

Green Computing - Energy Harvesting and Recycling

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Abstract

Nowadays computer penetration is increasing globally at an amazing rate; hence the energy consumption is also growing rapidly which in turn affect the environment. So holistic approaches are necessary to reduce energy consumption. This paper focus on awareness to the computer users with regards to green computing. It is considered as a major contributing factor to green environment. The goal of Green computing is to maximize the usage of computing resources efficiently with less energy consumption and reduce usage of hazardous materials from electronic waste which affect the environment. It also focuses on recyclability of products when they are produced with less hazardous materials and consume less energy during their life time. Here we tried to explore the current trends and challenges of Green computing and also what will be the future trends in Green Computing.

Keywords: Green Computing, Saving energy, e-waste, Recycle.

I. INTRODUCTION

Today computers are an essential part of individuals all around the world. However these tools are extremely toxic to the environment. Green computing is an environmental friendly concept where the main objective is to dispose computing devices in a way that reduces their environmental impacts.

To promote Green Computing

- **Green Use:**
Reducing the energy consumption of computing devices as well as using them in eco-friendly manner.
- **Green Disposal:**
Recycling unwanted electronic equipments.
- **Green Design:**
Designing energy efficient computing devices.
- **Green Manufacturing:**
Manufacturing computing devices with no impact on the environment.

II. IMPORTANCE OF GREEN COMPUTING

- Due to rapid growth of the internet, Computer energy is often wasteful not in use when leaving the computer is on.

- Printing email, meeting agendas often wasteful [4].
- Computer components like motherboard, memory, printers, spinning disks Consumers lot of energy. Example: for hours of usage, CPU uses 120 watts and CRT uses 150 watts. Therefore 5 days a week 562k Watts consumes.
- Pollutions due to manufacturing, disposal technique.
- Toxicity due to toxic chemicals involved in the manufacturing.

III. SAVING ENERGY WHILE WORKING

- Turn off the computer and monitor when not in use.
- Use LCD monitor instead of CRT monitor because CRT consumes lot of energy when compare to LCD.
- Buy energy efficient notebook computers, instead of desktop computers.
- Use hardware and software with energy star label. This label is a symbol of energy efficiency. Energy star is the trusted government-backed symbol for energy efficiency helping us all save money and protect the environment through energy efficient products and practices [5]. This label was established to reduce green house

gas emissions and other pollutants caused by inefficient use of energy.

Recent implementations of Green computing:

- Different wall papers consumes lot of energy so instead of setting different wall Papers, set blackle as a home page. Blackle is a website powered by Google customsearch.whose screen is black and fonts are graycolor.This arrangement consume less energy.
- To make the computer, environment friendly sleep and hibernate mode can be used. Both modes are activated by manually or operating system level.

Sleep mode:

When a computer is inactive for sometime then the system automatically switches to lower power state. This state preserve energy by cutting power, display hard drive and peripherals when pressing any key from keyboard, sleep mode deactivate and system takes back to its previous state .This mode mainly conserves battery power in laptop computers.

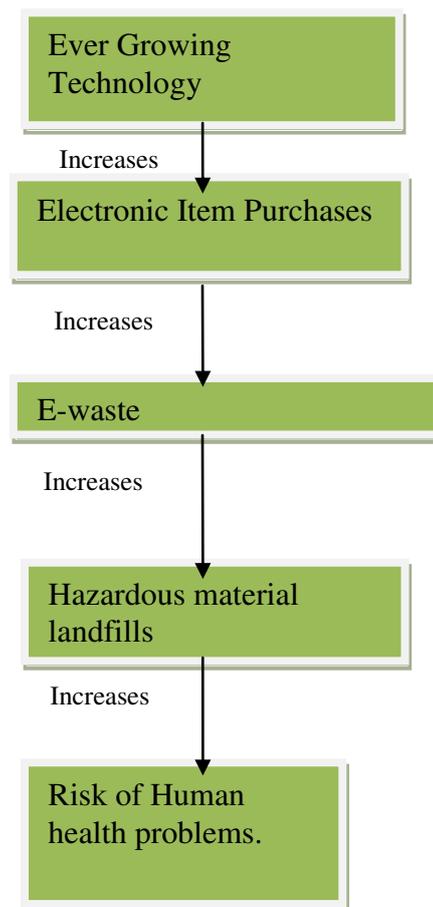
Hibernate mode:

This mode available on windows and Linux and it was designed for laptops and may not be available for all PC's. When this mode is activated, first data moves to hard disk of the system and then system is completely switched off. When the system is turn on, all files and documents appear as it is. In this method battery power can be save a lot when start up the PC's than sleep mode.

IV. E-WASTE (ELECTRONIC WASTE)

It is electronic equipments, generated from electrical and electronic equipments. Unwanted or unusable electronic equipments such as computer and its peripherals, Television, VCR, DVD and cell phones are commonly referred to as electronic waste.

Impact of E-waste:

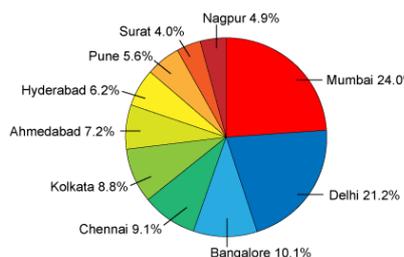


E-waste contains a combination of reusable raw materials as well as toxic materials [1]. Today much of the e-waste ends up in landfills. The toxic chemicals found in e-waste often leach into the ground or may be released into the air which in turn affect the environment. The most dangerous materials used in consumer electronics are,

i) **Lead-** which can be found in circuit board and CRT monitor. It is particularly dangerous to the environment as well as it can cause permanent damage to the brain and nervous systems.

ii) **Cadmium-** as toxic ,it is used in resistors for chips and in semiconductor. It accumulate a human body particularly kidneys.

iii) **Mercury-** Used in batteries, switches.It spread out in water, transforming mentholated mercury that can cause brain damage.



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

Source: Department of Information Technology

Chart: CopperBr

E-waste generation in India

V. MULTIDIMENSIONAL CHALLENGES

- Poor design and complexity of electronics.
- E-waste is full of all kinds of materials such as metals, plastics and chemicals that are mixed together. Toxic materials are attached to non toxic materials which are very difficult to separate.
- Awareness of information on dangerous of E-waste has been very limited.

VI. RECYCLE PROCESS

Huge amount of computer System and related products are discarded every day. The reuse equipments allow saving energy and reducing impact on the Environment, which can be due to electronic waste[2]. One of the major challenges is Recycling the PCB(printed circuit board) and cable from E-waste.PCB boards contain such precious metals as gold, Silver, platinum and such base metals as copper, iron and aluminum. .Capacitor and LED components make up a large proportion of electronics on PCB has exotic and often hazardous materials used as dielectrics.

So the e-waste is processed by melting circuit boards, burning cable sheathing, to recover copper wire.

VII. RESPONSIBILITIES

Government:

- *Strict regulations against dumping e-waste. Separate e-waste bins should be provided, with penalties for those who do not use them

- *Regulatory agencies in each district.
- *R&D in hazardous waste management.

Industries:

- *Label materials to assist in recycling.
- *Adoption of waste minimization Techniques.
- *Green packaging options.

Citizens:

- *Use recycled content.
- *utilize minimal packaging.
- *Those made with fewer toxic constituents.

VIII. CONCLUSION

The ever growing technology in electrical and electronic sector has resulted in increase of E-waste. More than 100 crore mobile phones in circulation, nearby 25% end up in e-waste annually. India, which has emerged as the world second largest mobile market, it is also fifth largest producer of e-waste. TamilNadu is the second largest producer of e-waste, but it has only one recycle unit. Reusing electronics can indirectly help to prevent health problems, by reducing green house-gas emission and also it offers protection to environment. To make the computer society completely green everyone should do the following things.

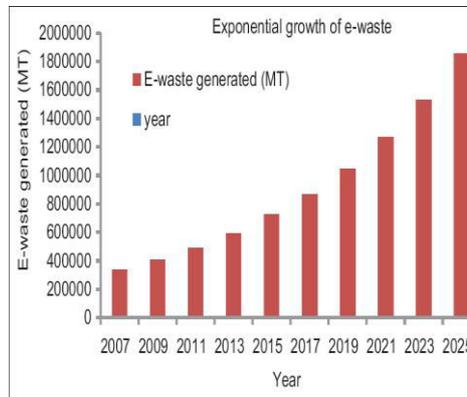
*Instead of discarding computers, upgrade their parts in order to make them new.

*Reuse and recyclability of electronics equipment is a beneficial alternative than disposal.

IX. FUTURE TRENDS

Almost every successful person begins with two beliefs the future can be better than the present and we have the power to make it so...Unfortunately many consumers think of purchasing the newest technology without considering what will happen to their old electronics when they replace them. The possible step is to make people aware of E-waste and for electronic manufacturers to stop using dangerous hazardous materials. India is still struggling to dispose of basic solid waste of municipalities, and in such situation E-waste poses a challenge not only

economically but technically. If this situation continues, World will become a heap of e-waste which will affect our future generation extremely.



E-Waste exponential growth

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