

Application of Green Computing in Institutions Imparting Computer Aided Education

Dr. Devendra Pandey^{1*} Dr. Kamlendu Pandey²

^{1,2} Assistant Professor, Department of ICT, Veer Narmad South Gujarat University, Surat

Abstract – Green Computing is now becoming a legislative requirement for all kind of usage in computers and digital media. Due to high spurt in the dependencies of business and education on computers and related equipment, there is a huge stress for manufacturing storage and delivery of such services. The green computing starts with the manufacturing and ends with the e-waste disposal processes so at every end care has to be taken to minimize the damage done to environment. It is a vast area but this paper limits its discussion for educational institutions only. The various green computing measures which can be taken in ICT institution are underlined. Also various green computing strategies are also discussed.

-----X-----

1. INTRODUCTION

In the recent years there has been a virtual explosion of electronic devices which computers, smart phones and all equipment and accessories due to advancements in technology of digital computing. Almost every organization is taking the benefit of the technology and using it maximizes their returns on investment. The field of education is not an exception, perhaps this is the most leading sector which is focusing on producing a work force and knowledge force of people who can work in this digital era. Governments have made policies to maximize the uses of technology. Good as far as benefits are concerned but it is coming with a huge cost of environmental damage. Right from the production to usage, the entire life cycle of equipments have their own environmental impacts. The Green Computing is the branch to deal with this damage, propose and take the steps to minimize the environmental damage. With increasing emphasis on environmental protection now the same Govt. is making rules and regulations to safeguard the environment. Green computing is a wide field which encompasses every possible effort to save environment in computing world. With awareness in the common people even the customers are demanding the power aware and smart systems which have minimum environmental effects. This paper discusses this area in the context of education and suggest various steps, strategies and remedies as to apply green computing aspects to ICT based institutions.

2. GREEN COMPUTING IN INSTITUTIONS USING ICT

According to Chris Rochel's study of green computing in ICT school [2], he found energy consumption for some of his technological needs, looking at ways to

make his computer use more sustainable, examine ways to make his school technology uses more environmentally friendly and feeding back on how a Green Computing Initiative runs in his school. Looking to the following facts:

- Computer technology use accounts for 2% of anthropogenic CO₂ – That is roughly equivalent to the aviation industry and it is predicted that computer use will double in the next few years!
- Extra heat generated by computers means more heat in the office/ school, which translates to more use of air conditioning.
- Fifteen billion batteries are made and sold across the globe every year.
- 130 million cell phones each year go into retirement. Recycling 100 million phones would recover 3.4 metric tons of gold—gold that would not have to be mined. PCs contain gold too: 1.2 tons of PC scrap electronics has more than can be extracted from 17 tons of gold ore.
- Flaws in Windows XP's sleep mode and Microsoft's choice of "High Performance" as the default performance option may have added \$5 billion to power bills annually worldwide.
- As much as 40 percent of the energy used by electronics in a home is consumed when devices are switched off.

- Computers and computer monitors typically represent the second-highest power consumption in office settings.
- The energy saved by recycling one plastic bottle will power a computer for 25 minutes.
- Electronics are responsible for 25% of home energy use
- Unplug! Each year in the U.S., electronic devices that are turned off but not unplugged use electricity worth \$3 billion.

There is a lot of energy being used. Our use of technology is clearly adding to a serious global problem. However, we can make a difference. By making our computer experience greener, I believe we can do two things immediately. Firstly, we can reduce our energy consumption considerably by following a few simple steps/ guides. I will explore some of these in the next post. Secondly, by reducing the amount of energy we use when using technology, our electricity bills will come down. How cool is that – we can do our bit for the environment, and make money while doing it – now that has to be good!

3. VARIOUS GREEN COMPUTING STRATEGIES

Looking to the threat of environmental damage with the progressive thought of going for computerization all the way, the world has come out with various points and strategies which we can follow to minimize the damage. So terms are discussed as under we will see them in detail.

1. Carbon Free Computing
2. Solar Computing
3. Virtual Computing

3.1. Carbon-free computing

Checking the carbon foot print of any process or product is now embedded in the legislation of most of the developed and developing countries. Manufacturing process of all electronic products make use of the processes which has certain carbon emission. This emission has to be measured on per product and per component basis. Not only carbon but nitrous oxide and fluorocarbons are also to be taken into account. After 1997 Kyoto protocol a documentation of every product and its carbon foot print is must. The producer has to all to do all the efforts to minimize this footprint. Eg. company like Dell assess as how many trees will be required to be planted to produce on processor or laptop to minimize the emission. Not only trees but other ways like development of wet lands , green maturing, wasteland development are also considered in this. [9]With this point in view the companies can levy charges from the

customer as environmental cess or under any other specific term. The Governments have come out with the concept of carbon credits which one can earn by saving the quantum of carbon emission. The companies are encouraged by the Governments to innovate and refurbish the manufacturing, storage and delivery processes by awards and tax benefits.

2.2. Solar Computing

The power generation is another source of environmental damage if done in conventional ways like thermal and hydraulic. It is important to calculate how much damage a power generation does per unit of power. As conventional methods create pollution the solar power comes as a rescue and a solution to this issue. The efficient solar cells must be manufactured for powering equipment as to reduce the need of conventional power generation. The solar cell production may also have emissions but are very less compared to other ways. Solar with Photo voltaic cells can be used to power the devices. This field is still in infancy and requires lot of research and funds to come with all acceptable norms and should be dependable in all situations. Many electronic industries are doing this initiative and very soon we may come with fully usable efficient solar power mechanisms;

3.3. Virtual computing

This is the strategy to be used by user rather than manufacturer. It works on a simple concept to reduce the demand of electronic goods with efficient use of resources. The decrease in the demand will trigger low volume of production and thereby decreasing the carbon emission. Following technologies can be used to achieve this objective

1. Centralized computing
2. Wireless Networks
3. Internet of Things
4. Cloud Computing
5. Smart devices

All the above ways lead to the reduction of devices and network infrastructure which will ultimately be reflected in the quantum of productions[10]. Example cloud computing[8] has facilitated a complete virtual environment for hardware, operating systems, applications and software. The companies now don't need any physical infrastructure on their premises as they have all of them available in virtual mode. With a simple tab and a powerful internet connection entire organization can be controlled.

4. REMEDIAL APPROACH

Practical Thoughts of Green computing in computer education. Green computing focuses four "R" [2] *Reduce, Reuse, Recycle, Respect and Responsibility*. If we apply these R's to our use of Technology, We can make our computing experience more environmentally friendly and sustainable for the future. This will examine what we can do for each of the four "R"s. an attempt to reduce environment problems.

4.1 Reduce

It is clear that Technology uses huge amounts of energy. However, we can make a difference with some simple steps. Our work habits which use technology can be modified to minimize the impact on the global environment. Here are some suggestions:

- Set your computer to hibernate during extended periods of inactivity – Hibernate uses less power than sleep mode.
- Unplug devices overnight (Weekends at work). Energy saving by doing this are huge.
- Use notebook computers whenever possible.
- Don't use screen savers – They use more energy than you think.
- As far as possible power saving hard disk and other storage devices should be used
- Set PRINT settings – Print double side and only when you have to.

4.2 Reuse

With technology developing at an ever increasing pace, it is often difficult to continue using the devices we have when there something new just around the corner. We often compelled to get the latest gadget. However, there are numerous charitable organizations both locally and globally which are looking obtain and then send old hardware to less economically developed nations and sectors of society in need. These companies will destroy all data on the donated computers and repair faulty parts. This reuse leads to thousands of people having access to computers which they would not have had otherwise. Try doing a search for such an organization near you!

4.3 Re-cycle

Almost everything connected with technology can be recycled. Find a Re-cycling company near you.

- The display unit of most of the digital systems contains lead, mercury and chromium. The elements can be extracted and reused.

- Optical devices like Blue Ray and compact disks contain nickel, glass, plastic and some gold too which can be recovered by professionals
- Mouse, batteries laptops too have components and materials which can be recycled. Find a Re-cycling company near you

4.4 Respect

Respect covers all of Green Computing. It is important that we Respect everything we come into contact with. Respect is something we all desire, and therefore something we all must give. By truly respecting our computing experience, use and actions we can help to create a more sustainable future for all of us.

4.5 Responsibility

A responsibility chart must be used with responsible human resources which look after the aspects of green computing and audit it periodically. The responsibility framework must be composed of the staff from all the departments which are using e resources with a management on the top. The responsible person must arrange awareness programs and technical seminars so as to encourage green computing.

5. CONCLUSION

The paper emphasizes on the requirements of green computing in educational institutions which are using ICT for teaching and other administrative processes. The paper careful outline all the actions which can lead to green computing. It discusses the strategies like carbon computing, solar computing and virtual computing to encourage green computing measures. Lastly some important remedial approaches like Reduce, reuse, recycle, respect and responsibility are discussed as ways to increase green computing efforts for environmental protection. Many green

REFERENCES

- [1] <http://www.wipro.com/corporate/media/newsdetail.aspx?id=1562> [Last visited on 14th Dec, 2017].
- [2] <http://techmeetsed.com/2011/04/15/green-computing-part-2-what-can-we-do/> [Last visited on 18th Dec, 2017]
- [3] <http://green-compute.com/> [Last visited on 31/08/ 2011]
- [4] <http://www.teno-preneur.net/informationdesk/sciencetech-magazine/2007/nov07>

- [5] <http://searchdatacenter.techtarget.com/definition/green-computing>
- [6] <http://www.greencomputing.co.in/>
- [7] <http://timesofindia.indiatimes.com/topic/Green-computing>
- [8] Lin, Kai, et. al. (2017). "Green video transmission in the mobile cloud networks." IEEE transactions on circuits and systems for video technology 27.1: pp. 159-169.
- [9] Asad, Zakia, and Mohammad Asad Rehman Chaudhry (2017). "A two-way street: Green big data processing for a greener smart grid." IEEE Systems Journal 11.2: pp. 784-795.
- [10] Nanath, Krishnadas, and Radhakrishna R. Pillai (2017). "The influence of green IS practices on competitive advantage: mediation role of green innovation performance." Information Systems Management 34.1: pp. 3-19.

Corresponding Author

Dr. Devendra Pandey*

Assistant Professor, Department of ICT, Veer Narmad South Gujarat University, Surat