Green Computing – Combating our Digital Ecological Footprint

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Introduction

A computer that is on for eight hours a day consumes almost 600 kWh and emits 175 kg of CO_2 per year. Given that 95.2% of households own at least one computer in the United States, these devices alone exacerbate the effect of greenhouse gas emissions. Green computing, is an emerging environmentally friendly approach to efficiently producing, using, and disposing such devices in a manner that minimizes their carbon footprint.

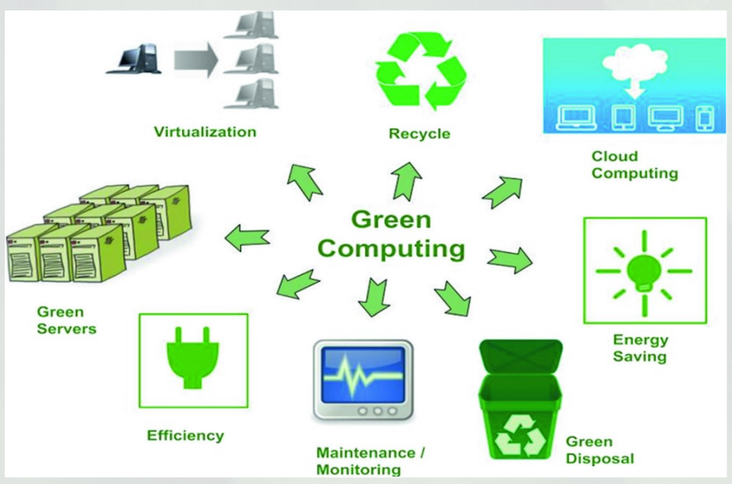

Fig 1: Various aspects of green computing.
Source: https://link.springer.com/chapter/10.1007/978-3-030-48141-4_9

As active users of computers, we need to understand the system's hardware and software energy concerns.

Hardware power efficiency facts:

- A CRT (Cathode Ray Tube) monitor uses more power than an LCD (Liquid Crystal Display) or LED (Light Emitting Diode) monitor.
- Machines with lesser RAMs (Random Access Memory) used for heavy works such as playing video games or running simulations consume more power as compared to a larger RAM used for the same job.
- Microprocessor chips being the part that performs calculations use anywhere between 50-200 watts. Outdated chips are either incompatible to perform calculations at the same speed as new ones or consume more power than their updated versions.
- With time, systems accumulate dust especially in fans and heatsinks, slowing down the CPU speed. This, in turn, pushes the fans to use more energy to maintain temperature and speed.

Software power efficiency facts:

- Given the same hardware requirements, Linux OS consumes more energy than the Windows or Mac OS.
- Specific CPU systems for specific works tend to be the most energy-efficient. A multi-core system is preferred when running heavy simulations while a single-core system works perfectly for limited usages such as browsing and video streaming.
- There may be various ways to computationally solve a problem but each algorithm comes up with a ton of wastage and junk data created alongside the algorithm. Intelligent algorithms can increase energy efficiency and reduce CPU usage.

Project Goals

- Understand generally applied computing practices, debunk myths and adopt the most energy-efficient option.
- Determine level of responder's interest and willingness to invest in energy monitoring system applications.
- Gauge people's awareness of the energy crisis and UC San Diego's net-zero carbon neutrality initiative.
- Ascertain the preferred alternative source of energies.

Methods

A questionnaire consisting of questions associated with relevant individual computing practices and computing awareness was circulated online through Facebook, Instagram, e-mail, and LinkedIn. The results arrived at below are from a sample pool of 100 individuals primarily consisting of UCSD students, faculty and staff, approximately 82% of which spend 8-12 hours or more on computer systems.

Results

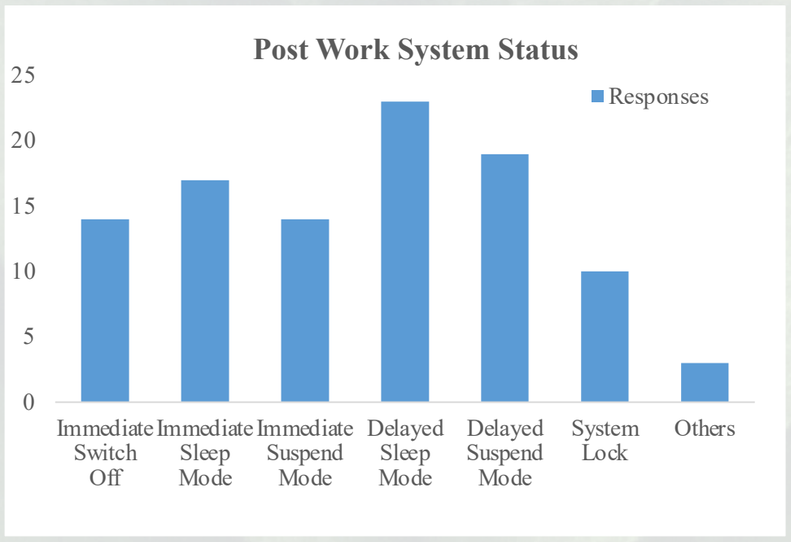

Fig 2: Survey responses indicate that only 14% of individuals shut down their systems after long work hours, while the majority switch to sleep, suspend, or lock mode.

It was noted that a fair number of participants believed in the following myths when choosing to leave their systems on sleep, suspend or lock modes over shutting down their systems. Discrediting those statements here:

- Turning to sleep mode saves power : A computer in sleep mode uses less power compared to an active one but the difference is negligible.
- Starting a computer causes an energy surge that uses more energy than leaving a computer in sleep mode : Although there is a small surge in electricity when the computer boots, it lasts only for a fraction of a second as compared to a computer left overnight on a sleep mode.
- Turning computers off every day damages the system : Computers are designed to handle more than 40,000 on/off cycles. Leaving the computer on would lead to unnecessary heat stress, wear, and energy use on the system.

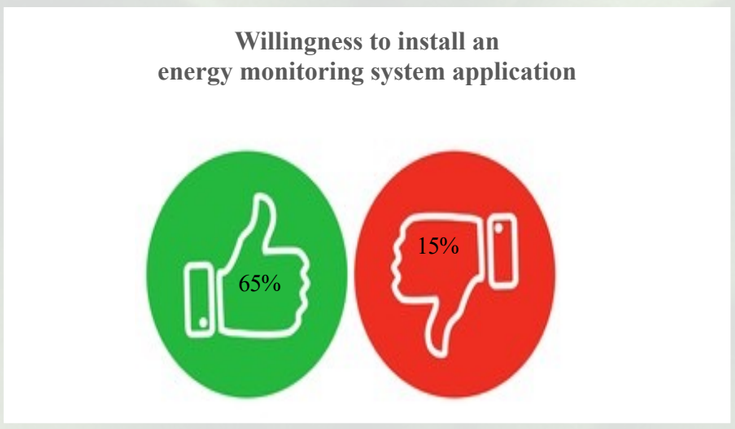

Fig 3: While a fifth responded 'Not Sure', results show that more than half (65%) of the survey participants wish to make a deliberate step towards green computing by investing in energy monitoring systems applications to keep their power consumption in check.

Current Work

An online self checklist of tasks to be completed before we sign off from work on computers in homes and offices.

Before we actively put into practice these green computing ways, what is worth mentioning based on the survey results here below is that in times where data and information is so widely spread and accessible, 15% of the population was uninformed about the crisis and a surprising 33% are yet to learn of University of California's mitigation strategies. But as a community, we can surely achieve the goal of a 100% awareness.

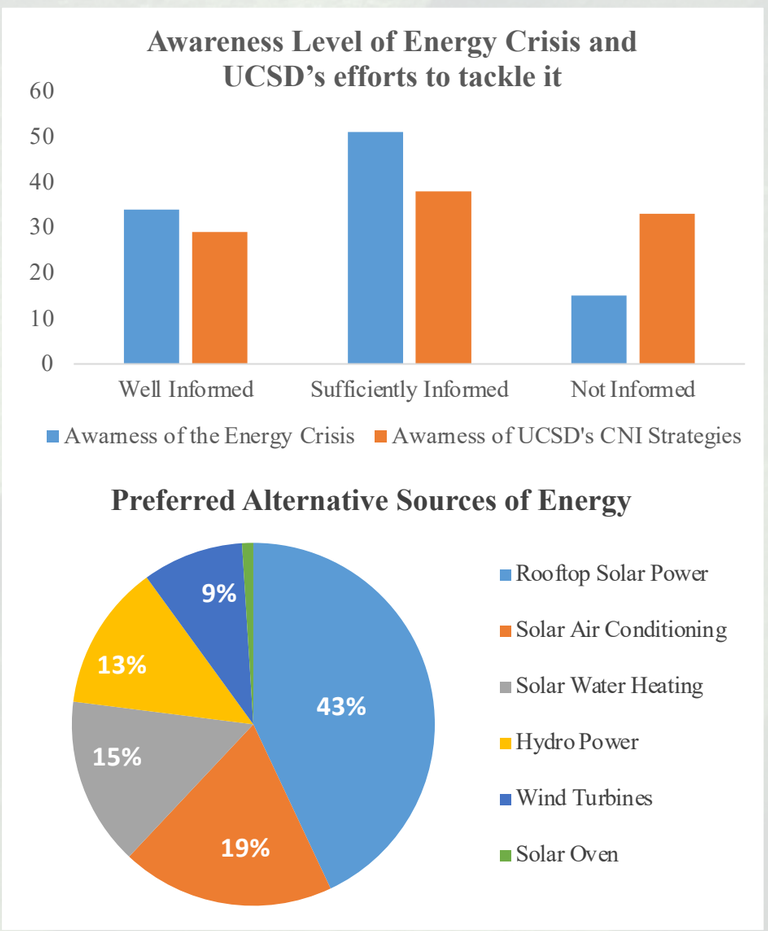

Fig 4: Survey results display that 85% of participants are aware of the ongoing energy crisis, 43% of the pool informed about UCSD's goal towards net-zero GHG emissions, and solar power is the most popular alternative choice of energy among 78% of them.

Conclusions: Four simple rules

- Calculate the carbon footprint of your work.
- Keep, repair, and reuse devices to minimize electronic waste.
- Choose your hardware carefully.
- Follow the energy efficiency checklist before signing off from work.

Literature Cited

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