



ISSN No. 0974-7087



Environmental Information, Awareness, Capacity Building and Livelihood Programme (EIACP)

Programme Centre-Hub



Department of Environment
Chandigarh (U.T.)

Supported by



Ministry of Environment,
Forest & Climate Change
Government of India,
New Delhi

THE SILENT CRISIS: E-WASTE


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Vol. 20.1.1

E-WASTE

India, as a developing nation, has and is experiencing rapid technological and industrial growth. It is evident that economic development in any country increasingly depends on machinery and technological advancements, which in turn require the widespread use of electronic devices and gadgets. This has contributed to a significant rise in the production & consumption of electronic & electrical products. Consequently, the generation of electronic waste (e-waste) has also increased considerably.

E-waste stands for Waste Electrical and Electronic Equipment (WEEE) and is defined as any electrical or electronic equipment-fully or partially discarded by consumers or bulk users-as well as items rejected during manufacturing, repair, or refurbishment. Since our daily lives depend heavily on electronic gadgets, the amount of e-waste will continue to grow, creating serious challenges for proper waste management and environmental protection.

CAUSES OF RAPID E-WASTE GENERATION

- **Fast economic and industrial growth** has made electronic devices cheaper and more easily available, leading to an increase in their purchase and disposal.
- **Rapid technological advancements** encourage people to upgrade their devices frequently. Many gadgets are thrown away not because they stop working, but because newer models or updated software make older ones seem outdated.
- **Changing consumption patterns**, rising incomes, and urban lifestyles have created a trend of quickly replacing gadgets. This high rate of obsolescence increases e-waste generation.
- **Population growth**, especially the rise in mobile phone users across all income groups, contributes to large volumes of discarded electronics.
- **Educational Technology** The shift in education towards digital tools like smartboards and smart classrooms is reshaping study patterns. While these technologies improve learning, they also lead to a rise in electronic waste (e-waste), as older devices are quickly discarded, posing environmental challenges.
- **Low public awareness** about proper e-waste disposal and existing laws worsens the problem. Even in big cities, people often lack knowledge about safe disposal practices, showing the need for better awareness and enforcement
- **Shift towards greener technology-** With the evolving environmental landscape, it is evident that there is a growing

shift towards greener technologies, such as solar and wind energy, to meet energy demands and reduce reliance on fossil fuels. However, this transition also contributes to the increased production and generation of electronic waste (e-waste).

E-WASTE COMPOSITION

E-waste contains a mix of useful and harmful materials, which is why it needs special care during handling and recycling. Most of the weight of e-waste (over 80%) comes from common materials like iron, aluminium, plastics, and glass. Although valuable and hazardous materials are present in smaller amounts, they are extremely important.

In general, iron and steel (ferrous materials) make up about 50% of e-waste, followed by plastics (21%), non-ferrous metals (13%), and other materials (source: CUI J., ZHANG L., Metallurgical recovery of metals from electronic waste. A review, J. Hazard. Mater., 2008, 158, 228). Precious metals such as gold, silver, copper, and platinum are also found in e-waste, making recycling a profitable and resource-saving activity.

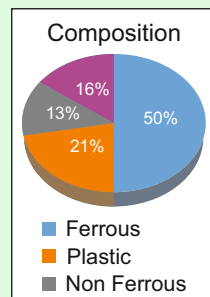
At the same time, e-waste contains many toxic substances and heavy metals that can be dangerous to human health and the environment if not handled properly. Harmful chemicals like Poly Chlorinated Biphenyls (PCB) are found in transformers and condensers, while flame-retardant chemicals such as Tetrabromobisphenol A (TBBA), Poly Brominated Biphenyl's (PBB), and Polybrominated diphenyl ethers (PBDEs) are commonly used in plastics, wires, and circuit boards. CFCs are present in cooling equipment and insulation, and PVC is widely used in cable coverings. Heavy metals including arsenic, barium, beryllium, cadmium, lead, lithium, mercury, and nickel can leak into the environment, causing serious health and environmental problems.

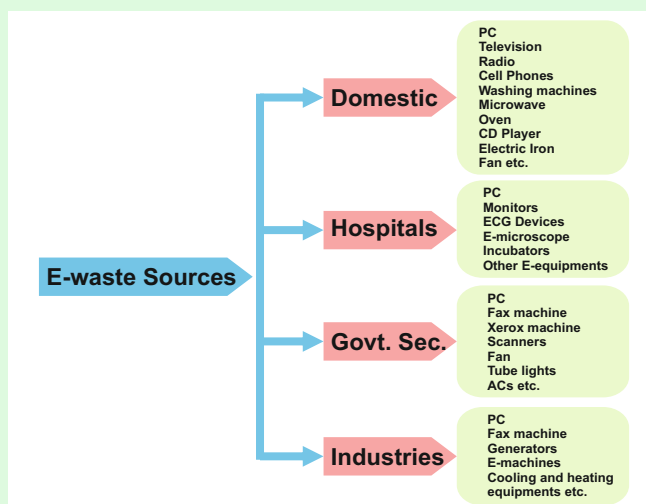
CATEGORIES OF ELECTRICAL AND ELECTRONIC EQUIPMENT

(As per E-Waste Management Rules, 2022 as per schedule 1)

1. Information Technology (IT) and Telecommunication Equipment

Includes centralized data processing systems, personal computers, mainframes, minicomputers, user terminals, printers, telephones (including cordless phones), tablets, phablets, inverters, modems, fax machines, and other similar devices.





2. Consumer Electrical, Electronics & Photovoltaic Panels

Includes televisions (LED/LCD), refrigerators, washing machines, air conditioners (excluding centralized AC plants), set-top boxes, digital cameras, solar panels/solar PV modules and cells.

3. Large and Small Electrical and Electronic Equipment

Includes large cooling appliances, freezers, clothes dryers, dishwashers, electric cookers, stoves, hot plates, microwave ovens, electric kettles, and indoor air purifiers.

4. Electrical and Electronic Tools

Includes drills, saws, sewing machines, welding tools, soldering tools, and similar equipment.

5. Toys, Leisure, and Sports Equipment

Includes electrical toy trains, car racing sets, handheld video games, and similar recreational electronics.

6. Medical Devices

Includes radiotherapy equipment, cardiology devices, dialysis machines, pulmonary ventilators, and their accessories.

7. Laboratory Instruments

Includes gas analysers and other laboratory equipment containing electrical or electronic components.

IMPACTS OF E WASTE

Electronic waste (e-waste) poses serious threats to both human health and the environment. Rapid technological advancement and improper e-waste management have intensified these risks, making e-waste a major global hazard. The two most significantly affected areas are environmental quality and human well-being.

1. Effects on Human Health

Exposure to toxic substances released from e-waste has led to severe health consequences. Studies show that dioxin levels in air can exceed the World Health Organization's recommended limits by 15 to 56 times. Elevated concentrations of dioxins have been detected in human milk, placentas, and hair, indicating widespread exposure through air, water, and food (Robinson, 2009). As e-waste generation continues to rise, so do associate health risks.

Human exposure occurs primarily through ingestion, inhalation, and skin contact, resulting in numerous illnesses. Hazardous components found in e-waste—such as arsenic, asbestos, lead, mercury, cadmium, brominated flame retardants, and polychlorinated biphenyls—are linked to damage to the nervous, respiratory, reproductive, immune, and endocrine systems. Long-term exposure can lead to chronic diseases including cancer, organ failure, bone damage, hormonal disorders, and developmental defects.

Overall, the increasing volume of improperly managed e-waste represents a growing public health concern, emphasizing the urgent need for effective e-waste control and safer recycling practices.

2. Air Pollution:

When e-waste is burned or broken down improperly, it releases harmful dust particles and chemicals like dioxins into the air. These pollutants can cause respiratory problems and increase the risk of serious diseases like cancer and tumours, especially for people who handle e-waste. As a result, air pollution continues to rise, leading to long-term harm to the environment.

3. Soil Pollution:

E-waste dumped in landfills or illegally disposed of can leak heavy metals and toxic chemicals into the soil. These contaminants can harm crops and make soil unsafe for farming. Over time, this reduces agricultural productivity and can threaten local wildlife and ecosystems.

4. Water Pollution:

Heavy metals from e-waste can also seep into the groundwater, eventually reaching rivers, lakes, and ponds. This causes water to become acidic & toxic, which harms aquatic life & makes it difficult for communities to find safe drinking water. The pollution can spread far from the recycling sites, impacting both the environment and human health.

INDIA E-WASTE STATISTICS

India is currently the third-largest generator of e-waste in the world, ranking just after China and the United States. Rapid growth in technology use, increasing consumer demand, and shorter lifespans of electronic products have significantly contributed to this rise.

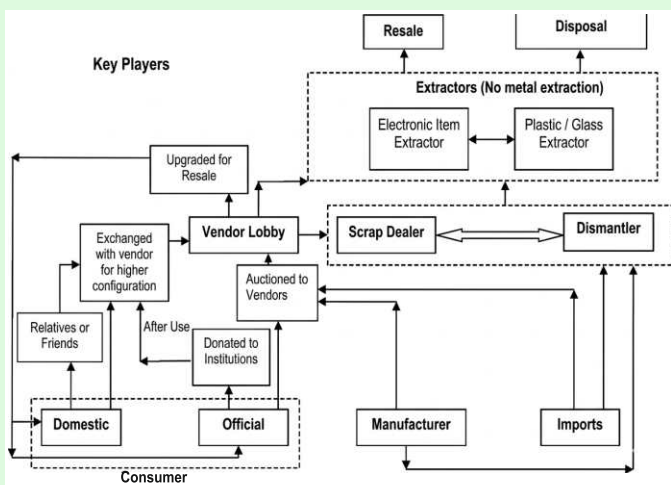
RAPID INCREASE IN E-WASTE GENERATION

India's e-waste generation has grown sharply by around 73% over the last five years. In 2021–22, the country generated approximately 1.6 million metric tonnes (MT) of e-waste. According to UN these figures are likely to increase in the coming years.

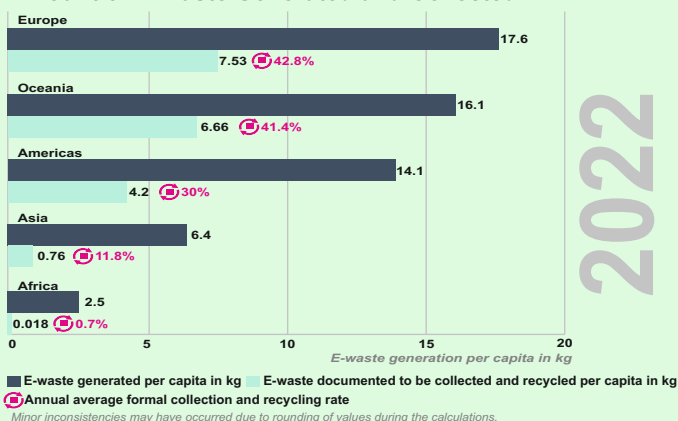
Data from the Central Pollution Control Board (CPCB) shows significant improvement in the formal collection and processing of e-waste, mainly due to stricter regulations and the implementation of Extended Producer Responsibility (EPR). During FY 2023–24, about 61.94% (Source: <https://www.downtoearth.org.in/waste/indias-e-waste-surges-by-73-in-5-years>) of e-waste was formally collected, dismantled, and recycled or disposed of safely. This figure is projected to rise further, reflecting progress in organized recycling infrastructure.

ONGOING CHALLENGES OF THE INFORMAL SECTOR

Despite these improvements, the informal or unorganized sector continues to pose a major challenge. In the past, over 95% of India's e-waste was managed by informal workers using unsafe and environmentally harmful methods. Such practices often result in the release of toxic substances, leading to serious health risks for workers and environmental pollution.

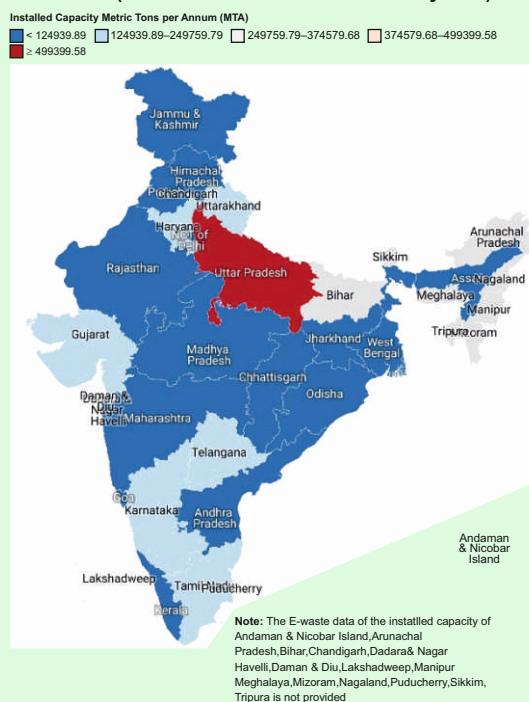


Amount of E-Waste Generated and Collected



(Source- The global E waste Monitor 2024)

India: 2023 (E-waste status of dismantlers/recyclers)

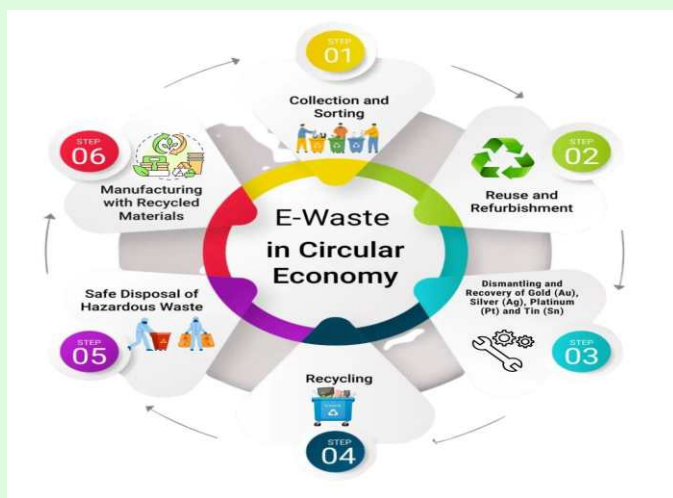
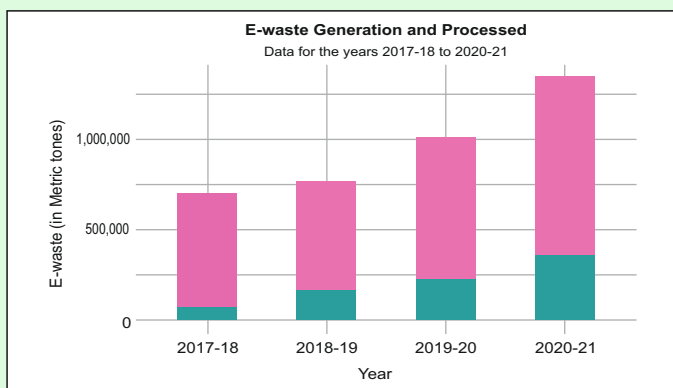


(source: <https://www.sciencedirect.com/science/article/pii/S294975072300024X>)

RECYCLING OF E-WASTE

Recycling waste electrical and electronic equipment (WEEE) is challenging because e-waste contains a complex mix of plastics, metals, chemicals & other materials. To manage this safely and sustainably, modern collection & treatment systems are needed, along with advanced technologies to recover valuable metals.

Today, some of the commonly used eco-friendly and cost-effective recycling methods include **hydrometallurgy**, **pyrometallurgy**, **electrochemical processes**, **mild extraction**, and **vacuum-based technologies**. These methods mainly focus



on recovering valuable metals, while materials that cannot be recycled often receive less attention.

The **technical process of e-waste recycling** generally involves:

- 1. Collection** – Gathering discarded electronic items from homes, offices, and industries.
- 2. Pre-processing**
 - Separating different materials based on their type.
 - Disassembling items to remove harmful or useful parts like batteries.
 - Upgrading materials using mechanical techniques to prepare them for refining.
- 3. End Processing**
 - Refining and recycling materials to turn them into usable secondary raw materials.
 - Incinerating or disposing of the parts that cannot be recycled or reused.

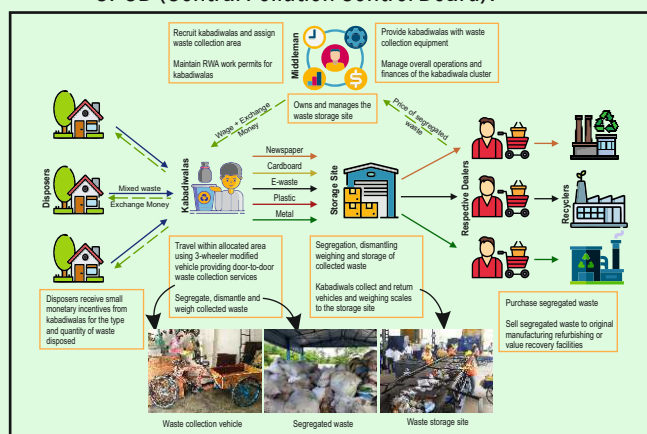
Overall, effective e-waste recycling ensures valuable resources are recovered while reducing environmental harm from toxic waste.

The **E-Waste (Management & Handling) Rules, 2022** were published in 2022 and came into force from 1st April 2023. These rules were introduced to manage the growing concern of e-waste in India and to give stakeholders time to prepare the necessary infrastructure for their implementation.

Key Highlights:

1. Applicability:

- These rules shall apply to every manufacturer, producer refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, refurbishing, dismantling, recycling and processing of e-waste or electrical and electronic equipment listed in Schedule I, including their components, consumables, parts and spares which make the product operational
- Regulatory bodies include SPCBs/PCCs (State Pollution Control Boards/ Pollution Control Committees) and CPCB (Central Pollution Control Board).



2. Exemptions: The rules do not apply to:

- ❖ **waste batteries as covered under the Battery Waste Management Rules, 2022**
- ❖ **packaging plastics as covered under the Plastic Waste Management Rules, 2016**
- ❖ **micro enterprise as defined in the Micro, Small and Medium Enterprises Development Act, 2006 (27 of 2006)**
- ❖ **radio-active wastes as covered under the provisions of the Atomic Energy Act, 1962 (33 of 1962) and rules made there under.**

RESPONSIBILITIES

1) Responsibilities of the manufacturer :- All manufacturers shall:

- Register on the portal.
- Collect e-waste generated during the manufacture of electrical and electronic equipment and ensure its recycling or disposal.
- File annual and quarterly returns in the prescribed form on the portal by the end of the month following the relevant quarter or year.

2. Responsibilities of the Producer:- Producers of electrical and electronic equipment listed in Schedule I shall:

- Register on the portal.
- Obtaining and implementing Extended Producer Responsibility (EPR) targets as per Schedule III and IV through the portal.
- Creating awareness through media, publications, advertisements, posters, or other communication methods.
- File annual and quarterly returns in the prescribed form on the portal by the end of the month following the relevant quarter or year.

3. Responsibilities of the Recycler:- All recyclers shall:

- Register on the portal.
- Ensure facilities and recycling processes comply with standards or guidelines issued by the Central Pollution Control Board.
- Send fractions or materials not recycled in their facility to respective registered recyclers.
- Dispose of recycling residues in an authorised treatment, storage, and disposal facility.
- Maintain records of e-waste collected, dismantled, recycled, and sent to registered recyclers on the portal, and make records available for verification or audit when required.
- File annual and quarterly returns in the prescribed form on the portal by the end of the month following the relevant quarter or year.
- Accept waste electrical and electronic equipment or components not listed in Schedule I for recycling, provided they do not contain radioactive material, and upload details on the portal.

- Create awareness through media, publications, advertisements, posters, or other communication methods

4. Simple Ways to Dispose of E-Waste Responsibly in India

A. Be a responsible buyer:

Before buying new electronic items, check their quality and durability. Avoid products that may stop working quickly, as they add to waste.

B. Reuse and recycle:

Instead of buying new gadgets, try to reuse or recycle old electronic items. Recycling helps reduce pollution and protects the environment.

C. Know your devices:

Understanding what materials are used in electronic products helps you make better and eco-friendly choices while buying.

D. Choose eco-friendly products:

Look for labels like Energy Star when buying electronics, as these products consume less energy and are better for the environment.

E. Avoid unnecessary purchases:

Do not buy gadgets unless you really need them. Too many unused devices lead to hoarding and more e-waste.

F. Repair instead of replacing:

Repairing electronic items is often cheaper than buying new ones. Simple repairs can extend the life of your devices.

G. Protect personal data:

Before disposing of old electronics, remove all personal data. The safest option is to hand them over to a certified e-waste recycling company.

H. Organise unused gadgets:

Sell, donate, or recycle devices you no longer use instead of storing them at home.

I. Locate recycling centres:

Find nearby e-waste collection or recycling centres to dispose of electronics responsibly.

J. Use cloud storage:

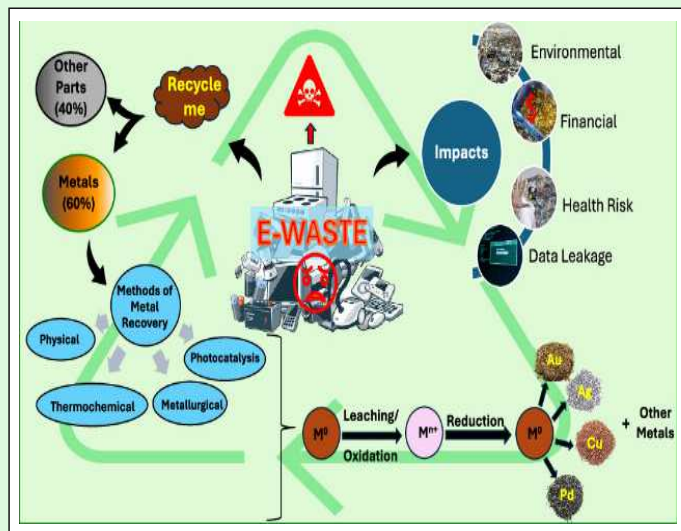
Store data online instead of buying extra storage devices to reduce electronic waste.

K. Return devices to stores:

Many electronic stores now offer take-back or recycling programs. Ask store staff about such options. Eg- Cashify, e-commerce sites.

L. Take care of your devices:

Regular maintenance, like cleaning and proper charging, can increase the lifespan of electronic products & reduce waste.



KEY STRATEGIES ADOPTED BY CHANDIGARH POLLUTION CONTROL COMMITTEE FOR RESPONSIBLE E-WASTE MANAGEMENT

CPCC has implemented several "best practice" strategies to ensure that e-waste is diverted from landfills and handled by authorized agencies.

- Awareness Sessions:** E-waste awareness sessions are being conducted in schools, colleges, and RWAs to educate the public on the detrimental impacts of informal disposal (through unorganized scrap dealers) and to promote management through the formal, authorized sector.
- 15-Day Collection Drive:** A special 15-day e-waste collection drive from 03.01.2026 is being conducted to cover all sectors of Chandigarh, with the Global Youth Federation and Karo Sambhav operating a dedicated mobile van collection service to ensure safe and scientific recycling. For specialized assistance, citizens can reach the Toll-Free Number: 1800-2121-434 or contact 9878551489 and 9779476624.

- CPCC is continuously working to include more collection agencies to improve the frequency and timeliness of e-waste pickups. By expanding the network, the city aims to eliminate the "last mile" barrier that often leads people to sell e-waste to the informal sector.



List of authorised E waste recyclers in Chandigarh

List of Authorised Collection Points for Disposal of E-Waste under E-Waste Management Rules

S.No	Name of Collection Point	Address	Contact No.
1.	Ortech India Corporation	SCO 2901-2902, 1st Floor, Cabin No. 3, Sector 22-C, Chandigarh	9317009000
2.	Karo Sambhav (Partner)	Plot NO. 90/3, Near Bus Stand, Vill. Khuda Ali Sher Chandigarh	9596100677

Conclusion- E-waste recycling plays a crucial role in safeguarding the United Nations' Sustainable Development Goals (SDGs) by promoting environmental sustainability, reducing pollution, and conserving valuable resources. By properly recycling electronic waste, we prevent harmful substances like lead, mercury, and cadmium from contaminating ecosystems and human health, directly supporting SDG 3 (Good Health and Well-being) and SDG 12 (Responsible Consumption and Production). Additionally, e-waste recycling recovers valuable materials such as gold, silver, and copper, reducing the need for mining and supporting SDG 8 (Decent Work and Economic Growth) by creating green jobs. Overall, it contributes to a circular economy, helps reduce carbon emissions, and advances SDG 13 (Climate Action).

SDG'S RELATED TO AGRICULTURE AND ALLIED SECTORS



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