E-Waste Recycling Best option for Mineral Substitution and Environmental Protection – P. Parthsarathy and Keshav A.Bulbule, E-Parisaraa, Bengaluru. *(E-mail:kabulbule@gmail.com)*

Waste Electrical and Electronic Equipments (WEEE) or E-waste is the fastest growing waste stream all over the world. Minerals form the basis of the industrial development of any country. One cannot imagine electronic devices without the consumption of huge amounts of metals and nonmetals which themselves are derived from naturally occurring finite, nonrenewable minerals.

A conservative estimation indicates that in India 3 million tons of E-waste is generated annually, with Maharashtra leading in E-waste generation at an annual increase rate of 19.8% and Madhya Pradesh with lowest annual rate of 7.6%.

E-waste is not hazardous but unscientific recycling of E-waste is not only pollutes soil, water and air but also leads to loss of resources. Solid waste management has been a burning problem in cities especially mixed with lamp waste. Incandescent lamp waste mainly contains non-biodegradable glass whereas fluorescent lamps and CFL waste once broken cause soil, water air pollution due to the release of several chemicals including mercury.

Traditional mining involves survey for mineral deposits, excavation, exploration, usual metallurgical operations like ore dressing, extraction of crude metal either by pyrometallurgy or by hydrometallurgy, followed by refining to get pure metal. Unfortunately mineral deposits are finite and non-renewable. But, in the light of unbelievable advancement in the field of information and technology demand for metals has become an ever increasing phenomenon. The best way to substitute minerals/metals is by practicing scientific and environmentally sound methods of recycling E-waste by urban mining/ surface mining/green metallurgy.

Urban mining is a process of reclaiming raw materials from products, buildings and waste from towns, cities and metropolitan areas. Recycling and disposal of electronic waste in developing countries is gaining importance not only due to the recovery of resources hidden in them but also due to impact on the environment.

Perhaps first time in India, environmentally sound methods practiced at *E-Parisaraa* (India's first approved E-waste recycling facility) on recycling of recycling E-waste and lithium-ion batteries (LIBs) used as a source of energy for mobile phones, telecom towers, laptops, cameras and other hand held devices etc. are found to contain recyclable metals like cobalt, nickel, copper, aluminum and polymer. Neodymium magnets used extensively in the memory storage devices like hard discs, speakers, etc have been good source of Nd. Recovery of metals like cobalt, nickel, and neodymium etc from E-waste gain immense importance as the corresponding mineral deposits are not abundantly found in India.

As per available statistics, in Bengaluru city alone 3 million fluorescent lamps (FLS) per annum reach their end of life. If all these are subjected for scientific recycling, they substitute for minerals as shown in the following table

Sl. no	Savings from	Consumption/ savings of raw consumed for production of One Ton of Glass	Savings on recycling of glass from all 3 million FLs
1	Sand consumed	585 kg	1719.9 Tons
2	Feldspar consumed	68 kg	199.92 Tons
3.	Lime stone consumed	171 kg	502.74 Tons
4.	Soda Ash consumed	184.5 kg	542.43 Tons
5.	Mining waste saved	172.8 kg	508.03 Tons
6.	Carbon dioxide emission	0.66 tons	1940.4 Tons
7.	Energy saved	40%	
8.	Air pollution saved	20%	
9.	Mercury release	0.002%	1.08 tons of mercury can be prevented from polluting soil, water and water

Savings on non-renewable sources like mineral deposits, coke, fluxes, water, energy, etc. in the recovery of mild steel, aluminum, copper etc. can be enormous. Emission of NOx and SOx can be prevented.

In simple recycling E-waste is not only eco and environment friendly but also can generate employment for rural poor. Government of India has considered scientific recycling of E-waste ***(Swachh Digital)*** as a part of ***Swachh Bharat.***