Waste-to-energy plants: Significance and Challenges

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Why is in news? 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.?

A brief about waste-to-energy projects

Waste-to-energy projects use non-recyclable 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 2-3% – 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.

Waste-to-energy plants use this portion to generate power. The waste is combusted to generate heat, which is converted into electricity.

Waste-to-energy plants in major cities could also consume a portion of the non-recyclable dry waste generated in urban local bodies (ULBs) nearby.

Status of Waste to Energy plants in India

Around 92 plants with aggregate capacity of around 250 MW have been set up in India for electricity generation from urban, agricultural and industrial waste.

According to a report, "Value of Waste", by the Associated Chambers of Commerce and Industry, investors had valued WtE in India at ~US$ 1.5 billion in 2017 and expected it to grow to about US$ 11.7 billion by 2052.

According to Ministry of New and Renewable Energy, the total estimated energy generation potential from urban and industrial organic waste in India is approximately 5,690 MW.

Benefits of Waste to Energy Plants

Waste-to-energy is often promoted as "clean energy" when compared to wasteful incineration practices of the previous decades. In this regard, it is utilizing energy that would otherwise be wasted, while not technically increasing the amount of waste burned.

Landfills are the last resort when it comes to waste management, causing numerous issues such as the production of greenhouse gases, the usage of large pieces of land, the potential for pollutants to seep into the ground and groundwater etc. Waste-to-energy processes at specialist incineration plants can greatly reduce the volume of waste that is landfilled.

Another benefit of waste-to-energy over landfilling is the opportunity to recover valuable resources such as metals post-incineration. They can then be sent for recycling and kept in the economy

Steps taken to promote installation of Waste to Energy plants

The steps taken by Government to promote installation of Waste to Energy plants for generation of energy from municipal solid waste include the following:

Under the amended Tariff Policy-2016, provision has been made for Distribution Licensee(s) to compulsorily procure 100% power produced from all the Waste-to Energy plants in the State.

Ministry of Road Transport and Highways amended the Central Motor Vehicles Rules, 1989 in June 2015 and included the provisions for usage in motor vehicles BioCNG produced from waste (including MSW).

National Policy on Biofuels-2018 promotes the production of Bio-CNG and other biofuels.

Government announced Sustainable Alternative Towards Affordable Transportation (SATAT) Initiative, under which Oil Marketing Companies (OMCs) purchase Bio-CNG produced by waste including municipal solid waste.

Certificates for availing concession on custom duty are being issued by the Ministry of New and Renewable Energy for import of machinery and components required for initial setting up of projects for generation of Power and Bio-CNG from nonconventional materials including municipal waste.

Ministry of New and Renewable Energy has been implementing a Programme on Energy from Urban, Industrial, Agricultural Wastes/ Residues and Municipal Solid Waste.

Challenges to Waste to Energy

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

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 can’t be used for power generation; it should be composted instead.

The calorific value of segregated and dried non-recyclable 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.

Second is the high costs of energy production. The cost of generating power from waste is around Rs 7-8/unit, while the cost at which the States’ electricity boards buy power from coal, hydroelectric, and solar power plants is around Rs 3-4/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.

Third: Many waste-to-energy projects have failed because of improper assessments, high expectations, improper characterisation studies, and other on-ground conditions.

The quantity of waste generated by cities varies due to multiple factors, including season, rainfall, and the floating population. Importantly, 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.

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.

The way ahead

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Setting up waste-to-energy projects is complex and needs the full support of the municipality, the State and the people. 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.

Without all these efforts, the project may not be a success, which in turn will stress the State government to manage all the accumulated waste, which can be a costly mistake.