

E-Waste: Impact on Life and Therefore the Surroundings in India

Ravinder Charan¹, Shailendra Singh Jhala², Ravi Prakash Maheshvari³

¹Department of Electrical Engineering, ²Department of Mechanical Engineering,

³Department of Civil Engineering, Governement Engineering College, Banswara

Email: ravindercharan35@gmail.com, rpamaheshvari@gmail.com

Abstract: Nowadays with the speedy pace of technological transformation, (Waste Electrical and Electronic Equipment) WEEE is changing into a conspicuously rising challenge likewise as business chance across the world. It's one in every of the quickest growing waste streams within the world. E-waste will have an adverse impact on human life and the global environment due to its improper handling and therefore the poor government legislation. In India, toxic-waste management assumes bigger significance not only due to the generation of its own e-waste, however due to 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 objective of this paper is to review the present scenario of E-Scrap in India, like magnitude of the matter, health and environmental hazards, methodologies used for disposal and recycling, existing legal framework, concerned organizations and therefore the future perspective of the green Globe.

Keywords: WEEE, E-Waste, Toxic Waste, E-Scrap, Green Globe.

Introduction:

"E-Waste", Electronic Scrap or "Waste Electrical and Electronic Equipment" (WEEE) may be a waste consisting of any broken or unwanted electrical or electronic appliance. The E-Waste is the extremely major problem and challenge across the planet. Throughout the last decade, it's 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 client headed growth combined with speedy product degeneration and technological advances is a new big environmental challenge. It is an emerging problem as well as a good business chance for the developing countries, increasing considerably 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% . The Poisonous – Waste is packed and shipped from developed countries into the developing countries within the name of trade likewise as by paying high value. 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. This paper highlights the associated issues and strategies to address this emerging problem, in the light of initiatives in India. The foremost major reason behind this growing challenge is the exponential

growth within the international 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 nowadays these mobile, broadband as fixed broadband subscriptions are doubled.

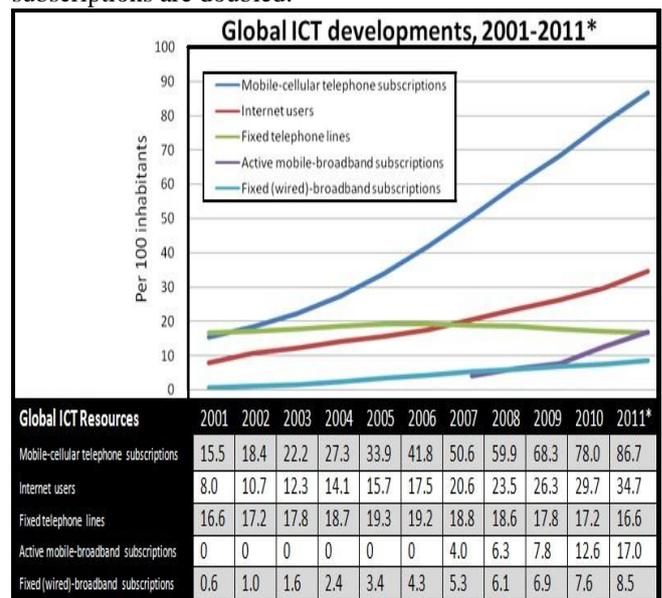


Figure 1: Source: <http://www.itu.int/ict/statistics>

WHAT CONTRIBUTES TO E-WASTE?

The growing convergence of data, communication and entertainment has given a replacement impetus to the Electronics Hardware Sector that includes 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 that have become obsolete or are discarded due to: Advancement in technology, Changes in fashion, style, status or perception, nearing the end of their helpful 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 Equipments	PC's, 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.)

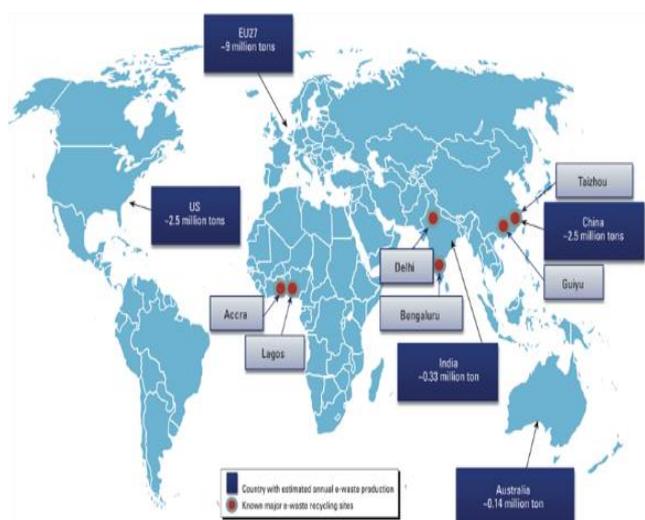


Figure 1: Magnitude of e-waste: across the globe:

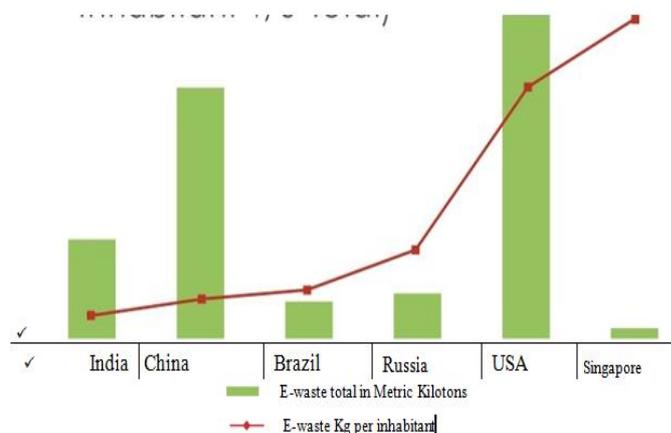
In step with a report by UNEP titled, "Recycling - from E-Waste to Resources," e-waste generation and its exponential growth rate impart data and statistics that had to be analyzed by people across the world. Fifty million tons of E-waste is produced each year and the amount of e-waste being made - including mobile phones and PC's – might rise by maximum amount as 500 percent over ensuing decade in some countries, like India.

MAGNITUDE OF E-WASTE: INTERNATIONAL The U.S. is the world leader in manufacturing electronic waste, moving away regarding three million tons annually. China already produces regarding a pair of.3 million tons (2010 estimate) domestically, second only to the U.S.. Despite having illegal e-waste imports, India and China remains a serious e-waste merchandising ground for developed countries. Environmental Protection Agency estimates that solely 15-20% of e-waste is recycled, the remaining of these electronics go directly into landfills and it will result in the leach of lead into the bottom water inflicting issues to the human health. Electrical waste contains hazardous however conjointly valuable and scarce materials. Till 60 elements can be found in complex electronics. In the

U.S., an estimated 70% of heavy metals in landfills generally comes from discarded electronics.

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

✓ In European Union (EU), e-waste is growing thrice quicker than average annual municipal solid waste generation. A recent supply estimates that total quantity 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% annually.



MAGNITUDE OF E-WASTE: INDIA

Studies thus far reveal that the overall 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 overall ewaste generated within the country, western India accounts for the biggest population at 35%, whereas 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 highest 10 states generates 70% of e-waste in India in order of highest contribution to waste electrical and electronic equipment (WEEE) which includes the 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).

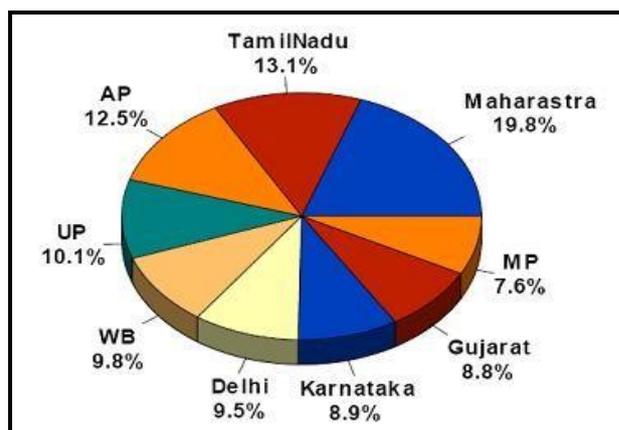


Figure 2: Source: <http://www.cpcb.nic.in/docs/EWasteGuidelines-2007/Frontpage1.pdf>

- ✓ 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, was 3,32,979 Metric Tons (MT).and estimated import of e-waste was about 50,000 tons. Out of which 1, 44,143 tones was available for recycling, but only 19,000 tons was actually recycled.
- ✓ India imports nearly 50,000 tons of e-waste yearly.

E-SCRAP RECYCLING: INDIA

Due to 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), made a committee to evolve 'Road Map' for Management of Wastes as well as E-waste Management within the Country.

- ✓ As per info. of Central Pollution Control Board (CPCB), there are 36,165 industries in our country generating about 6.2 million Metric Ton (MT) of hazardous waste per annum, 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 subtle machinery or personal protective things like Masks or Glove is employed for the extraction of different materials. All the work is finished by bare hands and solely with the help of hammers and screwdrivers. Despite of men, women and children are also routinely involved fort these work. Waste elements that does not have any resale or reuse value are openly burnt or disposed off in open dump areas. Pollution issues related with such backyard smelting using crude processes are resulting in fugitive emissions and slag containing heavy metals which result in health related problems.



Value* of electronic hardware production in India

• IMPACT ON HEALTH

Electronic wastes will cause widespread Health injury due to the emissions of toxic materials, poisonous gases and water that is polluted. It contains many valuable as well as harmful components: Valuable components embody 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 with health issues. According to N.M. Taphani, Regional Officer, Pollution Control Board, this Electronic Waste is extremely dangerous for environment and hence shouldn't 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 problems and problems created by EWaste. However, the workgroup for these divisions are presently functional only in Bangalore, Mumbai and capital of india. Whereas the density of e-waste within a country is on the increament, at present there's no well equipped e-waste recycling plant in India, so only the informal strategies has been accustomed to dispose the e-wastes. Table 2 explain the different toxic constituents available in E-waste and their impact on the health in the form of various diseases.

• IMPACT ON ENVIRONMENT

Electronic wastes will cause widespread environmental injury due to the emissions of harmful(toxic) materials, poisonous gases and the contaminated water.

- ✓ India is known as the third biggest greenhouse gas emitter with its contribution standing at 5.3 percent behind countries like China and the USA, the Govt. mentioned in LokSabha on August 22, 2011. "regarding the current information available, the countries which are the biggest contributor in the form of percentage term regarding greenhouse gas emissions are China 19.5 %, United States of America 19.2 %, India 5.3 %, Russia 5.1 %, Japan 3.6 % and Germany 2.6 % ," Environment Minister Jayanthi Natarajan mentioned.

- ✓ India Today has done survey and resulted that on , November 30, 2011 the national ambient air quality standards are the normal annual average for PM10 is 60 microgram per cubic meter. Since last three years, PM10 in Delhi rise up from 198 in 2008 to 243 in 2009 and 259 in 2010 year. Also the cities surrounding Delhi such as Faridabad and Meerut, air quality is monitored, observed an increase in PM10 levels . The data Available shows that the major concerns for human health from exposure to PM10 include respiratory problems , damage to lung tissues, heart diseases, and even cancer, and premature death. Ironically, other metros appear to have a much cleaner ambient air as compared to Delhi. The Mumbai has an annual PM10 average of 94 while Kolkata has 98 and Chennai has 59 PM10. All The three metros have seen a marginal decrease in PM10 levels as compared to the last two years. Even the other cities have seen a decrease in PM10 levels in 2010 as compared to the last year which includes Agra, Bangalore, Pune as well as Surat. The only cities to have PM10 levels among the national standards are Kochi (36), Madurai (47) and Chennai (Madras) (59).

THE PROSPECT FOR FUTURE EMISSIONS

World greenhouse gas emissions are expected to gradually increase by 1.9 percent per annum between 2001 and 2025. A lot of the increase within these emissions is expected to occur in the developing world where rising economies, such as China and India, fuel economic development with fossil energy. The countries which are developing have their emissions expected to grow above the average of the world at 2.7 percent annually between 2001 and 2025; and surpass emissions of industrialized countries close to 2018. The U.S. produces lump sum 25 percent of global carbon dioxide by burning fossil fuels; primarily as our economy is the largest in the world and we meet 85 percent of our energy needs by burning fossil fuels. The U.S. is projected to lower its carbon intensity by 25 % from 2001 to 2025, and to stay below the average of the world scenario.

E-SCRAP STRATEGIES: IN INDIA

Recycling and reuse of fabric are the next level of potential choice to minimise the e-waste. Recovery of metals, plastic, glass and different materials reduces the magnitude of e-waste. It's time that the manufactures, consumers, regulators, municipal authorities, state governments, and policy makers take up this matter as serious, so that the various important parts represented in Figure 3 is addressed in an integrated manner. Sustainability of e-waste management systems should be ensured by improving the effectiveness of collection and recycling systems available.

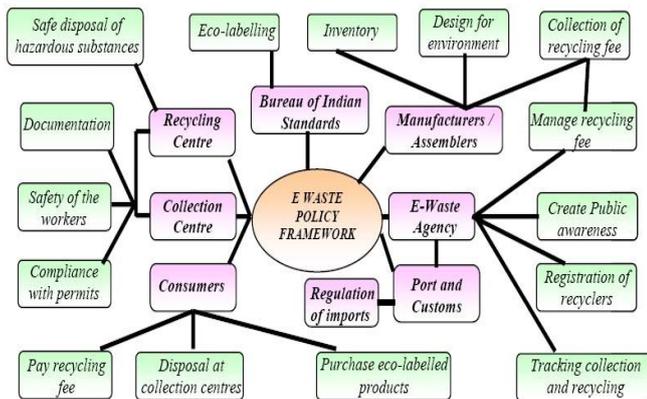


Figure 3: Source: <http://www.swlf.ait.ac.th/UpdData/International/NRIs/Electronic%20waste%20management%20in%20India.pdf>

The Policy shall address all problems starting from production and trade to final disposal, as well as 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 capable management should be in place. The law should prohibit the disposal of e-wastes in municipal landfills and motivate owners and generators of e-wastes for proper recycling the wastes. Manufactures of products should be created financially, physically and legally responsible for their products. A public-private democratic forum (E Waste Agency) of deciding and downside resolution in Ewaste management should be developed. . this might be a unit comprising regulative Agencies, NGOs, trade Associations, specialists etc. to stay pace with the temporal and spatial changes in structure and content of E-waste. This unit is the feedback providing mechanism to the govt that may

sporadically review the present rules, plans and methods for E-waste management. The efforts to enhance the case through laws, although a very important step area unit typically solely with modesty effective attributable to the dearth of social control. whereas there has been some progress created during this direction below the pressure of NGO's like inexperienced piece and with the support of agencies akin to GTZ, the govt within the method of functioning and drafting the methods and polices that create harder to bring all the E-Wastes. The social control of laws is commonly weak thanks to lack of resources and underdeveloped legal systems. Penalties for non- compliance and targets for assortment or exercise area unit typically accustomed guarantee compliance.

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 and principles have acquire result from the May 1, 2012. the principles are applied to each producer, client or bulk client concerned within the manufacture, sale, and buy and process of electrical and equipment or elements, assortment centre, dismantler and recyclers of e-waste. These rules ought to be 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, tiny and medium enterprises act 2006 (27 of 2006) and
- ✓ Radioactive waste as lined below the provision of atomic energy act 1962(33 of 1962)

RECOMMENDATIONS

The management of E- waste is also obsessed at 3 levels, viz. Legislative, body and Technical measures.

- ✓ There's an immediate need for strengthening the legislative frame work and creating them more stringent. This might be done by introducing specific rules/law governing the reuse and recycle like as final disposal of e-waste. Lack of tight regulations and awareness, makes dumping a best destination for E-waste.
- ✓ Producers of the electronics/electrical equipments must be made responsible for end of life management of electrical/electronic products. Producers ought to be rulebound to take back their products.
- ✓ After the end of product life and to get it recycled/disposed in an environmentally safe manner without at any health risk.
- ✓ Amendments to the HW (M,H &T) Rules should be created to bring SEZ areas below its extent so as to prevent dumping of e-wastes in SEZs.
- ✓ Import of CRT should be banned. A mechanism should be established for regulating charity goods and its route to its meant destination. Import of equipment should be permitted only if new.
- ✓ A comprehensive national inventORIZATION of E-waste must 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 own a centralized facility together with a big network for e-waste collection of their brand, as extended producer responsibility.

- ✓ There is a requirement to strengthen the infrastructure for management of E-waste at CPCB and SPCB level. Development of human, financial and technological resources is the necessity of the hour.
- ✓ A core group should be made for management of E-waste including representatives from MoEF, CPCB SPCB, Ministry of Information Technology, Manufacturers Associations with few committed NGOs.
- Testing/Scanning procedure for goods at high sea should be established. Port Authority/Customs capability in terms of scanning of products at high seas should be enlarged.
- ✓ Success stories of international practices got to be analyzed and adopted as per the requirement of the country for quick and efficient management of E-Waste.
- ✓ □ Use of Hazardous substances like Cadmium, Mercury, Lead and PCB ought to be reduced with raw substance substitution within a given time interval. This being a nonstop activity, info must be collected, updated and disseminated on a everyday basis.
- ✓ 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 different material is mandated either within the private or public sector for understanding various nuances of recycling and pollution management and publicize identical.

• **ORGANIZATIONAL INVOLVEMENT IN INDIA** To tackle the Large challenge and convert it into the employment chance, Government, NGO's and varied personal organizations trying forward and take initiatives towards 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 organisation turnover of Rs. 250 Crore in FY 2013 with a profit percent 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 Wiprobranded computers from recycling yards in Delhi, Bangalore and Chennai. **Trishyiraya Recycling India Private Limited: TPL** is a totally owned Indian subsidiary of SIMS Recycling Solutions. SIMS group is a USD 8.0 billion corporation having facilities in over 200 locations across the world. Radha trade (world's largest and quickest growing manufacturing industry - Radha, 2002; DIT, 2003) HCL, Tata Teleservices, HP and Nokia and plenty of different organization are coming up with.

E-SCRAP FUTURE PROSPECT IN INDIA:

E-waste, with the speedy scientific progress has been created and new frontiers reached with the arrival of the twenty first

century. Progress has brought with it some issues, viz. big quantities of Non-Decomposable Electronic Dump/Wastage; this is acquiring monstrous proportions. With regard to a study by the government of India, it's been found that the amount of E waste in the country is growing at 10-15% annually and 95% of it will yourself end up in urban slums – 434000 metric tons. According to a new UN report released in Bali, Indonesia by 2020, India's ewaste 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 quickly growing mobile telecom in India can take its toll by 2020 once e-waste from discarded phones can 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 worldwide dumping ground.

□ According to Central Pollution Control Board during 2005, 1.347 lakh MT of e-waste was generated within the country . that is anticipated to extend to regarding 8.0 lakh MT by 2012.Considering the expansion rate, the degree 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.

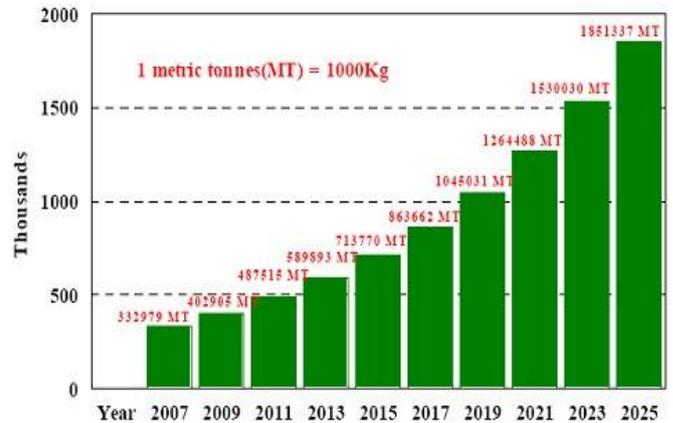


Figure 4: Source: <http://www.cpcb.nic.in>

• **FUTURE PROSPECT OF THE GREEN GLOBE** UN environmental conference in Cartagena, Colombia, attended by more than 170 countries in October 2011, has in agreement to accelerate a worldwide ban on the export of hazardous waste including that sent for recycling, from leaving wealthy countries destined for developing countries.

CONCLUSION

India is able to play a leadership role on the worldwide stage and can emerge as the third largest economy within the world after the US and China. Despite a booming economy, India ranks poorly on economic condition. Thus 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 will convert this challenge into an opportunity to indicate the world that India is prepared to agitate future issues and might set international credible standards regarding environmental and health problems.

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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/Alka line/ 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

Table 4: explain authorities and their duties regarding EWaste

Ministry of Environment and forests, under the Environment (protection) Act, 1986	i. Identification of hazardous wastes as per Rule 3 ii. Permission to exporters as per rule 14(3)
Central Pollution Control Board constituted under the Water (Prevention and Control of Pollution) Act, 1974	iii. Permission to importers as per Rule 13(3) i. Coordinate activities of the State Pollution Control Boards and ensure implementations of the conditions of imports ii. To 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 referring 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 Harmful Wastes Rules and in analysis of hazardous wastes .