International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)
Web Site: www.ijettcs.org Email: editor@ijettcs.org, editorijettcs@gmail.com
Volume 3, Issue 2, March – April 2014 ISSN 2278-6856

"WEEE Recycling: Impact on Life and the Environment in INDIA"

Pooja Vashishta[1], Sumiti Kapoor[2]

[1]DIT University, Dehradun 248009, India
[2]IMS Unison University, Dehradun 248009, India

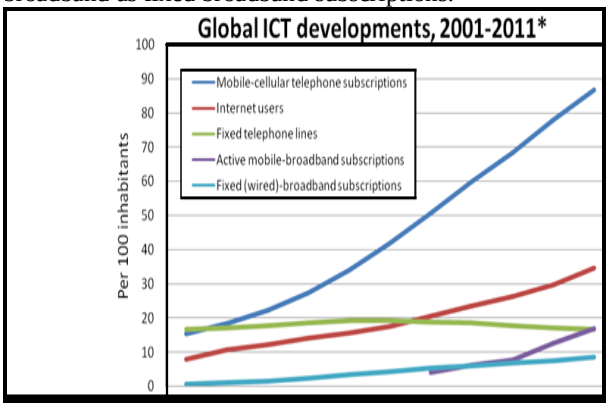
Abstract: ***Today with the rapid pace of technological transformation, WEEE (Waste Electrical and Electronic Equipment) is becoming a prominently emerging challenge as well as business opportunity across the globe. It is one of the fastest growing waste streams in the world. E-waste can have an adverse impact on human life and the global environment due to its improper handling and the poor government legislation. In India, toxic-waste management assumes greater significance not only due to the generation of its own e-waste but also because of the dumping of e-waste from developed countries. Because of poverty and inequality, lack of appropriate infrastructure and procedures for its disposal and recycling, India is becoming a global dumping ground for the African and Asian Counties. The main aim of this paper is to review the current scenario of E-Scrap in India, like magnitude of the problem, health and environmental hazards, methodologies used for disposal and recycling, existing legal framework, involved organizations and the future perspective of the green Globe.***

Keywords: E-Scrap / WEEE / Toxic-Waste, Health and Environmental hazard, E-Waste Legal Framework.

1. INTRODUCTION

Electronic Scrap, "E-Waste" or "Waste Electrical and Electronic Equipment" (WEEE) is a waste consisting of any broken or unwanted electrical or electronic appliance. The E-Waste is one of the extremely major issues and challenge across the world. During the last decade, it has been assumed that the role of providing a forceful leverage to the socio - economic and technological growth of a developing Countries. The consequence of its consumer oriented growth combined with rapid product obsolescence and technological advances are a new environmental challenge. It is an emerging problem as well as a great business opportunity for the developing countries, increasing significantly and produces both the toxic and valuable materials in them.

The ratio of the contents of the E-waste including iron, copper, aluminum, gold and other is over 60%, while plastics account for about 30% and the hazardous pollutants comprise only about 2.70% (Widmer et al., 2005). The Toxic – Waste packed and shipped from developed countries into the developing countries in the name of free trade (i.e. donations, Toxics Link, 2004) as well as by paying high price. The recycling of this waste creates disaster long-term health consequences of constantly being fuels and toxic chemicals. As per the latest World Bank and Census 2011 report (TimesofIndia - 19th May 2011) 41.8% of total population is still below the poverty line due to the Inequality and most of them are involving themselves in such a risky and dangerous recycling operations of the E-Waste because that is a way to make their living. The paper highlights the associated issues and strategies to address this emerging problem, in the light of initiatives in India. The most prominent reason behind this growing challenge is the exponential growth in the global ICT developments. According to the Census report 2011, during the last decade (2001-2011**),** With 5.9 billion mobile-cellular subscriptions, Figure 1 shows the global penetration reaches 87% and 79% in the developed and developing world. And Mobile-broadband subscriptions have grown 45% annually over the last four years and today there are twice as many mobile-broadband as fixed broadband subscriptions.



Global ICT Resources	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Mobile-cellular telephone subscriptions	15.5	18.4	22.2	27.3	33.9	41.8	50.6	59.9	68.3	78.0	86.7
Internet users	8.0	10.7	12.3	14.1	15.7	17.5	20.6	23.5	26.3	29.7	34.7
Fixed telephone lines	16.6	17.2	17.8	18.7	19.3	19.2	18.8	18.6	17.8	17.2	16.6
Active mobile-broadband subscriptions	0	0	0	0	0	0	4.0	6.3	7.8	12.6	17.0
Fixed (wired)-broadband subscriptions	0.6	1.0	1.6	2.4	3.4	4.3	5.3	6.1	6.9	7.6	8.5

Figure 1: Source: http://www.itu.int/ict/statistics

2. WHAT CONTRIBUTES TO E-WASTE?

The growing convergence of information, communication and entertainment has given a new impetus to the Electronics Hardware Sector which comprises mainly of four sub-sectors namely: Industrial Electronics, Computers and peripherals, Communication and Broadcast Equipment and Strategic Electronics and Components. E-waste includes all types of electronic equipments which have become obsolete or have been discarded due to: Advancement in technology, Changes in fashion, style, status or perception, nearing the end of their useful life. Table 1 shows the different sources of the E-Waste.

Table 2: E-Waste Sources

Sources of E-Waste	
Household Appliances	Washing machines, Dryers, Refrigerators, Air-conditioners, Vacuum cleaners, Coffee Machines, Toasters, Irons etc.
Office, Information & Communication Equipment	PCs, Laptops, Mobiles, Telephones, Fax Machines, Copiers, Printers etc.
Entertainment & Consumer Electronics	Televisions, VCR/DVD/CD players, Hi-Fi sets, Radios, etc
Lighting Equipment	Fluorescent tubes, sodium lamps etc. (Except: Bulbs, Halogen Bulbs)
Electric and Electronic Tools	\Drills, Electric saws, Sewing Machines, Lawn Mowers etc. (Except: large stationary tools/machines)
Toys, Leisure, Sports and Recreational Equipment	Electric train sets, coin slot machines, treadmills etc.
Imports	\Developed Countries (i.e. US, UE etc.)

3. MAGNITUDE OF E-WASTE: ACROSS THE GLOBE

An estimate, according to a report by UNEP titled, "Recycling - from E-Waste to Resources," e-waste generation and its exponential growth rate impart data and statistics that had to be analyzed by people across the globe. 50 million tons of E-waste is produced each year and the amount of e-waste being produced - including mobile phones and computers - could rise by as much as 500 percent over the next decade in some countries, such as India.

3.1 MAGNITUDE of E-WASTE: INTERNATIONAL

The United States is the world leader in producing electronic waste, tossing away about 3 million tons each year. China already produces about 2.3 million tons (2010 estimate) domestically, second only to the United States. Despite having banned e-waste imports, India and China remains a major e-waste dumping ground for developed countries. Environmental Protection Agency estimates that only 15-20% of e-waste is recycled, the rest of these electronics go directly into landfills and it can lead to the leaching of lead into the ground water causing problems to the human health. Electrical waste contains hazardous but also valuable and scarce materials. Up to 60 elements can be found in complex electronics. In the United States, an estimated 70% of heavy metals in landfills come from discarded electronics.

✓ In USA, it accounts 1% to 3% of the total municipal waste generation.

✓ In European Union (EU), e-waste is growing three times faster than average annual municipal solid waste generation. A recent source estimates that total amount of e-waste generation in EU ranges from 5 to 7 million tons per annum or about 14 to 15 kg per capita and is expected to grow at a rate of 3% to 5% per year.

3.2 MAGNITUDE OF E-WASTE: INDIA

Studies so far reveal that the total e-waste generation in India is approximately 1, 46,180 tons to 3.3 lakh tons per year and is expected to touch 4 to 5 lakh tons by 2011 and is expected to grow at 10-15% per year. Of the total e-waste generated in the country, western India accounts for the largest population at 35%, while the southern, northern and eastern regions account for 30%, 21% and 14%, respectively.

✓ Sixty-five cities in India generate more than 60% of the total e-waste generated in India.

✓ The top 10 states generate 70% of e-waste in India in order of highest contribution to waste electrical and electronic equipment (WEEE) include Maharashtra, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. Figure 2 shows the state-wise E-Waste generation in India (tons / year).

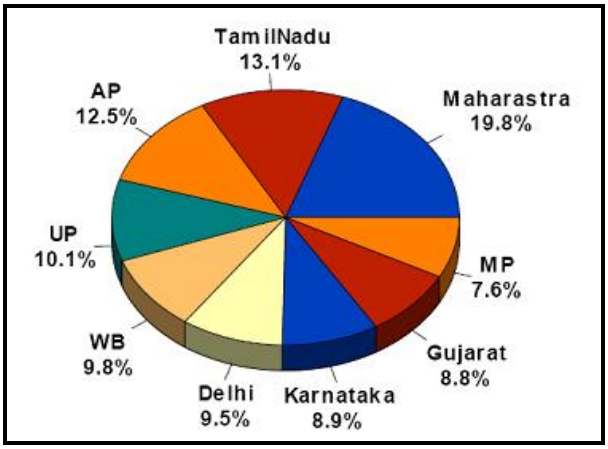


Figure 2: Source: http://www.cpcb.nic.in/docs/E-WasteGuidelines-2007/Frontpage1.pdf

✓ According to a study on e-waste assessment conducted jointly by MAIT and the German government's sustainable development body GTZ, in April 2010, The total quantities of generated e-waste in India, during 2007, were 3,32,979 Metric Tons (MT).and estimated import of e-waste was about 50,000 tons. Out of which 1, 44,143 tones were available for recycling but only 19,000 tons actual recycled.

✓ India imports almost 50,000 tons of e-waste yearly.

4. E-SCRAP RECYCLING : INDIA

Based on the recommendations of the 'Principal Director of Audit, Scientific Department, New Delhi' on the Performance Audit Report on 'Management of Waste in

India', Ministry of Environment & Forests (MoEF), constituted a committee to evolve 'Road Map' for Management of Wastes including E-waste Management in the Country.

✓ As per information of Central Pollution Control Board (CPCB), there are 36,165 industries in the country generating about 6.2 million Metric Ton (MT) of hazardous waste every year, of which Land fillable waste is 2.7 million MT (49.55%), incinerable 0.41 million MT (6.67%) and Recyclable Hazardous Waste 3.08 million MT (43.78%).

✓ Only 19 % of total waste has been recycled by the formal Sectors and the rest of the E-Waste directly goes to the informal sectors.

Due to lack of awareness, the workers are risking their life and the environment as well. The valuable fractions are processed to directly reusable components and to secondary raw materials in a variety of refining and conditioning processes. No sophisticated machinery or personal protective equipment like Masks or Glove is used for the extraction of different materials. All the work is done by bare hands and only with the help of hammers and screwdrivers. Not only the men, women and children are also routinely involved in these operations. Waste components which does not have any resale or reuse value are openly burnt or disposed off in open dumps. Pollution problems associated with such backyard smelting using crude processes are resulting in fugitive emissions and slag containing heavy metals of health diseases.

4.1 Impact On Health

Electronic wastes can cause widespread Health damage due to the emissions of toxic materials, poisonous gases and the polluted water. It contains both valuable as well as harmful components: Valuable components include precious metals such as gold, silver, copper, palladium, etc and Harmful substances like lead, cadmium, mercury, beryllium, BFR, polyvinyl chloride and phosphor compounds and hexavalent chromium in one form or the other are present in such wastes that produces several kind of diseases and pollution. According to N.M. Taphani, Regional Officer, Pollution Control Board, this Electronic Waste is highly dangerous for environment and hence should not be disposed with the regular garbage. The Ministry of Environment and Forests (MoEF) of the Government of India has developed a special guide for these issues and problems created by E-Waste. However, the workgroup for these divisions are currently functional only in Bangalore, Mumbai and New Delhi. While the density of e-waste in the country is on the rise, at present there is no well equipped e-waste recycling plant in India, only the informal methods has been used to disposed e-wastes. Table 2 explain the various toxic constituents available in E-waste and their effect on the health in the form of various diseases.

Table 3: Source: http://www.ces.iisc.ernet.in/energy/paper/ewaste/ewaste.html

Toxic Elements in Electronic Devices and its Impact health		
Components	**Toxic Constituents**	**Effect**
Cathode ray Tubes (CRTs) /TV	Lead oxide and cadmium And Barium (be)	disabilities, behavioral problems, seizures, coma and even death , central and peripheral nervous systems, hemopoietic system, genitourinary system, reproductive systems (male and female). Heart, spleen and Muscle weakness
Batteries (Automotive/Alkaline/ Button /Nickel-Cadmium Rechargeable/ Lithium/ computer)	Lead-Acid, mercury, sulfuric acid, cadmium, poly Vinyl Chloride(PVC)	Skin burn, skin allergy, inhaled or ingested, Cancer , fetus, neural damage, blood system and kidney damage, liver
Old Refrigerators, Heat Pumps and Air Conditioners	Freon, a chemical known as a Chlorinated Fluorocarbon	Each molecule of a CFC can destroy over 100,000 molecules of the earth's protective ozone coating , leading increased risk of and sunburn, cataracts and skin cancer
Motor Oil	Toxic oxide	One quart of oil can kill fish in thousands of gallons of water
Printed Circuit Board	Lead and Cadmium	Skin burn, blood system and kidney damage
Capacitors and Transformers	Poly Chlorinated Biphenyls	inhaled or ingested
Wires Burning	Dioxins, Bromine	Inhaled or ingested, air pollution, poisonous co2

4.2 Impact on Environment

Electronic wastes can cause widespread environmental damage due to the emissions of toxic materials, poisonous gases and the polluted water.

✓ India is the third biggest greenhouse gas emitter with its contribution standing at 5.3 percent behind countries like China and the USA, the Government said in LokSabha on August 22, 2011. "As per current information available, the countries which are the largest contributor, in percentage term regarding greenhouse gas emissions are China 19.5 per cent, USA 19.2 per cent, India 5.3 per cent, Russia 5.1 per cent, Japan 3.6 per cent and Germany 2.6 per cent," Environment Minister Jayanthi Natarajan said.

✓ According to India Today survey, November 30, 2011 the national ambient air quality standards, the normal annual average for PM10 is 60 microgram per cubic meter. In the last three years, PM10 in Delhi has gone up from 198 in 2008 to 243 in 2009 and 259 in 2010. Even cities surrounding Delhi such as Faridabad and Meerut,

where the air quality is monitored, saw an increase in PM10 levels. Available literature shows that the major concerns for human health from exposure to PM10 include respiratory ailments, damage to lung tissue, heart disease, cancer, and premature death. Ironically, other metros appear to have a much cleaner ambient air as compared to Delhi. Mumbai has an annual PM10 average of 94 while Kolkata has 98 and Chennai 59. All three metros saw a marginal decrease in PM10 levels as compared to the previous two years. Other cities which saw a decrease in PM10 levels in 2010 as compared to the previous year include Agra, Bangalore, Pune and Surat. The only cities to have PM10 levels within the national standards are Kochi (36), Madurai (47) and Chennai (59).

4.3 The Prospect for Future Emissions

World carbon dioxide emissions are expected to increase by 1.9 percent annually between 2001 and 2025. Much of the increase in these emissions is expected to occur in the developing world where emerging economies, such as China and India, fuel economic development with fossil energy. Developing countries emissions are expected to grow above the world average at 2.7 percent annually between 2001 and 2025; and surpass emissions of industrialized countries near 2018. The U.S. produces about 25 percent of global carbon dioxide emissions from burning fossil fuels; primarily because our economy is the largest in the world and we meet 85 percent of our energy needs through burning fossil fuels. The U.S. is projected to lower its carbon intensity by 25 percent from 2001 to 2025, and remain below the world average.

5. E-Scrap Strategies: in India

Recycling and reuse of material are the next level of potential options to reduce e-waste (Ramachandra and Saira, 2004). Recovery of metals, plastic, glass and other materials reduces the magnitude of e-waste. It is high time the manufactures, consumers, regulators, municipal authorities, state governments, and policy makers take up the matter seriously so that the different critical elements depicted in Figure 3 is addressed in an integrated manner. Sustainability of e-waste management systems has to be ensured by improving the effectiveness of collection and recycling systems.

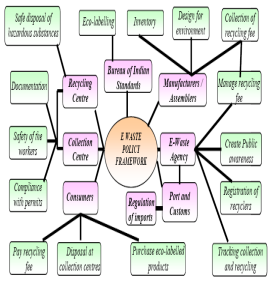


Figure 3: Source: http://www.swlf.ait.ac.th/UpdData/International/NRIs/Electronic%20waste%20management%20in%20India.pdf

The Policy shall address all issues ranging from production and trade to final disposal, including technology transfers for the recycling of electronic waste. Clear regulatory instruments, adequate to control both legal and illegal exports and imports of e-wastes and ensuring their environmentally sound management should be in place. The regulations should prohibit the disposal of e-wastes in municipal landfills and encourage owners and generators of e-wastes to properly recycle the wastes. Manufactures of products must be made financially, physically and legally responsible for their products. A public-private participatory forum (E Waste Agency) of decision making and problem resolution in E-waste management must be developed. This could be a Working Group comprising Regulatory Agencies, NGOs, Industry Associations, experts etc. to keep pace with the temporal and spatial changes in structure and content of E-waste. This Working Group can be the feedback providing mechanism to the Government that will periodically review the existing rules, plans and strategies for E-waste management. The efforts to improve the situation through regulations, though an important step are usually only modestly effective because of the lack of enforcement. While there has been some progress made in this direction under the pressure of NGO's like Green piece and with the support of agencies such as GTZ, the government in the process of functioning and drafting the strategies and polices which make more difficult to bring all the E-Wastes. The enforcement of regulations is often weak due to lack of resources and underdeveloped legal systems. Penalties for non- compliance and targets for collection or recycling are often used to ensure compliance.

5.1 Controlling Authorities, Duties and Corresponding Rules:

E-waste Rules are notified by the Ministry of Environment and Forests (MoEF), Government of India, on the May 12, 2011. The Rules will come into effect from the May 1, 2012. The rules shall apply to every producer, consumer or bulk consumer involved in the manufacture, sale, and purchase and processing of electrical and electronic equipment or components, collection centre, dismantler and recyclers of e-waste. These rules shall apply to every collection centre, dismantler, and recycler of e-waste and shall not apply to

- ✓ Batteries as covered under the batteries rules 2001
- ✓ Micro, small and medium enterprises act 2006 (27 of 2006) and
- ✓ Radioactive waste as covered under the provision of atomic energy act 1962(33 of 1962)

Table 4: explain authorities and their duties regarding E-Waste

Ministry of Environment and forests, under the Environment	i. Identification of hazardous wastes as per Rule 3 ii. Permission to exporters as per rule 14(3)

(protection) Act, 1986	iii. Permission to importers as per Rule 13(3)
Central Pollution Control Board constituted under the Water (Prevention and Control of Pollution) Act, 1974	i. Coordinate activities of the State Pollution Control Boards and ensure implementations of the conditions of imports ii. Monitor the compliance of the conditions of authorization, import and export. iii. Conduct training courses for authorities dealing with management of hazardous wastes iv. Recommend standards for treatment, disposal of waste, leachate and specifications of materials v. Recommend procedures for characterization of hazardous wastes
State Pollution Control Boards constituted under the Water (Prevention and Control of Pollution) Act, 1974	i. Grant and renew authorization under rule 5(4) and rule 8 ii. Monitor the compliance of the various provisions and conditions of authorization iii. Forward the application for imports by importers as per rule 13(1) iv. To review matters pertaining to identification and notification of disposal sites
Directorate General of Foreign Trade constituted under the Foreign Trade (Development & regulation) Act 1992	i. Grant license as per rule 13(5) ii. Refuse license for hazardous wastes prohibited for imports under the Environment (protection) Act, 1986
Port Authorities and Customs Authorities under the customs Act, 1962	i. Verify the documents as per rule 13(6) ii. Inform the ministry of Environment and Forests, Govt. of India of any illegal traffic as per rule 15 iii. Analyze wastes permitted for imports and exports iv. Train officials on the provisions of the Hazardous Wastes Rules and in analysis of hazardous wastes

5.2 RECOMMENDATIONS

The management of E-waste may be taken up at three levels, viz. Legislative, Administrative and Technological measures.

✓ There is an immediate need for strengthening the legislative frame work and making them more stringent. This could be done by introducing specific rules/law governing the reuse and recycle as well as final disposal of e-waste. Lack of stringent regulations and awareness, makes dumping a preferred destination for E-waste.

✓ Producers of the electronics/electrical equipments must be made responsible for end of life management of electrical/electronic products. Producers should be rule-bound to take back their products.

✓ After the life of the product is over and to get it recycled/disposed in an environmentally safe manner without health risks.

✓ Amendments to the HW (M,H &T) Rules must be made to bring SEZ areas under its ambit so as to prevent dumping of e-wastes in SEZs.

✓ Import of CRT should be banned. A mechanism has to be established for regulating charity goods and its route to its intended destination. Import of equipment should be permitted only if new.

✓ A comprehensive national inventorization of E-waste needs to be undertaken on a priority basis.

✓ The key to effective E-waste management is an efficient collection mechanism of the e-waste. The producers of electronic equipment may be mandated to have a centralized facility along with a wide network for e-waste collection of their brand, as extended producer responsibility.

✓ There is a need to strengthen the infrastructure for management of E-waste at CPCB and SPCB level. Development of human, financial and technological resources is the need of the hour.

✓ A core group should be constituted for management of E-waste including representatives from MoEF, CPCB SPCB, Ministry of Information Technology, Manufacturers Associations and a few committed NGOs.

✓ Testing/Scanning procedure for goods at high sea should be established. Port Authority/Customs capability in terms of scanning of goods at high seas has to be increased.

✓ Success stories of international practices need to be analyzed and adopted as per the need of the country for speedy and efficient management of E-Waste.

✓ Use of Hazardous substances like Cadmium, Mercury, Lead and PCB should be reduced with raw material substitution within a given time frame. This being a continuous activity, information needs to be collected, updated and disseminated on a regular basis.

✓ Establishment of a clearing house of information on e-waste assembling and manufacturing is immediately mandated

✓ The concept of eco-labeling of electronic products needs to be introduced so that consumers can choose to buy electronic goods that cause less pollution and which are more environment friendly. BIS may be asked to fix these criteria/standards.

✓ There is a need to have more R & D projects on recovery of precious and non ferrous metals in an environmental friendly manner.
✓ Establishment of a model eco-friendly recycling unit integrating all aspects of disassembly and recovery of metals and other material is mandated either in the private or public sector to understand various nuances of recycling and pollution control and disseminate the same.

5.3 Organizational Involvement in India

To tackle the big challenge and convert it into the employment opportunity, Government, NGO's and various private organizations looking forward and take initiatives in this direction. The **Cerebra Integrated Technology Ltd. (BSE: 532413),** India's leading total It solution provider announced on 31 August 2010 in Mumbai to setup its unit at Bangalore as India's largest recycling unit with Cemelia Resource Recovery Pvt. Ltd. offering environmental restoration solution for the electronic, electrical and equip firm. The company will be investing Rs. 50 Crore for the proposal unit and aim to achieve a company turnover of Rs. 250 Crore in FY 2013 with a profit margin of 25%. **Wipro:** The environmentalist organization Greenpeace International last September dumped some 500 kilograms of electronic waste outside of Wipro's Bangalore headquarters. The activists said that they had collected the scrapped Wipro-branded computers from recycling yards in Delhi, Bangalore and Chennai. **Trishyiraya Recycling India Private Limited: TPL** is a wholly owned Indian subsidiary of SIMS Recycling Solutions. SIMS group is a USD 8.0 billion corporation having facilities in over 200 locations across the globe. Radha Industry (world's largest and fastest growing manufacturing industry - Radha, 2002; DIT, 2003) HCL, Tata Teleservices, HP and Nokia and many other organization are also planning.

6. E-Scrap Future Prospect in India:

E-waste, with the rapid scientific progress has been made and new frontiers reached with the advent of the 21st century. Progress has brought with it some problems, viz. large quantities of Non-Decomposable Electronic Dump/Wastage; this is acquiring monstrous proportions. According to a study by the government of India, it has been found that the amount of E waste in the country is growing at 10-15% per year and 95% of it will end up in urban slums – 434000 metric tons. According to a new UN report released in Bali, Indonesia by 2020, India's e-waste from old computers will jump 500% from 2007 levels, whereas South Africa and China will witness a 200-400% rise in computer-related waste. The rapidly growing mobile telephony in India will take its toll by 2020 when e-waste from discarded phones will grow 18 times from 2007 levels, a period during which China is estimated to see a seven-fold rise in the electronic waste from mobile phones and as result India becoming a global dumping ground.

✓ According to Central Pollution Control Board during 2005, 1.347 lakh MT of e-waste was generated in the country. Which is expected to increase to about 8.0 lakh MT by 2012.Considering the growth rate, the volume of e-waste will reach nearly 0.7 million MT by 2015 and 2 million MT by 2025. Figure 4 shows the Estimated Growth of E-Waste in India.

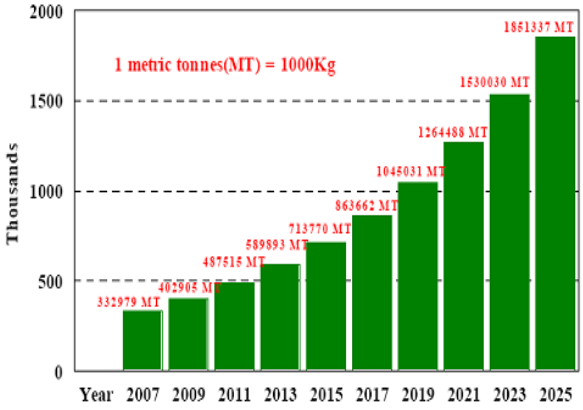


Figure 4: Source: http://www.cpcb.nic.in

6.1 Future Prospect of the Green Globe

UN environmental conference in Cartagena, Colombia, attended by more than 170 countries in October 2011, has agreed to accelerate a global ban on the export of hazardous waste including that sent for recycling, from leaving wealthy countries destined for developing countries.

7. CONCLUSION

India can play a leadership role on the global stage and emerge as the third largest economy in the world after the US and China. Despite a booming economy, India ranks poorly on poverty. Therefore India need to catch-up in various areas and also need an urgent approach to manage the e-waste hazard by technical and policy-level interventions, implementation and capacity building and increase in public awareness such that it can convert this challenge into an opportunity to show the world that India is ready to deal with future problems and can set global credible standards concerning environmental and health issues.

References

[1] Sardinia 2007, Eleventh International Waste Management and Landfill Symposium, Last accessed on June 17th, 2011 Available from: http://www.swlf.ait.ac.th/UpdData/International/NRIs/Electronic%20waste%20management%20in%20India.pdf

[2] Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796756/ [Last accessed on June 17th, 2011]

[3] Ministry of Environment and Forests (Moef), New Delhi March, 2010

[4] **Available from: http://articles.timesofindia.indiatimes.com/2009-11-11/pune/28074435_1_e-waste-weee-maharashtra-pollution-control-board [Last accessed on June 18th, 2011]**

[5] Available from: http://www.livemint.com/2010/02/22163815/By-2020-India8217s-ewaste.html [Last accessed on June 18th, 2011]

[6] Kumar Ajay, "E-waste dismantling units, Shastri park, Delhi", GTZ, 2007

[7] Annual Report 2010-2011, Ministry of Environment & Forests (MoEF)

[8] Vivek Khattar, Jaspreet Kaur, E-waste Inventorisation in India, MAIT-GTZ study, 2007

[9] REPORT ON INVENTORIZATION OF E-WASTE, *Environment Protection Training & Research Institute, (EPTRI)*

[10] Dr. S Chatterjee, Scientist –E Dept. IT, CGO Complex New Delhi, 2011 "E-Waste and India"

URLs

- ✓ April 7, 2011 http://wastelines.com/2011/04/07/understanding-ewaste/
- ✓ http://www.weeerecycle.in/
- ✓ http://www.weeerecycle.in/publications/reports/E-waste_Assessment_Report_ICC_Revised.pdf