WASTE TO WEALTH: THE WASTE MANAGEMENT ALTERNATIVES

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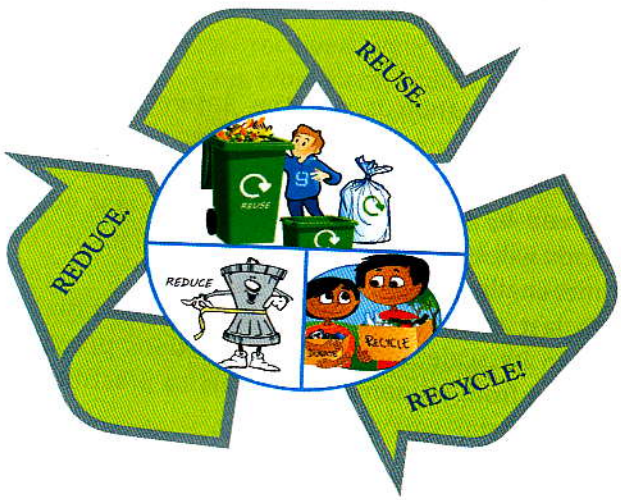
Industrializations become very significant for developing countries like India having large number of population. Rapid increase in urbanization and per capita income lead to high rate of municipal solid waste generation. In recent times, E-waste and plastic waste also contribute considerably to total waste stream due to utilization of electronic and other items. These wastes may cause a potential hazard to human health or environment if any of the aspects of solid waste management is not managed effectively. Even today, large portion of solid waste is dumped indiscriminately on outskirts of towns or cities without any prior treatment. This leads to groundwater contamination and increase in air pollution due to leachate percolation and release of gases respectively. Improper waste segregation and other factors lead recycling sector to work on outdated technology.

India – Waste Generation Scenario:

Every year, about 55 million tonnes of municipal solid waste (MSW) and 38 billion litres of sewage are generated in the urban areas of



Waste to Wealth

India, which is the second most populous nation in the world, comprises 17.86% of the world's population. It is projected to be the world's most populous country by 2022. About 32.8% of its population is urban and with the urban population increasing at 3-3.5% per annum, the per capita waste generation is increasing by 1.3% per annum. At the present rate, waste generation is projected to increase from 62 million tonnes per year to about 165 million tonnes in 2030. According to the data from the Ministry of Environment, Forest and Climate Change, the Government of India, only about 75–80% of the municipal waste gets collected and only 22–28% of this waste is processed and treated. With growing public awareness about sanitation, and with increasing pressure on the government and urban local bodies to manage waste more efficiently, the Indian waste to energy sector is poised to grow at a rapid pace in the years to come. The dual pressing needs of waste management and reliable renewable energy source are creating attractive opportunities for investors and project developers in the waste to energy sector.

India. In addition, large quantities of solid and liquid wastes are generated by industries. Waste generation in India is expected to increase rapidly in the future. As more people migrate to urban areas and as incomes increase, consumption levels are likely to rise, as are rates of waste generation. It is estimated that the amount of waste generated in India will increase at a per capita rate of approximately 1-1.33 per cent annually. This has significant impacts on the amount of land that is and will be needed for disposal, economic costs of collecting and transporting waste, and the environmental consequences of increased MSW generation levels.

Types of Waste:

Waste can be broadly classified into:-

i. Urban Waste.
ii. Industrial Waste.
iii. Biomass Waste.
iv. Biomedical Waste.

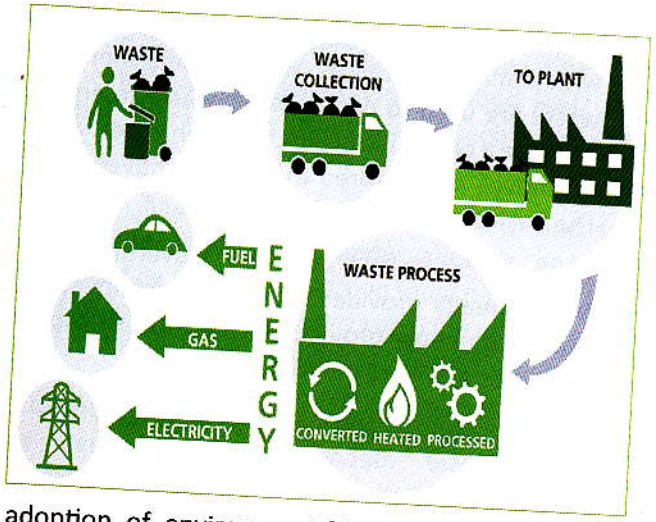
Urban waste includes Municipal Solid Waste, Sewage and Faecal Sludge, whereas industrial waste could be classified as Hazardous industrial waste and Non-hazardous industrial waste.

Growth Drivers:

The quantum of industrial waste generation is also on a higher side. More than 8 million tonnes per annum is India's present hazardous waste generation. Maharashtra (22.84%), Gujarat (22.68%) and Telangana and Andhra Pradesh put together (13.75%) are the leading states in the country in hazardous waste generation, followed by Rajasthan, Tamil Nadu, Madhya Pradesh and Chhattisgarh. Just these seven states, contribute to nearly 82% of the hazardous waste generated in the country.

Importantance of Waste to Energy:

Most wastes that are generated, find their way into land and water bodies without proper treatment, causing severe water pollution. They also emit greenhouse gases like methane and carbon dioxide, and add to air pollution. Any organic waste from urban and rural areas and industries is a resource due to its ability to get degraded, resulting in energy generation. The problems caused by solid and liquid wastes can be significantly mitigated through the



adoption of environment-friendly waste-to-energy technologies that will allow treatment and processing of wastes before their disposal. These measures would reduce the quantity of wastes, generate a substantial quantity of energy from them, and greatly reduce environmental pollution. India's growing energy deficit is making the government central and state governments become keen on alternative and renewable energy sources. Waste to energy is one of these, and it is garnering increasing attention from both the central and state governments. While the Indian Government's own figures would suggest that the cost of waste to energy is somewhat higher than other renewable sources, it is still an attractive option, as it serves a dual role of waste disposal and energy production.

Need For a New Energy Source:

The high volatility in fuel prices in the recent past and the resulting turbulence in energy markets has compelled many countries to look for alternate sources of energy, for both economic and environmental reasons. With growing public awareness about sanitation, and with increasing pressure on the government and urban local bodies to manage waste more efficiently, the Indian waste to energy sector is poised to grow at a rapid pace in the years to come. The dual pressing needs of waste management and reliable renewable energy source are creating attractive opportunities for investors and project developers in the waste to energy sector. In addition to energy generation, waste-to-energy can fetch significant monetary benefits. Some of the strategic and financial benefits from waste-to-energy business are:

- **Profitability:** If the right technology is employed with optimal processes and all components of waste are used to derive value, waste to energy could be a profitable business. When government incentives are factored in, the attractiveness of the business increases further.
- **Government Incentives:** The Government of India already provides significant incentives for waste to energy projects, in the form of capital subsidies and feed in tariffs.
- **Related Opportunities:** Success in municipal solid waste management could lead to opportunities in other waste such as sewage waste, industrial waste and hazardous waste. Depending on the technology/route used for energy recovery, eco-friendly and "green" co-products such as charcoal, compost, nutrient rich digestate (a fertilizer) or bio-oil can be obtained. These co-product opportunities will enable the enterprise to expand into these related products, demand for which are increasing all the time.
- **Emerging Opportunities:** With distributed waste management and waste to energy becoming important priorities, opportunities exist for companies to provide support services like turnkey solutions. In addition, waste to energy opportunities exist not just in India, but all over the world.

India Waste to Energy Potential

According to the Ministry of New and Renewable Energy (MNRE), there exists a potential of about 1700 MW from urban waste (1500 from MSW and 225 MW from sewage) and about 1300 MW from industrial waste. The ministry is also actively promoting the generation of energy from waste, by providing subsidies and incentives for the projects. Indian Renewable Energy Development Agency (IREDA) estimates indicate that India has so far realized only about 2% of its waste-to-energy potential.

Technologies for the Generation of Energy from Waste:

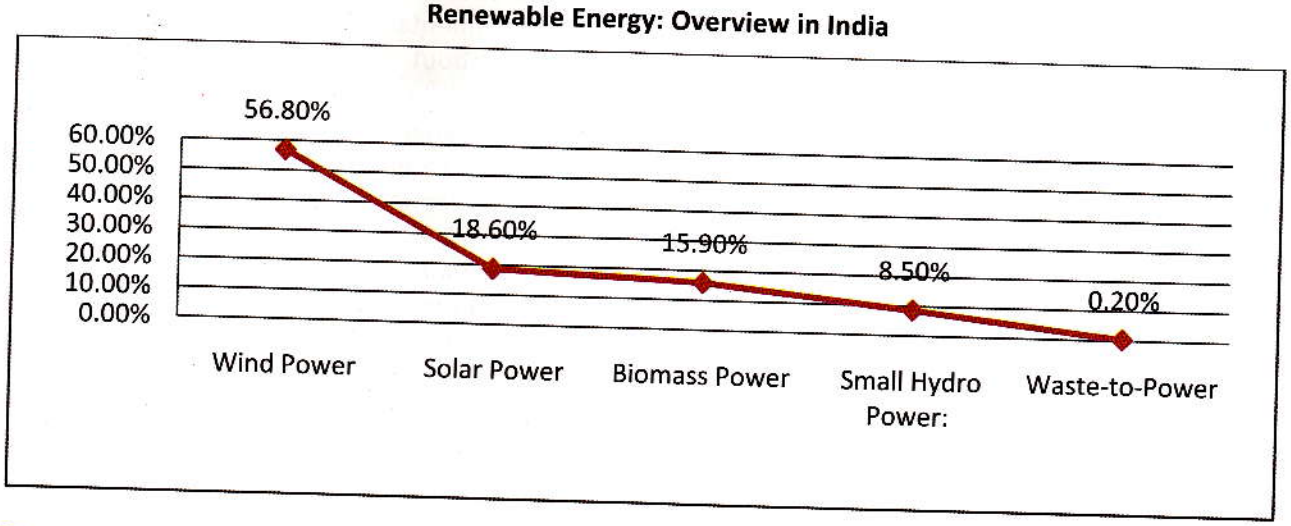
Energy can be recovered from the organic fraction of waste through thermal, thermo-chemical, biochemical and electrochemical methods.

- **Thermal Conversion:** The process involves thermal degradation of waste under high temperature. In this, complete oxidation of the waste occurs under high temperature. The major technological option under this category is incineration.
- **Thermo-chemical conversion:** This process entails high temperature driven decomposition of organic matter to produce either heat energy or fuel oil or gas. They are useful for wastes containing high percentage of organic non-biodegradable matter and low moisture content. The main technological options under this category include Pyrolysis and Gasification.

Renewable Energy Overview and Targets

- **Bio-chemical Conversion:** This process is based on enzymatic decomposition of organic matter

Renewable Energy: Overview in India



by microbial action to produce methane gas, and alcohol etc. This process, on the other hand, is preferred for wastes having high percentage of organic, bio-degradable matter and high level of moisture, which aids microbial activity.

- **Electrochemical Conversion:** Electrochemical conversion in the context of waste to energy refers typically to microbial fuel cells (MFC). These systems are developed to trap the energy from wastes, where the reduction-oxidation machinery of immobilized microbial cells is catalytically exploited, for the accelerated transfer of electrons from organic wastes, to generate electricity and bio-hydrogen gas.

Waste to Energy: Government Efforts

The Indian Government has recognized waste to energy as a renewable technology and supports it through various subsidies and incentives. The Ministry of New and Renewable Energy is actively promoting all the technology options available for energy recovery from urban and industrial wastes. MNRE is also promoting the research on waste to energy by providing financial support for R&D projects on cost sharing basis in accordance with the R&D Policy of the MNRE. In addition to that, MNRE also provides financial support for projects involving applied R&D and studies on resource assessment, technology up-gradation and performance evaluation.

The figures above refer to newer and fast developing renewable energy sources and are managed by MNRE. In addition India had 50,017.97 MW of installed large hydro capacity, which comes under the ambit of Ministry of Power.

Installed Grid Interactive Renewable Power Capacity in India 2017

Source	Total Installed Capacity (MW)	Target 2022 (MW)
Wind power	32279.77	60,000.00
Solar power	12288.83	100,000.00
Biomass power (Biomass & Gasification and Bagasse Cogeneration)	8182.00	10,000.00
Waste-to-Power	114.08	
Small hydropower	4379.85	5,000.00
Total	57244.23	175,000.00

Source: MNRE, 2017

Off-grid power Capacities in MW

Source	Total Installed Capacity (MW)
Biomass (non-bagasse) Cogeneration	651.91
SPV Systems	438.95
Biomass Gasifiers	186.88
Waste to Energy	164.45
Water mills / micro hydel	18.81
Aero-Generators / Hybrid systems	2.98
Total	1463.98

Source: MNRE Report 2017

In addition to grid connected renewable electricity and Off-grid renewable energy sources, India has 4.95 million of family biogas plants as of 28 February 2017.

According to MNRE, there is a potential to recover 1,300 MW of power from industrial wastes, which is projected to increase to 2,000 megawatt by 2017-18.

Waste to Energy Tapped Potential

There exists an estimated potential of about 225 MW from all sewage (taking the conservative estimate from MNRE) and about 1460 MW of power from the MSW generated in India, thus a total of close to 1700 MW of power. Of this, only about 24 MW have been exploited. Thus, less than 1.5% of the total potential has been achieved.

Potential of Energy Recovery from Urban and Industrial Wastes in India

State/Union Territory	From Liquid Wastes (MW)	From Solid Wastes (MW)	Total (MW)
Andhra Pradesh	16.0	107.0	123.0
Assam	2.0	6.0	8.0
Bihar	6.0	67.0	73.0
Chandigarh	1.0	5.0	6.0
Chhattisgarh	2.0	22.0	24.0
Delhi	20.0	111.0	131.0
Gujarat	14.0	98.0	112.0
Haryana	6.0	18.0	24.0
Himachal Pradesh	0.5	1.0	1.5
Jharkhand	2.0	8.0	10.0
Karnataka	26.0	125.0	151.0
Kerala	4.0	32.0	36.0
Madhya Pradesh	10.0	68.0	78.0
Maharashtra	37.0	250.0	287.0
Manipur	0.5	1.5	2.0
Meghalaya	0.5	1.5	2.0
Mizoram	0.5	1.0	1.5
Orissa	3.0	19.0	22.0
Pondicherry	0.5	2.0	2.5
Punjab	6.0	39.0	45.0
Rajasthan	9.0	53.0	62.0
Tamil Nadu	14.0	137.0	151.0
Tripura	0.5	1.0	1.5
Uttar Pradesh	22.0	154.0	176.0
Uttaranchal	1.0	4.0	5.0
West Bengal	22.0	126.0	148.0
Total	**226.0**	**1457.0**	**1683.0**

Source: MNRE, 2017

Current Waste-to-Energy Installed Capacity in India:

Grid-Interactive Power	(Capacities in Mw)	Contribution (%)
Waste to Power		
Urban	20.20	27.4
Industrial	53.46	72.6
Total	**73.66**	
Off-Grid/ Captive Power	**(Capacities in Mweq*)**	Contribution (%)
Waste to Energy		
Urban	3.50	4.6
Industrial	72.30	95.4
Total	**75.8**	

Source: MNRE, 2017, *MWEq: Megawatt Equivalent

Constraints Faced by Waste to Energy Sector:

The growth of this sector has been affected on account of the following constraints:

- Waste-to-Energy is still a new concept in the country. Most of the proven and commercial technologies in respect of urban wastes are required to be imported.
- The costs of the projects especially based on biomethanation technology are high as critical equipment for a project is required to be imported.
- In view of low level of compliance of MSW Rules 2000 by the Urban Local Bodies, segregated municipal solid waste is generally not available at the plant site, which may lead to non-availability of waste-to-energy plants.
- Lack of financial resources with Urban Local Bodies.
- Lack of conducive policy guidelines from State Governments in respect of allotment of land, supply of garbage and power purchase / evacuation facilities.

Conclusion:

Population growth and particularly the development of megacities is making SWM in India a major problem. The current situation is that India relies on inadequate waste infrastructure, the informal sector and waste dumping. There are major issues associated with public participation in waste management and there is generally a lack

of responsibility towards waste in the community. There is a need to cultivate community awareness and change the attitude of people towards waste, as this is fundamental to developing proper and sustainable waste management systems. Sustainable and economically viable waste management must ensure maximum resource extraction from waste, combined with safe disposal of residual waste through the development of engineered landfill and waste-to-energy facilities. Waste-to-energy (WTE) plants are among the most efficient ways to convert garbage to electricity. WTE plants reduce the waste volume drastically in most eco-friendly manner, at the same time reducing the necessity of landfills. Garbage is very efficiently utilised, and much needed electricity is generated, bridging the gap for electricity requirement. It is time all cities pay attention to this source for power as an economical way to tackle the city waste.

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SWACHHTA Ranking 2017 of Higher Educational Institutions concluded

'SWACHHTA' Ranking- 2017 of Higher Educational Institutions is an exercise to rank Higher Educational Institutions (HEIs) on the basis of cleanliness and hygiene has been undertaken and concluded. This exercise will generate peer pressure amongst institutions in the all important area of cleanliness. Parameters for a clean campus were formulated, like student/toilet ratio, kitchen hygiene, availability of running water, modernity of toilet and kitchen equipment, campus green cover, garbage disposal in hostels and academic buildings, disposal techniques, water supply systems and also, a certain weightage was also given as to whether the institutions have adopted any neighbouring locality or village to spread awareness and activities in Swachhta.

About 3500 HEIs responded to the online invitation, submitting all their details as per format. The top 174 institutions were shortlisted as per criteria and officials from UGC and AICTE inspected the premises of all 174 institutions. Finally, the top 25 institutions across various categories like Universities, Technical Institutions, Colleges and Government institutions were selected and they were awarded.

Bilal Dar – Inspiring story of an 18 year old boy from Srinagar

By looks, Bilal Dar is like any other boy from Srinagar, but he has done something that won him PM Shri Narendra Modi's praise. PM specially mentioned this boy's efforts in keeping Wular lake clean.

In his Mann Ki Baat address on 24th Sept, 2017, PM said -

"Just a few days ago some one drew my attention towards Bilal Dar, a young man of 18 years from Srinagar. And you will be glad to know that Srinagar Municipal Corporation has made him their brand ambassador and when there is a talk of brand ambassador, there is a general feeling that he/she must be a Cine artist or a sports-personality. But not in this case. Bilal Dar got connected to the 'Swachhata Abhiyan' or Cleanliness Campaign since the age of 12-13 years and has been working for the last 5 to 6 years. He clears plastic, polythene, used bottles, dry or wet waste – every piece of dirt from Asia's biggest lake near Srinagar. He also earns from this activity. His father had died of cancer at a very young age but he connected his livelihood with cleanliness. I congratulate Srinagar Municipal Corporation for taking this initiative towards sanitation and for their imagination to appoint an ambassador for this cause of cleanliness because Srinagar is a tourist destination and every Indian wants to go there; and if such attention is given to Cleanliness it is a very big achievement in itself. And I am glad that they have not only appointed Bilal as their ambassador but also given him a vehicle, and also a uniform and he goes to other areas and educates people about cleanliness and inspires them and keeps tracking them till results are achieved. Bilal is very young age wise but is a source of inspiration for all of us who are interested in cleanliness.

Bilal Dar (Source: Express Photo by Shuaib Masoodi/File)

I congratulate Bilal Dar."

We also congratulate Bilal and wish him all the best!