

Green Technology : Emerging trends towards sustainable Innovation

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ARTICLE INFO

ABSTRACT

Article History:

Accepted: 01 Aug 2023

Published: 09 Aug 2023

Publication Issue

Volume 9, Issue 4

July-August-2023

Page Number

301-307

In recent years, People expect high performance and new technology to accomplish their task conveniently and as fast as possible to stand in this competitive world. In some past decades many technologies had been invented to facilitate user. But over and irresponsibly uses of the technology put negative impact on environment. The term “Green Technology” is encapsulates different kind of technology in order to reduce the company’s environmental footprint. Day by day it is necessary to invest in green computing to make a human life sustainable on planet and reduce the repletion of natural resources. The paper presents different trends that needs to implement in achieving green technology like reducing the use of hardware, focusing on biodegradable products, increase energy efficiency, cost saving, most importantly to reduce emission of greenhouse gases followed by challenges faced by particular technology. In this paper, we have discussed the term green computing with its emerging sectors and how it can be beneficial for sustainable environment.

Keywords : Green Technology, Sustainable environment, GHG emission, natural resources.

I. INTRODUCTION

“Green Technology” and “Sustainable Technology” is a demand of the world as considering the environmental issues. Some global issues are becoming major concern for the whole world such as global warming, climate change, energy consumption, repletion of natural resources, melting of snow due to generated heat by computing devices, increasing sea level etc. all factors are responsible to damage environment and put an

impact on human health, animals and plants. The natural resource are depleting as per time going on to fulfil demand of mankind. We reached at this point where we need to invest more efforts to implement green technology in our daily life to survive on planet. Before things goes out from human’s hand everyone should identified the importance of green technology. Many organizations and government agency had given their contribution in the field of green technology by driving campaign to aware citizens, by providing

policies and regulations, by providing different green technologies used in different fields. As per growing awareness among people about environment they are considering green technology everywhere as possible as in their daily life in order to save environment. In this paper, we have discussed the various innovations happened to achieve the green and sustainable technologies in order to make aware to people about to save environment and natural resources.

Understanding Green Technology:

Yet as the whole earth are facing environmental issues such as reduction of natural resources, energy loss, emission of CO₂, increasing temperature, climate mitigation. Global warming is growing problem for the society and government. Green Technology is one of the ways to fight against such a big problem. Green Technology is an eco-friendly technology that limit the environmental footprint caused by human activity in order to limit depletion of natural resources, reduce the global warming, limit carbon emission, Decreases the E-waste. Green technology can be defined as design, processes, services, manufacturing, and packaging in order to fulfil the criteria i.e. produce less electricity, protect natural resources, encourage for healthy and comfort environment for all habitats, negligible emission, safe and clean to use. In parallel green technology brings an opportunities for businessman, stockholders to do some more innovative and eco-friendly to maintain economic status of a business as well as limit the damage of environment [3]. As it is the part of the renewable energy branch of the environmental technology movement, the importance of green technology cannot be ignored [2].

Following reasons are playing a vital role to considering green Technology:

- To achieve sustainability in products and environment.
- To reduce depletion of natural resources.

- Encourage the use of technology to achieve healthy and clean environment.
- Reduce deforestation and degradation of environment.
- Encourage the uses of non-renewable resources such as wind energy, solar energy etc.

Sustainable Innovation:

The word innovation is derived from a 'Latin word' innovare that means 'renew'. The combination of sustainability and innovation is indispensable to realize new combinations, which can lead to innovation process tackling the current sustainability challenges [12]. Innovation term is a major part of national economic policy as well as it is an important key factor of sustainable development strategies.

Innovation can be understand as ability of industrialist, organization, firm, end user that contributes to technology and science by giving something innovative in manufacturing of products, organizational operation, and services in order to make an organization successful in competitive world with balancing the economic condition.

Goal of Green Technology development:

• Sustainability

Development of Green technology is right path to achieve sustainability in context of society, environment, economic. By adopting green technology an organization can execute their task in energy efficient way and also can get better performance with green and clean environment.

• Awareness

Goal of green technology is spreading awareness among people towards environmental issues rising by an IT operation and human activities. Human awareness about environment and global issues are focusing them to go green, achieve green in every field.

- **Innovation as modern Technology**

Production of green technology brings an IT based data center towards sustainability that is a basic step to make human feel green with modernity concept. Green technology provides opportunities or responsibility to IT user or another citizen to do the something innovative as well as sustainable to environment that helps to businesses improve their performance in parallel of economic status by placing their footprint in modern competitive world.

- **Promote use of renewable resources**

As per study, Green development in different technologies is opportunities to create some innovative in green manner that helps to promote the use of renewable resources instead of non-renewable resources. Quantity of non-renewable resources are reducing day by day that are not sustainable such as coal and oil. Production of green technology is a responsibility to save natural resources that are non-renewable by avoiding over and unnecessary use of electronics and by encouraging manufacturer to use renewable resources to maintain environmental sustainability.

- **Encourage Reusability**

Sustainable technology encourages reusability of discarded or traditional equipment. Components that are made by biodegradable material that can be recycle or reuse in production of new electronics devices. Some of companies are giving their efforts towards green steps by trading with reusable or recycling part of computers and use it in manufacturing of new one that helps them to sustain their business in cost effective manner.

II. OBJECTIVES OF THE RESEARCH

1. To spread awareness towards environment, social and economic sustainability among people.

2. To get aware users about existing green technologies in different field.
3. Expose the existing innovations in technologies to make it sustainable.

III. RELATED WORK

Many organizations had taken their steps to address energy consumption, cost saving, increasing rate of E-waste, sustainable manufacturing etc. In this paper we are throwing a light on such organizations they are giving their contribution to limit the harmful impact on environment.

1. Dell Technology

Dell technology provides their contribution in green technology by manufacturing sustainable and reusable products. They partnered with Intel Corporation to explore their idea to make their component easily replaceable, reusable, and repairable without compromising performance. Dell technology providing sustainable material in their product such as bio based plastic, paper fibber, recyclable steel, closed loop material, recycled plastic etc., in order to achieve sustainable environment. Dell also committed to provide 100% eco-friendly packaging by 2030 to achieve their sustainability goals. Dell technology offers many sustainable (green) products made by recyclable plastic and steel with recyclable packaging in order to reduce carbon foot print and to increase energy efficiency, some examples are: Latitude 9330(26% recycled plastic and packaging), PowerEdge R750 (Thermal design with 12% recycle steel), Dell 24¹¹P2422H (85% recycle plastic with energy star), Precision 3570(5-sustainable material) etc. [7].

2. Intel Corporation

Intel IT plays an important role to contribute in achieving sustainable environment. According to their report Intel Company taking their initiatives behind

the dual goal “Do what’s right for the business and what’s right for the environment”. According to Intel’s report most of energy consumed by server in data centre, to overcome from this problem Intel has produces disaggregated server deployed in data centre to gain the idea of decoupling of CPU\DRAM from networking devices modules that works in shared manner in different modules in order to cost saving and reduce E-waste. This approach has provided approx. 44% cost saving. Intel’s different way of thinking about data centre cooling can contribute to reduce electric cost and provide highest data centre efficiency [4].

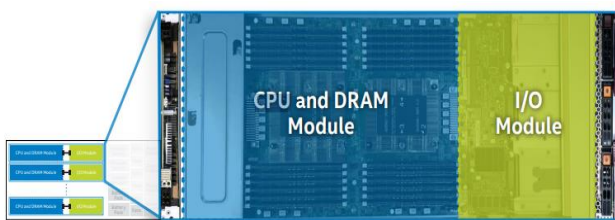


Figure: 2-socket disaggregated Server [4]

3. Hewlett-Packard (HP)

HP assist user to ‘Go Green’ by providing eco-solution. HP has focused to make their business, processes, manufacturing and services greener. HP continues to adhere to energy efficiency engineering and currently 90% of its notebook, 40% of its desktop PCs, 88% of its monitor, and 100% of its workstation platform comply with EPA energy star standards [10]. HP drives a DFE-program; HP’s design for environment that promote customer relationship by bringing together to all designers and environmental products. HP has been offering PC’s with energy efficient features and one of the first company to deal with U.S. Energy Star program [13]. HP produces energy-efficient operations that leads to saving energy and reduce E-waste. HP’s packaging features also helps in to reduce carbon emission. Some lighter products such as Touch smart IQ and special edition PCs are example of HP’s efforts towards green computing. HP’s efforts like lowering the CO₂, Responsible recycling, improve energy

efficiency; company is leading a global leader in the context of eco-friendly environment.

4. Adani Green Energy Limited (AGCL)

AGCL plays an important role to make future cleaner and greener. IT is the one of the largest renewable company that works with green energy aimed with solar energy manufacturing. AGCL group targeted production of green energy and hydrogen, climate change also. They are pulling their efforts to create innovative and no carbon generation technology to provide greener future to India [14].

5. Borosil renewable limited (BRL)

The organization is the one of the solar glass producer in India who works on sustainable future with solar glass. BRL is playing an important role to develop awareness on climate change, social issues and other environmental issue faced by society. BRL is manufacturer of renewable energy resources with minimizing use of toxic material while manufacturing of glass[15].

6. Tata Power Company

According to Wikipedia, Tata Power Company is an electric utility company. It is India’s largest power integrated company that aimed to generate, transmit and distribute electricity in efficient way. The company is taking green initiative from power services with energy saving and try to being best rooftop solar provider in India [16].

Examples of Green Technology:

There are some other technologies widely used and implemented in eco-friendly way to achieve green that we are going to discuss below:

1. Micro-Hydropower plant

Somewhere hydropower plant is somewhat difficult to achieve because that can have large impact on local ecosystem and land. There is another solution with green is to implement micro hydropower with minimum economy and small landscape by establishing on river and canal without CO₂ emission and harm water animals. Benefit to implement that plant is that it can work 24/7, until water flowing on minimum space.

2. Wind Turbine

In upcoming decades, wind energy is best source of renewable energy with the use of natural resources rather than fossil fuel. Wind turbine is one of cheapest solution to produce electricity in renewable form; wind energy doesn't cause carbon emission, so it can be a good example to reduce greenhouse gases. Wind turbine is green technology that converts wind into electricity without consuming natural resources. But there is an issue with wind turbine to make electricity while there is no air blowing, there can be a solution to overcome to this problem is that electricity can be stored in batteries for future use.

3. Solar Technology

Solar technology is most widely adopting technology to overcome the power consumption problem. Solar panel uses sunlight to generate electrical energy through its photovoltaic panels. Main advantage of using solar is that energy can be stored in thermal storage and batteries to produce electricity for later use. There are two basic adoption of solar energy technology that are:

1. *Photovoltaic*: The photovoltaic technology that observes energy from sunlight into PV cells and creates electrical charges to convert it into electricity.

2. *Solar thermal power*: This technology uses mirror to reflect sunlight onto receiver and convert it into heat to produce electricity or can be used for future use.

4. Electrical vehicle

Vehicle runs by fossil fuel should be replaced by electric vehicle, which is helpful to limit the carbon emission but if electricity is generated by natural gas or by coal than it can be another concern. Combining electric vehicle with solar panel can be better solution with zero emission.

5. Natural gas

Now a day's natural gas is a mostly preferred sources of energy for cooling, heating, producing electricity that emit almost 50% less CO₂ than coal. Somewhere it is a temporary solution to limit carbon emission. In becoming decades it should be replaced by some another plan.

6. LED

LED lighting is an example of rapid advancement of technology. LED is more energy efficient and eco-friendly rather than traditional bulb. Its long life capacity make it sustainable and it uses almost 85% less energy and it can be better solution to the economic scale. LED can be used as solar power that is a good example of green technology.

7. Biogas

It is most preferable source of energy as an example of green technology. It is a renewable source of energy that produces energy and heat by decomposing organic waste by microorganism in absence of oxygen. The main component of biogas is methane that is helpful for generating heat and energy. It is a biological process that facilitates rural areas by providing light and cooking gas. By making biogas we can achieve ecological balance and limit the deforestation.

8. Smart power management system

Almost 10% of electricity is consumed by plugged in devices that is also a big problem for environment. SPMS is a solution to that problem by cut of devices automatically when no longer needed and manage power usage. SMPS is a system based on artificial intelligence that can sense the total consumption of electricity by a device and automatically cut power supply that leads to save a large amount power.

9. Plastic waste catchment system

Waste plastic or E-waste is also a big concern for society. Plastic waste catchment system is one of the green solution for the problem that remove plastic waste from ponds and river by bubble barrier concept that lifted up the plastic waste from surface and helps to make ocean clean.

10. Biodegradable toothpaste

According to a survey report 99% of toothpaste made by plastic that compose in soil and land, cause much plastic waste. In recent years, many eco-friendly toothbrushes that are made by wood, bamboo and another recyclable material have been introduced.

11. Green infrastructure

As new technologies are implementing every day, we are losing green landscape in urban areas causes many health issues and much pollution. Therefore green infrastructure is also a major topic to be focused while achieving green environment in Metro cities. Green infrastructure can be explained as nature support system that is interconnection of wet land, green valleys, green roof, park, waterways, and wildlife habitats [1]. It is also significant model to achieve and practice green everywhere.

Day by day, as people are getting more aware and concerning about environmental issues, therefore use of green technology is gaining popularity in every field. This awareness is pushing the market to introduce and improved green Technology [9].

IV. Conclusion And Future Scope

In past decades, world are facing many environmental problem due to over use of natural resources. Growing amount of carbon emission is major concern for whole globe and causes many health issues for human. Government and many organizations have taken many initiatives to limit environmental footprint by human activities. After all findings we concluded that people are getting aware about environmental problem that's why many green technology have been implemented to limit the depletion of natural resources, limit CO₂, reduce E-waste in few past years and we have to make people more aware about uses of all existing green technology about to adopt in their daily life. To make business and society greener, it brings everyday new and exciting opportunities and challenging ideas for innovating more new green technologies to minimizing environmental footprint. After all finding we concluded that still there is lack of awareness and practices of green technology in company's operation due to limitations and challenges to business. This study open a window of opportunities for other researchers to promote use of green technology among people by overcome from those limitations and for further green innovation to achieve Clean and green environment.

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Cite this article as :

Khushbu Kumawat, Col. (Prof.) S.S. Sarangdevot, "Green Technology : Emerging trends towards sustainable Innovation", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 9, Issue 4, pp.301-307, July-August-2023. Available at doi : <https://doi.org/10.32628/CSEIT2390424> Journal URL : <https://ijsrcseit.com/CSEIT2390424>