

Optimisation Of E-Waste Generation - A Case Study

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ABSTRACT: ‘Use and Throw’ policy adoption by users and manufacturers, lack of awareness and poor intermingled management practices, innovations and industrialisation has led to generation of E- waste which in coming years will be a considerable component Municipal Solid Waste (MSW). One of the major contributors of E- waste is engineering institutes due to mandatory provision of different facilities according to norms after IT and electronics sector. Engineering Institutes are being funded for development under different schemes for which the major purchase is of electronic gadgets. The quantity of E- waste as per AICTE norms is calculated theoretically and practically which comes out to be 0.334 tonnes / year for 7 years life cycle and 0.262 tonnes / year till the obsolescence of 2009 at institutes. If followed the norms of AICTE, the generation rate of E –waste can be kept still to minimum as compared to present rate of generation in future. This paper gives study of quantity calculation of E- waste generated theoretically and practically in one of the reputed Engineering Institutes which will further led to suggestion of optimisation for E – waste generated. This study will further be extended suitable management of E- waste through a mathematical model for Engineering Institutes.

Key words: E- waste, electronic gadgets, obsolescence

Introduction

E- waste is that component of the MSW which is till date not properly managed in the developing countries like India currently it is 1 % of total MSW. The major types of E- waste are categorised and classified as per the guidelines of UNEP into 10 different categories of E-waste (UNEP, 2007). The growing industrialisation from past decade, technological advancement, improvement in life style, ease of usage and availability, innovations has led to increase in the utilization of E- gadgets (Kumar et. al, 2011) and are the major reasons for the generation of E- waste (Ramesh and Joseph, 2006). Also the management of E- waste is not proper due to lack of awareness, poor practices and insufficient legislations and rules (Srivastava, 2009). Engineering institutes are one of the major contributors of E- waste. It is mandatory to provide all facilities as per the norms of All India Council for Technical Education (AICTE). Few of the engineering institutes are awarded with grants for the development under which the major purchase is observed of electronic gadgets and digital instruments. With the new purchase of electronic gadgets, old E-gadgets are either made obsolete. But if optimized properly E- waste generation can be reduced or at least kept to its present conditions. The most traditional management practice followed at Engineering Institutes for E- waste is storage and dumping, but option of optimization is not implemented.

Methodology

Waste Identification: A few of the guide lines as suggested by USEP and MoEF, CPCB are used for physical identification of E waste. The methods adopted were physical survey and questionnaire survey. Physical survey was carried out at leading engineering institute and other engineering institutes physically. From all the observations of colleges the major sources of E- waste generating at engineering institutes are as in Table 1.

Table 1: Types of E- waste generating at engineering institutes

Category	Names of E- gadgets
Large Household Appliances	Fridges, Air conditioners, Electrical Oven, Coolers etc
Large Household Appliances	Fans, Water dispenser etc
IT and Telecommunication equipment	PCs, monitors (CRT/ LCD), laptops, Printers, Xerox machines, Scanners, Fax machines, Modems, Calculators, Cartridges etc
Consumer equipment	Video projector, Cameras etc
Lighting equipment	Light bulbs, Fluorescent tubes, Long life light bulbs (energy saving), Rechargeable lamps, Cells, Batteries, UV tubes etc

Since long back all technical institutes are abide by the norms laid down by the AICTE for the provision of different facilities. At the establishment of any engineering institutes, it is mandatory to provide different electronic gadgets at different laboratories. The norms for provision of gadgets are as given in below table 2.

Table 2: AICTE norms for engineering institutes

Stream	Number of PCs to students ratio (Min 20 PCs)	Printers including Color Printer (% of total no of PC's)
Diploma	1:6	10%
UG	1:4	10%
PG	1:2	10%

(Source: All India Council for Technical Education Approval Process Handbook (2011 – 2012), Appendix 5.1, page no. 99)

The collected data is represented in below fig 1 which shows the distribution of E- waste unit wise and as its percentage contributing in total E- waste produced in leading engineering institute.

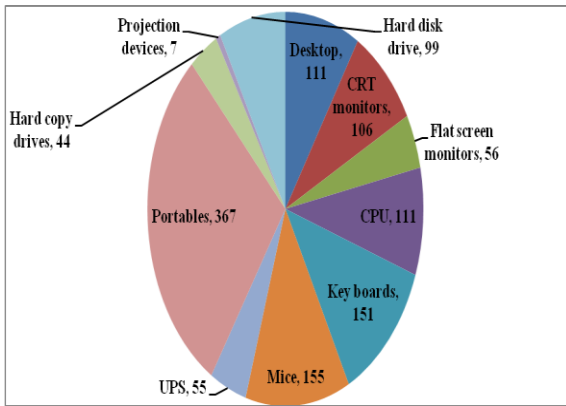


Fig 1: Unit wise E- waste generated at leading engineering institute.

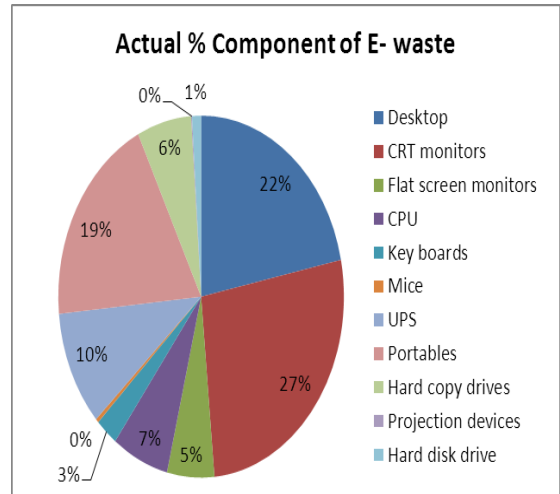
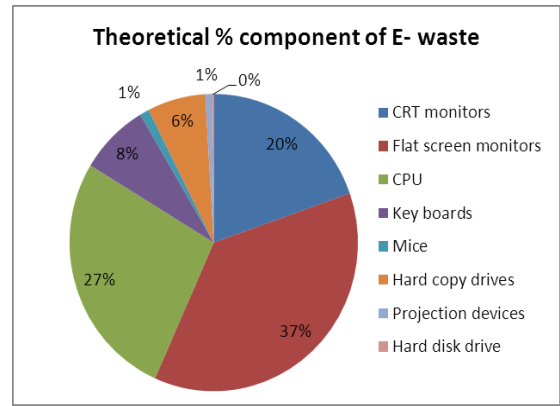


Fig 2 and Fig 3: Theoretical and Actual E- waste Contribution as % component

Methods: There are no hard and fast rules as well as fixed guide lines for such type of study. Hence a few approaches as referred have been used to meet with following objectives. Theoretical quantity of E- waste: The E- waste generating at selected engineering institutes of Maharashtra is calculated theoretically. The theoretical calculation is based on the parameters like strength of the engineering institute and norms of AICTE for provision of facilities at engineering institutes. Actual calculation of E-waste generation: The quantity calculation is based on the approach II followed by USEPA for the actual E- waste generated. Hence with the collected data and records, the task of quantification is done. The data is collected category wise and summed up. The average 1st life of E – waste is considered for the calculation. Thus a quantity per unit is calculated. Then from the mass of electronic gadgets (in Kg), the quantity can be calculated as Kg/ year and further in Tones/ year.

Results and Discussion

Calculation of quantity of E -waste generation at leading engineering institute. A specimen calculation for Theoretical of E- waste generation shows the Quantity of E – waste to be 0.334 Kg/ year. The quantity of E-waste is calculated for the period of maximum first use i.e. 7 years for all gadgets selected. The unit wise contribution of gadgets is shown in fig 2. The data was collected for the obsolescence carried out at parent institute. For which a purchase data records were used during the years 1986 to 2009 as the procedure of obsolescence was carried out in that duration of 23 years. The actual units made obsolete are shown in below fig 3. From this data actual quantity of E- waste generated at leading engineering institute for selected gadgets is 0.2627 Kg/ year.

Thus from the calculated results, it can be seen that with change in technology and advancements, the use of CRT monitors has reduces and thus they are accordingly replaced by flat screen monitors. The use of UPS has almost seen to be negligible now a days. Need of optimisation: As per the data analysis, if the life cycle of 7 years is followed, total 3 life cycles are complited upto year 2009.The results showed that with completion of cycles, the rate of generation of E – waste is increasing linearly. the pattern is observed as shown in below fig 4.

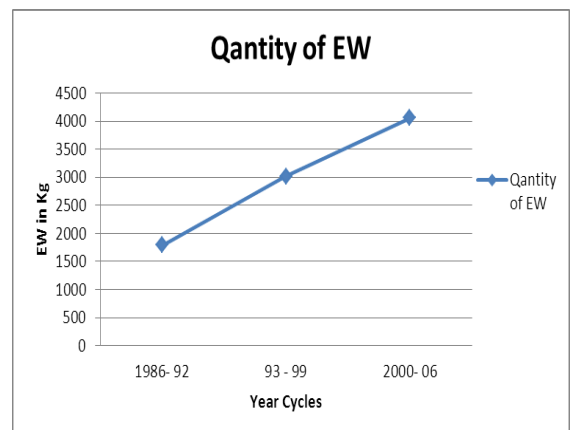


Fig 4: increase in the rate of E- waste.

Conclusion

The above study of quantification of E- waste in leading engineering institute reflects in general the type and generation of E- waste in all engineering institutes. It also depends upon mainly the intake capacity of institutes and the guidelines of AICTE. Presently the availability of e gadgets has found to be exceeded than that mentioned in the norms of AICTE. Thus in future while purchasing new electronic gadgets for institutes, previous gadgets should be disposed off properly or if they are working at least those gadgets should be donated or resold. The purchase of new gadgets should be carried out as per norms of AICTE. This will lead to the least generation of E- waste in the institutes and it will help to minimise the E- waste generating. This practice of optimisation is needed to be implemented so as to minimise the load on treatment and tedious disposal practices of E- waste.

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