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One Step towards Energy Self Sufficiency for Farm Using Organic Waste

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ABSTRACT:

There are two major problems our country or the whole world is facing i.e. scarcity of electricity and managing waste effectively. Today for us the waste is which we generate by our daily activities at home/ offices/ other work areas. But actually we ignore the organic waste getting generated in farms or rural areas. In this research paper we are going to studyone of the waste management modal used in the remote area of Jalgaon District (M.S., India). This modal is made to make the effective use of the farm and cattle shed waste sothat the daily expenses can be reduced and generating additional revenues. By using Bio-gas they are generating electricity and the remaining gas is used for cooking purpose. From the byproduct or by using the outlet slurry of Gobar Gas / Bio Gas is used for making vermi-compost manure. Vermi-compost is getting used as manure on their own farms as well as by selling it they are generating good amount of revenue. The efforts are taken once but the benefits and the profit are ongoing.

KEY WORDS**:** *Biogas, Gobar Gas, Organic waste, compost, Energy*

I. INTRODUCTION

According to the Prognosis from the United Nations (2007), the world population will likely to increase by 2.5 billion over the next 40 years, passing from the 6.7 billion to 9.2 billion in 2050. This population increase is equivalent to the world's population in 1950 and will be absorbed mostly by the less developed countries whose population is projected to rise from 5.4 billion in 2007 to 7.9 billion in 2050. In contrast to this the population of more developed countries is expected to remain stable at 1.2 billion. The population rise will be more concentrated in the urban areas than that of rural areas. [3]

The biggest challenge in 2050 will be of Solid waste management.

Solid waste management: Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. [1]

Waste management is the precise name for the collection, transportation, disposal or recycling and monitoring of waste. This term is assigned to the material, waste material that is produced through human being activity. This material is managed to avoid its adverse effect over human health and environment. [7]

Organic waste or green waste is organic material such as food, garden and lawn clippings. It can also include animal and plant based material and degradable carbon such as paper, cardboard and timber. Burying organic waste in landfill is a big problem and it's not just because of the resources we lose.[4]

Solid waste means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations .[6]

Waste management is all the activities and actions required to manage waste from its inception to its final disposal. This includes amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management encompassing guidance on recycling etc.[4]

The term usually relates to all kinds of waste, whether generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, or other human activities, including municipal (residential, institutional, commercial), agricultural, and special (health care, household hazardous wastes, sewage sludge). Waste management is intended to reduce adverse effects of waste on health, the environment or aesthetics. [4]

Benefits of waste management:

Waste is not something that should be discarded or disposed of with no regard for future use. It can be a valuable resource if addressed correctly, through policy and practice. With rational and consistent waste management practices there is an opportunity to reap a range of benefits. Those benefits include:

1. *Economic* - Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles can lead to efficient practices in the production and consumption of products and materials resulting in valuable materials being recovered for reuse and the potential for new jobs and new business opportunities.
2. *Social* - By reducing adverse impacts on health by proper waste management practices, the resulting consequences are more appealing settlements. Better social advantages can lead to new sources of employment and potentially lifting communities out of poverty especially in some of the developing poorer countries and cities.
3. *Environmental* - Reducing or eliminating adverse impacts on the environmental through reducing, reusing and recycling, and minimizing resource extraction can provide improved air and water quality and help in the reduction of greenhouse emissions.
4. *Inter-generational Equity* - Following effective waste management practices can provide subsequent generations a more robust economy, a fairer and more inclusive society and a cleaner environment. [4]

Due to the simplicity and financial reasons,solid waste disposal on sanitary landfill has been the most common practice for many decades. However a study of Eriksson et al., (2005) shows that reducing landfill in favour of increasing recycle of energy & materials lead to a lower environmental impact, lower consumption of energy resources, & lower economic costs. Landfilling of energy-rich waste should be avoided as far as possible, partly because of the negative environmental impacts from landfilling, and mainly because on low recovery of resources.[8]

To provide the solution to the energy recovery and recycling of the waste, there are many methods such as biogas generation, vermi-compost etc.

Biomass is considered a vital alternative to fossil fuels and can be used for a range of energy needs. Energy from biomass can be produced in three different ways:

- Direct burning of biomass to get the energy
- Convert biomass to ethanol and methanol to be used as liquid fuels in engines
- Ferment biomass anaerobically to obtain a gaseous fuel called biogas (Methane)

Biomass and its derivatives like animal excreta and crop residues are converted to organic manures to replace the chemical fertilizers. It takes simple aerobic fermentation to convert this biomass to organic manure. However, when biomass is treated anaerobically, biogas is formed, leading to the production of high value enriched organic manure. Biogas is a combination of Methane and Carbon dioxide in a ratio of about 60:40 and it contains traces of gases like Hydrogen Sulphide, Nitrogen etc. The calorific value varies from 20 – 25 MJ / M3[2]

Biogas can be used to

- Treat the market, hotel and other institutional waste;
- Waste of Silk warms, Jaggery cocking waste, Poultry litter etc.,.
- Electric power generation through bio gas
- Production of biogas by using de-oiled cake

Vermicompost is the use of earthworms for composting organic residues. Earthworms can consume practically all kinds of organic matter. Earthworms have the capacity to eat as much matter as their own weight and produce the same amount of manure per day in the form of castings. It has become imperative to adopt earthworm farming for sustainable agricultural production and for the economic prosperity of the farmers.

Vermicompost offers the following advantages: [2]

- Can convert 1000 tonnes of moist organic matter into 400 tons of high value compost
- Castings or excreta of earthworms are rich in nutrients and bacterial and actinomacetes population

***The potential benefits include*:**

- Reduction of noxious qualities of a wide variety of organic waste, elimination of smell, reduction of harmful microorganisms
- Production of marketable organic fertilizer
- Production of aqua life, birds and animal food or even human food by drying earthworms
- Additional benefit to the farmers
- Increases soil fertility and bacterial activity in the soil
- Increases micro grains in the soil and enhances water absorption capacity
- Helps the plant root get air easily
- Increases plant resistance to pests, fungus and other deceases

Vermiwash

- Liquid fertilizer collected over passage of water through a column of worms in action useful as foliar spray
- Collection of excretory products and mucus secretion of earthworms along with micro nutrients from solid organic molecules [2]

II. RESEARCH METHODOLOGY

This paper is a working paper of the PhD thesis "Management of farm Waste by Developing Cooperative Model of Generation of Electricity using Organic Farm Waste in Jalgaon District." Based on secondary data studied through books, Journals, manuals, e-sources and pervious researches

III. MODEL STUDY

Here for this paper we have studied the waste management model of Go-VidnyanAnusandhan Kendra, Haripura, Tal-Yawal, Dist- Jalgaon (M.S) founded by Mr. PrabhakarMuralidhar Mande. In 2003 he put the 1st step by starting a small cattle farm (Goshala) with 10 pure Indian Breed cows. But his dream was different so to manage the waste coming out from the cattle farm he established Gobar gas unit and then Electricity generating unitfrom Methane (gas produced by gobar gas plant). Haripura is a remote location (tribal area) and there is no facility of school so he started Residential school for the Aadivasi children. Then he under took the development of the nearby areas and he worked on watershed management to raise the water table in that area. Then he realize that using the drainage and toiletry waste of the school he can generate more Methane so he established 5 more Biogas reactors and connected the Gas pipes of Biogas and Gobar Gas plants to collect the Methane in single gas collector to use as domestic cooking gas (fuels) and to generate electricity. Electricity generated from gas is majorly utilized for pumping the water from ground and fill the water tanks, for lightning purpose etc. The byproduct of BIOGAS and GOBAR GAS is in slurry form and used for Vermi-compost. They are selling the Vermi-compost at very low cost to the farmers and themselves using it for their own farms.

In short they are doing:

1. Biogas / Gobar gas production for cooking purpose and electricity generation.
2. Running a boarding school for tribal students.
3. Working for watershed development
4. Vermi-compost and compost manure generation from bio-waste.

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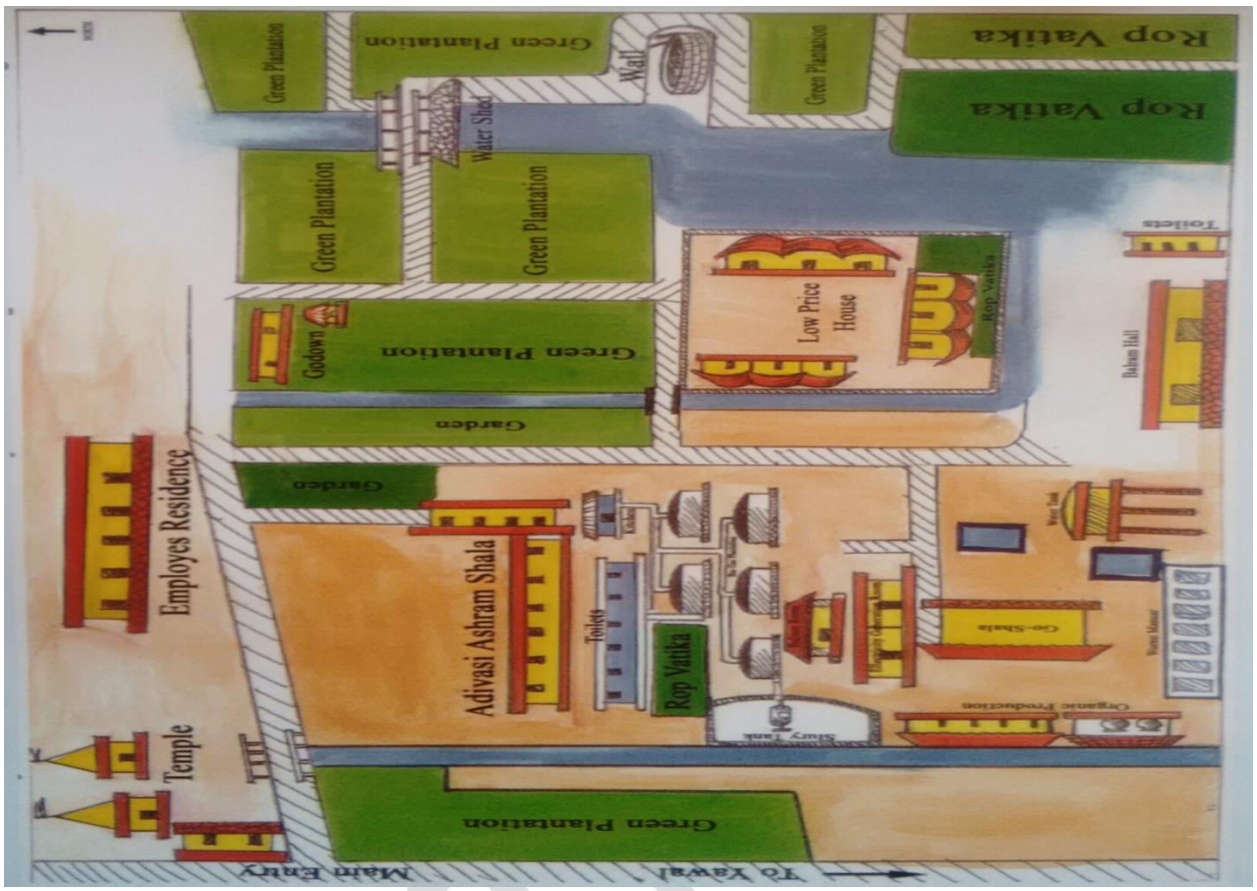

Fig.1- DRAWING OF THE ENTIRE GO-VIDNYAN ANUSANDHAN KENDRA, HARIPURA [5]

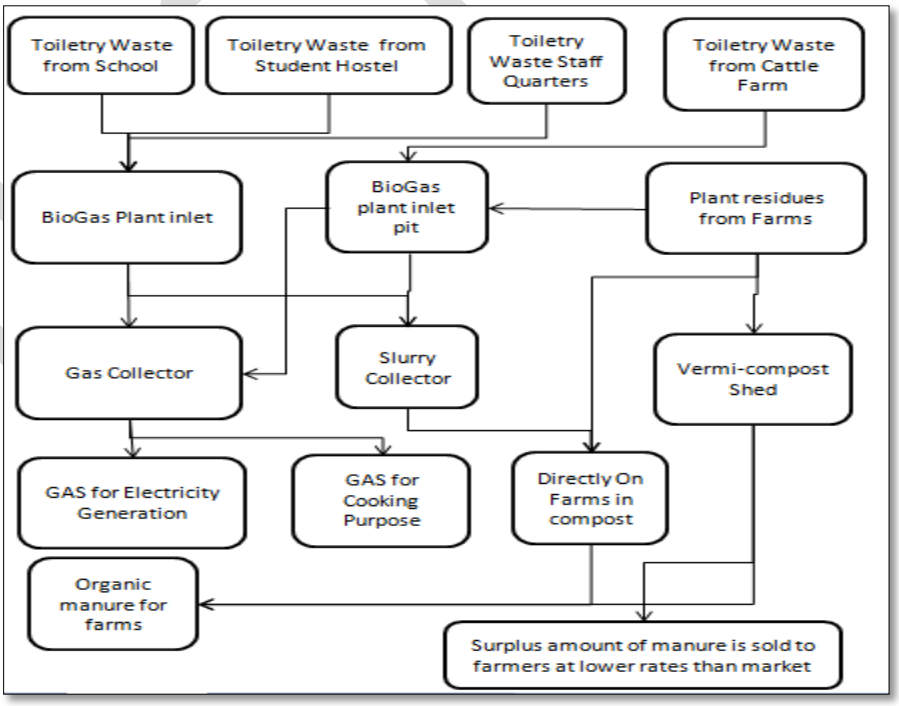

Fig. 2: FLOW CHART OF THE ORGANIC MATERIAL CONVERSION TO ENERGY AND MANURE

IV. FINDINGS

1. They are not using LPG, kerosene, wood, or cow dung cakes for cooking instead they are using Biogas. And even with for electricity they rely on biogas by which they can run full farm, school, staff houses, water tanks, cattle sheds for around 4-5 hours with full capacity.
2. They are not using artificial fertilizer but instead they are using organic manure.
3. Using this type of modals, farmers can reduce the cost over fertilizers, cooking gas, electricity etc. Biogas is a clean, less polluted and free source of energy so more beneficial in terms of environment and economics.
4. As on 31st may 2016 Renewable Power plants constituted 28% of total installed capacity and Non-Renewable Power
   Plants constituted the remaining 72% [9]

TABLE I: CONTRIBUTION OF DIFFERENT SOURCES OF ELECTRICITY SOURCES IN INDIA

Source	Total Installed Capacity (MW)	Percentage
Wind Power	26,866.66	62.7
Solar Power	6,762.85	15.7
Biomass Power (Biomass & Gasification and Bagasse Cogeneration)	4,831.33	11.3
Small Hydro Power	4,273.47	10
Waste-to-Power	115.08	0.3
Total	42,849.38	100

V. CONCLUSION

From this modal we can conclude

1. This is a cost effective modal as the input to this process is a waste and output is the clean form of energy.
2. By using waste we can achieve full / partial self sufficiency in terms of cooking gas and electricity.
3. Vermi-compost or cow dung manure can be a low cost substitute for chemical fertilizers and a good side-business for farmers, which will reduce the farmer's investment and increase the revenue. Using organic manure will increase the fertility of soil.

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