

UNDERSTANDING WASTE-TO-ENERGY PLANTS

The Hindu

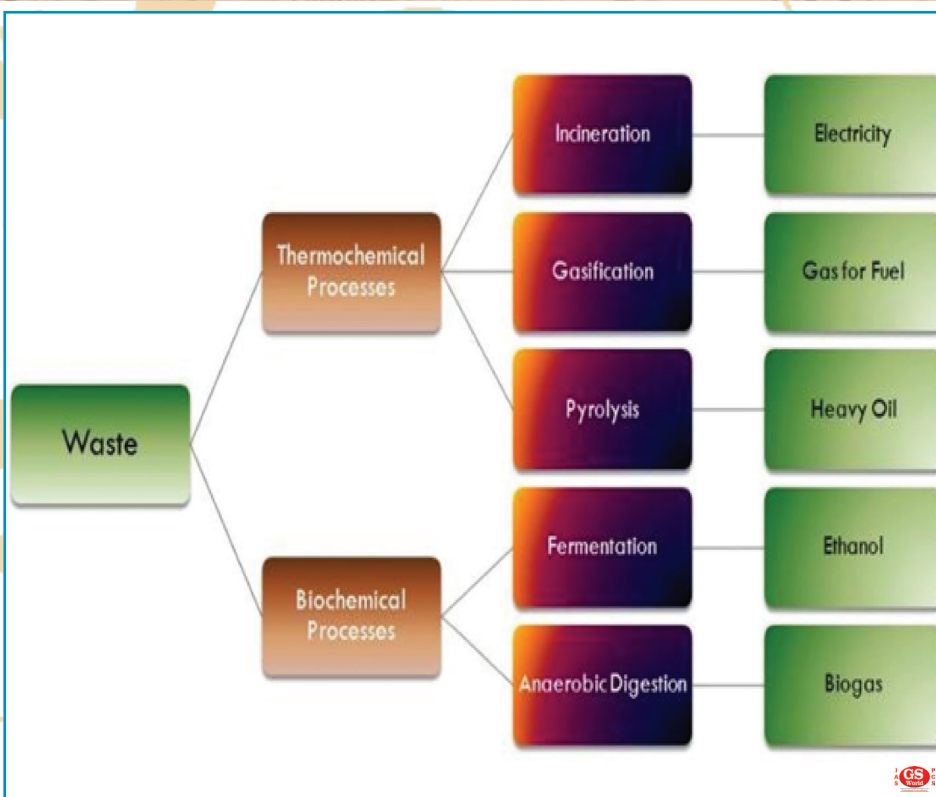
Paper-III
(Environment & Ecology)

The Kerala government recently announced the State's first waste-to-energy project in Kozhikode. The planned facility is expected to be built in two years and generate about 6 MW of power. There are around 100 waste-to-energy projects around the country but only a handful of them are operational, thanks to various production and operational challenges.

What do Waste-to-Energy Projects Do?

Waste-to-energy projects use nonrecyclable dry waste to generate electricity. The process increases the State's power generation capacity and eases the solid waste management (SWM) burden. Generally, solid waste in India is 55-60% biodegradable organic waste, which can be converted into organic compost or biogas; 25-30% non-biodegradable dry waste; and around 15% silt, stones, and drain waste.

Of the non-biodegradable dry waste, only 23% — including hard plastics, metals, and e-waste — is recyclable. The remainder consists of low grade plastic, rags, and cloth that can't be recycled. This fraction of the non-recyclable dry waste is the most challenging portion of the present SWM system; the presence of these materials also reduces the efficiency of recycling other dry and wet waste. It is this portion that wastetoenergy plants use to generate power. The waste is combusted to generate heat, which is converted into electricity.



What is the Kozhikode Project?

Kozhikode has a population of about 6.3 lakh and generates approximately 300 tonnes per day (TPD) of waste. Of this, around 205 TPD is biodegradable and 95 TPD is non-biodegradable. The municipality is currently using the biodegradable material to generate organic compost in various composting plants. Of the nonbiodegradable waste, only about 5 TPD out of the 95 TPD is recycled; the remaining non-recyclable dry waste could be used to generate power at the wastetoenergy plant.

Why do waste-to-energy plants fail?

While waste-to-energy plants seem like a simple solution, they have several challenges en route to becoming feasible.

1. First is the low calorific value of solid waste in India due to improper segregation. The calorific value of mixed Indian waste is about 1,500 kcal/kg, which is not suitable for power generation. (Coal's calorific value is around 8,000 kcal/kg.) Biodegradable waste has high moisture content and cannot be used for power generation. The calorific value of segregated and dried nonrecyclable dry waste is much higher, at 2,800-3,000 kcal/kg, sufficient to generate power. However, segregation (ideally at the source, if not at the processing plant) should be streamlined to ensure the waste coming to the facility has this calorific value.
2. Second is the high costs of energy production. The cost of generating power from waste is around ₹78/unit, while the cost at which the States' electricity boards buy

Waste-to-energy plant

- A waste-to-energy or energy-to-waste plant converts municipal and industrial solid waste into electricity and/or heat for industrial processing. In a power plant, waste is burned at high temperatures, and the heat results in the formation of steam. The steam then drives a turbine which produces electricity. In addition to generating electricity, burning waste also reduces the amount of material that would probably be buried in a landfill. Burning of municipal solid waste (MSW) reduces the amount of waste by about 80%. Thus providing many social and economic benefits which cannot be easily quantified.
- Waste-to-energy plants use pollution control technologies such as baghouses, scrubbers, and electrostatic precipitators to reduce emissions of air pollutants such as nitrogen oxides, sulfur oxides, and particulates.

Global Data on Waste-to-Energy

- Globally, waste-to-energy production is increasingly being viewed as a potential energy diversification strategy. Sweden has been a leader in waste-to-energy production for the past 20 years. Municipal solid waste is expected to increase to about 2.2 billion metric tons by the year 2025.
- Statistics collected by international organizations such as the World Bank and the United Nations show that the greater the degree of economic development and urbanization, the greater the amount of solid waste generated. Income level (gross domestic product or GNP) and urbanization are generally correlated with disposable income and standard of living. As the levels of these factors increase, so does the generation of solid waste, with urban residents generating almost twice as much solid waste as rural residents.
- Waste reduction efforts are projected to reduce peak waste levels in OECD countries by the year 2050, East Asia and Pacific countries by 2075, and continue to increase waste in sub-Saharan Africa. Global waste generation is projected to possibly reach 11 million metric tons per day by 2100.

power from coal, hydroelectric, and solar power plants is around ₹34/unit. While State electricity boards are considering purchasing power from newer renewable energy sources like waste-to-energy, the price of the power generated needs to halve.

3. Finally, many waste-to-energy projects have failed because of improper assessments, high expectations, improper characterisation studies, and other on ground conditions.

Waste-to-energy projects can consume only non-recyclable dry waste, which is about 25% of the waste; they are expected to only use segregated non-recyclable dry waste as well, which is the only type of waste with a sufficiently high calorific value. But often these projects are expected to manage all types of waste generated in the city which is not good.

How can the plant tackle challenges?

Kozhikode's projected population and waste generation rate could avail around 100 TPD of nonrecyclable dry waste to generate power. The proposed plant could absorb another 40-50 tonnes of such waste from nearby urban local bodies (ULBs).

But this quantity of material, around 150 TPD, will be available only when the people follow strict segregation practices and also process biodegradable waste. Typically, waste-to-energy projects consume 50 TPD of material to generate 1 MW of power. At this rate, the potential to generate power from Kozhikode's and other ULBs' waste is around 3 MW. A higher capacity than this, such as the planned 6 MW, will be risky because enough material may not be available.

Operating waste-to-energy projects also depends on parameters like the municipal collection efficiency, waste segregation, moisture content, and the operational efficiency of existing biodegradable waste processing plants. If these plants have operational woes (as is common), the nature of waste will change drastically to have high moisture content and low calorific value, which will compromise power generation. Setting up waste-to-energy projects is complex and needs the full support of the municipality, the State and the people.

Waste-to-Energy in India

- The Ministry of New and Renewable Energy is promoting all available technology options for setting up projects for power recovery in the form of biogas/bio CNG/ electricity. Energy can be generated from urban wastes of agricultural, industrial and renewable nature such as municipal solid waste, vegetable and other market wastes, slaughterhouse wastes, agricultural residues, and industrial/STP wastes.
- The total estimated energy generation potential from urban and industrial organic waste in India is about 5690 MW. GIS based waste mapping tool has been developed under GEF-MNRE-UNIDO project to facilitate geographical mapping of availability of different types of waste across India and its energy generation potential.

Solid Waste Management Rules, 2016

- According to the rules, the polluters will classify the entire waste into three types such as biodegradable, non-biodegradable and domestic hazardous waste and keep them in separate bins and hand them over to the waste collector designated by the local body.
- Along with this, the usage fee fixed by the local bodies will be paid by the polluter. These charges will be determined by the regulations made by the local bodies.
- Under this rule various parties like— various ministries of Government of India such as Ministry of Environment, Forest and Climate Change, Ministry of Urban Development, Ministry of Chemicals and Fertilizers, Ministry of Agriculture and Farmers Welfare, District Magistrate, Gram Panchayat, Local Bodies, State Pollution Control Board The duties of etc. have also been mentioned.

Conclusion

To overcome its various challenges, the municipality must ensure that only non-biodegradable dry waste is sent to the plant and separately manage the other kinds of waste. Importantly, the municipality or the department responsible for SWM should be practical about the high cost of power generation, and include the State electricity department, perhaps as a tripartite agreement between the municipality, the plant operator, and the power distribution agency. It is also crucial to conduct field studies and learn from the experience of other projects.

Expected Question

Que. As per the Solid Waste Management Rules, 2016 in India, which of the following statements are correct?

- (a) The waste generator has to segregate the waste into five categories.
- (b) These rules will be applicable only to notified urban local bodies, notified cities and all industrial cities.
- (c) These rules provide precise and detailed criteria for landfill sites and waste processing facilities.
- (d) It shall be mandatory for the waste generator not to take the waste generated in one district to any other district.

Answer : C

Mains Expected Question & Format

Que.: Kerala recently announced the state's first waste-to-energy project in Kozhikode. What is a waste-to-energy plant and what do waste-to-energy projects do? Why do waste-to-energy plants fail? Discuss.

Answer Format :

- ❖ Briefly describe the state's first waste-to-energy project at Kozhikode in Kerala.
- ❖ What is a waste-to-energy plant?
- ❖ Write about waste-to-energy projects.
- ❖ Explain why waste-to-energy plants fail.
- ❖ Give a balanced conclusion.

Note: - The question of the main examination given for practice is designed keeping in mind the upcoming UPSC mains examination. Therefore, to get an answer to this question, you can take the help of this source as well as other sources related to this topic.