Different Perspectives of Green Technology

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ABSTRACT

Innovation in the path of technology is facing rapid growth in this age. The motivation to curve out new ideas has resulted from the continuous threats that are intimated to the human civilization owing due to the degradation of nature and its resources. The development of countries to improve and impart quality life style it the population has resulted an immense damage to nature. The quality of air, water and all elements are getting polluted to an alarming rate. In order to save the environment from these severe damage, technologists have developed totally new ways of power generation, building construction and automobile design which will not cause any carbon emission to global atmosphere but it will also not hamper the country's industrial development as well as domestic comfort. In this article, a brief effort is taken to demonstrate the benevolent nature of Green Technology which is a burning research topic having an extreme popularity among scientists. The innovation centered with green technology are encircled with emergence of green buildings, electric vehicles in the urban sector power industries have implemented solar and wind mega projects to secure continuity of power supply. The locomotives as well as automobile industries have redesigned their systems in a new way so that there is minimum wastage associated with improved efficiency. The agricultural sector is also showing an active response in defining new smart techniques of cultivation which contribute for a better ecology. The new ideas of cultivation using vertical farming like aquaponics and hydroponics been adopted by developed nations.

Keywords—*green technology, green buildings, vertical farming, aquaponics, hydroponics*

I. INTRODUCTION

The concept of Green technology (GT) is related with advancement and deployment of new components, tools and systems used to preserve the environment in all aspects [1]. The main agenda is to mitigate the harmful impact from human actions and to take proper action against all the ill activities, the Government plays a vital role. In this present era, this technology can be thought in the form of green buildings or renewable energy such as wind, hydro or solar.

Green technology strictly obeys the following criteria mentioned below:

a) The major target of green technology is to prevent the negative effects of human development that has adverse impact on environment.

b) It lowers greenhouse gas (GHG) emission percentage almost close to zero which is a sure positive outcome that help our mother earth to survive so that all forms of life can exist with minimum challenge.

c) Green Technology application guide to use the natural conventional resources along with upcoming new technologies and this help us to come out of the age long habit of depending on fossil fuels.

Green technology is an urge that describe the magnitude of intensity to expand to design various kinds of schemes and develop new materials for generating energy from non-toxic products [5]. Green technology has been branded as a major necessity to accomplish the tag of developed country where designers aim at developing sustainable projects that can be responsible for energy, water savings and thereby procuring a healthy environment in their project arena. The most common example that can be considered to understand green technology is the term green buildings. The green building is a special category of smart building that is equipped with all modern monitoring techniques that ensure perfect use of resources without wastage as per demand.The cooling process, lighting process all are planned in a smart manner

such that our comfort expectation is fulfilled along with minimum wastage of energy which increases the overall efficiency of the technology. As fossil fuels are getting exhausted and at the same time energy harvest from renewable energy is also having certain challenges, so it should kept in mind that energy expenditure must be made after intense planning so that the future generation do not fall in the dark world without sufficient power.

The detrimental impact of the conventional energy sources on the environment has triggered the immediate urge on municipalities and organizations to follow the green energy principle. A good example in this regard is related to megacity of Chicago where a considerable modern buildings have solar energy panels installed to meet its demand. [7]. The other issue which has led governments and private power corporates to pursue for renewable energy is that alarming depletion rate of fossil fuels. The current study on survey of fossil fuel reserve state that complete depletion of coal and petroleum will take by 2042 if immediate the present consumption rate is not lowered down [8].

Green technology (GT) is an extensive term which defines new innovative ways that create a friendly environmental. It is designed in such a way so that natural resources are conserved. The basic motto of GT is to curb down the use of fossil fuels and causing less damage to the human, animal, and plant health [20]. In this way GT can reduce the injection of pollutants that are released during power generation from fossil fuels and other harmful chemicals that are released during manufacturing process in industry sector [18].

Global warming has become a well-known fact by all by this age and the cause of this unwanted situation is application of energy without proper knowledge of the ill effects. The companies must study in details about all the positive as well as negative issues of any technology before starting the application in real world. The severe climate changes accompanied by hurricanes, cyclone, glacial disaster in mountains and ice melting in Polar Regions are the warning signals from the nature.

In order to preserve the planet, an extensive marketing must be started in all possible ways to invoke the awareness among public. The survey reports clarify that very few percentage of the population are having ample knowledge in this matter. To counteract this problem, many nations have started providing incentives which is offering economic benefits in paying bills. In this way, the focus is gradually being shifted to the new direction and results have come up where the energy consumers have shown a prompt response in accepting the new concept of living life.

II. WORLD WIDE SCENARIO OF GREEN TECHNOLOGY

The alarming situation of environment deterioration has encouraged many countries worldwide to take actions for implementing green technology. In 2020, Japan declared a policy that elaborated different methods of minimizing greenhouse gas to almost negligible condition. Japan made an active attempt to achieve the status of carbon neutral country and established Global Zero Emission Research (GZR) in 2020 January. Dr. Yoshino Akira was the director of this noble institute who received Nobel Prize in 2019 for chemistry field.

The primary renewable energy source of Japan to procure power is hydro energy with estimated potential over 87 terawatt hours. The world's largest hydrogen production unit is also located at Fukushima. In Asia, Malaysia is the fastest nation in adopting urban life. This trend of adopting modern life has raised emission levels on a large scale compared to other Asian countries. In 2009 a plan was made by Ministry of Energy which is dedicated for promotion of Green Energy. In order to acquire popularity among the public, incentive schemes were announced in 2014. The resolution of this incentive proposal was offering tax exemptions to the parties who take up the green energy plans as per directed by Government policy.

India has implemented a project called the "Green Energy Corridor" which has the objective to synchronize electricity produced from renewable sources, such as solar and wind, with traditional power stations in the grid. Indian green energy sector has shown a proactive response in the last five years. The total installed capacity from renewable sources have attained 100 GW units range on August 2022. In spite of securing this remarkable success, India imports oil and gas for which Prime Minister of India have taken a pledge to make India absolutely energy independent by 2047.

The European Union has taken a pledge in December 2019 with a novel expectation to become the first climate neutral continent by 2050.

China and USA are the two nations that has released maximum heat trapping gases in the atmosphere in order to sustain rapid industrialization and securing high life standards. The continuous natural disaster owing to global warming have invoked these nations to go green at the earliest. In April 2022, the renewable energy sector contributed 28% of the total generation that has set a record in USA. China's energy demand has caused release of about one-quarter of the world's greenhouse gases. Being an energy hungry nation China made extensive research in obtaining energy and discovered its huge potential in wind energy. At the same time China has adopted green hydrogen technology for industrial sector and aims to produce 100,000 to 200,000 tons of green hydrogen per year.

III. OBECTIVE OF GREEN TECHNOLOGY

The prime objective of Green Technology is to protect the environment, repair damage done to the environment in the past, and conserve the earth's natural resources. Green Technology has also become an escalating industry that has attracted enormous amounts of investment capital. The major objectives can be summarized as:

Reducing waste and emissions: This objective can be minimized if new release carbon foot prints are totally eliminated. The percentage of greenhouse gases existing in our atmosphere has already attained an alarming state and further new inclusion must be avoided. This can be ensured by adopting green technologies like electric vehicles and organic farming which do not release carbon compounds into the atmosphere.

Adopting Renewable, Clean Energy: Life cannot sustain without electricity and in this present age human civilization has become closely adopted with electricity usage. The power plants must use clean technologies to generate electricity and maximum power projects have been commissioned based on solar and wind energy. The rural sector have started using biomass stoves that are environment friendly. Hence burning of wood can be avoided and trees can be saved which release oxygen

Incentive schemes: Power policies are designed which encourage the customers to use green technology and refuse conventional power sources .In this way the response can be improved which will popularize the perspectives of GT. In this regard many industries have taken initiative to promote green buildings which are built on reusable materials which make the building efficient and environmentally friendly. The electrification of these buildings are done by renewable energy sources like solar energy where solar panels are installed at roof top.

Recycling process: The materials like paper, plastic,can and batteries that are dumped after use can be recycled after proper treatment so that the waste products accululation can be diminished at a considerable percentage.

Fig 1 shows the main goals of Green Technology

Fig 1

Green technology area covers a large extent comprising of a huge area of production and consumption technologies. According to an issue of US daily newsletter on green technology (2016 edition), the products developed and applied in this regard are eco- friendly discoveries that are composed of properties like efficient energy, recycling, health safety concerns, and resources which are renewable. In the construction of environmentally friendly buildings, the highest goals are; firstly: safeguarding natural resources conservation, eliminating the negative impact of construction activities on environmental safety by producing materials that are reusable or recyclable, and also causing an alteration in production pattern to reduce waste and pollutants. The second target is finding an alternative to undesirable practices which affects the environment and is challenging to humans' existence. When an appropriate design is used and a perfect plan for the construction is obtained, then an improvement in the energy efficiency of the building is unescapably possible.

The damage that is done to the atmosphere by human activities have resulted in serious climate changes .The carbon emissions have resulted in global warming that have destroyed our mother nature. To save our planet and the future generation extensive monitoring and control remedies have been adopted. The Prevention technologies refrain the production of hazardous materials or change human activities which minimize damages to the environment. At the same time new product substitution have been encompassed that has redesigned the whole production rather that utilizing new pieces of equipment. Besides, control technologies render hazardous materials harmless before entering the environment. The efforts of remediation and restoration technologies embody techniques and methods that develop the condition a perfect ecosystems.

The most well-known example of green technology is solar cell where light energy is converted to electricity through the process of photovoltaic effect. Apart from electricity generation, solar energy also results reduction in consumption of fossil fuels and low emission of greenhouse gases.

IV. CRITERIA FOR SELECTION OF GREEN TECHNOLOGIES

The Green technology is defined as the awareness for required for conserving natural environment and resources by modifying human applications in a major aspect. The functional area ranges in different sectors like bio-fuel, eco-forest, renewable energy, and solid waste management [17]. The collection of tools and procedures is the basic guideline which is an important deciding factor in helping human civilization to make proper choice of their future life. The basic foundation of this cult is adopting smart ways which promote industrial growth as well as satisfy the basic demands that are absolutely essential in order to lead a quality life style keeping in mind the preservation concept of planet earth. In order to create new technology, a certain set of features should be taken into consideration by the scientists. These basic guidelines will help to promote the much expected new paradigm in the latest era. In the following section the different points are described that are accepted universally for procuring new systems.

a) System Independence: It is the capability of the hi-tech device to function by its own self during task execution. The parameters like requirement of more capital or more labor check the degree of system independence of the particular tool.

b) Image of Modernity: This property is related on the basis on people's degree of acceptance of that particular process. The success of any product is seen from public reaction after it is released. If it is observed that there is a positive reaction from public and the demand of adopting rises up then it is concluded that the experimental outcome is successful. The technocrats thoroughly study the expectation associated with people of this modern age before developing any new system.. Image of modernity feature upgrades the social status of people.

c) Individual Technology vs. Collective Technology: It is that criteria which considers the societal/cultural standards in which the technology activates. The newly designed system can be functional on community or group basis wise or it can run for a single family also. Community basis technologies are more system dependent whereas individual or single family unit will need more systems independent technology. Depending on practical situations, both single and collective technologies are being worked out.

d) Cost of Technology: The economic viability is the turning point in deciding the future fortune of any system. It is basically degree of affordability of the technology that becomes a performance indicator. The price of the technology decides the acceptance level as cost is a major issue taken into consideration by all users. The final verdict like encouraging the promotion or discouraging the marketing of the new tool is deeply linked with the cost.

e) Risk Factor: It is another important object required to discover the degree of smooth operation of that technology in the local system. It basically defines to what degree is the technology is system dependent or system independent. In this context two types of risks are taken into considerations that are both the internal and external risk. The safety analysis is necessary so that the chance of adoption increases but in true sense it is almost impossible to eliminate all threats.

f) Single-Purpose and Multi-Purpose Technology: Every tool or technology can be either single target based or it can have multifunctional purposes. In comparison to single purpose technology, the multipurpose technologies are the ones that endow a variety of applications (e.g. a tiller which can be employed in land tilling, can also be used as powering water pump, and drying rice [24].

V. APPLICATION SECTORS OF GREEN TECHNOLOGY

The application of Green technology describe the different areas where more modifications can be done increasing the efficiency at the same time procuring smart ways that are effective in securing energy efficiency, waste reduction, and sustainable systemic evolution. The present aim of today is to become active participants who will adopt initiatives and dedicate completely to save our environment. A comprehensive survey states that the major key criteria that decide the implementation green technology include energy efficiency, interior environment eminence, justifiable site planning and management, procuring hazard free materials and resources, water efficiency.

a) Energy Sector: The power plants which run on fossil fuels inject high rate of carbon emission .For last few decades power generation was majorly carried out by these thermal stations that have already liberated an immense high magnitude of carbon dioxide in our atmosphere. In order to bring downcarbon foot prints, efforts are already given in promoting more solar or wind based power plants depending on geographic benefits of the sites. Green technologies bear the potential to guarantee environment protection and efficient use of resources. Power projects from solar wind energy and have already become a known issue. Initiatives

are taken to replace small diesel and coal-fired boilers with heat pumps and do not yield anyemissions into the atmosphere or soil in order to condense functional costs and pollution. The other technologies which are also being deployed in power generation are geothermal technology and fuel cells. The geothermal reserves are also getting utilized for power and heat generation that basically harness the energy inside the earth's center to generate heat or electricity. Normal batteries are getting replaced by fuel cells where convert thechemical energy contained in hydrogen is transformed to electricity and heat using an electrochemical process.

b) Transportation Sector: The conventional fuel based vehicles whose enginerun on diesel or petrol are the biggest contributors of greenhouse gases. The automobile sector of the recent age has started working on advanced transportation infrastructure in the form of electric bus or electric vehicles which are capable of minimization of environmental pollution at a significant percentage. Fig 2 shows how an electric car can be charged with the help of rechargeable batteries. Fig 2 shows how an electric car can be charged with the help of rechargeable batteries.

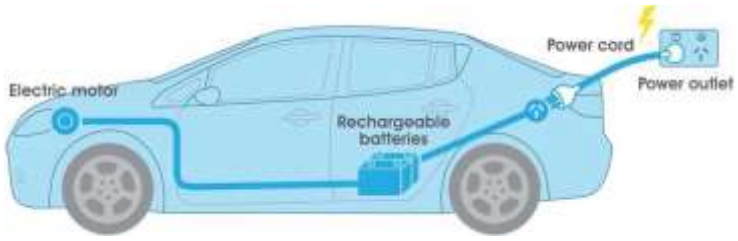

Fig 2

c) *Water Filtration*: Water purification sector has cordially accepted green technology processes around the world. About 80 percent of domestic water supply are returned back as waste water. The countries which have limited drinking water reserves have started the water purification by which sea water or waste water can be transformed into fresh water. The conventional wastewater treatment processes are expensive and require complex operations and maintenance. Upcoming researches in waste water treatment have developed "bioreactor" which is the most common green technologies in water treatment sector. Bioreactors are special devices containing bacteria and microorganisms where oxygen is supplied to speed up biochemical reactions. The reaction occurring inside the reactor eventually converts harmful pollutants into non-toxic forms. In bio filtrations, wastewater is allowed to pass through biofilm in either up-flow or down-flow orientation and in a continuous or discontinuous manner. The immobilized living microorganisms speed up the degradation of organic matter and pollutants present in the wastewater. In the following section different water treatment techniques are mentioned under green technology.

Membrane Bioreactor Solutions– It is a combination of biological, secondary, and tertiary wastewater treatment in one single step. The basic object is to reduce the carbon footprint that is evident in a sludge sewage treatment.

Ultra Filtrations Solutions– This process is applied in case of water treatment for drinking purpose. A membrane is used for filtration where pressure separates particles from liquid. All harmful elements like viruses, bacteria, protozoa, etc. are effectively removed.

Reverse Osmosis Systems –This process is employed as a supporting treatment where the water has undergone a pretreatment with removal of unwanted particles. To make the water used for human consumption reverse osmosis is carried out system for desalinating it.

Electro dialysis Reversal -This is a dedicated desalinating process wherein electricity is used against electrodes so the salt and other particles are separated. This process is widely applied in remote areas with minimum availability of pure drinking water.

Thermal Evaporation and Crystallization Systems – Evaporation and crystallization are most commonly used for wastewater treatment in brine water treatment. This process is collaborated with reverse osmosis to establish Zero Liquid Effluent Discharge systems. This is cost-effective disposal method and is widely accepted by companies who have their dedicated recycling system.

d)Green Agriculture : The agriculture sector has adopted various techniques like no-till farming, promotion ofgenetically modified organisms (GMO), organic farming and vertical farming .Collaboration of Integrated Pest Management (IPM) coupled with application of sensors help to achieve get better productivity with minimumdamage to the environment. Integrated Pest Management (IPM) offers long term protection to crops that preventand combat pest invasion on agricultural lands. IPM can facilitate progression of good quality crops with the least possible disruption to ecosystems. The advanced sensors that are present in the device have the perfect capacity to track minute variation in climate, pH levels in the soil and even the presence of insects. With the support of digital sensors farmers to maximize yields with proper water conservation, reduce waste and increase productivity.

No-till farming: It is also known as zero tillage which is basically a direct drilling process where crops are grown without soil plough. In this way, percentage of soil erosion is minimized along with ensuring minimal injection of greenhouse gases from the soil. Simultaneously the soil do not undergo erosion which is encountered due to tilling. This no-till farming also enhances the soil to retain carbon gases as well as the capacity to absorb more amount of carbon dioxide after harvesting from the crop leftover residues. The application cost is not at all expensive but the main requirement in this regard is ensuring proper training to the farmers. The major benefit of this farming is reduction of greenhouse gas emission to the environment.

GMO: The next article which is taken into consideration is application of biotechnology which aids in development of genetically modified organisms (GMO).It is a special process by which a crop's DNA is amended. The new modified DNA is not available naturally. These special biotech crops are more robust to combat with environment changes. It has the unique capacity to tolerate all sorts of climate changes. GMO's can also be grown with less demand of pesticides and do not require to be ploughed frequently.

Organic Farming: As the global population is increasing, the demand of food is also rising up. In order to provide continuity of food supply and balance the agriculture production, the researchers have emphasized on organic farming which not only diminishes the application of chemicals but at the same time it takes care of health as well as protects mother earth from the harmful chemical fertilizers which the farmers use to increase the crop productivity. The main aim of organic farming is procuring agricultural production from animal manure, organic waste, crop rotation, legumes using biological pest control techniques. In this way the application of chemical fertilizers can be brought down which consumes a large percentage of fossil fuels during manufacturing process. The crop rotation technique is a major characteristics of organic farming that facilitates planting different crops chronologically on the same plot of land to improve soil health, optimize nutrients in the soil and combat pest and weeds in the agro system. The general ideologies of organic farming are:

a)Nominal soil ruin and erosion,

b)Retaining long lasting soil richness by optimizing biological activities within the soil

c) Expansion of *Nitrogen fixation by the use of legumes that promote biological nitrogen fixation.*

d)Reconditioning of organic materials and crop residues to the greatest extent possible.

e)Taking care of animal welfare with respect to nutrition, housing, health issues, breeding.

f)Maintaining biological diversity within the system

g)Proper pest, weed and disease control

Fig 3

Fig 3 shows the different aspects associated with organic farming. In spite of having different advantage, the major limitation associated is the requirement of large land to produce the same amount of crops from inorganic sources.

Vertical farming: This is an entirely new concept of growing crops in vertically stacked layers rather than the traditional horizontal farming. Under this technique, plants are grown indoors in layers using LED lighting with an artificially controlled environmental. The basic two techniques employed for agriculture such as aquaponics and hydroponics. Hydroponics is a method of growing plants, without soil, This new farming technique can help in growing significantly more food on the same amount of area. Aquaponics is an innovative system of growing plants in absence of soil where source of manure are the fishes. Fertilizers are added to nourish the roots in hydroponics but in aquaponics, fish are grown simultaneously in the aquatic

environment that provide a natural source of organic nutrients through their excreted waste. The biggest farm of Europe has the ability to grow 1,000 tonnes of food a year. The farming sector have experienced increased yield and reduced water and fertilizer waste Fig 4 demonstrates the scheme of aquaponics used in vertical farming.

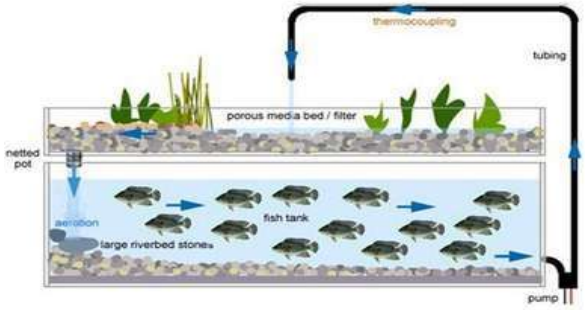

Fig 4

f) Building: The emergence of green building has shown a new path in construction engineering which has minimum impact on atmosphere quality as it uses reusable materials which make the building efficient and pleasant. The feature of recycle employed here saves natural resources by using new alternative building materials. This process of recycle reduces the wastage of materials and also the dumping of construction wastes to landfills. The interior lighting system of such buildings are dependent on sensors with highly efficient HVAC (heating, ventilating, and air-conditioning).The floors, furniture and painting are done using low volatile organic compound material. TCS in Bhubaneshwar is known to be India's first LEED certified green building IT campus. TCS Kalinga Park is spread over 45 acres with 50% green area received the highest ratings (Platinum) from Leadership in Energy and Environment Design (LEED) which is under the control of US Green Building Council that gives ratings to environmentally sustainable constructions. Figure 5 describes the different components of a green building.

Fig 5

Railways : The introduction of three phase locomotive technology in railway have reduced emission of 500 tonnes of CO annually. On the other hand the new locomotives also play role in power saving by applying regenerative breaking system.These locomotives are equipped with regenerative braking feature which are capable to regenerate electricity during braking act and power is fed back to grid. The model WAG7 conventional locomotive from BHEL Jhansi was the first to deploy regenerative braking feature in 2019. The first pure 120000 HP Indian made locomotive named WAG12 has been manufactured by Madhepura Electric Locomotive Pvt. Ltd. (MELPL) which was also equipped with regenerative braking The lighting sector of Zonal Railways have replaced by CFL/FL lights in self-propelled (EMU/MEMU) coaches with energy efficient LED lights. During 2019-20, 36500 coaches have been provided with energy efficient LED lights. All newly manufactured coaches from production units are being turned out with LED light fittings. Vision 2020 document of the Indian Railways states to procure utilization of at least 10% of its energy requirement from renewable sources. Solar power plants of 500 Mega Watt (MW) capacity solar plants on roof top of Railway buildings which will be used for meeting non-traction loads at Railway Stations.

VI. BENEFITS AND CHALLENGES OF GREEN TECHNOLOGY

Technology is a tool which is applied to extract the best solution to help in developing a quality life style. But sufficient precaution should be followed in order to monitor that the ecosystem and environment are not endangered. Green technology guide the correct path to the existing human society regarding proper planning of energy application. The three basic stigma on which the concept is developed are upright social parity, reliable economic viability and feasible ecological equilibrium. The latest reports on climate clarify that the pace environmental damage is so high that it will impose a serious threat in nearby future to the life kingdom prevailing on earth. The main cause of this serious matter is human action that have continuous tendency to go towards more improved life style at the expense of energy.

On the other hand it is also true that compromise is not the solution in order to protect the nature but actions should be taken to promote good development in all sectors by implementing pollution free systems.

The following points summarize in brief all the advantages of Green Technology:

i) It is not associated with polluting discharge matters that are harmful for environment.
ii) It prevents accumulation of waste water by recycle technique.
iii) It creates new job opportunities with new evolution of new technology.
iv) It benefits good agriculture production with minimum water wastage.
v) It prevents power wastage as it is equipped with modern sensors that can predict the perfect energy requirement for any room or building. In this way the users enjoy monetary saving in energy bill.
vi) The involvement of clean energy slow down global warming with reduced CO_2 emissions.
vii) It creates new business areas with innovative products developed and selected with economic aspects.
viii) It also saves the natural resources which will get extinct if immediate actions are not adopted.

Every initiative is related with certain benefic features along with certain limitations as well. The major challenge resides on research and development sector which need capital for development. The design of new materials along with smart clean energy generators involve expenses. It is evident that maximum product outcome is still at research stage and has not been introduced in practical field. The installation cost is much high for which it is difficult to increase the popularity among common people. At the same time, there is lack of training from which the users can get motivation to accept the new trend. In most countries proper policies are not decided to progress in green path.

VII. CONCLUSION

The conventional technology is associated with various disadvantages that can be easily overcome using green technology. In order to continue the survival of life on planet earth, green ideas have become a major issue in every stage. The sustainable development should progress always in benefit for mankind and this can be only ensured by adopting technology. The indispensable characteristic for sustainable development is conserving the natural quality of environment. The initiatives that are adopted in order to save the planet are responsible for sustainable development along with providing better future which is associated with steady economic growth. The green innovation is capable to fulfill all the basic needs of present human population with minimum compromise. The only probable solution is to arrange more awareness programs, technical workshops and train people to become expertise in handling these new innovations for the benefit of society and mankind.

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