

E-WASTE MANAGEMENT



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OBJECTIVE

- To research and develop a model to collect the used, damaged electronic product and study the feasibility aspect for the E-waste recycling and its management.
- To develop a model by which we can provide incentives for the return old, used and damaged electronic products and recycle it for the extraction of precious metals and useful heavy metal such as antimony, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, mercury, nickel, zinc, gold.
- To study and research, the current market practices to tackle the uprising problem of the E-waste and develop efficient methods using latest technology to manage and recycle it effectively and efficiently.
- To check the feasibility and cost-benefit analysis of the project in the process of E-waste management by researching more efficient methods for the extraction of heavy metals and valuable metals like antimony, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, mercury, nickel, zinc, gold.

ABSTRACT

To research and develop a model to collect the used, damaged electronic product and study the feasibility aspect for the E-waste recycling and its management by incentivizing the consumers to return the damaged and used electronic product back to the registered vendors.

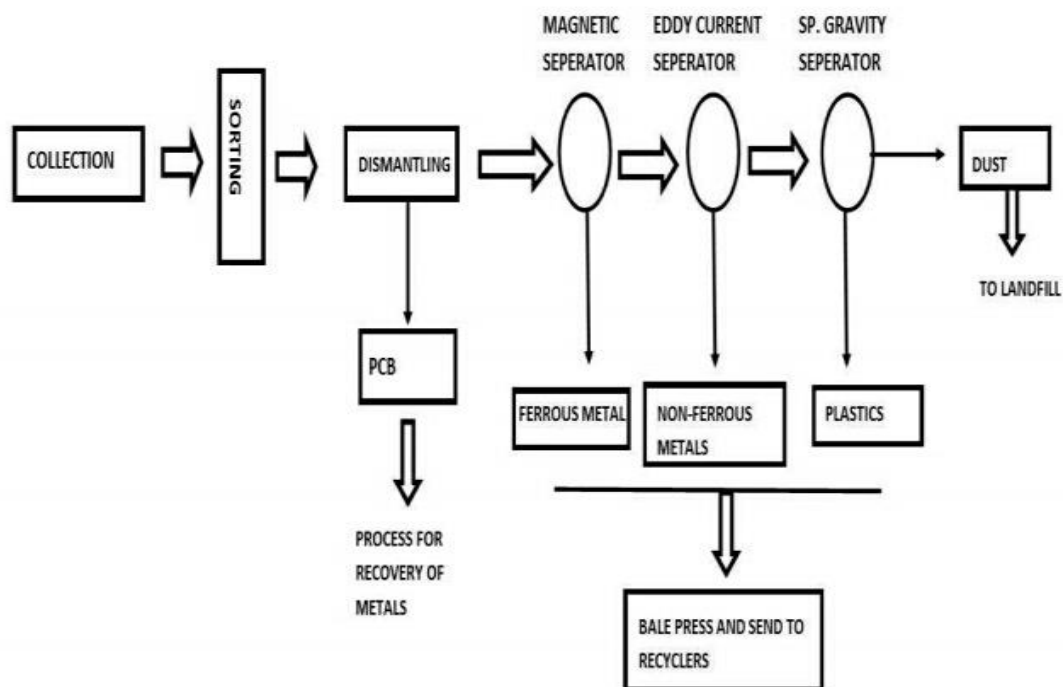
Such registered vendors will separate the electronic products based on criteria such as material and its uses and the methods of the extraction of useful metal and heavy metal such as antimony, barium, beryllium, cadmium, chromium, cobalt, lead, lithium, mercury, nickel, zinc, gold and the method of recycling it for reuse.

Separation Method:

1. Electrostatic Separator.
2. Eddy current Separator.
3. Magnetic Separator.
4. Specific gravity Separator.

After the separation, the parts and the products allotted to an efficient method to extract precious metals and useful metals and to recycle parts whichever possible to make the process feasible.

This recycled and extracted parts then can be reused as per their applicability.



REPORTS ON E-WASTE:

- **ASSOCHAM** report “E-waste in India by 2015” states that the generation of E-waste will be 50,000 MT in 2015 and about 1.5 lacs workers are employed in Delhi.
- A case study by **Gupta Reena, Sangita and Kaur Virender** concluded that E-waste in India are very different from other countries and rapidly increasing E-waste volumes both domestically generated as well as through imports. The major problem we face in India, there is no such technologies or clear policy about E-waste and hence in efficient recycling processes result in substantial losses.
- According to the **Comptroller and Auditor- General’s (CAG) report**, over **4 lakh tons** of electronic waste are generated in the country annually.
- According to UN report “**GLOBAL E WASTE MONITOR 2014**” **1.7 million tons** of E-waste was generated in India annually.
- India Ranked 3rd generating 3.2 Million tonnes of E-waste and the Report of ASSOCHAM-EY estimate it to be 5 Million tonnes in 2021.
- According to World Economic Forum (WEF) Report, 2019 Titled: ‘A New Circular Vision for Electronics, Time for a Global Reboot’ says consumer discarded 44 Million tonnes of electronics each year and only 20% is recycled sustainably.
- The Global E-waste Monitor 2020 shows consumer discarded 53.6 Million tonnes of electronics in 2019, up 20% in 5 years.

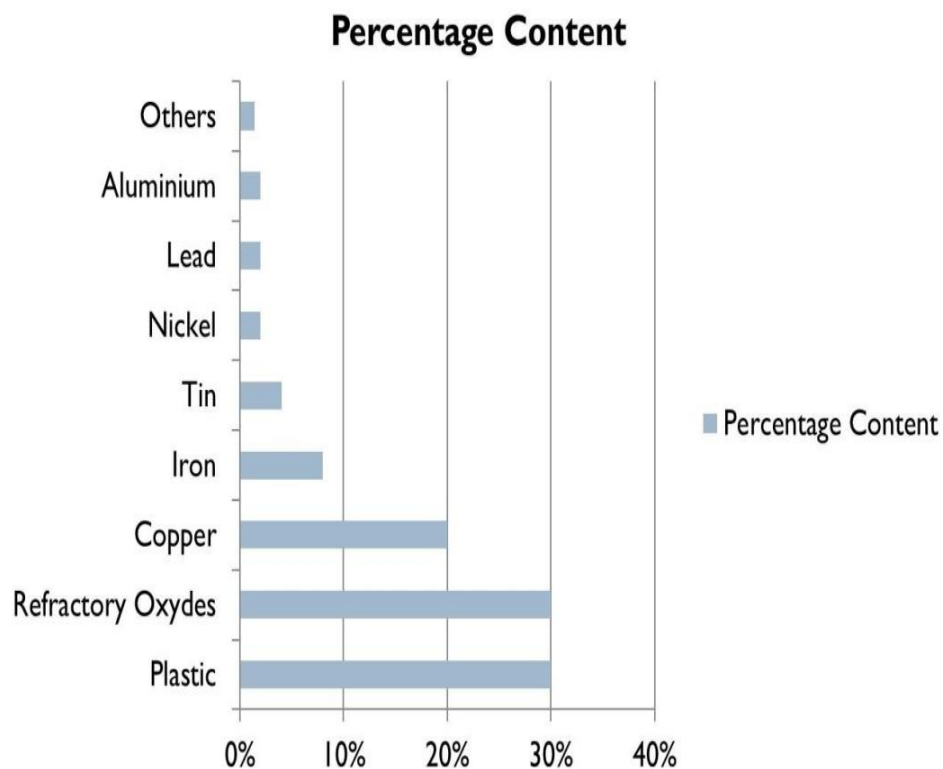
Need of the Study:

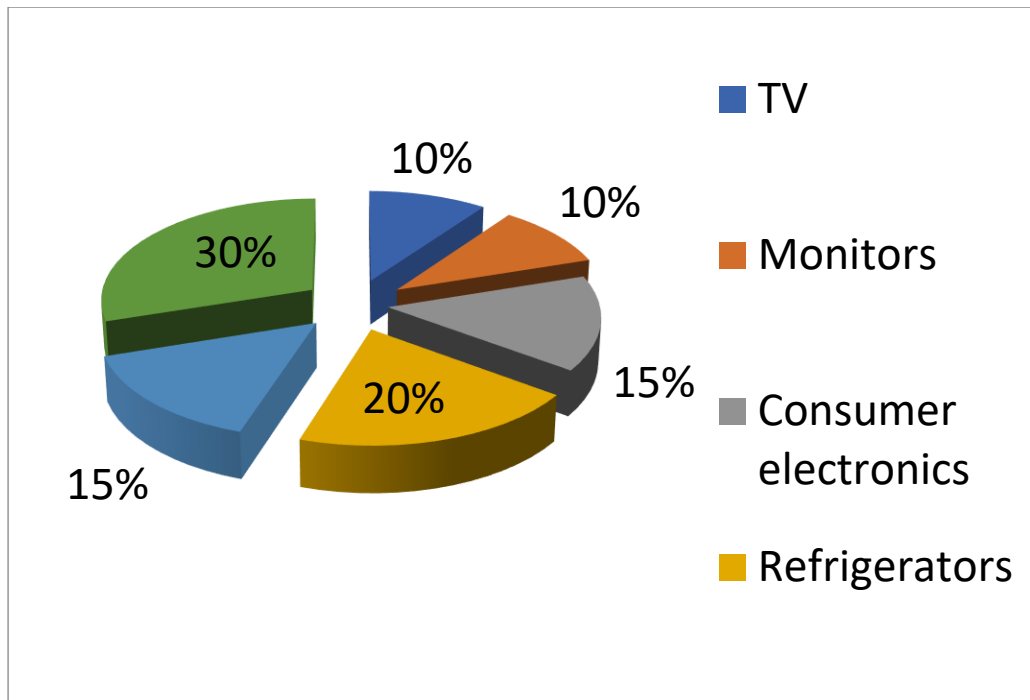
- **Toxic design:** Approx. 40% of heavy metals found in landfills come from electronic waste.
- **Financial incentives:** In e waste there are number of valuable and recyclable elements such as gold, silver etc. are present and they are not recycled properly in India.
- **Lack of regulation:** In India rules and regulation fail to fix responsibility on consumers, hence awareness is very less.
- The exponential rise in the use of the technology and its constant upgradation led to the high generation of E-waste without having necessary required infrastructure to dispose and manage E-Waste properly.
- The adverse effect of the E-waste of the environment resulting a direct impact on the humans and natural resources if not managed and disposed off properly.
- Around **95%** of India’s E-Waste is recycled by Informal sector as per Report by **World Economic Forum** on 24, january, 2019.

India's E-waste both a growing problem and an opportunity.

- This growing E-waste presents a looming environmental hazard as well as a lucrative opportunity.
- A survey conducted by the Manufacturers' Association for Information Technology (MAIT) and GTZ, the German technical collaboration agency estimated that India generated 3.3 lakh tonnes of E-waste in 2007. Additionally, another 50,000 Metric Tonnes (MT) is illegally imported to India. By 2011, E-waste generated in India is expected to touch 4.7 lakh tonnes annually.

E-Waste Composition





Source: Basel Action Network (BAN) Report, 2001

E-waste Treatment Methods:

Process	Energy reuse	Metal reclamation	Environmental impact
Shredding	Low; non-metals are landfilled	High; metals sent to smelter	High
Municipal incineration	High, as this process aims to maximize this	None, unaddressed	All toxins either released through smoke or slag
Pyro metallurgical recovery	Low, non-metals not included in scope	High	Large energy Requirements
Thermal depolymerisation	High, waste transformed into useable materials	None, unaddressed	Low, efficient process, organic toxins decomposed
Plasma arc gasification	High, waste transformed into useable materials and power	None, unaddressed	Low, efficient process, toxins decomposed
Bioleaching	Low, non-metals are landfilled	High, many metals have 90% recovery rates	Very low energy process

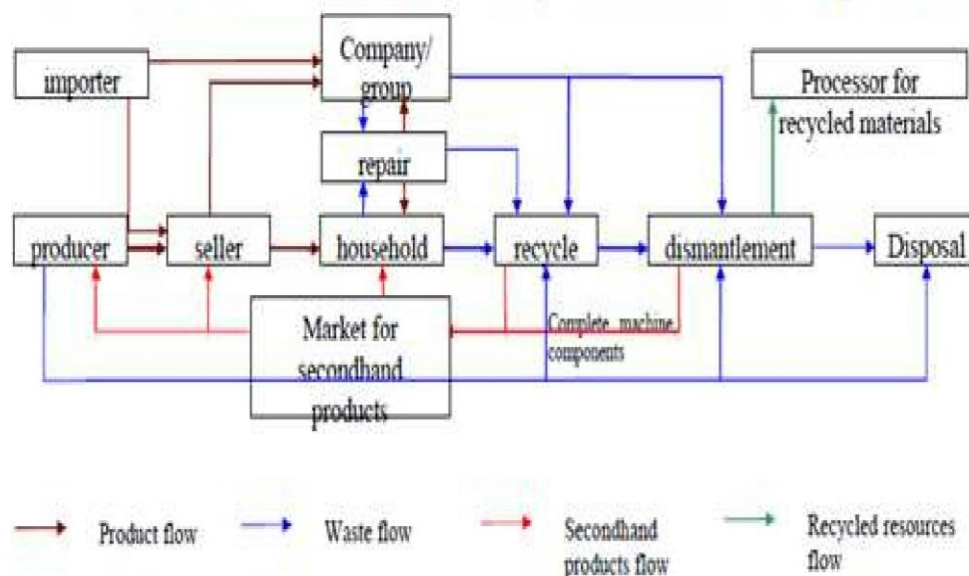
In **hydrometallurgical treatment** the main steps are acid or caustic leaching of solid material. From the solutions the metals of interest are then isolated and concentrated via processes as solvent extraction, filtration and distillation. Leaching agents are used to selectively dissolve precious metals from the mixture. Different leaching agents are used to separate different metals.

Metal	Leaching Agent
Base Metals	Nitric Acid
Gold and Silver	Cyanide or Thiosulphate
Copper	Sulphuric Acid or Aqua Regia
Palladium	Hydrochloric and Sodium Chlorate

After the solution containing metals is transported out a precipitating agent is mixed which precipitates the metal out like zinc precipitate **gold from cyanide solution**.



Flows of e-wastes recycle and disposal



Flow Diagram

RECOMMENDATIONS

- To charge **advance Recycling Fee** and a **consumer producer agreement form** to collect the used and damaged electronic waste like **Take -Back Programs**.
- To adopt effective methods for the collection and latest technology to deal with the growing problem of the E-waste effectively and efficiently.
- To research and develop more efficient methods that will make this process of E-waste management feasible by collaborating with countries like USA, Norway, China.
- To change policy in regards of E-waste management and **Amendments in E-waste (Management and Handling) Rules 2011** more stringent and effective so as to collect the electronic waste so as to dispose, recycle, reuse properly and efficiently.
- **Enhancing Producer Responsibility**: Producers take back systems should be introduced to cover the entire life cycle of Electrical and electronic equipment's, starting from their production until their disposal.
- **Introduction of ranking system** to categorize producers on basis of E waste collection efficiency to fix its responsibility and penalize it if falls short. Customers pay higher ARF to companies with lower ranks.
- **Research and Develop** to implement environment friendly recycling Infrastructures and methods.
- **Improve Quality and service life** of Electronics and Electrical Equipment's (EEE).
- **Low-cost Technology use** in view of maximum resource recovery attract excessive dumping or imports of E-waste from developed countries.
- **Ban on Imports** of E-waste.
- **Penalizing and Enforcing** prescribed and mandated methods used to collect, transport, recycle, repair, disposal process of E-waste.
- **Attract Investment** by Incentivizing in taxes break schemes.
- **Promote public awareness** programs on E-waste recycling.
- **Impart trainings** to generators of E-waste handling.
- **Reward and Reprimand schemes** for compliance and non-compliance of E-waste management Rules and Regulations guidelines.
- **Old for New Rebate Programs**.
- **Need for Dedicated Legislation**. Environment Protection Act provides for separate regulations for waste with 'Distinct' characteristics- Biomedical Wastes (M&H) Rules, 1988; Lead acid batteries, the Batteries (M&H) rules- 2001, etc.

Case Study of Different countries Policy on E-waste

E-waste Policy in the U.S.A

Currently there is no U.S. Federal mandate to recycle electronic waste; however, 25 states have enacted legislation requiring state-wide e-waste recycling. Despite state-wide recycling efforts, it is estimated that 13.6%⁹ to 26.6%¹⁰ of e-waste is recycled in the U.S. states have taken widely different approaches to recycling, some of them are:

1. California policies:

- California spearheaded the State legislative movements on e-waste recycling through the 2003 Electronics Waste Recycling Act (SB 20).
- Aims to reduce the use of hazardous substances, specifically cadmium, hexavalent chromium, lead and mercury, in certain electronics sold in California.
- Retailers to collect an Electronic Waste Recycling Fee ranging from \$6 to \$10 from consumers who purchase certain electronics with cathode ray tubes (CRT), liquid crystal display (LCD) and plasma display devices.
- Retailers are able to retain 3% of the collected fees in order to cover the costs of collection. Retailers then submit the rest of this fee to the Board of Equalization, who reimburses recycling centers and organizations, such as Green Citizen, which provide free recycling of e-waste to consumers and businesses.

2. New York Policies:

- The New York State Electronic Equipment Recycling and Reuse Act (NYSEERRA) requires manufacturers to collect and recycle or reuse their brands of products, for free for residents and small businesses.
- It is illegal for residents to discard electronics in the trash with the exception of rechargeable batteries and will be eligible for free collection through a manufacturer take-back program.
- Requires manufacturers of certain electronic equipment to establish a convenient system for the collection, handling, and recycling or reuse of discarded electronic waste.

China

The number of electronic products in use and number of e-wastes in China

- The amounts of electronic products in use: 2.1 billion sets
 - The life year for e-products is about 10-15 years in China
 - E-Waste amount generated: 79.23 million sets; about 2 million tons per year.
- Current

Status of Electronic Wastes treatment in China:

- Classification and dismantlement by hand
- Treatment on circuit board
- Treatment on electrical wires and cables
- Treatment on CRT
- Treatment on printing ink.

Norway is making strides in the area of E-waste management. Norway leads the way on electronic waste.

- While EU countries panic about whether they can meet the strict requirements of the looming WEEE directive the union's northern next door neighbour has been quietly getting on with it.
- Reports from the return systems for EE waste show that a total of 102,000 tons of EE waste was collected in Norway in 2004.
- Dealers, importers and manufacturers have, along with local authorities, been instrumental in facilitating the high collection levels for such waste.
- "This means that the goal of collecting 80 percent has been reached with a substantial margin, and that proper treatment is being secured for large quantities of hazardous substances via the return system for EE waste," said Håvard Holm, director general of the Norwegian Pollution Control Authority (SFT).
- Analysis of the figures shows wide variations in the return rates of different products. Almost all household appliances, home and office computers and lighting equipment are returned, whereas electronic toys and mobile phones are far less likely to make it back to the manufacturers.

E-waste disposal: what India can learn from Norway

Majority of brands operating in India do not have a tangible responsibility to handle waste that is generated by their goods at end-of-life stage The Central Zone bench (Bhopal) of **National Green Tribunal (NGT)** recently ordered all producers and manufactures of electrical and electronic equipment (EEE) in Madhya Pradesh, Chhattisgarh and Rajasthan to set up collection centres and take back systems for discarded electronic goods. The bench came down heavily on producers and manufacturers for failing to implement extended producer responsibility (EPR), under **E-waste rules 2011**. There is only one e-waste collection centre in the whole of Madhya Pradesh. The situation is no different for most of the states of the country. EPR is the most defining provision in the e-waste regulation of our country. According to EPR, manufacturers are responsible for the postconsumer waste of their respective EEE products. The e-waste rules were notified in 2011 and came into effect in 2012. It has been three years since the rules were notified and two years since they came into force but only a handful of companies have come forward to manage the end-of-life cycle of the products that have been put by them in the market.

CONSUMER PRODUCER AGREEMENT FORM

BAR CODE AND UNIQUE CONSUMER CODE

FORM

Consumer Producer Agreement Form

The agreement has been made between (consumers
name).....

Resident
of.....

And hereafter referred to as consumer

And

..... (Manufacturer)hereafter referred to as
manufacturer.

Terms and conditions-:

1. The device IDhas been purchased by as mentioned
consumer on _____
2. The consumer agrees to return or sell the product after its life term is
complete only to the registered recyclers as mentioned or any recycler
registered under this act.

3. The consumer allows the producer to contact the consumer after its
expected end life is complete.

4. The consumer agrees to pay a sum of____in the form of ARF (advanced
recycling fee)

For this Research Project on E-waste management:

Duration: 2 Months

Estimated Budget:

ACTIVITY	COST
<ul style="list-style-type: none">Electronic based company visit to accumulate data on the consumption of the electronic products.	₹ 300/head/visit
<ul style="list-style-type: none">Survey in Different district area of Delhi about the types of electronic product and it materialize uses, their lifetime, actions taken to dispose off the used and damaged product and their collection methods.	₹ 300/head/visit
<ul style="list-style-type: none">Research on current method used to recycle and disposing off the E-waste and its impact to the environment.	₹ Nil
<ul style="list-style-type: none">To develop a model for effective collection of E-waste.	₹ Nil
<ul style="list-style-type: none">To extrapolate the data collected and develop an efficient model for collection and extraction process.	₹ Nil
<ul style="list-style-type: none">Miscellaneous	₹ 1000
TOTAL ESTIMATED	₹ 10000-14000

PROPOSAL:

1. Site visit at the manufacturing/assembling plants for Electronics and Electrical Equipment's (EEE):
 - Components of the (EEE).
 - Data collection of the products in demands (life-period, serviceability, durability, etc.).
 - Quality and life-period of (EEE).
2. Site visit at Recycling plants/Registered Companies:
 - Methods used for Transportation, Segregation, Extraction, Recycling, Disposal, etc.
 - Problems faced during any process.
3. Site visit at vendors, shops:
 - To accumulate data on purchasing patterns.
4. Home visit to collect data based on :
 - Geographical factors like districts-wise, urban or rural, etc.
 - Spending/Purchasing capacity.
 - Methods of disposal of damaged/used old Electronic products.

These data collected, analyze and extrapolate to have a better understanding of a specified region to solve/modify the problems faced and to provide an effective and economic solution to Handle, Recycle or disposal of E-waste.

Facilities Required:

- Computing facilities for Data Extrapolation.
- To supervise the company visits.
- Data Processing and modelling.

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