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Study of Various Waste to Energy Production Techniques and its Potential in India

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Abstract—With the ever-rapid pace of urbanization comes the problem of waste. As we tend be more materialistic, we tend to generate more garbage. The western world has already adopted this technique successfully and we in India have with our population the potential of being one of the largest producers of Energy from Waste. This paper tends to highlight the various Waste to Energy (WTE) techniques prevalent in the world at present

Keywords-*Municipal Solid Waste (MSW); Waste-to-Energy (WTE): Tonnes per Day (TPD)*

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I. INTRODUCTION

Municipal Solid waste is the curse of modernization and a consumer based economy. With the ever-growing population of the India our country, the landfills are growing humongous and with our population the unavailability of land for the landfills is a problem which will only increase.

The solution could be in the generating power through Waste using the various WTE technologies.

There are challenges in the adoption of these but a lot of work has been done in the filed taking into account the Indian scenario to suggest that it is high time that we adopt these methodologies

This authors through this paper is trying to again highlight some of the work being done in the Indian scenario alongwith education in the various WTE technologies in the present day world

II. RELATED WORKS

Some of the works are presented as follows

Saini et. al [1] in their research have made a very commendable study of the feasibility of adopting these WTE technologies in India. The authors have made a study of the Municipal Solid Waste (MSW) generated in about 75 cities in the country and have made conclusion as to the feasibility of the WTE technology in India. They have sourced their data from authentic databases, viz. NEERI (National Environmental Engineering Research Institute, Nagpur), NSWAI (National Solid Waste Association of India) and CPCB (Central Pollution Control Board, New Delhi). The authors have also made a study on the relation between the calorific value of the MSW and the bio degradable and paper percentage. The authors have also made an attempt for recommendation in the present policy in order to make WTE a success for India.

The author have also highlighted in their paper the work done by Rao et all 2000 and brought in the formula used for calculation of the Energy generation potential.

The research also highlights the Comparison of WTE technologies in India (Lal & Reddy 2009; *MSW Manual 2000; **Matt Crowe *et al* 2002) which shows the capital requirement for various WTE technologies.

They have also done a global tariff comparison of the energy generation from MSW.

Vijet. al [2]has in his study has again iterated the problem of MSW being generated due to rapid urbanisation happening in India. The study highlights the lack of landfills to cope with the huge amount of waste which is being generated by the cities in India. Delhi alone produces about 6800 TPD. Greater Mumbai another 6500 TPD. In total as per the research out of the 22 cities highlighted, about around 27000 Tonnes of waste is generated every day.

The author highlights the need for proper collection and dumping of garbage.

Mani et al [3]in their paper have given an elaborate explanation of the various problems faced Urban Local bodies in management of solid waste. They have in their paper tried to highlight the various schemes and policies being adopted by the Government for MSW management. They have also tried to give a glimpse of the WTE technologies prevalent in the modern word.

Ghatak et al [5] in his research has highlighted and address some of the issues of the MSW management in India. The research touches on the point that India has a large part of MSW management under uncontrolled sector like the rag pickers etc. He has highlighted the issues of garbage collection and the shortage of the necessary equipment and infrastructure required for the huge mass of the garbage. Thus the result of the garbage filled streets of India.

The major research is being done in the complexity of the garbage collection of the country and the amount of MSW being generated.

III. POTENTIAL OF THE COUNTRY TO PRODUCE ENERGY THROUGH WASTE

A lot of work is being done to create awareness of the policy changes being made in the country and also the need of certain changes.

A lot of study has also been done to check the content of the garbage in India.

Here lies the good news as most of the study shows that a large part around 50-60% of the MSW in India is organic. Also due to the predominance of rag pickers in the country, this unorganized sector actually helps in taking up the 'so called' valuable garage like plastics, bottles and metals which are reusable and also harmful if burnt.

Studies also shows that around 6 – 10% of the MSW is paper which helps in boosting the calorific value of the MSW.

In the studies of **Saini et. al [1]**it has been shown that out of the only 75 cities in India there is a production of 195000 Tonnes per day of MSW generated.

As a rule of thumb it is said that 4 tonnes of MSW is equivalent to 1 tonne of fuel or 2 tonne of coal.

In a sense the potential of India is production of energy equivalent to 50000 tonnes of fuel of 100000 tonnes of coal per day.

Although the numbers are country wide Delhi alone has a potential of generating energy equivalent to 1400 tonnes of fuel or 3200 tonnes of coal per day.

IV. MSW TO ENERGY TECHNOLOGIES

A. Incineration

a. Depolymerisation

This uses a process of thermal decomposition wherein, in the presence of water, the organic compounds are heated at a very high temperature. This process is called as Hydrous Pyrolysis.

The process if done without the use of oxygen is known as Pyrolysis. The process takes plastic and bio-mass as their main ingredient. The rest of the ingredients works as thermos chemical decomposition. This process involves a simultaneous change in the physical and chemical composition.

This process is often known as replication of the conditions under which fossil fuels were created.

b. Gasification

This process converts carbonaceous substance into carbon dioxide, carbon monoxide and some amount of hydrogen. This process also employs high temperature. However in this process combustion does not take place. Steam and/or oxygen is used as a fuel.

A gas is produced in this process which is known as Synthesis Gas or Syngas and is a good source of alternate energy.

c. Pyrolysis

It is like Hydrous Pyrolysis but without the use of oxygen. This process involves the use of agricultural waste or organics waste from industries.

d. Plasma Arc gasification

This process involves the use of plasma torch to ionize the gas and obtain Syngas. The process generates electricity while compressing the waste.

B. Non thermal technologies.

a. Anaerobic digestion

It involves fermentation. It is slow process. This process uses micro organism to destroy the biodegradable content. There is no presence of oxygen in this process. It is used both in domestic and commercial level to tap the release of energy. This process helps to reduce the greenhouse gases from the atmosphere. This process is commercially known as Bio Gas.

V. STATE WISE MSW GENERATION POTENTIAL

A study was also made in the research by Saini et al [1] wherein in state wise MSW power generation was calculated and is also shown below as Table 1

State/Union Territory	Total MSW(T/day) (2015) p	Energy Potential 2015 (p) (MW)
Maharashtra	23627.56	470.19
Uttar Pradesh	14597.03	290.48
West Bengal	12504.27	248.84
Tamil Nadu	9725.21	193.53
Andhra Pradesh	10344.37	205.85
Karnataka	8628.03	171.70
Delhi	13304.83	264.77
Gujarat	8342.24	166.01
Madhya Pradesh	4925.32	98.01
Punjab	4841.02	96.34
Rajasthan	4957.24	98.65
Haryana	2325.63	46.28
Bihar	2057.14	40.94
Kerela	1733.49	34.50
Chhattisgarh	1134.61	22.58
Jharkhand	994.39	19.79
Orissa	867.83	17.27
Jammu &Kashmir	782.60	15.57
Uttarakhand	447.71	8.91
Assam	358.51	7.13

Goa	245.28	4.88
Pondicherry	217.02	4.32
Tripura	144.31	2.87
Andaman & Nicobar Islands	115.92	2.31
Himachal Pradesh	74.10	1.47
Mizoram	67.39	1.34
Manipur	63.87	1.27
Meghalaya	56.78	1.13
Dadar& Nagar Havelli	30.11	0.60
Daman & Diu	30.09	0.60
Nagaland	15.38	0.31
Sikkim	15.38	0.31
Arunachal Pradesh	14.20	0.28
Lakshwadeep	3.89	0.08
INDIA	**127593**	**2539.10**

Table 1: State wise MSW generation & Energy Generation from 2011(p) to 2020(p) (NEERI 1996; NSWAI; Census website 2011)

The above value shows a staggering amount of power which the so called garbage in India has.

VI. CONCLUSION

The researches mentioned in this paper suggests that India has potential of generating around 2500 MW of power from ots so called garbage alone.

The task will not be easy as there would have to be a certain discipline which is to be brought in the garbage collection scenario.

Also some policy changes have to be brought in and there will also be a large amount of capital investment required.

However if successful the WTE technology will solve the tqo perennial problems of the country

a. The shortage of power, and
b. The garbage problem

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