

**RESEARCH ARTICLE** ||

# Agriculture Waste Management - A Case study on Bowenpally Mandi

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**Abstract**

Food losses and waste are the third most prominent source of greenhouse gas emissions. Agriculture waste being biodegradable can be composted to generate biofuel instead of dumping it into landfills. Understanding this, the Bowenpally market of Telangana, in 2020, has set up a sustainable biogas plant of 10 tons capacity. In the present study, details regarding waste management were collected and presented in a case study form - Problems, course of events, relevant factors, outcome, and analysis as suggested by Spicer (1952). Ten tons of approximate daily waste of the market can generate up to 6,290 kg of CO<sub>2</sub> per annum. ‘Anaerobic gas lift reactor’ produces biofuel supplied to market kitchens and power the street lights and stalls. Within due time Bowenpally market digested 1,400 tons of vegetable waste that produced 32,000 units of electricity and 7,000 Kilo Litres of bio manure. Such recycling and recovery management practices, which are low cost, are the need of the hour. This study tries to bring the initiative of the local mandi into the limelight that has vast scope to replicate at different markets, hostels, canteens, etc.

**Keywords:** *Biofuel; Mandis (market); Sustainable; Waste management*

**INTRODUCTION**

This year 2021, was declared an international year of fruits and vegetables by the United Nations to raise awareness of the health benefits and nutritional aspects of fruits and vegetables (FAO, 2020 (a)). It also addresses food loss and waste (FLW) (30 percent of all food globally), impacting food security and contributing to greenhouse gas emissions. Technically, food loss and food waste are different.

Food loss is the reduction in quality and quantity from post-harvest-up to retailing (excluding it), i.e., during the supply chain process: losses that occur while transporting, and processing (FAO). An estimated loss of 50 % of food happens even before reaching the consumers in the supply chain, says the Food and Agriculture Organization (FAO). The following Table 1 enlists crop-wise the food loss percentage across the world.

Table 1. A tabular representation of crop-wise food loss percentage across the world

Food Group	Food loss percentage
Roots, tubers and oil-bearing crops	25
Fruits and vegetables	22
Global losses for all commodities	14
Meat and animal products	12
Other	1
Cereals and pulses	9

Source: FAO. 2020 (b). World Food and Agriculture: Statistical Yearbook 2020. Rome.

Food waste means the reduction in quality and quantity at retailers to consumers, i.e., food left unsold at retail outlets because of its malformed shape, vagaries in color, products crossing expiring

date, and leftover food at households. In association with the Waste & Resources Action Program (WRAP), United Nations Environment Program (UNEP) released the Food waste index report 2021, which

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states that in 2019, globally, 931 million tons of food is wasted<sup>3</sup>.

The United States Environmental Protection Agency (EPA) gave the sustainable food management inverted pyramid. On top (most preferred activity) was a reduction in losses at source followed by Donating the extra food to the people in need (shelter homes), feeding animals, industrial uses (waste oils for fuel conversion), Composting - used as a soil amendment. At the bottom of the pyramid, the least preferred way of disposal of waste was Landfills.

Landfills are sites located far away from the city, acting as dumping grounds for waste generated from surrounding areas. With the increasing population and expanding cities, these places are not that far away anymore from the human population, acting as a breeding place for several diseases. The open landfills prone to leaching on precipitation contaminate the groundwater, further upon decomposition release vast amounts of Greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>).

Waste is classified by Raveesh *et al.* (2015) into several subcategories based on source (Industrial, commercial, Domestic, agricultural), and based on the danger level (hazardous and non-hazardous). One such classification is Non-biodegradable (Dry) waste, including plastic, glass, etc., and biodegradable (Wet) waste - kitchen waste, green waste at markets and retail shops, garden and agriculture waste, etc. Waste management has four basic principles - Reduce, Reuse, Recycle and Recover. Composting can recycle biodegradable waste, and an anaerobic digestion process recovers methane gas. Mr. Trilochana Mohapatra, Director General of ICAR, mentioned in the foreword for 'Creating wealth from Agri waste' that India generates about 350 million tons of agriculture waste per annum. Only 5 percent of it is recycled, 18 % is composted, and the rest 77% is directly reaching the dumping sites.

Apart from individual households, large quantities of waste are spawned at markets understanding that an initiative is taken in the Bowenpally market of Telangana state, discussed further in detail.

## Materials and Methods

A case study is an intensive method of studying a phenomenon in its natural setting. It depicts the 'What' and 'Why' aspects of the case. It helps in a

detailed examination of basal facts helpful for theory formation and constructing a hypothesis.

This study focuses on one of the sustainable initiatives taken in the Telangana State Bowenpally Vegetable market. In this study, the researcher conducted an empirical inquiry to understand biogas production from vegetable waste, a phenomenon, which has vast scope and practicability. Data is collected primarily by having an interview with the Secretary and Grade- III Secretary of Bowenpally market Mr. Srinivas, Mr. Satya Narayana, and staff of Ahuja engineering services (technical partner in this waste management activity). The secondary data was taken from newspaper articles, the Mann ki Baat Radio program by the Prime Minister of India, and articles related to waste management. The presentation of case study followed the format suggested by Spicer (1952) - Problems, the course of events, relevant factors and, the outcome and analysis which gives a holistic approach to any situation.

## Results and Discussion

### About market:

The establishment of Dr. B.R. Ambedkar Vegetable Market Yard in Bowenpally was in 2002. It is extended in 23 acres and five guntas (1 Gunta is 101.17 m<sup>2</sup>) with 174 commission agents and 843 hamalis. This mandi provides amenities to farmers such as Farmer's rest house, subsidized meals (@10 rupees), drinking water, and medical dispensary facilities. This exclusive vegetable market also has a biogas plant started in collaboration with Ahuja Engineering services, a Hyderabad-based company working on environmentally sustainable and financially feasible waste management. After the pilot study in the market (for six months) to understand working and utility, the biogas plant was upscaled.

### A. Problems

In this study, the problem dealt with - food waste is not a new concept that happened overnight. Markets send the total waste generated to landfills for disposal. Bowenpally Market officials stated that every day on average, 10 tons of waste will be generated. This quantity of waste has the potential to generate approximately 6,290 kg of CO<sub>2</sub> per annum. To address this issue, under Swachh Bharat Mission (SBM - launched by GOI in 2014 to solve the problems of sanitation and waste management), they have installed an 'anaerobic gas lift reactor' -

patent of Council of Scientific & Industrial Research-Indian Institute of Chemical Technology (CSIR – IICT) Unknown (2021).

## B. The course of events

The installed reactor cost Rs. 3 crores and was funded by the Department of Biotechnology (2 crores) and Department of Agriculture marketing (1 crore) Telangana, Geetanath (2021) under technical supervision CSIR- IICT executed Ahuja Engineering Services.

The procedure of waste management activity - Business Insider (2021, March 7)

- All the waste generated (rotten + vegetables left unsold) in the Bowenpally market and nearby yards are collected.
- Chop the giant vegetables into convenient pieces and run them over the Conveyor belt to the shredder.
- Shredder crushes all the vegetables into a smaller and uniform size and sends them to a grinder.
- This grinder further crushes the content into a pulp (slurry) and passes them to anaerobic digesters.
- Anaerobic digesters are large tanks that allow the bacteria to survive in oxygen-lacking areas to decompose nutrient-rich waste and release methane and carbon dioxide (biofuel).
- The gas generated is collected and stored in ballons until its further use.
- Bio Manure is obtained, apart from the gas, as a by-product.
- This entire process is referred to as *Bio methanation*.

## C. Relevant factors

The Prime Minister acknowledged the installation of the unit in the Mann ki Baat radio program, which brought the limelight to this feasible biogas plant. The market committee reported – “as of February 2021 - 1,400 tons of vegetable waste were digested that produced 32,000 units of electricity, 7,000 Kilo Litres of bio manure.’ On seeing its efficiency of it, DBT announced further funding to establish five more similar plants in different market yards with varying capacities (Gudimalkapur, Gaddiannaram -

5 tons/day, Erragadda, Alwal, Sarrornagar- 500 kgs/day) suitable to the generated market waste.

## D. The outcome and analysis - Express News Service. (2021)

- Around 30 kg of biofuel generated per day is supplied to the kitchen facilities 400-500 m away from the unit.
- Fostering 400- 500 units of electricity, which powers the administrative building, market water supply network, about 100 streetlights, and 170 stalls of the market. Setting up this biogas unit helped reduce the electricity bill by half (previously Rs. 3 lakhs per month on average).
- Usage of produced liquid bio manure as fertilizer in the farmers’ fields.
- Lastly, usage of large amounts of waste sustainably.

## Conclusion

Agriculture is considered a noble profession, a direct association with nature, still responsible for the emission of 21 percent of Greenhouse gases. The total amount of agriculture waste generated per annum can turn out 18,000 MW of power as well as generate green fertilizer. Waste considered as unwanted, unusable material, usually gets dumped into a landfill. But, biodegradable waste, which is wealth, needs to be recycled and recovered. Therefore, initiatives like Bowenpally market biogas plants need to be multiplied into different districts and states, wholesale, regulated, and retail market yards. Scientists should test the feasibility of other organic waste management practices like thermal treatment (pyrolysis) and Mechanical- biological treatment (using aerobic bacteria).

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