# Practice Green Computing to Combat Global Warming

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**Abstract:- Technological developments and advancements are making a significant effect on our daily lives, be it in the industry, in arts, in science etc.,  However, the knowledge and skill dedicated by the human society towards these lifestyle improvements has indirectly contributed to an ecological threat that the world is facing today, called Global Warming.  When we scrap the old to accept the new, greenhouse gases like $CO_2$, Methane and Nitrous Oxide are emitted in the process, contributing to Global Warming.**

**In today's era, computers have become an integral part of our life to solve our various problems.  Everyone uses computers for their own purpose without being aware of the harmful side effects, impacting the environment.  As increase in the number of computer user's around the world, the consumption of electricity also increases.  Ultimately, increase in carbon emissions in the surroundings.  Controlling the $CO_2$ emissions is one of the first of many steps that we must take in order to combat global warming, which can be done by practicing Green Computing.**

**Green computing refers to an environmentally sustainable computing. It is the study and practice of design, manufacture, use, and dispose of computers efficiently with minimal or no impact on the environment [11]. In this paper, we discuss the different aspects to understand "Green Computing". Also, questionnaire has been done on the awareness of Green Computing. Comparative data has been collected before and after practicing Green Computing. We are promoting Green Computing in The Community College for Girls, Khamis mushyat, KSA, through seminars and are implementing the techniques as well. Also, propagating awareness to neighbors, friends and relatives. Green computing approaches aid us to make a secure place to inhabit. Consequently, Green computing is the eventual requisite to defend the environment and save energy.**

*Keywords:- Green Computing, Global Warming, EPEAT, Power Management.*

## I.  INTRODUCTION

In the tremendous and vast universe, the Earth is the only planet known to support life.  But, the lifestyles of human are extremely destructive towards nature. The lifestyle from finding the food, clothing, shelter and the method in manufacturing and using the devices, almost everything is harmful to the Earth. As we all know, Global warming is one of the most talked about the danger to our Mother Earth. It is increasing day by day. There are a lot of causes for increasing the Global Warming. The mankind's contamination of the atmosphere will effect in global warming. During the past 10 decades, the Earth's temperature has increased to 0.6°C. Whereas, it is predicted to rise further 2 to 3°C by the end of 21st century. An environmental awareness must be raised in people subsequently all the necessary action should be taken to save the Earth ultimately save the human life upon the earth.

## II.  GLOBAL WARMING - CAUSES AND IMPACTS

The raise in the average temperature of Earth's atmosphere is Global warming. Greenhouse gases such as Carbon dioxide, Methane, Nitrous oxide cause Global warming. The most significant cause of Global warming is Carbon dioxide, as it emits 72% comparatively more than other green house gas emissions. It is unavoidably created by burning fuels; by deforestation; the heat generated by computer and its devices. From the last 5 decades, $CO_2$ emissions have been radically raised and yet rising by around 3% annually.  The emitted $CO_2$ remains in the atmosphere for 10-20 decades. Thus, an increase in the concentration of carbon dioxide in the atmosphere eventually increases the temperature of the Earth.  Due to this natural disasters such as hurricanes, storms will become more powerful, floods and droughts will become more common, transformation in Eco-system etc.,

## III.  METHODOLOGY

### A.  Green Computing

There is no use of just talking about the causes and impacts. It's essential to think optimistically to take necessary action to reduce Global Warming. Reducing the $CO_2$ emissions is one of the primary steps that we must take in order to combat global warming. These $CO_2$ emissions can be reduced by practicing Green Computing. Green computing refers to an environmentally sustainable computing. It is the study and practice of designing, manufacturing, utilizing, and disposing of computing devices efficiently with minimal or no impact on the environment [12].

### B.  History of Green Computing

In 1992, the U.S Environmental Protection Agency (EPA) launched "Energy Star", a labeling program designed to promote and recognize energy-efficient products to reduce greenhouse gas emissions [22]. The device contains Energy Star logo uses 20-30% less energy than required by federal

standards. The first energy star labeled products are Computers and monitors. The name, "Green Computing " coined after the Energy Star began.



Fig 1:- Logo: Energy Star

### C. Purpose of Green Computing

In this technological world, no one can live without Personal Computers (PC's), so, wise utilization of the electronic devices makes them friendlier to the environment. Nowadays, PC consumes large amount electricity and produce $CO_2$ emissions by the heat generate by it to be considered an Eco Friendly solution.

The main purpose of Green computing are,

To inculcate the social responsibility among public and create environmental awareness; To lower the carbon footprints on the environment; To avoid the improper use of power consumption and to get better energy management; maximize energy efficiency during products' life time; promote reuse, refurbish and recyclability; To reduce pollution and toxicity by reducing the usage of hazardous material; Curtail travel requirements for employees; Manufacturing greener products leads new business opportunities. Lessen the usage of paper; Promote refurbishing for the next generation.

## IV. APPROACHES TO GREEN COMPUTING

Today's computer users are started to rely on special fan to cool the computer system. It is possible to make cool for one computer system. But it is hard to balance to achieve the same for each and every computer worldwide. According to research, if 8 hours of usage of a computer for 5 days a week needs 562 Kilowatts but if the computer is left switched "on" without proper power saver modes, this can lead to 1600 Kilowatts. In large institution, eg., a university, the invoice of the power consumption for computers alone hits to $2 million per year, obviously, much carbon-dioxide has been emitted to the atmosphere! The United States produce 22 billion pounds of electronics annually. Since the computer/electronic sectors consume lot of electricity accordingly, the yearly energy output has lot of carbon footprint which further contributing to Climate Change.

| Component | Energy consumption (On Mode) | Energy consumption (Off Mode) |
|---|---|---|
| Desktop PC | 180 | 83.3 |
| 15-17" Monitor | 50 – 60 | 7.8 |
| Laser Printer | 481 | 4.5 |
| Inkjet Printer | 22 | 5 |
| CPU | 120 | 85 |

Table 1. Energy consumption in watts

There are many different approaches to solve this issue. They are Power Management, EPEAT, Virtualization, and Material Recycling.

### D. Power Management

The Advance Configuration and Power Interface (ACPI), an open industry standard, allows an operating system to control the power saving aspects of its underlying hardware. This permits a system to automatically turn off components such as monitors and hard drives after set periods of inactivity [24]. By purchasing and using such standard product is one of the best approaches towards green computing.

### E. EPEAT

EPEAT (Electronic Product Environmental Assessment Tool) is a tool through which the consumer can assess the effect of a product on the environment. It helps in identifying greener products and other electronic devices. Also, it provides guidance on performance criteria which facilitates sound purchase decisions and recognizes the efforts of manufacturer's in reducing the environmental impact of the products [20].

### F. Virtualization

Virtualization is the replacement of hardware with software.

It makes one physical computer, acts and performs like many physical computers. Advantages are greater efficiencies in power consumption; no need of any new hardware, no need to update individual software, inexpensive and uses less energy eventually saves the natural resources.
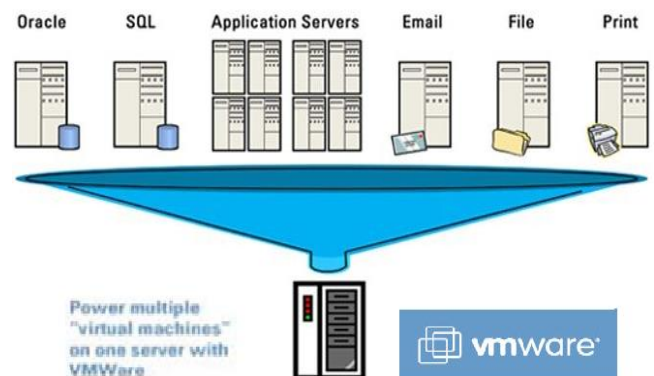


Fig 2:- Virtualization

## G. Material Recycling

Every year 130 million cell phones get retired. It is estimated that 315 million computers become obsolete in every 7 years. Users in China and India require the creation of new computers. Then think about the old equipment? What to do? Obviously, it leads to dispose of. This waste is called E-Waste. E-Waste caused by the improper practice of disposing computer and its components. It has a number of indirect contributions on the environment. As a result, soil, water and air are easily contaminated. Becoming aware of the effects of E-Waste is the first step in arresting this problem. July, 2015 (NBC NEWS). E-Waste management includes manufacturing, processing techniques, recycling and consumer awareness efforts. By practicing 3R's (Reuse, Refurbish and Recycle) protects the environment from harmful emissions.

- Reuse*:* Instead of disposing electronic devices such as computer, donate to the people who may not have or have lesser quality computers. Donate computers to schools, churches, libraries, non-profit organizations and lower income families.
- Refurbish: Whenever the device's new version releases, instead of discarding or replacing the computer, it can be upgraded by getting a new CPU, memory chips etc.
- Recycling: If it is inevitable to reuse or refurbish then there is a better option of Recycling. Companies can recycle the plastics and other components can reduce the waste and toxins which affect the environment.

## V. IMPLEMENTATION OF GREEN COMPUTING TECHNIQUES

Organizations all over the globe realize the corporate social responsibility towards the environment. Most companies believe in conserving energy, power and using environmental friendly products that helps in reducing the carbon footprint. Nowadays, it is essential for all sized organizations to implement the aspects of green computing in their daily workings.

➢ *Switching to Greener Products*

B. Solar Computing: Powering PCs with the Sun: It is a part of VIA Green Computing Initiative, VIA Solar Computing seeks to defeat the challenges of power infrastructure deficiencies and to define clean energy solutions. Solar-powered computing solutions are less polluting, inexpensive, more reliable and more flexible for a wide variety of new markets, applications and environments. The $CO_2$ emissions can be reduced by utilizing solar power products. Many solar power products are available which promotes Green computing such as Chipsets, Processor Solar charger Laptop bags etc.,



Fig 3:- (a) VIA Green Product



Fig 3:- (b) Solar charger Laptop bag

### A. The Zonbu Computer

The Zonbu computer is an energy efficient computer consumes less power supply. The device runs the Linux operating system using a 1.2 gigahertz processor and 512 Mega of RAM [16].



Fig 4:- Zonbu Computer

### B. Fit –PC

Fit-PC consumes only 5 watts of power in a day than a traditional PC consumes in 1 hour. Fit-PC emits less carbon dioxide.



Fig 5:- Fit –PC

### D. The ultra-portable and Asus Eee PC

The computer is small in size, low power CPU, compact screen, light weight, inexpensive, embedded Wi-Fi and uses USB for storage and uses less power  than a standard laptop which  ultimately  emits less $CO_2$.



Fig 6:- Asus Eee PC

### E. Sunray thin client

A Sun Ray Thin client consumes less electricity from  4 to 8 watts of  power, eventually emits less $CO_2$[21].



Fig 7:- Thin Client

➢ *Practicing Greener Techniques: Ways to reduce energy consumption; reduce $CO_2$ emissions to reduce Global Warming.*

- Turn "off" the computer when not in use, even for an hour. It can reduce energy use by 810 kWh/year.
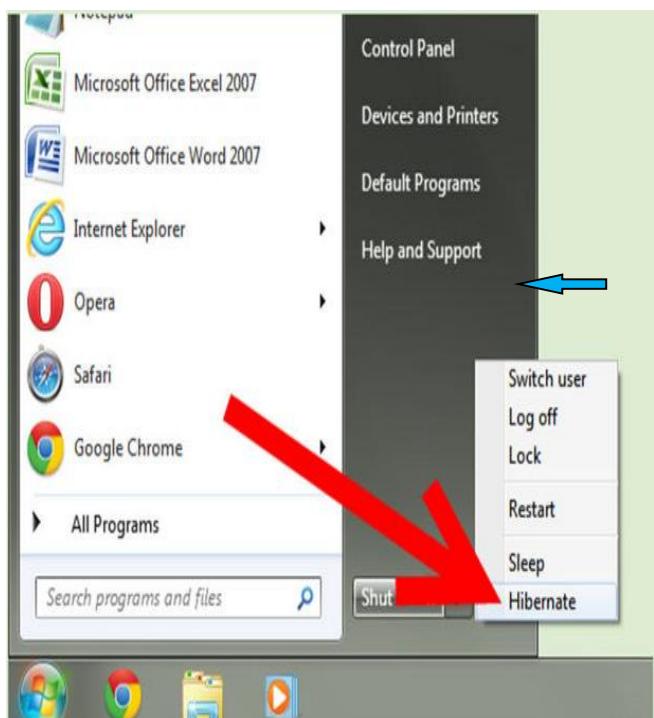- Use power saver mode (Sleep mode, Hibernate mode).



Fig 8:- Sleep mode, Hibernate mode

- Turn "off" the monitor, printer and all peripherals when not in use.
- Don't use Screen saver as it consumes more power.
- Start using the "Energy Star" labeled products.
- Plug the computer to surge protector with a master control outlet.
- Choose dark backgrounds because bright background consumes more power.
- Liquid Crystal Displays are preferable than CRT monitors.
- Use LED or CFL bulbs instead of incandescent lights.
- Greener Browsing –:A Switch from Google to Blackle. Blackle is an energy saving search engine powered by Google search. It has a dark background which consumes less energy. Computer screen with white background consumes 74 watts whereas Black background consumes 59 watts. By switching from Google to Blackle, Earth would save 750 MW / year.



Fig 9:- Blackle

- Paper and Printing Techniques: Trees were cut down for many purposes, whereas 90% of trees were cut down every year for paper usage. The cutting down of trees results in rising the amount of carbon dioxide in the atmosphere. Controlling deforestation controls global warming.1 ton of office paper needs to cut down 24 trees; whereas 1 ton of recycled paper saves 17 trees. So,
- Promoter recycling and use recycled papers
- Reduce excess printing / photocopying
- Avoid unwanted printing / photocopying
- Take double-sided printing / photocopying
- Use projector instead of giving handouts in the meeting room.
- Encourage reduction of paper generation through e-mail.
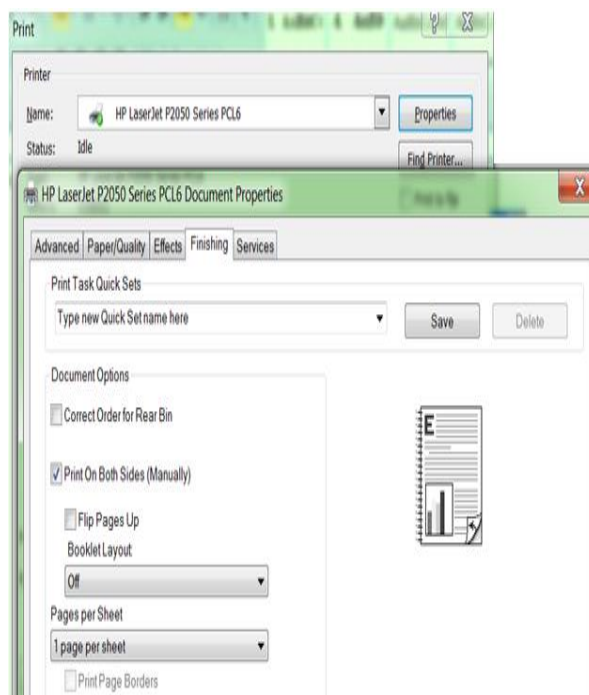- Reduce Margins settings so that your printer uses less paper.



Fig 10:- Double-Sided Print option

## VI. CASE STUDY AND QUESTIONNAIRE

As a global citizen, we have responsibilities to our mother Earth. Our first role towards nature is to raise awareness to reduce carbon footprint which contributes Global Warming by practicing Green Computing among students, friends and neighbors.

We take an oath that for every semester, we have to raise awareness of Green Practice by delivering a special lecture. This semester, we started raising awareness with our 4th level students of King Khalid University. Before we started our lecture about the awareness of Green Computing Techniques, we collected basic information from the students about awareness and Green Computing practice and after a month of our special lecture, again we collected the same information from the same students. We found an optimistic comparative result which encourages us to step forward.

The following chart shows the comparison between before and after practicing Green Computing.

Comparison between before and after practicing Green Computing

□ Before Awareness of Green Computing (Out of 20 students, Answered "Yes" )
■ After Awareness of Green Computing (Out of 20 students, Answered "Yes" )
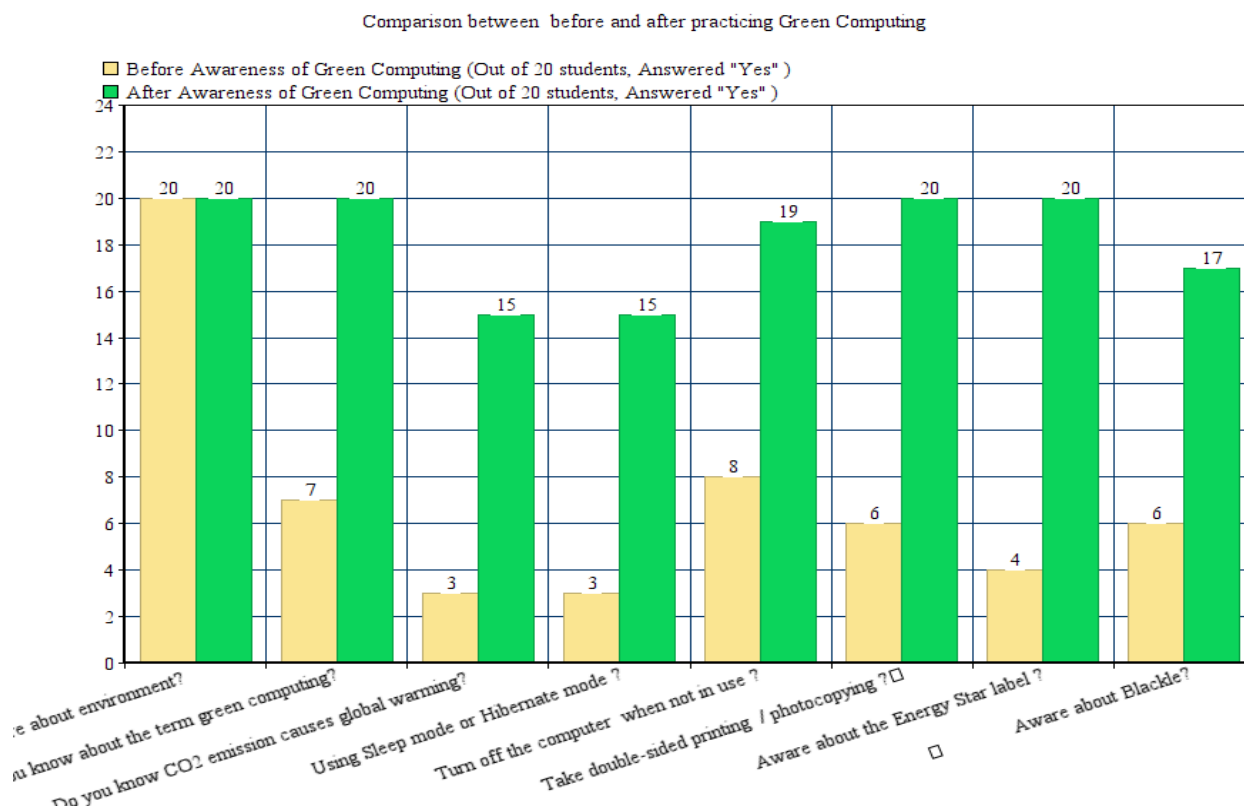


As a faculty of Computer Science, We have the responsibility to create awareness among students about an importance of practicing Green Computing along with the concept of 3R's (Reduce, Reuse and Recycle).Though the sample size may not be adequate but as we propagated, so do the students then thousands of students will join together towards nature conservation; This great efforts will be a drastic step to protect our Mother Earth from destruction.

## VII. CONCLUSION

Small changes eventually add up to a huge result. Creating awareness of the techniques of Green Computing, use of energy efficient products and 3R's (Reduce, Reuse and Recycle) will reduce the harmful impacts of $CO_2$ emissions. Positive actions for a green computing take a slight effort, however the decrease in energy consumption normally transform into instant savings and controls Global Warming. Every individual should assure for the 4th "R" viz. "Respect"; Respect our Mother Earth which ultimately leads us to save the planet. The paper concludes with a take home message that, "Practice Green Computing to initiate Global Cooling".

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