-250 electrical units per day and 20 KW Biogas generator runs for 10-12 hrs/day. The generated power is utilizing at Rashtrothana Goshala Farm for water lifting from borewell, cowshed lighting, chaff cutting machine, agricultural operation, milking machine, biogas slurry pumping. Presently Goshala is saving about Rs. 30,000/- per month towards electricity bill. In Goshala, lighting, drinking water, irrigation water and flour milling services are provided using power derived from the biogas based power generation system. The system consists of a 20 KW biogas engine generator system with all the accessories for fuel processing and electricity distribution. The biogas power system has functioned for 3 years, meeting all the electricity needs of the goshala. The cost of the project is Rs. 38.45 lakhs and payback period is about three years.*

Keywords: *Biogas, Biogas Power, Goshala and Slurry.*

INTRODUCTION

Livestock and Dairy Farming forms integral part of the Indian Farming systems. Animal husbandry has often provided a safety net and sense of security to rural Indian Communities. Live stock play crucial role in rural India contributing about 9% to GDP and employing about 8% of the labour force. Energy generation through Bio-methanation process can greatly help in meeting local energy needs for cooking, heating, lighting and running of agro-industrial units.

Besides, Biogas plants bring much needed improvement in the sanitation and environment around the households, reduce smoke related diseases and thereby improve quality of life. Digested slurry can be used as soil conditioner for crop production and improving the physical structure of the soil.

METHODOLOGY

Rashtrothana Goshala is located at Ghatisubramanya Village of Bangalore rural district, Karnataka State and having 150 animals. Installed Bio-methanation plant is based on UASB Technology and capacity of the plant is 150 m^3 per day. About 3 to 4 Tons of cowdung, Agriculture waste and Kitchen waste is available at Goshala, converted into slurry with help of shredder and fed to the anaerobic digester. The digester ensures that the slurry undergoes bio-methanation process for few days and organic material is converted to biogas having 60-65 percent of methane content.

The biogas generated is collected from top, the clear liquid over flow is recycled for slurry preparation and remaining quantity of bottom slurry is used as organic manure. The biogas generated is fed to a generator to produce electricity. The present Biogas plant generates about 200-250

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electrical units per day and 20 KW Biogas generator runs for 10-12 hrs/day. The generated power is utilizing at Rashtrothana Goshala Farm for water lifting from borewell, cowshed lighting, chaff cutting machine, agricultural operation, milking machine, biogas slurry pumping. Presently Goshala is saving about Rs. 30,000/– per month towards electricity bill.

Apart from the fact that biogas produced is effective in reducing harmful greenhouse gas emissions, the compact design of the plant makes it convenient for use and utilizes less footprint area. The treatment of organic waste is done in closed digester hence there is no odour and organic matter is recycled to generate nutrient rich bio-manure.

RESULTS AND DISCUSSION

The performance highlights and economics of the installed biogas power plant are presented in Table 1 and 2.

Biogas Scrubber

The biogas generated will contain H_2S and hence the biogas needs to be scrubbed. The system provided is a proprietary Scrubber Tower using specially developed microbial culture on a packing media. Nutrients are dosed, which are essential for the growth of microorganisms. The gas and liquid is passed in counter current in the tower and "clean" gas is fed to the engine. Nutrient dosing tank along with agitator, dosing pump are used and dosage is adjusted according to the H_2S content. The biogas analysis is carried out in a small laboratory built at site.

Biogas Compressors

Compressor is used for pressurizing the biogas from the gas storage to the gas scrubbing section. For efficient combustion to take place with in the 100 percent biogas fired engine, it is imperative to maintain certain minimum pressure of the biogas at the inlet of the biogas engine. Blowers are provided just before the biogas engine to consistently maintain this parameter during the engine operation.

Table 1
20 KW biogas power plant highlights

Basic Information	
Process technology	: UASB
Design Capacity	: 150 m^3 Biogas /day
Cowdung and other organic waste available	: 3-4 ton/day
Electricity Generation	: 200-250 Electrical Units/day 20 KW Generator runs for 10-12 hrs
Energy Yield	: Equivalent to 85 KG LPG /DAY
Biogas Utilization	: Electricity Generation
Organic Manure	: 2 tons/day
	: (2 Tons/day organic manure × Rs. 2000/- = Rs. 4000/-)
Electricity Consumption	: 10-15 Electrical Units/day
Total Project Cost	: Rs. 38.45 lakhs (including interest for the bank loan availed)
MNRE-GOI share	: Rs. 8.00 lakhs
Payback period	: Three years

Table 2
Cost-Economics

	: 1 year	*For 3 year*
A) Revenue generation		
Cost of electricity @ Rs. 5.00 KWh (5 × 200 × 30 days)	: 3,60,000.00	10,80,000.00
Cost of organic manure @ Rs. 2000/tone (2*t* × 2000 × 30 days)	: 14,40,000.00	43,20,000.00
Total income	: 18,00,000.00	54,00,000.00
B) Operation and maintenance cost		
Cost of the cowdung @ Rs. 0.50/ kg (0.50 × 4000 kg × 30 days)	: 72,00,00.00	21,600,00.00
Cost of labour @ Rs. 6000/month	: 72,000.00	2,16,000.00
C) Auxiliary Consumption	: 18,000.00	54,000.00
Total	: 8,10,000.00	24,30,000.00
Payback period -Before MNRE Subsidy	3.88 Years	
After MNRE Subsidy	3.00 Years	

Power Generation

The biogas engine generator set is the main heart and soul of this power generation plant. The capacity of the installed biogas engine generator set is 20 KW and having all the standard accessories

and control systems. Generated electricity is used for running of borewell, milking machine, chaff cutter machine and captive consumption.

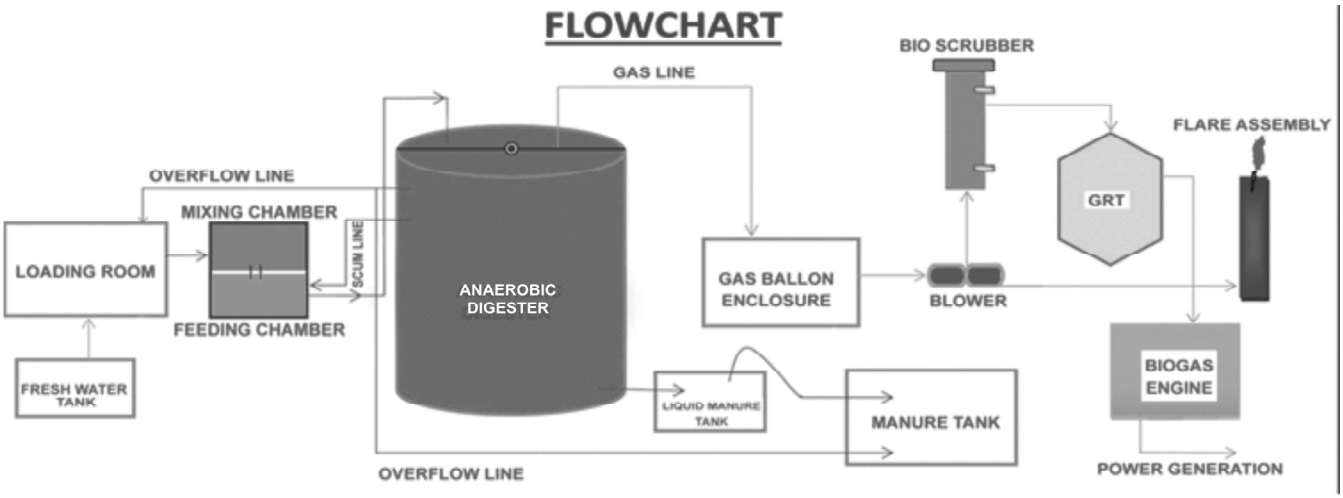
Biogas Flare

Biogas flare is an essential item and is used to flare the biogas when not in use, excess generation or during shut down. It has a pilot flame and control valves, which will automatically flare the biogas.

Application of Bio-digested Slurry in Agriculture

Bio-digested slurry is the by-product obtained from the biogas plant after the digestion of the organic matter. The bio-digested slurry has a great potential as organic manure and it can be applied to all the crops. Considering the nutrient values and cost of the nutrients replaced by the slurry, it can be noted that the bio-digested slurry is as valuable as main product of methane gas.

Generated biogas slurry was applied to the Agricultural field of Goshala for raising of Vegetables like Carrots, Bhendi, Radish, Paddy and Maize. Recommended dose of manure about 5 tonnes per hectare and it was observed that yield increases by 10-20 percent besides improving the physical properties of soil and water holding capacity.



Rashtrotthana Goshala-Biogas Power Plant

CONCLUSION

The benefits of Biogas Power Generation are Independence from irregular and costlier state grid power, Ensure continuity of electricity due to self efficiency in power generation, environment friendly and also ensure getting good quality organic manure.

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