

Waste to energy technology

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Why in news?

- Indian Railways has commissioned the country's first government waste to energy plant at Bhubaneswar.

What are wastes to energy plants?

- Waste-to-Energy (WtE) or Energy-from-Waste (EfW) is a **form of energy recovery** and the **process of generating energy in the form of electricity and/or heat** by processing of waste into a fuel source.
- Modern waste-to-energy plants are very different from the trash incinerators as the latter plants usually did not remove hazardous or recyclable materials before burning.

How does it work?

- Most waste-to-energy plants **burn municipal solid waste**, but some burn industrial waste or hazardous waste.
- A modern, properly run waste-to-energy plant sorts material before burning it and can co-exist with recycling.
- Waste-to-energy plants are similar in their design and equipment with other steam-electric power plants, particularly biomass plants.
- A few plants **use gasification**, but most **combust the waste directly** because it is a mature, efficient technology.

About the new West Bengal plant:

- The waste to energy plant uses a patented technology called **POLYCRACK**, is first-of-its-kind in Indian Railways and fourth in India.
- It is the **world's first patented heterogeneous catalytic**

process which converts multiple feed stocks into hydrocarbon liquid fuels, gas, carbon and water.

- Polycrack Plant can be **fed with all types of** plastic, petroleum sludge, un-segregated MSW (Municipal Solid Waste) with moisture up to 50%, e-waste, automobile fluff, organic waste including bamboo, garden waste etc..
- The combustible, non-condensed gases are re-used for providing energy to the entire system.
- The process is a **closed loop system** and does not emit any hazardous pollutants into the atmosphere.
- This process will **produce energy in the form of Light Diesel Oil** which is used to light furnaces.

Advantages of Polycrack over the conventional approach:

- Pre-segregation of waste is not required to reform the waste. Waste as collected can be directly fed into Polycrack.
- It has high tolerance to moisture hence drying of waste is not required.
- Waste is processed and reformed within 24 hours.
- It is an enclosed unit hence the working environment is dust free.
- Excellent air quality surrounding the plant.
- Biological decomposition is not allowed as the Waste is treated as it is received.
- All constituents are converted into valuable energy thereby making it **Zero Discharge Process**.
- Gas generated in the process is re-used to provide energy to the system thereby making it self-reliant and also bring down the operating costs.
- Operates around 450 degrees, making it a low temperature process when compared with other options.

Benefits:

- In terms of volume, usually waste-to-energy plants

incinerate 80 to 90 percent of waste, thus helping large cities from choking due to unmanageable waste

- Sometimes, the **residue ash is clean enough to be used for some purposes** such as raw materials for use in manufacturing cinder blocks or for road construction.
- In addition, the **metals** that may be burned are **collected from the bottom of the furnace and sold to foundries.**
- Some waste-to-energy plants **convert salt water to potable fresh water** as a by-product of cooling processes.
- Waste-to-energy plants cause **less air pollution than coal plants.**
- It is **carbon-negative** – processing waste into biofuel releases considerably less carbon and methane into the air than having waste decay away in landfills or the lake.

Criticisms:

- Burning municipal waste does produce **significant amounts of dioxin and furan** emissions to the atmosphere as compared to the smaller amounts produced by burning coal or natural gas. Dioxins and furans are considered by many to be serious health hazards.
- Waste-to-energy plants **produce fly ash and bottom ash.** The fly ash contains toxic metals such as lead, cadmium, copper, and zinc as well as small amounts of dioxins and furans. The bottom ash may or may not contain significant levels of health hazardous materials.
- **Odour pollution** can be a problem when the plant location is not isolated.

Plastic pollution

- Plastic pollution is the **accumulation of plastic objects and particles like plastic bottles, bags and micro beads in the Earth's environment** that adversely affects wildlife, wildlife habitat, and humans.

Facts:

- Half of all plastics ever manufactured have been made in the last 15 years.
- Production increased exponentially, from 2.3 million tons in 1950 to 448 million tons by 2015.
- Production is expected to double by 2050.
- Every year, about 8 million tons of plastic waste escapes into the oceans from coastal nations.

Most of the plastic trash in the oceans **flows from land**. Trash is also carried to sea by major rivers, which act as conveyor belts, picking up more and more trash as they move downstream. Once at sea, much of the plastic trash remains in coastal waters. But **once caught up in ocean currents, it can be transported around the world.**

Concerns:

- **Mismanaged Plastic Waste (plastic dumped openly):** In the form of micro plastics/microbeads when plastic enters the environment via inland waterways, wastewater outflows and transport by wind or tides cannot all be filtered out once it enters the ocean. As plastics travel with ocean currents, an island of trash called the **Great Pacific Garbage Patch** has been created.
- **Spurious Biodegradable Plastic:** In the absence of robust testing and certification to verify claims made by producers, spurious biodegradable and compostable plastics are entering the marketplace.
- **Online or E-Commerce Companies:** Apart from the plastic we consume through traditional retail, the popularity of online retail and food delivery apps, though restricted to big cities, is contributing to the rise in plastic waste.
- **Micro plastics:** After entering into the aquatic environment, microplastics can travel vast distances floating in seawater, or sediment to the seabed. A

recent study has revealed that microplastics in the atmosphere are trapped by the clouds and the falling snow.

- Micro plastic particles are commonly white or opaque in color, which are commonly mistaken by many surface-feeding fishes as food (plankton) and can even move up the food chain to human consumers.
- **Marine Litter:** It is estimated that plastic pollution accounts for 60-80% of marine plastic waste.
- **Improper Implementation and Monitoring:** In spite of the notification of the Plastic Waste Management (PWM) Rules, 2016 and amendments made in 2018, local bodies (even the biggest municipal corporations) have failed to implement and monitor segregation of waste.

Solutions for Plastic waste management:

- **Reduce:** First step in reducing plastic waste is to minimize single use plastics by supporting a tax on plastic bags, restraint on manufacturing of plastics, and using alternatives of plastic or biodegradable plastic. E.g. Project REPLAN (stands for Reducing Plastic in Nature) launched by Khadi and Village Industries Commission (KVIC) aims to reduce consumption of plastic bags by providing a more sustainable alternative.
- **Reuse:** Reusing plastics can reduce the demand for new plastics; hence it can act as the natural restraint on plastic manufacturing.
- **Recycle:** Plastic recycling is the process of recovering waste or scrap plastic and reprocessing it into useful products. It offers several benefits like:
 - Economic benefits due to value addition
 - Generates employment
 - Reduces depletion of fossil fuel reserves.
 - Reduces landfill problems
 - Recycling of plastics requires less energy

- **Recovery:** It is the process of converting non-recyclable plastics into a range of useful forms of energy and chemicals for industry. Since plastics contain mainly carbon and hydrogen, with similar energy content to conventional fuels such as diesel, they can be used as a potential source of fuel.
- **Extended Producer Responsibility (EPR) :** EPR is a policy approach under which producers are given a significant financial and physical responsibility (with respect to segregation and collection of waste at the source) for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent wastes at the source, promote product design for the environment and support the achievement of public recycling and materials management goals.

Noise pollution:

- Noise pollution is generally defined as ***regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms.***
- According to the WHO, **sound levels less than 70 dB are not damaging** to living organisms, regardless of how long or consistent the exposure is.
- Exposure for more than 8 hours to constant noise beyond 85 dB may be hazardous.

Sources of Noise Pollution:

- Street traffic sounds from cars, buses, pedestrians, ambulances etc.
- Construction sounds like drilling or other heavy machinery in operation
- Airports, with constant elevated sounds from air traffic, i.e. planes taking off or landing
- Workplace sounds, often common in open-space offices
- Constant loud music in or near commercial venues

- Industrial sounds like fans, generators, compressor, mills
- Train stations traffic
- Events involving fireworks, firecrackers, loudspeakers etc.
- Conflicts generate noise pollution through explosions, gunfire etc...

Effects of noise pollution in humans:

- Hypertension is a direct result of noise pollution that causes elevated blood levels for a longer period of time.
- Hearing loss can be directly caused by noise pollution.
- Sleep disturbances are usually caused by constant air or land traffic at night.
- Children appear to be more sensitive to noise pollution and they are affected from hearing impairment to psychological and physical effects.
- Elevated blood pressure caused by noise pollution, especially during the night, can lead to various cardiovascular diseases.
- Dementia isn't necessarily caused by noise pollution, but its onset can be favored or compounded by noise pollution.
- Impairment of developing nervous system of unborn babies which may lead to abnormal behavior in later life.

Effects of Noise Pollution on Wildlife and Marine Life:

- Thousands of oil drills, sonars, seismic survey devices, coastal recreational watercraft and shipping vessels are serious cause of noise pollution for marine life.
- Noise pollution thus interferes with cetaceans' (whales and dolphins) feeding habits, reproductive patterns and migration routes, and can even cause hemorrhage and death.
- Land animals are also affected by noise pollution in the

- form of traffic, firecrackers etc.,
- Birds are especially affected by the increased air traffic.
 - **Control of noise pollution:**
 - Noisy machines should be installed in sound-proof chambers.
 - Highway traffic should be diverted through bye-passes and over-bridges and Pressure horns should not be allowed.
 - Proper lubrication and maintenance of machines needs to be done.
 - Protective devices like ear muffs or cotton plugs should be provided to workers working in noisy installations.
 - **Green Belts** along the roads, coastal areas absorb sound and reduce noise level by 10-15 db. E.g. Neem, Ashoka etc...
 - Enforcing **acoustic zoning by keeping human settlements away from noise** producing industries, aerodromes, railway stations etc...

Measures taken:

- Noise has been recognized as a pollutant under Environment Protection Act, 1986.
- Day and night limits of noise level have been prescribed.
- 100 metre radius area around hospitals, educational institutions and courts has been declared a '**Silence Zone**' where use of horns, loudspeakers and bursting of crackers is banned.
- **Use of loudspeakers** is a public nuisance and is **punishable under section 133 of IPC.**
- There are provisions related to noise pollution under Motor Vehicle Act, Factories Act, Railways Act and Aircraft Act.