Waste to Energy in India

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The world is moving towards calling wastage as "resources". It is important that India unfailingly sets up a system that doesn't just cut down the rampant increase in unhygienic surroundings but also recovers at least a fraction of what we have already lost as waste. Energetica India checks the on-ground details about energy recovery from waste in India.

With a population that accounts to nearly 17% of the world's overall count, the amount of waste generated in India is perhaps quite imaginable. Urban India generates 188,500 tonnes per day (TPD) of waste at an average rate of 0.5 kg of waste per person per day. It is seen that due to increased income and a change in the lifestyle of people, the per capita waste generation has considerably increased in the past decade.

India has a lot of catching-up to do in the space of Solid Waste Management (SWM); with apparently not much happening on the ground. Most of Municipal Solid Waste (MSW) in India ends up in open dumps; where they are set on fire; thereby releasing toxic green house gases in the air or remain just as they are; further causing potential health threats to the inhabitants nearby.

A proper system, which reroutes this waste to capture the usable parts and dispose off the unusable, is therefore the need of the hour.

When we talk of waste management, there are two options that can be considered. The first is material recovery, which is fundamentally recovering usable or recyclable items from the waste such that they can be used again in their similar forms.

Second is the conversion of Waste to Energy; energy recovery is a process of redemption of the energy that was used in the production of these products (now rendered as waste). Obviously, not all of the energy used can be got back in usable form, therefore material recovery comes before energy recovery in the hierarchy of waste management.

TABLE 1: WASTE GENERATION DATA IN COUNTRIES DEPENDING ON THEIR INCOME.

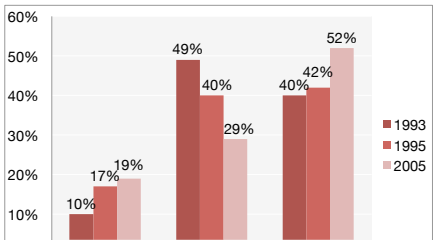
Countries	Per Capita Urban MSW (kilogram/day)	
	1995 (Records)	2025 (Calculated Assumptions)
Low - Income	0.45 - 0.90	0.60 - 1.00
Middle - Income	0.52 - 1.10	0.80 - 1.50
High - Income	1.10 - 5.07	1.10 - 4.50

TABLE 2: POPULATION GROWTH AND IMPACT ON OVERALL URBAN WASTE GENERATION AND FUTURE PREDICTIONS UNTIL 2041

Year	Population (Millions)	Per Capita Waste Generation	Total Waste generation Thousand Tons/year
2001	197,3	0,439	31,63
2011	260,1	0,498	47,3
2021	342,8	0,569	71,15
2031	451,8	0,649	107,01
2036	518,6	0,693	131,24
2041	595,4	0,741	160,96

Variation in MSW Composition in India

MSW in India mostly comprises of materials of three different types: organic, recyclable and inert. The variation in the composition of MSW over the years is shown below:



As we see the trend in the composition of waste over the years (from the above chart), the amount of organic waste has considerably increased. Since the W2E processes work only on organic waste, the usefulness of Waste to Energy course of action in India has definitely increased.

TABLE 3: WASTE TO ENERGY TECHNIQUES PRACTICED IN MAJOR CITIES IN INDIA

City	MSW Generated (TPD)	Present Waste Handling Techniques	
		RDF / WTE (TPD)	Biomethanation (TPD)
Mumbai	11.645	80	Yes
Kolkata	12.060	Nil	Nil
New Delhi	11.558	825	Yes
Chennai	6.404	Nil	Nil
Chandigarh	509	500	Yes
Pune	2.724	600	Yes
TPD= Tonnes/ Day			
No Biomethanation quantity mentioned			

TABLE 4: POWER GENERATING POTENTIAL FROM MSW IN INDIA

Period	MSW Generated (TPD)	Power Generation Potential (MW)
2002	97.174	1.638
2007	130.927	2.266
2012	189.986	3.276
2017	265.834	4.566

W2E Techniques

There are various techniques which get organic elements of waste transformed into useful energy. The most common of these are:

Anaerobic Composting:

In this method, the waste is exposed to anaerobic microbes, like bacteria, which break down the organic matter in the absence of oxygen. The energy is recovered in the form of biogas and compost in the form of a liquid residual.

TABLE 5 : POTENTIAL FOR ENERGY GENERATION FROM MSW AND FOSSIL FUEL DISPLACEMENT

City	MSW Generated (TPD)	Calorific Value (MJ/kg)	Power Production Potential (MW)	Coal substituted (TPY)
New Delhi	11.040	7,50	186,80	2.078.043
Kolkata	11.520	5,00	129,90	1.445.194
Mumbai	11.124	7,50	186,60	2.075.263
Nagpur	801	11,00	19,80	220.216
Hyderabad	4.923	8,20	91,00	1.012.526
Chennai	6.118	10,90	149,00	1.657.716
Mj/kg= Mega Joules per Kg				
TPY= Tonnes Per Year				

TABLE 6: W2E ACHIEVEMENTS AND TARGETS FROM MNRE

W2E System	Target for 2012-13 (MW)	Cumulative Achievement -30/4/2012
Grid Power	20MW (Urban & Industrial)	
W2E Urban	-	89.68 MW
W2E Industrial	-	
Off-Grid Power	20MW (Urban & Industrial)	102.95 MW
W2E Urban		
W2E Industrial		
Family Biomass Plants	1.25 lakhs	45.09 lakhs

Biogas consists of methane and carbon dioxide and can be used as fuel or, by using a generator it can be converted to electricity on-site. The liquid slurry can be used as organic fertilizer. Biogas is a very efficient fuel. This process is also termed as Biomethanation.

Refuse Derived Fuel (RDF):

Refuse Derived Fuel refers to the segregated high calorific fraction of processed MSW. RDF can be defined as the final product from waste materials which have been processed to fulfil guideline, regulatory or industry specifications mainly to achieve a high calorific value to be useful as secondary/substitute fuels in the solid fuel industry. The most important property of RDF is that, unlike coal, it can be derived and manufactured and hence is renewable.

RDF is mainly used as a substitute to coal (a fossil fuel) in high-energy industrial processes like power production, cement kilns, and steel manufacturing.

Waste- to- Energy Combustion (WTE):

WTE combustion is a mechanism which involves thermal breakdown of MSW through controlled combustion. The waste is reduced into an ash which further is used to generate electricity, steam or other such forms of energy.

The only difference between RDF generation and WTE combustion is that the purpose of the latter is volume reduction of the waste rather than production of energy. However, the energy generated at the end just adds value to the process.

Since most of the waste in India is organic (around 52%) and around 10% of it is paper, MSW is apparently renewable and hence W2E is recognized as a renewable source of energy by the Government of India.

Why has W2E been a failure in India?

The best way to handle mixed waste, as in India, is the conversion of waste to energy. However most of the attempts to install these in the country have collapsed down.

A WTE project in 1980s, a large scale biomethanation project, and two RDF projects in 2003 have failed. An earlier WTE plant, which was built in Timarpur, New Delhi is not in operation anymore. The existing projects also hardly work. In fact, failure of WTE however raised enormous public opposition and has hindered any efforts in that direction.

What perhaps is the reason for such recurring failures? Some of the possible causes for these failures are:

Improper Segregation: India lacks a source separated waste stream. The organic waste is mixed with the other two types. Hence the operations of the W2E techniques are hindered and a lack of smoothness causes the attempts to be short lived.

A large scale biomethanation plant built in Lucknow to generate 6 MW of electricity, failed to run because of this.

Logistical Errors: It is seen that the W2E plants built are technologically correct. However they fail to sensibly connect theory with practice. The plants are designed for handling more waste than can be acquired and the local conditions are not considered while importing the plant technology.

Lack of Funds: There has been no allocation of funds for plant maintenance; thereby creating obvious grounds for their wreckage.

W2E Initiatives

Though it is true that most W2E attempts in India have collapsed, there have been certain small scale projects that have been successful as well.

Twenty thousand household biogas units installed by Biotech, a bio gas technology company from Thiruvananthapuram, Kerala divert about 2.5% of organic waste from landfill. By doing so, they save up to USD 4.5 million (INR 225 million) to Thiruvananthapuram, and Kochi ULBs every year in transportation costs. These biogas units also avoid around 7,000 tons of CO_2 equivalent (TCO_2) emissions every year.

In fact the government is also taking initiative to make W2E a more common practice in India. The Ministry of New and Renewable Energy (MNRE) recently released details on its achievements in the W2E space (see table 6).

Requirements of the Sector

There are no faults as such in the technique. The mistakes rather are happening in the execution of the technique. So right now what India requires is an integrated system of waste management comprising of separation of waste and then the treatment of each component accordingly. Each site and the local conditions need to be analyzed thoroughly and solutions have to be designed accordingly. Only then it is possible to make W2E work in India.

Sources:
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