Green Computing-Making Technology Fruitful

Prasant Singh Yadav, Vaibhav Kumar, Sunil Kumar

Abstract: - As twenty first century belongs to computer, gizmos and electronics items energy issues will get a serious rings in the coming days as the public debate on carbon emissions, global warming and climate change get hotter taking into consideration in popular use of information technology industry, it has to lead a revolution of sort by turning green in a manner no industry has done ever before.

Keywords:- Grave Approach, Cradel, Disposal, E-Waste, Green Computing Task Force, Best practice- Disposal

I. WHAT IS GREEN COMPUTING?

The positive (or least negative) relationship between the physical computer and its impact to the environments in which it moves through cradle to grave**.**

Green computing is the study and practice of using computing resources efficiently. We love our computers for all the ways they make our lives (and the world) better -- the wealth of knowledge (and democratizing force) of the Internet, the instantaneous communication, the sophisticated tools that help us work and create and share. But this modern world's greatest tool is among our most disposable and resource-heavy items. Performance-wise, computer design has progressed staggeringly well and astonishingly fast but looking at it from a green perspective, the work has barely begun. It takes a lot of energy to create, package, store, and move every 10-20 megabytes of data. Even with energy prices as cheap as they are now, it will soon cost more to power a computer for four years than it does to buy a new one. When a computer dies it either rots in a landfill, or children in the developing world end up wrestling its components apart by hand, melting toxic bits to recover traces of heavy metals. Manufacturing computers means the use of lead, cadmium, mercury, and other toxics in general and laptop in particular. Normally, computers can contain 4 to 8 pounds of lead alone. Modern IT systems rely upon a complicated mix of people, networks and hardware, as such, a green computing initiative must be systemic in nature, and address increasingly sophisticated problems. Elements of such as solution may be comprised of items such as end user satisfaction, management restructuring, regulatory compliance, disposal of electronic waste, telecommuting, virtualization of server resources, energy use, thin client solutions. Companies in every industry, from nonprofits to consumer goods, are paying much closer attention to their power bills,

- Prasant Singh Yadav,
- Vaibhav Kumar,
- Sunil Kumar,

Associate Professor, VIMT, Ghaziabad, UP, India
M.Tech Scholar, Mewar University, Rajasthan, India

As the amount spent on data center power has doubled in the past six years. IT is the biggest user of energy, says Robert Rosen, CIO of the National Institute of Arthritis and Musculoskeletal and Skin Disorders. U.S. based data centers consume as much power in a year as is generated by five power plants. As 21st century belongs to computers, gizmos and electronic items, energy issues will get a serious ring in the coming days, as the public debate on carbon emissions, global warming and climate change gets hotter. If we think computers are nonpolluting and consume very little energy we need to think again. It is estimated that out of $250 billion per year spent on powering computers worldwide only about 15% of that power is spent computing- the rest is wasted idling. Thus, energy saved on computer hardware and computing will equate tones of carbon emissions saved per year. Taking into consideration the popular use of information technology industry, it has to lead a revolution of sorts by turning green in a manner no industry has ever done before. It is worth emphasizing that this “green technology” should not be just about sound bytes to impress activists but concrete action and organizational policy. Opportunities lie in green technology like never before in history and organizations are seeing it as a way to create new profit centers while trying to help the environmental cause. The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings. According to green experts, it’s no wonder that computers and other electronics make up two-fifths of all lead in landfills. To counter this growing pollution threat all over the world due to the growing use of electronic device in general and computers in particular there a need to look for a green computer. So far, consumers haven't cared about ecological impact when buying computers, they've cared only about speed and price. But as Moore's Law marches on and computers commoditize, consumers will become pickier about being green. Devices use less and less power while renewable energy gets more and more portable and effective. New green materials are developed every year, and many toxic ones are already being replaced by them. The greenest computer will not miraculously fall from the sky one day, it’ll be the product of years of improvements. The features of a green computer of tomorrow would be like: efficiency, manufacturing & materials, recyclables, service model, self-powering, and other trends. Green computer will be one of the major contributions which will break down the 'digital divide', the electronic gulf that separates the information rich from the information poor.

II. GREEN COMPUTING – WHY?

- Growing public environmental awareness
- Increasing impacts on environmental and human health
- Corporate social responsibility

III. CRADLE TO GRAVE APPROACH

Full life-cycle analysis, not just the product on our desks

A Manufacturing – Fossil Fuels

- Average desktop computer with monitor requires 10 times its weight in chemicals and fossil fuels to produce
- 240 kg of fossil fuel for CRT monitor (United Nations University)
- 266 kg of fossil fuel for LCD monitor (Williams, 2003)

B Manufacturing – Monitors

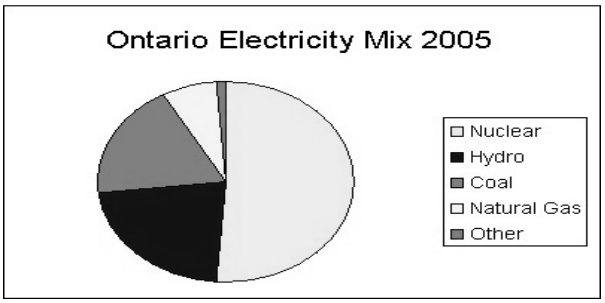
- CRT – lead and zinc leach ate mean monitors are hazardous waste (Lee *et al*., 2004) Lead: bioavailability in soil - can attack proteins and DNA, as well as interfere with nervous system function (Bechara, 2004; Needleman, 2004)
- LCD – 4-12 mg mercury /unit (Williams, 2003)
- Liquid crystals – polycyclic or halogenated aromatic hydrocarbons, 588 different compounds, 4% have potential for acute toxicity, but show no mutagenic effects in bacteria tests (Williams, 2003)

C Manufacturing – Other Toxins

- PBDE – similar structures to PCB and DDT
- Bioavailability, environmentally persistent biomagnifies in blood, fatty and liver tissue.
- Extraction impacts – refining of petroleum for energy and plastic, mining and smelting of metals
- Solvents in microchip fabrication – hydrochloric acid, hydrofluoric acid, arsenic, benzene and hexavalent chromium (Williams, 2003)

IV. USE – ENVIRONMENTAL IMPACTS

- Electricity consumption for desktops and peripherals
  - 120W CRT+CPU; more for older machines



- Fossil fuel power – Greenhouse gas emissions, mercury atmospheric pollution, SOX and NOX lead to acid rain and smog formation
- Nuclear power – difficulties with long term management of radioactive wastes

V. DISPOSAL – ELECTRONIC WASTE

- Short product life expectancy (2-4 years)
- Same toxins in manufacturing process can cause environmental contamination
- Human health risks
- Lead, barium, chromium, CNS disruptors etc. (Baul, 2002)
- Human rights problems – "Exporting harm"

E-waste Impacts in China

E-waste Impacts in China

VI. MANUFACTURING – GOOD NEWS

- Greener technology
- PBDE-free plastic
- lead-free soldering
- fewer toxic solvents
- Plastics labelled with recycling codes
- Less material used

VII. USE – GOOD NEWS

- Laptop 15W total
- New technology often more energy efficient
- LCD system: 80W total
- CRT system: down to 120W from 270W
- Independent certification bodies e.g., TCO, Nordic Swan, EU Eco-label
- Energy saver features are now standard

VIII. WASTE – GOOD NEWS

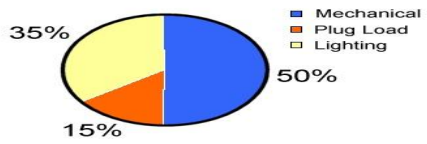
- RECYCLING
- METAL RECOVERY
- SEMI-PRECIOUS METAL RECOVERY
- STEWARDSHIP PLEDGE (BASEL ACTION NETWORK)

IX. EXAMPLE UNIVERSITY CAMPUS HAS

- 110,000,000 kWh of electricity
- 4,700 homes
- 9.2 million dollars
- 32,800 tonnes of carbon dioxide per year, or over 7,000 cars (in one year)

A Breaking down Electricity

- 50% mechanical
- 35% lighting
- 15% plug-load
- Where can we find efficiencies



15% = $1.38 million, 4,900 GHG, 1200 cars

B Green Computing Task Force

- Identify green computing best practices
- Examine computing procurement guidelines
- Identify energy conservation strategies and practices
- Identify equipment disposal procedures
- Recommend a campus awareness program

C Specific Objectives:

- identify green computing best practices at organizations and in other sectors
- benchmark the organizations of against these best practices
- examine the need for and nature of computing procurement guidelines
- identify energy conservation strategies and practices
- identify equipment disposal procedures
- recommend a campus awareness program

X. RECOMMENDED POLICY ON ENVIRONMENTAL PROTECTION

- Acknowledges a responsibility for and a commitment to protection of the environment on a continuous improvement basis
- Promotes and supports environmental management policies and environmentally responsible practices at every level and every department
- Is committed to minimizing environmental impacts arising from the organization activities Establish and define a green purchasing policy for computers.
- Determine environmental evaluation criteria to compare technologies and components, utilizing reliable third party monitoring and testing organizations independent of suppliers.
- Adopt standards issued by ecological standards associations and identify their labeling programs, i.e., Energy Star, EnerGuide, Green Seal, etc. to incorporate into procurement practices.
- Construct terms and conditions for future tenders and contracts.
- Communicate procurement information and resource links via Purchasing Service's website
- Incorporate training and education of new environmental criteria and processes into existing client training program.

XI. BEST PRACTICES – POLICY

- Northland College Sustainability Mission Statement
- Sustainable Development Policy for the Association of Canadian Community Colleges

International Institute for Sustainable Development

XII. CRADLE CRITERIA

Consider companies which manufacture and operate in environmentally sensitive ways, i.e., use raw materials for manufacturing that meet a maximum post-consumer reusable waste targets; use raw materials that are recyclable at the equipments' end-of-use stage; use packaging concepts that are environmentally friendly or recyclable.

A Operational Use Criteria

Consider companies which manufacture: to Energy Star electrical efficiency standards; products which are environmentally sensitive in daily operations; and research new equipment / improve equipment in an effort to consume less resources or consume recyclable resources through-out its useful life.

B End-of-Use Criteria

Include and conduct life cycle analysis when evaluating equipment, goods or services.

C To Grave Criteria

Consider companies which manufacture using raw materials that are recyclable at the end-of-use / disposal stage.

D Best Practice – Disposal

- Current UG e-waste disposal program represents a best practice
- E-waste is divided into two separate streams, CRT monitors and all other electronic equipment
- General e-waste is sent to Production Works where it is dismantled and redistributed to scrap companies and recyclers
- CRT monitors sent to an environment friendly Toronto-based company

E Recommendations – Disposal

- Maintain current program, plus:
- Obtain suitable space for storage of e-waste and monitors
- Develop and implement methodology for tracking tonnage diverted from landfill
- Formalize reuse and reallocation procedures and policies
- Green Computing Criteria (impact measures)

F Awareness Program

- Survey to gauge awareness of energy reduction and waste reduction practices and identify barriers to participation
- Campaign development offering incentives and long-term behaviour modification strategies
- Measure success and publicize success

F Best Practices– Energy Conservation

- Implementing power management options on machines
- Reducing the overall "on" time of the system as a whole
- Reducing the overall "on" time of the monitor in particular

XIII GREEN COMPUTING CRITERIA (IMPACT MEASURES)

Power consumption of each component; interface with user; life cycle (months/years before replacement is required); other consumables required to maintain. Recommendations for this section focus on strategies for promoting energy management practices and behaviour by the Sustainability Coordinator (recommendations regarding energy-efficient hardware can be found in the next section on procurement)

- Survey current power management policies and practices across campus.
- Develop a plan, with IT personnel, to reduce energy consumption across campus.
- Identify standard practices for implementing an energy reduction plan.
- Coordinate participation of IT in an energy reduction plan with campus environmental policies and campus awareness programs.
- Work with Physical Resources to improve electrical metering practices in order to
- enable the development of an energy consumption measurement program and energy indicators that

A Energy Conservation Strategies

- Survey current computer power management policies and practices across campus
- Coordinate participation of IT personnel in an energy reduction plan
- Develop configuration standards, with IT personnel, to reduce energy consumption of computers

XIV. CONCLUSION

As we studied above the phenomena of green computing .without giving obstacles to the rapidly growing use of IT infrastructure the Serious rings in the coming days as the public debate on carbon emissions, global warming and climate change get hotter, can be overcome by making the proper awareness, right manufacturing technology using un harmful ingredients, proper, disposal of the It waste, efficient energy conservation strategy and by giving Procurement guidelines. It has to lead a revolution of sort by turning green in a manner no industry has done ever before.

Top 3 priorities

- Energy conservation strategy
- Campus
- Procurement guidelines awareness

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