

1.6 Green IT Goals

The **goal of green computing** is to attain economic viability and improve the way computing devices are used. Green computing practices include the development of environmentally sustainable production practices, energy efficient computers and improved disposal and recycling procedures. There are other goals of green information technology, most notably at the design and manufacturing stages.

In all cases, four main aims are:

- to cut down to as little as possible the amount of energy used.
- to minimize the inclusion of harmful materials.
- to use as many biodegradable materials as possible.
- to extend as far as possible the life of the equipment.

1.6 **Environmentally responsible business policies practices and metrics**

- ❖ Sustainable business practices are characterized by environmentally-friendly practices initiated by a company for the purposes of becoming a more sustainable organization.
- ❖ These companies aim to reduce their environmental footprint through initiatives that cut down on waste, poor

environmental stewardship and unethical environmental practices that offer a reduced level of sustainability within company practices.

- ❖ Sustainable business practices differ among industries and are often specific to the company type and the product or service it produces.

The **definition of sustainability** is:

“The quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance.”

1.7 Sustainable Business Practices

1. Be Intentional About Sustainability

- ❖ Sustainability needs to be incorporated into corporate strategies and reflected in **organizational business goals**.
- ❖ This means making this a priority in every aspect of organizational operations.
- ❖ As with any other business initiative, you need to make a plan of action and assign accountability. Hold people accountable and measure the results

2. Partner with Employees

- ❖ Invest the time in **training employees** on the importance of sustaining the environment and share what the organization is doing to help conserve resources.
- ❖ Solicit additional ideas from employees for resource conservation.

- ❖ Get an idea about what employees are experiencing and can offer ideas to reduce waste and improve their work environment.

3. Water and Electric Conservation

- ❖ Conserving water is something where everyone participate in by reducing the opportunities for wasting this valuable resource.
- ❖ For example, converting to energy-efficient faucets, toilets, and lighting can be a great way to save water, energy, and budget dollars.

4. Supply Chains

Statistics show that **customers prefer working with sustainable companies** that are environmentally friendly. Maintain a list of sustainable friendly vendors and make it a priority to only use organizations that embrace sustainable business practices. **Negotiate contracts** with this expectation made clear.

5. Develop a Recycling Program

Develop an in-house program for recyclable products like:

- fluorescent light-bulbs
- electronics
- computers and monitors
- paper products
- supplies

Use of waste management vendor to help create a process for this.

6. Chemical Management

Chemical impact on environment is being plundered in recent times. Strive to use green cleaning products and non-chemical products for pest control and weed management. Use chemical vendors to help train employees on the proper use and disposal of chemicals.

7. Purchase Only Energy Efficient Products

Use of energy-efficient electronic products and use environmentally friendly settings on office equipment. Choose computer, electronic, and IT acquisition products that are **EPEAT** registered to ensure the highest levels of efficiency.

8. Develop Sustainability Work Policies

Develop sustainability **policies and procedures** to reinforce the efforts. Things like, power down equipment at the end of the day and enable energy savings settings on all computers and desktops, are examples of policies that can support the cause. The challenge to sustain the environment can be overwhelming, but if each of the organizations, large or small, does its part, everyone can contribute to conserving this great planet that is home for all living things.

1.8 Metrics used for measuring power consumption in data centres.

a) (TDE) Thermal Design Power

It is the measurement of maximum amount of power required by cooling of computer system to dissipate. It is the maximum amount of power which a computer chip can take when running a real application.

b) (PUE) Power Usage Effectiveness

It is used for comparison of energy used by computing application and infrastructure Equipment and the energy wasted in overhead. The PUE can be described as the ratio of overall electricity consumed by the facility of a data centre to the overall electricity consumed by IT equipment's (network peripherals, servers, storage, routers, etc.). Value of PUE depends on the location of datacentres and construction done for that Datacentre. Thus it is different for all datacentres.

$$PUE = \frac{\text{Total Facility Energy}}{\text{IT equipment energy}}$$

c) (DCiE) Data centre Infrastructure Efficiency

It is the reciprocal of PUE. PUE and DCiE are most commonly used metrics that were designed for the comparison of efficiency of datacentres. IT Equipment Power can be described as the power that data centre has taken for the management of IT equipment's, processing of IT equipment's and storing the data in disk drives or routing the data within the datacentre. Total Facility Power is IT equipment power plus power needed by uninterrupted power supply (UPS), generators (needed to provide power in case of power failure), Batteries, cooling system components such as chillers, CRACs, DX air handler pumps, units, and cooling towers.

$$DCiE = \frac{1}{PUE}$$

d) (CPE) Compute Power Efficiency

It is a measure of the computing efficiency of a datacentre. As each watt consumed by server or cluster did not draw fruitful work all the time, some facility consumed power even in idle state and some consumed power for computing. Although 100% of facility capacity will never be used, but the need for maximum output from the electrical power which datacentre has taken. CPE is defined as

$$CPE = \frac{\text{IT equipment utilization}}{PUE}$$

e) (GEC) Green Energy Coefficient

It is a measure of green energy (energy that comes from renewable sources) that is used by the facility of a datacentre. For evaluating the environment friendly nature of a data centre this metric is used. It is selected as a PUE metric by green grid organization in November 2012. Energy consumed is measured in kWh. It is defined as

$$GEC = \frac{\text{Green Energy Consumed}}{\text{Total Energy Consumed}}$$

f) (ERF) Energy Reuse Factor

It is a measure of reusable energy (energy that is reused outside of datacentre) that is used by datacentre. For making cloud, environment friendly data centre should use renewable energy such as electricity generated by wind power, hydro power etc. ERF is selected as PUE metric by green grid organization in November 2012. It is defined as

$$ERF = \frac{\text{Reused energy used}}{\text{Total Energy Consumed}}$$

g) (CUE) Carbon Usage Effectiveness

It is a measure of carbon dioxide emission in environment by the data centre. It is selected as a PUEmetric by green grid organization in November 2012. Where E_{CO2} : Total carbon dioxide emission from total energy absorbed by the facility of a data EIT: Total energy consumed by IT equipment's. E_{CO2} includes all greenhouse gases (GHGs) such as CO_2 and methane (CH_4) that are emitted in atmosphere. This value is taken for whole year analysis.

$$CUE = \frac{E_{CO2}}{E_{IT}}$$

h) (WUE) Water Usage Effectiveness

It is a measure of required water by a data centre annually. Water is needed - a) For cooling the facility of a data centre. b) For humilation. c) For apparatus associated power generating d) For production of energy.

$$WUE = \frac{\text{Water Used Annually}}{E_{IT}}$$

Advantages of Green Computing

- * Green computing can save energy
- * Green computing can save money in the long run

- * More sophisticated recycling processes
- * Waste reduction
- * Reduction of the resource depletion problem
- * Less pollution
- * Less greenhouse gas emissions
- * More efficient hardware use
- * Sustainable IT practice
- * Increases pressure to go green in the IT industry
- * Reduction of health risks for customers
- * Better working conditions
- * Teleworking may improve flexibility
- * Green computing may strengthen the brand of companies
- * Positive impact on our flora and fauna

Disadvantages of Green IT

- * Significant upfront costs
- * Plenty of knowledge may be required
- * Green IT may conflict with profit maximization goals
- * May slow down computer networks
- * Technological change may make older IT-systems obsolete

- * Acceptance inside companies may be rather low
- * Lacking awareness of the general public
- * Green IT may be vulnerable to safety issues
- * May not be manageable for small businesses
- * Reliance Maintenance may be difficult
- * Many technologies aren't actually that green

