Green Computing: Analyzing Power Consumption using Local Cooling

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Abstract

   In recent years energy consumed and heat produced by computers are so high which creates more harmful problems in environment. To reduce this, industries and organizations are concentrating more on Green Computing. It is the technology which makes us to know how to utilize computers and computer related resources in an efficient manner and to save environment. In this paper, we analyze the power consumed by various hardware parts in the computer with different configuration and based on this, we tend to provide a solution for less power consumption. The analysis is prepared with the help of the software *"Local Cooling"*.

Keyword: Green Computing, Environment, Energy, Power, Local Cooling.

I. INTRODUCTION

   Green computing is also known as green IT. It is the process of using computer and other resources in an environment efficient way. Recent computer systems are the combination of people, hardware, software and networks, etc.,[1] which produce more hazards to environment. Green is used to reduce power consumption and increases energy efficiency. Computer / Laptop sale is increasing day by day so power consumed by them is too large. By reducing energy consumption, global warming can be reduced. Green Computing tries to provide solution to various environment related issues and provides an alternative technology. Nowadays more research works are going in this area to reduce the harmful impact to save the environment. Government has also made various steps to reduce environmental problems because of Computers. In this paper we compared various power options in Laptops and Desktops with the help of the software LocalCooling and provided better practices to be followed which reduce power consumption.

II. HISTORY

   An average desktop computer has a power usage of between 80 and 250 watts, depending on graphics cards and additional peripherals. The cost to the University to operate a typical computer and monitor workstation (130 watts @ 11c kW/h) for 24 hours per day, 7 days per week, 365 days per year, is $129.73. The same workstation operating only during work hours – 8 hours per day, 5 days per week, year round is only $30.80.

   An enormous amount of energy is wasted while the computer or printer sits idle, perhaps while you are in a meeting, on the telephone, or at lunch. Any current computer, printer, fax machine, or photocopier has energy saving features that put the machine into a sleep mode when it's not in use. Substantial power savings of between 50 to 90 per cent can be immediately realized [8].

   In 1992, the US Environmental Protection Agency (EPA) introduced ENERGY STAR as a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Computers and monitors were the first labeled products. Through 1995, EPA expanded the label to additional office equipment products and residential heating and cooling equipment. In 1996, EPA partnered with the US Department of Energy for particular product categories. The ENERGY STAR label is now on major appliances, office equipment, lighting, home electronics, new homes and commercial and industrial buildings and plants.

   Through its partnerships with 18,000 private and public sector organizations, ENERGY STAR delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices. ENERGY STAR has successfully delivered energy and cost savings across the country, saving businesses, organizations, and consumers $24 billion in 2012 alone. Over the past two decades, ENERGY STAR has been a driving force behind

the more widespread use of such technological innovations as efficient fluorescent lighting, power management systems for office equipment, and low standby energy use.[2]

III. LOCAL COOLING

This tool is used to track the power consumption of a computer or a Laptop. It displays the amount of power consumed by computer, monitor, processor and other peripherals. It tells when to shutdown the monitor, spin down the disk and hibernate the system.

It reduces energy bill, the amount of green house gas emission. It controls the computer and helps to the efficiency of computer [4]. Here are some sample screens of the Local Cooling software.
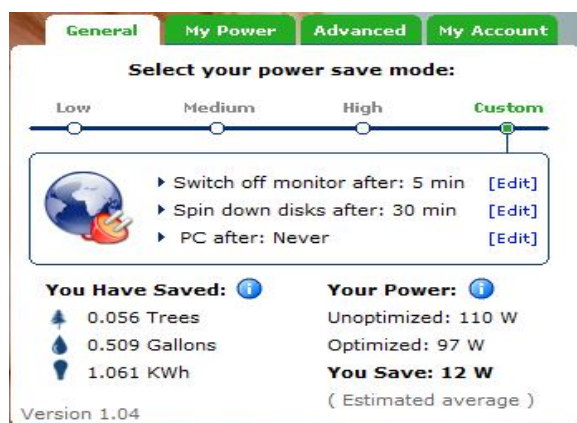

Fig 1: General setup screen of Local Cooling Software

Fig 2: Power consumption of hardware devices

IV. GLOBAL IMPACT

According to a report by Forrester Research, by the end of 2008, there were over one billion PCs in use worldwide. As PC adoption grows globally, it is estimated that there will be more than two billion PCs in use by 2015. It took 27 years to reach one billion but will only take 7 more years to double that number [5]. If N Computing systems were used at a ratio of 6 N Computing devices to each PC, Energy use would decline by over 143 billion kilowatt hours per year CO_2 emissions would decrease by 114 million metric tons. That's like planting 550 million trees; E-waste would be reduced by 7.9 million metric tons [5].
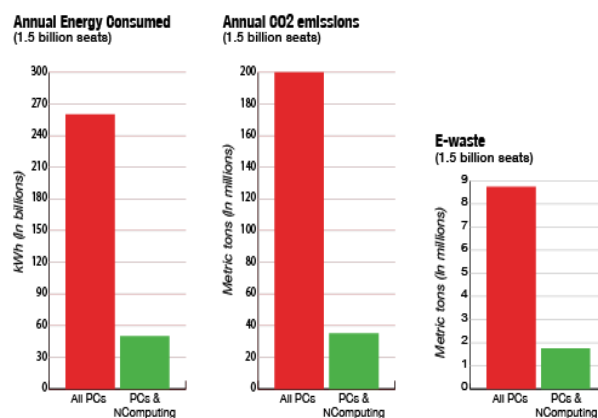

Fig 3: Annual energy consumption, CO2 emission and E-Waste

V. GOVERNMENT REGULATIONS

1. The Restriction of Hazardous Substances (RoHS) framed an act in Feb 2007 which restricts the use of Lead, Mercury, Cadmium, Polybrominated biphenyls and Polybrominated diphenyls while manufacturing electronic and electrical products [6].
2. The Electronic Products Environmental Assessment (EPEAT) has standards based on IEEE 1680 to PC's products and assess the energy consumption though out the life time of the product [6].
3. The Organization for Economic Co-operation and Development (OECD) has published a survey of over 90 government and industry initiatives on "Green ICTs [7].
4. In 2006 energy star program was revised so that all the manufacturers should paste stickers on their products.

5. Climate Savers Computing Initiative (CSCI) has taken steps to reduce power consumption in PCs.
6. The Green Electronic Council (GEC) assists people to buy greener computer.

VI. ANALYSIS

The Local Cooling software provides data on the energy consumption of various components like CPU, Display Device etc. We installed that software in different computers with different configuration and have a brief analysis over the power consumed by those computers. The options available in the software are listed below.

A. Power Saver Mode

It is a feature in the computer which reduces power consumption. During inactivity the monitor will go dark which reduces the power consumed by monitor by 30 -115 Watts. In our analysis we analyzed by switching off the monitor after 15 minutes, Spin down the disk after 1 hour and never switch off the PC, this saves power upto10 Watts. The same continued by switching the monitor after 10 minutes, Spin down disk after 30 minutes and switching off PC after 4 hours, it saves 20 watts. When we done the same process with some more reduced timings when compared to the previous two, that is "Switching off monitor after 5 minutes", "Spin down disk after 15 minutes" and "Switching off PC after 1 hour", it saves 28 watts.

Factors	Time		
Switch OFF Monitor after	15 Mins	10 Mins	5 Mins
Spin Down Disk	1 Hour	30 Mins	15 Mins
Switch OFF PC after	Never	4 Hours	1 Hour
Power Consumption			
Unoptimized	126W	126W	126W
Optimized	115W	105W	98W
Power Save	11W	21W	28W

TABLE 1: POWER SAVER MODE COMPARISON

With single computer, 28 Watts power is saved so think when the same activity is followed in all computers means more power will be saved.

B. Power Consumption

1) Monitor

Different monitors with different resolutions and energy consumed by them are shown here. Monitor with 17-19'' with different resolutions consumed 36 Watts. When we tested with 15''@1024*768 resolution, it consumed only 30 watts. In single computer if it is possible to save 6 watts then think of a college with 1000 computers. It is possible to save 5000 Watts.

Monitor Type	Power Consumption
Monitor 17-19'' Screen @1280*1024	36 Watts
Monitor 17-19'' Screen @1366*768	36 Watts
Monitor 17-19'' Screen @1280*768	36 Watts
Monitor 15'' Screen @1024*768	30 Watts

TABLE 2. COMPARISON OF POWER CONSUMPTION BETWEEN MONITORS

2) Hard Drive

It is a hardware which stores information. Nowadays Pc's contains two or more hard disk drives. A PC with 1 drive consumes 8 Watts, 2 drives consume 16 Watts and 3 drives consume 24 Watts. For simple calculation and for web search 1 or 2 drives are enough so it is possible to save 8 to 16 Watts per computer.

Number of Drives	Power Consumption
2 connected Drives	16 Watts
3 connected Drives	24 Watts
1 connected Drive	8 Watts

TABLE 3. COMPARISON OF POWER CONSUMPTION WITH NUMBER OF DRIVES

3) CPU

It is the hardware of the computer which is used to do many operations like arithmetic, logical, input, output, etc., The latest processors consumes nearly 45 Watts whereas the old processors consumes 20 to 30 Watts.

CPU Type	Power Consumption
Core 2 Duo	**45 Watts**
Core™ i3-2120@3.30 GHZ	45 Watts
Pentium III Xeon Processor	24 Watts
Core™ i5-2410M @2.30G	45 Watts
Pentium IV	30 Watts

TABLE 4. COMPARISON OF POWER CONSUMPTION WITH DIFFERENT PROCESSOR

4) Others

The other parts of the computer like graphics card which requires 6 Watts, Fan, Sound requires 15 Watts.

Others	Power Consumption
Graphics Card	6 Watts
Fan, Sound, More	15 Watts

TABLE 5. POWER CONSUMPTION BY OTHER DEVICES

By reducing the configuration as per the needs, it is possible to reduce power consumption.

V.BEST PRACTICES

- Shut down the CPU and other devices during inactivity.

- Use power-up and power down devices to switch off the devices when not in use.

- Do computer related tasks continuously so the in the remaining time it is possible to switch off peripherals to save energy.

- Try to use liquid-crystal-display (LCD) monitors rather than cathode-ray-tube (CRT) monitors.

- Try to use notebook rather than desktop whenever possible because a desktop requires more energy than a notebook.

- Proper power management techniques are used to save power.

- Reduce the use of papers while printing and recycle it.

- Dispose e-waste properly according to the law.

- Identify alternative power source.

VI. MATERIAL RECYCLING

Obsolete computers or other electronics are valuable source for secondary raw materials, if treated properly; if not, they are a source of toxins and carcinogens. Rapid technology change, low initial cost, and planned obsolescence have resulted in a fast-growing surplus of computers or other electronic components around the globe. Technical solutions are available, but in most cases a legal framework, a collection system, logistics, and other services need to be implemented before applying a technical solution. The U.S. Environmental Protection Agency, estimates 30 to 40 million surplus PCs, classified as "hazardous household waste", would be ready for end-of-life management in the next few years. The U.S. National Safety Council estimates that 75% of all personal computers ever sold are now surplus electronics.
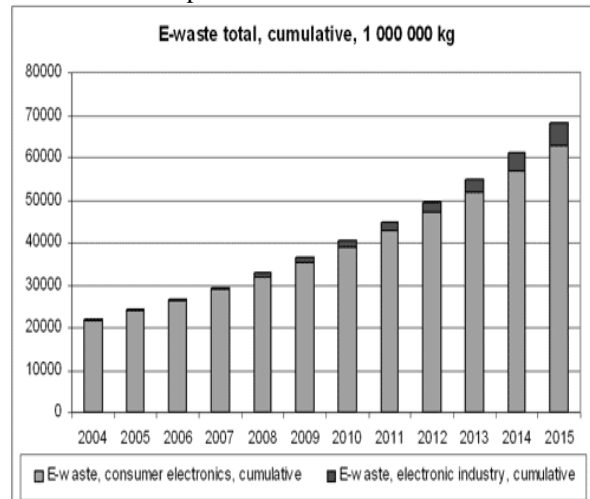

Fig. 4. E-Waste Cumulative Per Year

Unwanted electronics wastes are called as E-Waste. Managing and disposing the e-waste is the major problem. Many countries are facing major problem with this e-waste. E-waste is a potential threat to human health and environment because it has harmful substance like lead, Copper, Zinc, Cadmium, Plastic and other materials. It affects the ground water.
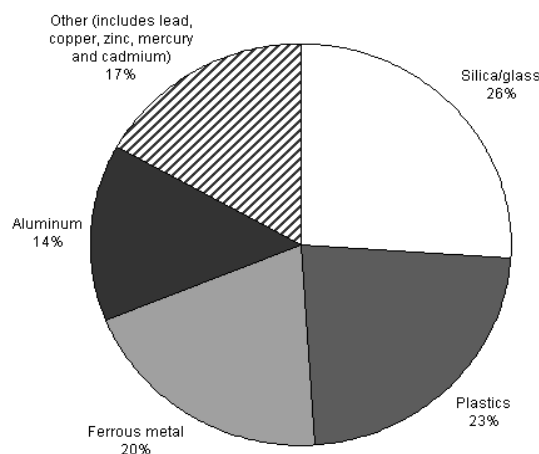

Fig. 5. Material Composition of PC

The better way is to recycle and reuse. It is important to create awareness about this among people.

VII.CONCLUSION

Green Computing helps to reduce global warming. It is used to minimize power consumption and an easiest way to dispose E-Waste. In this paper we analyzed power consumption of various hardware parts of PC in different configuration. Minimum

configuration requires minimum power consumption. For doing simple calculation and browsing, simple configuration is enough. By following the above said practices and using low configuration computer devices we can reduce power consumption of a computer by 30 Watts. When we apply this to maximum computers it is possible to reduce as much energy as possible. Some other ways to save power is to turn off the devices when not in use and keep the system in sleep mode while leaving the workspace.

VIII.REFERENCES

[1] "Parichay Chakraborty, Debnath Bhattacharyy, Sattarova Nargiza Y. and Sovan Bedajna", Green computing: Practice of Efficient and Eco-Friendly Computing Resources, International Journal of Grid and Distributed Computing Vol.2, No.3, September, 2009.

[2] http://users.jyu.fi/~riesta/Green_Computing.pd

[3]"Mrs.Sharmila Shinde, Mrs.Simantini Nalawade, Mr.Ajay Nalawade", Green Computing: Go Green and Save Energy, International Journal of Advanced Research in Computer Science and Software Engineering, ISSN: 2277 128X, Page | 1033, Volume 3, Issue 7,July 2013

[4] http://localcooling.en.softonic.com/

[5]http://www.ncomputing.com/company/green-computing

[6]http://www.brighthub.com/environment/green-computing/articles/71176.aspx

[7] http://en.wikipedia.org/wiki/Green_computing

[8]http://www.griffith.edu.au/sustainability/sustainabl e - campuses/sustainable-initiatives/energy/average-computer-energy-usage