Green Computing an approach towards a healthier environment

Krati Banal[1], Pratik J. Kurle[2], Priyanka Chawla[3]

[1]*Master of Technology student, ITS Engineering College, Greater Noida*

[2] *PGDORM students, Mumbai University, Mumbai, India*

[3] *Assistant Professor, ITS Engineering College, Greater Noida*

Abstract— *Today the percentage of green house gases is rising day by day in our environment. Computers are a basic need of the every person. Consumers are not aware of the harmful impact caused due to use of computers and electronic gadgets. The main aim of green computing is to reduce the harmful effects and make earth healthy and business growth. In this paper we represent initiatives, research issues, need of awareness and challenges in green computing.*

Keywords — *Energy Efficiency, Effect of Environment, Hazardous, Non-Toxic, Issue, Recyclable*

I. INTRODUCTION

"Go Green" is the new motto for all business and industries, as all have realized the need and importance of going green, in terms of cost reduction and public relations. Implementation of green technology is rapidly rising as an important goal in every business field, as currently the charges/cost of energy supplied to data centres, networks and computers is increasing every day. Government agencies are also taking initiatives to reduce green house gases emission and save energy by using green technology. Companies are pressurized by stakeholders, customers and regulatory agencies the Co2 footprint on the environment. Due to recent predications on the Climatic Changes has increased the expectations and interest of common individual on green IT. The importance is continuously increasing for both organizations and individuals to consider reducing their Green House effect.

This research paper represents Green computing and approach towards improving energy efficiency and reduction Co2 emission caused by computing devices. Our research paper takes us through initiatives of Green Computing and the benefits earned by using Green technology to improve the environmental balance. Research issues hindering the progress of making computing more eco-friendly are showcased through this paper. Various challenges faced by researches to make computing more green and efficient are explained by this paper. The intention of this research paper is to make the common user aware of the various aspects of Green Computing and motivating the common user to contribute towards a safer and a healthier environment for our future generations.

II. GREEN COMPUTING

A. Description

In 1992, Energy Star voluntary label program was launched by U.S. Environmental Protection Agency, which was designed to reduce the consumption of energy by an electronic product. The term "Green Computing" was probably introduced shortly after the Energy Star program began. Introduction of sleep mode functions in computers was the first step of green computing.

Green Computing can be defined as an initiative to conserve energy and save natural resources. Green Computing is a strategy to reduce of energy consumption and lowering the emission to green house gases from computers Green Computing is a study to identify various techniques of recycling or biodegrading of defunct products. Green Computing is a technology to decrease the hazardous effects caused by the manufacturing, usage and disposal of computers on the environment. Green Computing is a path to reduce the Carbon dioxide released by the Computing system and energy efficient resources to save money through reduction in energy consumption cost. Green computing is a concept to invent new techniques that emphasize on decreasing power consumption by computing units. Green Computing is a way to control emission of green house gases and controlling e-waste by use of non-toxic and recyclable materials in manufacturing computing devices.

B. Targets of Green Computing

Product Durability: Increasing the durability of a computer will be one the biggest achievements in Green Computing because as per Gartner "Manufacturing a computer utilizes 70% of the natural resources utilized by a computer in the entire lifecycle. A Gartner report has advised to look for Production durability which includes upgrading and modulating, as production of new computer has a larger ecological effect than producing a RAM which can be used to upgrade the existing computer.

Data Centres Efficiency: Data Centres require larger amount of energy. The U.S. Department of

Energy has estimated that data centres energy consumption is 100 to 200 times more than the energy consumption of a standard office building. Hence we need to find a better design for Data Centres which will reduce the energy consumption of computing devices, cooling systems and electrical systems of Data centres. Data Centres are located near power generating plants. This will indirect reduce the cost of Data Centre facilities.

Solar Energy Usage: Solar energy is an important aspect in green computing. Solar energy is one of the alternative energy which is clean and pollution free. A Taiwan based manufacturer VIA Technologies Inc is using solar panel technology in collaboration with Motech Industries, one of the leading manufacturers of solar products. Solar Cells manufacture by Motech Industries are properly installed in energy efficient platforms and system technologies produced by VIA Technologies, to develop devices that run completely on solar energy which are more reliable, less polluting and silent. Solar cells are very durable and require very low maintenance cost and provide energy at very low cost. Hence the production of Solar cells has increased worldwide and governments have started to recognize the importance and benefits of using solar energy.

Recycling of E-Waste: Green Computing is focusing on recycling computers. Gartner report has estimated that around 133,000 PC's are scraped every day by US companies and residents, however only 10 % of all these electronic products are been recycled. Recycling of these e-wastes is very important. Recycling of electronic products allows the companies to reuse the components like lead and mercury. Recycling process saves energy and reduces the impact on environment caused due to improper disposing e-waste.

Virtualization: Virtualization of computer resources is one of the important forms of Green Computing. Virtualization can be defined as abstracting of computer resources like running multiple logical computer systems on one of physical hardware system. Virtualization allows optimum use of computer resources. This trend of Green Computing, the amount of physical hardware systems indirectly reducing the energy consumption and also the reducing the cost of space utilization, rent etc.

III. EFFECTS OF COMPUTING

Currently computers and related services are consuming of lots of energy and resources which are creating various issues for humans and our environment.

Pollution: Today, computing equipments are manufactured which are causing various types of pollution like air, water and land pollution. Extensive use of computing devices are increasing sound pollution and heat in our environment and is one of the main reasons of global warming.

Consumption of Resources: Non-renewable resources like various kinds of metals are used to manufacturing computers. Natural resources like coals are being utilized to generate electricity for computing units. Renewable resources like trees, water are being used more rapidly than the renew process which is causing environmental imbalance.

Ecological Disturbance: Land which was previously used for grazing animals is now used to build data centres and commercial complex which are causing harmful effect to the environment. These changes are affecting the natural food chain and disturbing the ecological system.

Health Risks: Toxic Materials are used during production of computers which can cause cancer and various other health issues like obesity and carpal tunnel syndrome. Workers working in these manufacturing companies are complaining of various health issues caused by these toxic materials

IV. INITIATIVES ON GREEN COMPUTING

We can take basic initiative in office where individual person can contribute to make green environment, by using a technology efficiently which reduces pollution.

Use the latest chips and resources

Latest chip are 1,000 times faster than older one which increases computational speed and saves energy and memory space.

Use LED instead of LCD

LCD monitors are back illuminated with fluorescent tubes which work by running high voltage across a gas and the transformer releases lots of heat causing waste of energy. Whereas LED Monitors are back illuminated with LED which run at a low voltage and do not generate much heat causing less waste of energy.

Refer below chart for comparisons of energy consumption and cost of energy between LCD and LED Monitors.(referenced by: http://blog.whitesites.com/)

Model	Watts	KWH Per Day	KWH Per Month	KWH rate	Cost per Month
Samsung 24" 2493HM LCD Monitor x 2	154	2.156	64.68	.089	$5.75
Dell 24" U2412M LED Monitor x 2	54	0.756	22.68	.089	$2.02
Samsung 30" 305T LCD Monitor x 1	140	1.960	58.80	.089	$5.23

Proper recycling of Computers and peripherals

Computers and peripherals contain Toxic material. If these materials are informally disposed, they have a hazardous impact on our environment. Hence it is important to properly dispose and recycle computers, to control the harmful effects of informal disposable.

Use SSD (State –Solid Drive) instead of Hard Drive

SSD make system faster and reliable as compare to hard drive. It save energy and protect environment all type pollution.

Turn off computer when not in use

Power options of a computer can be used to apply sleep mode option when computer is not in use. This is option can be found in PC Control Panel options. This option turns the CPU to standby mode and the monitor to sleep mode when the computer is not actively used for few minutes of time which helps reduce energy utilization of a computer.

Use laptop instead of desktop PC

Laptops consume 80% less energy than desktop computers. Laptops have low maximum power consumption as compared to desktop computers, as Laptops have smaller power supply unit (PSU). Hence Laptops are preferred in place of desktop computer as laptops more energy efficient.

Use power management schema in offices

Consumer can use power management tool, which encourages saving memory and give updating system in very less time, consumer no need to wait for running do frequently without any interrupt and save energy.

Set low brightness on Monitor

Most of the monitors have brightness set at 80 and if set the brightness at 25, it helps save up to 7 watts per active hour. Hence it advisable to keep your monitor as low brightness as possible as it helps save energy and energy consumption cost.

Use apps which are able to energy saving

Many apps are available which consumer can use to save the energy and close the application when not required.

Use power saving mode

Consumer can use latest equipments having the power saving mode which reduce the energy consumption. Using Energy Star labelled electronic equipments.

Deletion of unused data

Consumer can remove the redundancy n data which are not in use in future. Which data are no longer to use save in hard disk instead memory save. It increases the speed of computer n save energy consumption.

Set standard mode in schedule break

Offices have fixed breaks on daily basis, so that time we can set standard mode in all computers which run automatically on a particular time.

Indentify new initiatives to reduce energy consumption

We need to find the new ways how to reduce the energy and use recourses with green environment.

Conducting Awareness/Training sessions

Consumer need awareness try to find new ideas which consumer give attention and aware how we save energy n save environment.

In a technology perspective many companies run green programs: - DELL run "PLANT A TREE FOR ME" consumer pay extra $2 for laptop n $8 for desktop which are used to grow the plant. All details mentioned in DELL (www.dell.com/earth), through which an individual can be part of green computing.

V. BENEFITS OF GREEN COMPUTING

The Green computing initiatives have various benefits for both common user and corporate industry.

Saving Energy: Green Computing is a technology which improves energy efficiency of computers and reducing the consumption of energy. Reducing energy consumption reduces utilization of natural resources like fossil fuels used for providing energy to computing devices.

Improvisation of Resource Utilization: Green Computing is improvising to find ways to improve resource utilization. Energy consumption is one of the main causes of CO2 emission and better resource utilization will reduce power consumption which reduces Co2 emission. A classic example of improved utilization of resources is running 20 virtual servers on one single physical server which increases efficiency by 80%.

Cost Reduction: Green Computing approach reduces energy consumed which indirectly reduces the energy consumption cost. Proper utilization of resources reduces the number resources required for computing which decreases the money spend on computing devices, this will save lots of money on the longer run.

Healthy Environment: Green Computing basic target is to reduce the harmful effects caused by computing on our environment. Energy efficient computers require less amount of energy and reduce the emission of green house gases in environment making our environment health and safer.

Regulatory Compliance and Improving Goodwill: Green Computing contributions done by businesses help meet the requirement of regulatory compliance, this improves social and corporate image. Green computing initiatives contribute for meeting sustainability demands of customers and employees.

VI. CHALLENGES IN GREEN COMPUTING

In a green computing many challenges are present which create the problems to adopt the green computing. Some challenges are given below.

1. ***High Cost:*** Current infrastructure of IT systems very advanced and costly, replacing these equipments will cost ever higher. Currently we not consider re-engineering process, as that will increase wastage of products. Second aspect is lead is used for manufacturing of computers, if we replace other materials like sliver, it will increase the cost of computers.
2. ***Human Nature:*** Human's don't believe in changing the product with a new one as they believe that the maintenance of the existing product is low, which has caused rise in the percentage of degrade products. Main issue rise due to human thinking and behavior is that they only think about the cost and maintenance of product and not the energy efficiency.
3. ***Lack of Industry Initiatives:*** In a industry have some benchmarks which define some standard and follow to make in manufacturing time, the main point of industries securities and provides the products in low cost maintain the high quality due to this aspect it not consider the environment and green IT aspect Cost saving and growth are the main point of industry. In this point we lack the green environment.
4. ***Lack of Awareness:*** Consumers are not aware about the green projects. In industry workers are not know how to save energy consumption and data efficiency. Consumers are not aware impact of the computers on our environment.

Main issue of environment due to IT industry, when we manufacture computer a large amount of lead are use, which increase the harmful toxic, and make environment polluted. The use of computer are very common now, every person use computer which increase the energy consumption and data storage space. Data centre are the main point of the energy consumption. Due the IT industry level Harmful gases(ch4, c6h6) are increases, which increase the pollution , main issue of IT industry consume a lot of energy and data storage space which volume are much higher . Due to all these reason percentages of co2 are increase which make climate are much hotter and polluted. In a green computing we try to resolve issues and make environment healthy and pollution free.

VII. RESEARCH ISSUES

There various research issues which researchers are facing to improve green computing. Some Major issues are mentioned in the following points:

1. ***Replacement of Lead:*** The main issue of IT industry to find the alternative of lead, we can use alloy as an alternative of lead like tin, silver, copper as these three are easy to use and not harmful for environment as compare to lead. But the melting point of tin 232 f as compare to lead is low which increases the energy consumption and silver and copper are expensive as compared to lead. These three are not able to work in high temperature, so it a challenge for researches to find an alternative materials which having high melting point and require less cooling.
2. ***High Power Density Issue:*** Main issue of high power density server is the increasing power, cooling and maintenance cost of these equipments. Limitation of power cooling and heating effect the net power availability, the main issue is maintaining the power density and cooling capacity.
3. ***Effects of E-Waste:*** Disposal of electronic waste are the main issue if we do re engineering process it take more time and cost which are not good aspect for economical growth of industry, most of the time we replace with new ones that is the main issue which increase the pollution and de grade product.
4. ***Data Centre Infrastructure***: Main issue of data centre is infrastructure, which consume lots of energy and cost. Many equipment and severs are used which produce heat and consume lots of energy to maintain the temperature we use ac and cooling system which produce harmful gases effect on environment

VIII. COMPARISON OF GREEN COMPUTING WITH NORMAL COMPUTING

Below is the comparison table on Green Computing and Normal Computing:-

TITLE	GREEN COMPUTING	NORMAL COMPUTING
Co2 emission	Green computing devices generate less heat which reduces Co2 emission.	Normal Computing devices generate more heat which increases Co2 emission.
Costing	Currently, Green computing devices are costing higher than normal computing devices.	Normal Computing devices are cheaper as compared to green computing devices.
Energy Efficiency	Green computing equipments more energy efficient than normal computing equipments which save energy and lower cost of energy consumption.	Normal computing equipments are less energy efficient than green computing equipments which require more energy and higher cost of energy consumption.
Virtualization	Green computing is trying to use improved virtualization performance software and applications.	Normal computing use basic virtualization software and applications.
Toxic Materials	Green Computing uses lesser toxic materials during manufacturing of computers.	Normal Computing uses more to toxic materials during manufacturing of computers.
Health Issues	Green computing reduces health risk caused due to computing	Normal computing has a harmful effect on health which can cause cancer.

IX. CONCLUSION

Till date normal consumer is not aware of the impact of the emission of CO2 from their computer, as they are only concerned about the price and updated version of computers. If every individual contributes towards green computing, it will decrease the effect caused by green house gas released by computing devices and also reduce the energy consumption by these equipments. More extensive research is required to improve and find new techniques for Green Computing. Green computing is mainly how to use gadgets eco friendly and reduce the impact on the environment. During the manufacturing of computers we use various harmful products which are not good for our environment and human being, so we need a solution to reduce the effect of these products and make an environment healthy and pollution free. In this paper we try to represent various issues whose solutions are not found and we need try to find solutions on these issues. So consumer awareness is important to reduces energy consumption and save energy. For the awareness we make a session and training which help to give the idea of consumer to protect the environment and give the idea how we take initiatives to protect the environment. Awareness of youth at academic levels will widen the scope of research. New Research related to Green Computing should be started at various academic institutes which will increase the chances of finding new ways of to make computing more energy efficient. In next our next research papers we will elaborate on the technical aspects of Green Computing and various research conducted by Electronic Giants at a corporate level.

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