

E-Waste Management Approaches in India

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Abstract—From last two-three decades, the global market of industrial and electronic equipment is changed and continues to grow exponentially all over the world. With these grows, electrical and electronic waste management is growing in same manner. Developing countries face tremendous problem which are related to the generation and management of E-Waste which are either from import or export illegally. There are a large number of harmful materials which containing toxic substances that can have an adverse impact on health and the environment. It is the global problem; if it is not handled decently within time; then the global world is affected. In India, E-Waste management presumes the major problem. This problem is not only generated from its own E-Waste but also the import dumping materials from other developed countries. The purpose of this article is to focus the issues and impact of this emerging problem. It is also required to sharpen on private and government agencies to do needful solutions.

Keywords - *Electrical and Electronic Equipments, Waste Electrical and Electronic Equipment, E-Waste, Central Pollution Control Board (CPCB), Extended Producer Responsibility, Personal Protection Equipment (PPE).*

I. INTRODUCTION

Electronic industry is one of the largest growing and manufacturing industry. From last few decades, tremendous changes in industrial pollution have also been released in different form which has been involved into the environment affect on health. Solid waste management is the major issue to handle in India. The global market of Electrical and Electronic Equipment (EEE) continues to produce exponentially, while the life-time of the product becomes shorter and shorter [1]. Therefore, the industry as well as waste management facing a new challenges E-Waste. Electronic waste, “E-Waste” or “Waste Electrical and Electronic Equipment” (“WEEE”) is waste material consisting of any broken or unwanted electronic and electrical appliances. It is currently handled by the unorganized sector. Due to awareness problem and lack of skills, knowledge, the department has remained labor dependent, environmentally unfriendly and unhealthy. When these materials are placed in landfills then they release harmful gases which are harmful for surrounding people and improper disposal expose to environmental unhealthy.

People are not aware about the future problems and possible negative impact of the rapidly increasing use of computers, monitors and electronics equipments. When these products are placed in lowlands by the unauthorized agency and untrained people, they lay health risk due to the hazardous material they contain. The improper disposal of products

leads to the cause of damaging the environment and the negative impact release in a form of earthquake, cancer etc.

The volume of WEEE grows rapidly every year in exponential form and is also believed to be one of the most critical waste disposal issues of the twenty first century for the entire world. IT and electronic industry growth, changes in lifestyle of people and easy available of electronic gadgets for common people which contribute to increase generation of E-Waste. Most of the developing countries face the environmental and health problem, which are arise from unauthorized import and unconventional disposal of E-Waste from the developed countries.

According to CPCB Guidelines (2008) [2], E-Waste is defined as waste generated from used electronic devices and house hold appliances which are not fit for their originally intended. It is said to be the fastest growing waste stream in the world, with the growth rate at 3% to 5% per year. It is three times faster than the general waste. It creates a management challenges to most countries worldwide. E-Waste management is a challenge for all over the world. It is not only due to its rapidly increasing volume, but more importantly because of its hazardous nature. Approx, 9% of the total E-Waste is made of hazardous substances such as lead, cadmium, mercury and other toxic chemicals. It contains numerous hazard contents which may pose a menace to the environment and human health. If it is not disposed of in the proper manner then environment and health affected in a large volume of people [3]. Today India is the World’s largest and the fastest growing manufacturing and consuming industry in the global world. The Indian industry is also affected by the global markets resulting as one of the largest markets for EEE products.

This paper is organized in seven sections. Section 1, introduce about the E-Waste, concept of E-Waste; Section 2 categorize the E-Waste into different categories on the base of substances; Section 3 define the current challenges and regulation related to E-Waste; Section 4, focus on how to manage and recycle E-Waste; Section 5, discuss about the different E-Waste management rules; Section 6, for the different authorized agency which work for E-Waste management and last the conclusion of this study is prescribed.

II. CATEGORIZATION OF THE E-WASTE

The composition of E-Waste is very huge and complex. Government of India categorizes the E-Waste from diverse and complex hazardous waste. It contains more than 1000 substances which are classified as hazardous and non-hazardous substances. EEE can be broadly categorized in the following categories[4].

- Large Household appliances
- Small Household appliances
- IT and Telecommunication Equipments
- Toys and Sports Equipments
- Medical Devices
- EEE Tools
- Automobile Tools
- Consumer Equipments
- Monitoring and Control Instruments

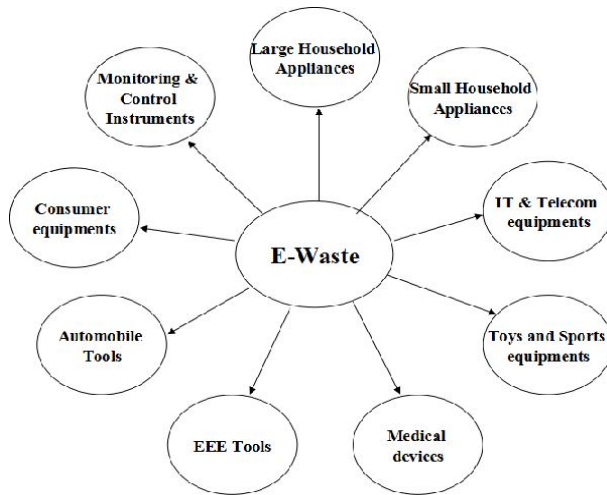


Figure 1: Categories of E-Waste

The above E-Waste are recycled or dumped by the different organization. In the process of recycling or recovery certain E-Waste fractions act as secondary staple for retrieval of items [5]. Recovery and recycle of different operations which are as follows.

- (i) **Dismantling:** It contains dangerous substances (CFCs, Hg, switches, PCB); from which removal of easily accessible parts containing valuable substances.
- (ii) **Segregation:** The act of Segregation or sequestering is done on ferrous metal, non-ferrous metal and plastic. This separation is normally done in shredder processes.
- (iii) **Refurbishment and Reuse:** Refurbishment and reuse of E-Waste has potential for those used electrical and electronic equipments which can be easily refurbished to put to its original use.
- (iv) **Treatment of dangerous materials and waste:** It is disposed of in landfill areas. Chloro Fluro Carbons (CFCs) are treated thermally. Printed Circuit Board (PCB) are disposed of in underground landfill sites. These are recovered from the elements would be much higher if appropriate technologies are used.

III. CURRENT ISSUES FOR E-WASTE MANAGEMENT

Presently in India, most of the activities right from the collection, transportation, segregation etc is done by the untrained people from unauthorized sectors. It is a good source of revenue generation and sources of job creation for many people in India. Most of the NGO and unregistered organizations involved in this area. But this organization run through illegal and untrained poor people collecting or selling the wastes like paper, plastic, polythene, cardboards etc. These labors are involved in dumping and recycling are

poor, illiterate and untrained. Most of the time these recycling is done without any proper Personal Protection Equipment (PPE)[6].

Today all over the world, quality of electronics goods and cost is reduced which is the alarm signal for environment and human kind. Because of this people frequently changed his electronic items in his daily life style. The cost of recycling E-Waste out passes the revenue recovered from materials especially in countries where environmental regulation is strictly followed. Thus, E-Waste mostly dumped in countries where environmental standards are low and working conditions are poor. Asia is one of the most popular dumping ground; but due to strict regulation; this trade is increased in particularly West-Africa.[7].

Most of the developing countries lack the waste removal infrastructure and technical capacities necessary to ensure the safe disposal of hazardous waste. It generates variety of health problems in these countries; like cancer, neurological, respiratory and birth defects [1]. Illegal imports of WEEE are the major challenges in developing countries. Some regulations have established but not strictly followed by the country.

Exactly, there are no well-established systems for controlling, sorting, storage, collection, transportation and disposal of E-Waste in India. Even worse, there is little or no effective enforcement of regulations related to E-Waste management and disposal. The first Guideline for environmental pollution for sound management of E-Waste under the Hazardous Waste (Management and Handling) Rules 2002 by Central Pollution Control Board (CPCB). These guidelines provides a roadmap for the management of E-Waste and supports the National Environmental Policy (2006).[2] These guidelines also emphasize Extended Producer Responsibility (EPR) as strategy for making the producers responsible for the entire life cycle of the product for take back of the electronic products from the market and proper disposal of the E-Waste.

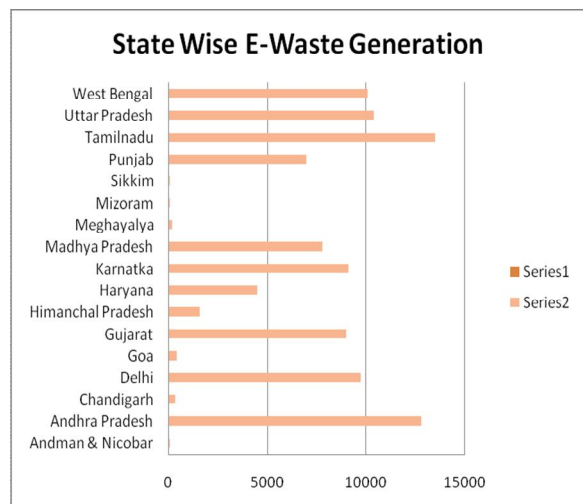


Figure 2: E-Waste Generation States (Adapted from Census of India 2011)

In figure 2 the information is collected from the website Department of Information Technology, Government of India. The major part of the electronic waste is generated by the Tamil Nadu and Andhra Pradesh and the minimum E-Waste is generated by the low density of population like Andaman & Nicobar, Sikkim, Mizoram, Meghalaya, Goa and Chandigarh.

States	Population Density	Literacy %	WEEE (Tonnes)
Andaman Nicobar	46	86.63	92.2
Mizoram	52	91.33	79.3
Sikkim	86	86.55	78.1
Himachal Pradesh	123	82.8	1595.1
Meghalaya	132	74.43	211.6
Madhya Pradesh	236	69.32	7800.6
Gujarat	308	78.03	8994.3
Andhra Pradesh	308	67.02	12780.3
Karnataka	319	75.36	9118.7
Goa	394	88.7	427.4
Punjab	551	75.84	6958.5
Tamil Nadu	555	80.09	13486.2
Haryana	573	75.55	4506.9
Uttar Pradesh	829	67.68	10381.1
West Bengal	1028	76.26	10059.4
Chandigarh	9258	86.05	359.7
Delhi	11320	86.21	9729.2

TABLE 1: INFORMATION OF POPULATION DENSITY, LITERACY & WEEE OF INDIA

In table 1, the information of population and literacy is collected from the Census 2011 of different states for social and economic growth, while the WEEE information is conducted by the International Resource Group Systems South Asia Pvt Ltd (IRGSSA) in 2005 [2]. In this paper, 17 states are used for analysis and found that literacy rate of Mizoram, Goa, Andaman & Nicobar, Sikkim & Delhi on top five. But when filter for the WEEE it is found that Tamil Nadu, Andhra Pradesh, Uttar Pradesh is the top most producer of E-Waste and Sikkim, Mizoram and Andaman Nicobar produce least no of WEEE in India. When it is analyzed on the base of above information, it is found that Chandigarh density of population is to high as well as literary rate is also increased in compare to other states but have less WEEE producer state in India [9].

Chandigarh launches a specific plan to manage and handle E-Waste in the State.

- The E-Waste Management and Handling Rules, under the Environment Protection Act, applies to every producer, consumer involved in the manufacture, sale, purchase and processing of EEE as well as to the collection centers and recyclers of E-Waste.

- Every concerned is directly make necessary arrangement for the handling of E-Waste, obtain necessary authorization from the Office and shift their E-Waste to authorized collection centers.

IV. CURRENT RECYCLING APPROACHES

This process faces a number of challenges, including dealing with hazardous materials such as CRT glass and finding markets for flame. Presently, no technology currently exists for recycling certain EEE in an environmentally friendly manner.

In 2005, more than 2 million tons of E-Waste were generated in the US alone, but only to 15-20 percent of that was collected for recycling. The rest, more than 80 percent of that was disposed of for lowland fillings. The hazardous materials in E-Waste can strip out of the landfills into ground water and streams and if the plastic components are burned, dioxins are emitted into the air [4]. It is estimated that 80 percent of the E-Waste collected for recycling exported to developing countries. This illegal traded waste is going to the informal recycling sectors in many Asian and African countries.

For E-Waste management, India depends on unorganized sector and only a smattering of organized E-Waste recycling facilities is available. 95% of the E-Waste is treated and traveled by the slums areas of the people, where untrained people carry out the process without any protective equipment. It affects not only to the health, but also for the environment. Recycle facilities require to initiate investment in this area by Technology, advanced equipments and processes [4].

V. E-WASTE MANAGEMENT RULES

It is the recent and emerging issues related to India for addressing the E-Waste. India implement E-Waste (Management and Handling) Rules 2011 were made official by the Ministry of Environment and Forests (MoEF) on 12th May 2011. It is affected on 1st May 2012 in India [10]. According to this regulation, the responsibility of the producer is defined, some are listed here.

- Collection of E-Waste generated during the manufacturing of EEE and channelizing it for recycling or disposal.
- E-Waste generated from the End Of Life (EOL) of their products in line with the principle of 'Extended Producer Responsibility.
- Collection centers or take back system applied either individually or collectively.
- Providing contact details of authorized collection centers to consumer so as to facilitate return of EEE.
- Creating awareness through publication, advertisement, information, booklets, posters and other means of communication to the people.

VI. E-WASTE MANAGEMENT AGENCY

Some of the most successful countries on E-Waste management system are Netherland and Switzerland. The Swiss E-Waste management system can be viewed as an

ERP based system, where each stake holder has their own clear definition of role and responsibility.

In India some of the Indian Enforcement Agencies are involved in E-Waste Management System.[11].

- **Ministry of Environment and Forests (MOEF) :** This agency is responsible for identification of hazardous wastes and provides permission to exporters and importers.
- **Central Pollution Control Board (CPCB):** It is constituted under the Water (Prevention and Control Pollution). It coordinates with the State Pollution Control Board, implements the rule of imports and monitor the procedures, condition of authorization, imports and exports management and hazardous waste.
- **State Pollution Control Board (SPCB):** It constituted under the water (prevention and Control of Pollution) to grant and update authorization.
- **Port and customs Authorities:** Authorities verify the documents and inform the Ministry of Environment and Forests of any illegal traffic and waste from imports and exports.

VII. CONCLUSION

According to the electronic waste management, 20 percent of the EEE are generated in 2007 were collected for recycling and at least 80 percent goes to landfills. Recycling is the key to reduce the E-Waste. At every stage recycling has environmental benefits in the life cycle of electronic product. It also reduces air and water pollution associated with making new products from raw materials. The major challenge is dumping of illegal electronics. Strictly enforcing these laws and discourage illegal agencies and unauthorized people who are working in this field.

One more challenging approach to minimize illegal dumping of EEE, is to impose strict laws. Strictly enforcing these laws is strongly suggested as a way to prevent.

Educate the general public about this critical problem which can become the terror for the health of the people and environment, if it is not control within time. From the above data, it is found that Chandigarh which have high density population literate people and good number of electronic organization in the state. But the E-Waste generated by the state is less in compare to other dense city.

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