





E-Waste Management in India



- **What is e-waste?**
- Electronic waste, or e-waste, is a term for electronic products that have become unwanted, obsolete, and have reached the end of their useful life.
- It refers to all items of electrical and electronic equipment (EEE) and its parts that have been discarded by its owner as waste without the intent of re-use.

E-Waste -The magnitude of the problem

The Global E-waste Monitor 2020

A record 53.6 million metric tonnes (Mt) of electronic waste was generated worldwide in 2019, up 21 per cent in just five years, according to the UN's Global E-waste Monitor 2020,

The new report also predicts global e-waste - discarded products with a battery or plug - will reach 74 Mt by 2030, almost a doubling of e-waste in just 16 years.

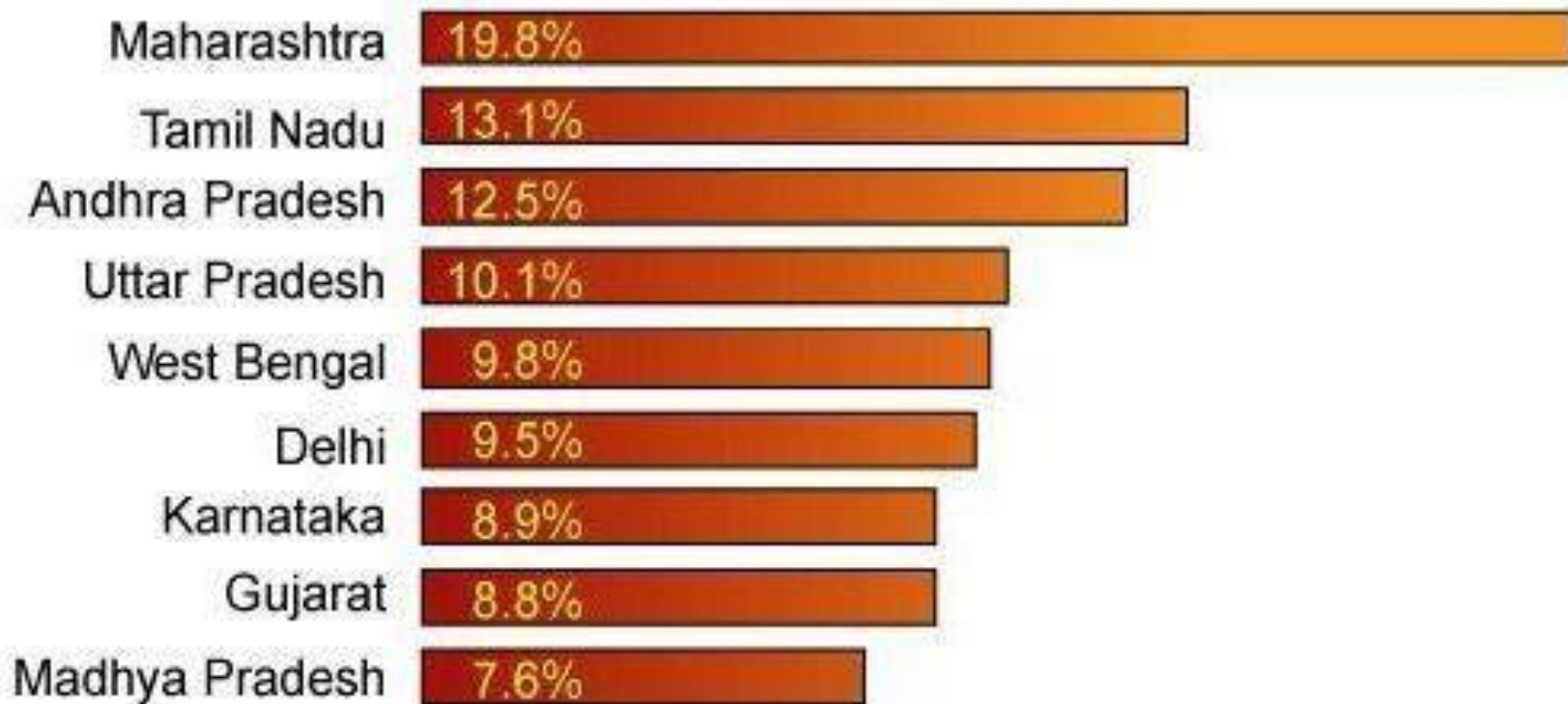
Only 17.4 per cent of 2019's e-waste was collected and recycled. This means that gold, silver, copper, platinum and other high-value, recoverable materials conservatively valued at US \$57 billion -- a sum greater than the Gross Domestic Product of most countries -- were mostly dumped or burned rather than being collected for treatment and reuse.

According to the report, Asia generated the greatest volume of e-waste in 2019 — some 24.9 Mt, followed by the Americas (13.1 Mt) and Europe (12 Mt), while Africa and Oceania generated 2.9 Mt and 0.7 Mt respectively.

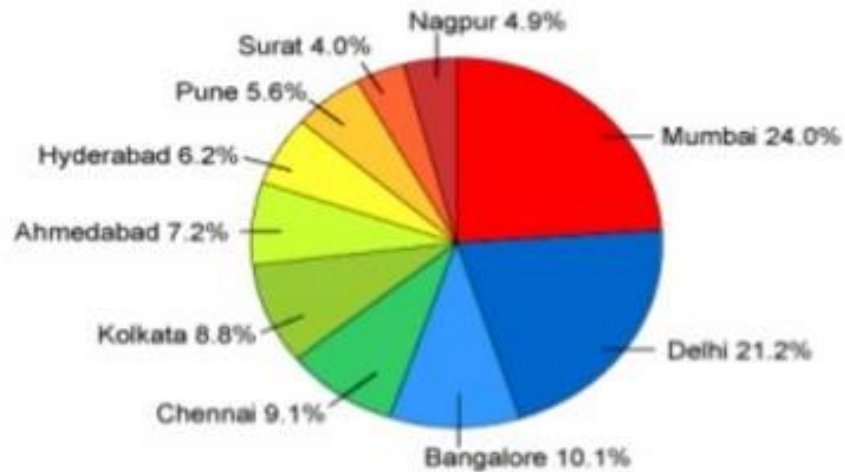


•India generates about 3 million tonnes (MT) of e-waste annually and ranks third among e-waste producing countries, after China and the United States. Reports state that it might rise to 5 million tonnes by 2021.

- Maharashtra is the biggest contributor to e-waste generation followed by Tamil Nadu and Uttar Pradesh
 - The government has reported that the **recycling rate of 10% in 2017-18 has risen to 20% in 2018-19.**



State-wise E-waste Generation in India (Tonnes/year)



City-wise E-waste Generation in India (Tonnes/year)

Exponential growth of e-waste



Particulars	Source	Health Effects
Lead	- Used in glass panels and in computer monitors - Solder in printed circuit boards and other Components	Lead tends to accumulate in the environment and has high acute and chronic effects on plants, animals and microorganisms.
Cadmium	- Occurs in chip resistors, infra-red detectors, and semiconductor chips - Some older cathode ray tubes contain cadmium	Toxic cadmium compounds accumulate in the human body, especially the kidneys.
Mercury	- It is estimated that 22 % of the yearly world consumption of mercury is used in electrical and electronic equipment - Mercury is used in thermostats, sensors, relays, switches, medical equipment, lamps, mobile phones and in batteries - Mercury, used in flat panel displays, will likely increase as their use replaces cathode ray tubes	- Mercury can cause damage to organs including the brain and kidneys, as well as the foetus. - When inorganic mercury spreads out in the water, it is transformed to methylated mercury which bio-accumulates in living organisms and concentrates through the food chain, particularly via fish.

Hexavalent Chromium/ Chromium VI 29	- Chromium VI is used as corrosion protector of untreated and galvanized steel plates and as a decorative or hardener for steel housings - Plastics (including PVC): Dioxin is released when PVC is burned. - The largest volume of plastics (26%) used in electronics has been PVC. PVC elements are found in cabling and computer housings. - Many computer mouldings are now made with the somewhat more benign ABS plastics	Chromium VI can cause damage to DNA and is extremely toxic in the environment.
Barium	Barium is used in computers in the front panel of a CRT, to protect users from radiation	Studies have shown that short-term exposure to barium causes brain swelling.
Beryllium	- Beryllium is commonly found on motherboards and finger clips - It is used as a copper-beryllium alloy to strengthen connectors and tiny plugs while maintaining electrical conductivity	- Exposure to beryllium can cause lung cancer. - Beryllium also causes a skin disease.

Toners

- Found in the plastic printer cartridge containing black and colour toners.
- Inhalation is the primary exposure pathway, and acute exposure may lead to respiratory tract irritation. Carbon black has been classified as a carcinogen, possibly carcinogenic to humans.

Phosphor and additives

- Phosphor is an inorganic chemical compound that is applied as a coat on the interior of the CRT faceplate.
- The phosphor coating on cathode ray tubes contain heavy metals, such as cadmium, and other rare earth metals, for example, zinc, vanadium as additives. These metals and their compounds are very toxic.

- Environmental and health impact of E-waste
- Impact on Human Health:
- Pollutants, their sources and effects on human health

Pollutant	Sources	Effect
Arsenic	Semiconductors, diodes, microwaves, LEDs, solar cells	Black-foot disease
Barium	Electron tubes, filler for plastic and rubber, lubricant additives	neurodegenerative diseases, lung diseases
Cadmium	Batteries, pigments, solder, alloys, circuit boards, computer batteries	Contain Carcinogens; causes Itai-Itai disease which affects kidneys and softens bones
Cobalt	Insulators	cause asthma

Pollutant	Sources	Effect
Lead	Lead rechargeable batteries, solar, transistors, lithium batteries, PVC	chronic kidney disease, neurological problems
Lithium	Mobile telephones, batteries	mental illnesses
Mercury	Components in copper machines and steam irons, batteries in clocks and pocket calculators, switches, LCDs	Affects the central nervous system, kidneys and immune system; causes Minamata disease
PCBs (polychlorinated biphenyls)	Transformers, capacitors, softening agents for paint, glue, plastic	Cardiovascular diseases, neurobehavioral and immunological changes in children

Pollutant	Sources	Effect
Silver	Capacitors, switches (contacts), batteries, resistors	Inhalation of silver dust can cause respiratory problems
Zinc	Steel, brass, alloys, disposable and rechargeable batteries, luminous substances	Metal fume fever, respiratory diseases

Environmental Impact

Air

- E-waste when dismantled and shredded, release dust or large particulates into the immediate environment and affects the respiratory health of workers.
- Further, unregulated burning of e-waste releases toxins which are potent and damaging to both human (neurological disease and impact on immune system) and animal health.

Water

- Water is contaminated by e-waste via landfills that are not properly designed to contain e-waste and due to improper recycling and subsequent disposal of e-waste.
- Heavy metals from e-waste cause toxification of surface water.

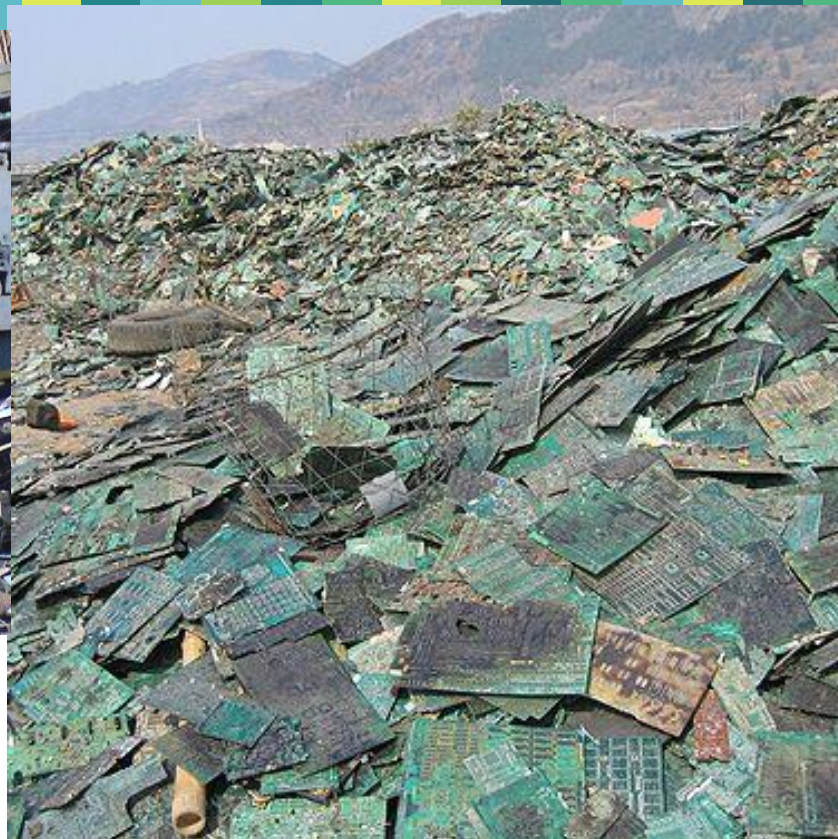
- Ground water is polluted by e-waste as heavy metals and other persistent chemicals leach from landfills and illegal dump sites into ground water tables.

Soil:

- Soil is contaminated by e-waste through direct contact with contaminants from e-waste or the byproducts of e-waste recycling and disposal and indirectly through irrigation through contaminated water.
- Contaminated soils have adverse impact on microbes and plants and the pollutants pass to higher animals and humans along the food chain.

Guiyu-China: Case Study

- Guiyu in China is major hub for the disposal of e-waste and is widely considered to be the largest e-waste disposal site in the world.
- Guiyu receives shipments of e-waste, both from domestic sources and from other countries. According to U.N. report "E-Waste in China," Guiyu suffered an "environmental calamity" as a result of the wide-scale e-waste disposal industry in the area.
- Unregulated and improper management of e-waste in the region has caused tremendous damage to the environment and pose a great threat to human health in the region.



International Conventions

- **1. Basel Convention on the Control of the Trans-boundary Movement of Hazardous Waste, 1992** (entered into force)
- Originally the Basel Convention did not mention e-waste but later it addressed the issues of e-waste in 2006
- The convention seeks to ensure environmentally sound management
- Prevention of illegal traffic to developing countries
- Building capacity to better manage e-waste.
- It aimed at creating innovative solutions for the environmentally sound management of electronic wastes.
- **2. Rotterdam Convention, 2004**
- The Convention seeks to promote exchange of information (through Prior Informed Consent) among Parties over a range of potentially hazardous chemicals (includes pesticides and industrial chemicals) that may be exported or imported.

Programmes

- **1. Awareness Program on Environmental Hazards of Electronic Waste**
- The project initiated by Ministry of Electronics and Information Technology aims to provide training,
- Tools and films aimed at creating awareness and reducing the impact of e-waste on the environment and health.
- **2. Creation of Management Structure for Hazardous Substances**
- The programme seeks to raise awareness among people about the 2016 Rules and its implementation.
- **3. Swachh Digital Bharat**
- The programme seeks to create awareness among the public about the hazards of e-waste recycling by the unorganised sector,
- To educate them about alternate methods of disposing of their e-waste.

- The general public is encouraged to participate in the programme, by giving their e-waste to authorised recyclers only.
- **4. Greene**
- It is a dedicated website which seeks to spread awareness about e-waste through social media

E-Waste Disposal and Recycling Practices in India

- **Unorganized sector/ Informal:**
- Around 90% of the recycling of E-Waste in India is done by the non-formal/unorganized sector.
- Non-formal units of e-waste recyclers are distributed all over India.
- Informal units generally follow the steps such as collection of the e-waste from the rag pickers, disassembly of the products for their useable parts, components, modules, which are having resell value.
- The rest of the material is chemically treated to recover precious metals and non-recoverable materials are disposed in landfills
- **Organized /Formal:**
- Organized recycling units are very few in India. Unlike the informal sector, the organized sector uses environmentally sound methods to recycle e- waste

Issues and Challenges

- **1. Lack of formal infrastructure:**
- There is huge gap between present recycling and collection facilities and quantum of E-waste that is being generated.
- There is no proper collection and take back mechanism.
- **2. Imports:**
- Cross-border flow of waste equipment into India is a major issue.
- India has been the destination of the hazardous and industrial wastes like mercury, electronic and plastic wastes from the United States, asbestos from Canada, defective steel and tin plates from the E.U., Australia and the U.S, zinc ash, residues, lead waste and scrap, used batteries etc. from European nations.

- Loopholes in legislations, porous ports and lack of checking facilities are major reasons for uncontrolled e-waste imports
- **3. Issues with informal sector:**
- **Child Labour:** According to ASSOCHAM report more than 4.5 lakh child labourers are observed to be engaged in various E-waste activities and that too without adequate protection and safeguards.
- **Occupational Health Hazard:** Unscientific method of recycling and lack of proper safety gear pose serious health hazard to those employed in the informal sector.
- **4. Gaps in Legislation:**
- E-waste rules are also violated at a regular basis and the informal sector remains unregulated.

Who gets the trash?

Sources: Basel Action Network, Silicon Valley Toxics Coalition, Toxics Link India, SCOPE (Pakistan), Greenpeace China, 2002.
NB: the arrows' thicknesses are not proportional to the traffic.



- Further, the responsibility of producers is not confined to waste collection, but also to ensure that the waste reaches the authorised recycler.
- There is no mechanism to ensure that the waste collected by producers has gone to unauthorised recyclers.
- **5. Lack of incentives:**
- There is a lack of incentive schemes to encourage people to adopt a formal path of recycling.
- The GST imposed a huge 12% tax on electronic recyclers which has further proven to be deterrent to formal recycling

- **6. Poor awareness and sensitization:**

- There is limited awareness regarding disposal, after determining end of useful life. Further, the lack of awareness leads to poor segregation of waste.

- **7. Environmental concerns:**

- Informal recycling and dumping of e-waste in landfills or burning of e-waste pose a severe danger to the environment and has far-reaching on animal and human health

• Best Practice

- *'Take-back' and Planet ke Rakhwale campaign- Nokia:*
- Nokia began its e-waste management campaign in 2009.
- Nokia set up drop boxes across the country to take back used phones, chargers and accessories, irrespective of the brand, at Nokia Care Centres.
- The campaign was a great success and the total quantity of mobile phones and accessories collected from this campaign from 2009 to 2015 was 160 tonnes.
- In the second phase (2009), Nokia launched "Planet KeRakhwale" take-back and recycling campaign which extended to 28 cities across India.

- **Green Warriors -Telangana:**
- "Green Warriors" in Telangana have been a part of the recycling/refurbishing chain, and has contributed towards the successful implementation of measures to control e-pollution.
- Their efforts have also been recognized by the Telangana government in its Telangana e-waste management policy, 2017

Way Forward

- 1. There is a need to strengthen the domestic legal framework to address the issue of unregulated imports of e-waste
- 2. Steps should be taken to formalize the informal sector by integrating it with the formal sector.
- Government should introduce vocational training programs to rightly skill the current unorganized sector employees to ensure their smoother transition to working with organized sector.
- 3. Governments must encourage research into the development of better environmentally sustainable e-waste recycling techniques
- 4. There is urgent need for a detailed assessment of the E-waste including characteristics, existing disposal practices, environmental impacts.

- 5. There is need of more recycling facilities and development of infrastructure to handle ewaste effectively.
- The government should encourage Public-Private Partnership for establishment of e-waste collection, exchange and recycling centres.
- 6. There is need of an effective take-back program providing incentives to producers.
- 7. Mass awareness programmes should be initiated to encourage consumers to reuse/ recycle electronic products and also educate them about the environmental and health hazards of e-waste.

•Management of E-waste:

- **Producers:**

- The government has implemented the **E-waste (Management) Rules (2016)** which enforces the **Extended Producer Responsibility (EPR)**.
- Under EPR principle the producers have been made responsible to collect a certain percentage of E-waste generated from their goods once they have reached their “**end-of-life**”.

- **State Governments:**

- They have been entrusted with the responsibility for maintaining industrial space for e-waste dismantling and recycling facilities.
- They are also expected to establish measures for protecting the health and safety of workers engaged in the dismantling and recycling facilities for e-waste.

•Recycling of E-waste:

- Most of India's **e-waste is recycled by the informal sector and under hazardous conditions.**
- A report by the Union Environment Ministry in 2018 found that many of India's e-waste recyclers didn't have the capacity to **handle a large quantity of waste.**
- **India's first e-waste clinic** for segregating, processing and disposal of waste from household and commercial units will soon be set-up in **Bhopal, Madhya Pradesh.**

E-Waste (Management) Amendment Rules, 2018

- E-Waste Management Rules, 2016 were amended by the Environment ministry.

Amended Rules

- It introduced the provision of registration of Producer Responsibility Organisation (PRO) with Central Pollution Control Board (CPCB).
- E-Waste collection targets have been mentioned in the rules
- It also introduced the Extended Producer Responsibility (EPR) targets for producers.
- The Central Pollution Control Board (CPCB) may conduct random sampling of electrical and electronic equipment placed in the market.
- Financial penalties can be levied by State Pollution Control Board with the prior approval of the CPCB.
- Penalties can be levied on the manufacturer, producer, importer, transporter, refurbisher, dismantler and recycler.