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NEWS LETTER ON GREEN TECHNOLGY

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EDITORIAL

This issue deals with Green technology which is a wing of Environmental Biotechnology. The Green technology is the advance scientific techniques used to fulfil the human needs with environmental sustainable way. The Green technology is mainly based on Green Chemistry. As US Environmental Protection Agency (USEPA) defines it, "Green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances…[it is] sustainable chemistry." It is not to be confused with cleaning up pollution, as it seeks to generate no pollution in the first place. The 12 principles of Green Chemistry, expounded in Green Chemistry: Theory and Practice by Paul Anastas and John Warner, tells us to design chemical reactions so that waste is eliminated, hazardous chemicals are not generated, energy needed is minimized etc.

As global increase of CO_2 crosses the 2% threshold, we are hurtling irrevocably towards a catastrophe. Global warming does not mean only warming, but more chaotic, more extreme weather. Ecological balance is on thin edge, some species is becoming extinct everyday, zoonotic diseases (like COVID) spreads from animals to humans, there is already war over drinking water rights, there may be war over food.

We must ask ourselves: Is this the world we would like to leave for our children? If not, we must think of alternatives. Green technology is an important alternative for mankind right now.

Asoke Prasun Chattopadhyay
Subhankar Kumar Sarkar

IN THIS ISSUE:

GREEN TECHNOLOGY

Green Technology is the application of science and technology with environmental sustainability for developmental purpose. It is also referred as environmental technology or clean technology. It is environmentally friendly, developed and used in such way so that it doesn't disturb our environment and conserves natural resources. Some techniques are use for green chemistry, environmental science, electronic devices to monitor and conserve the natural environment and resources. It, also known as sustainable technology, uses for long- and short-term impact on the environment. It is a technique used for generate energy to non-toxic cleaning products. An energy efficiency, recycling, health and safety concern, renewable resources, comes under this technology. One of the important uses of this technique is in the recycling industry. The recyclable material can be used for plastics, fertilizer, and fuel. The main goal of this technology is to conserve nature. Green construction and technologies focuses on reducing the overall impact of construction on human health and the natural environment.

Green Technologies towards Sustainable Future

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Abstract

Green technology is a broad term which refers to any innovation that is environment friendly and is aiming towards sustainable development. It has wide dimensions in terms of domestic and industrial applications. Green technology has the approach of environment friendliness across various spheres such as in the sectors of energy, green products, waste management followed by various other technological aspects. The major objective behind this is to promote the economy as well as proceed towards a greener and cleaner earth. Various processes come under the purview of green technology which includes green engineering, green chemistry, green nanotechnology and other innovative techniques that help to develop an eco-friendly terrestrial system.

Introduction

At present, green technologies would be the most significant aspect and contributor towards ecological well-being. Climate change has caused significant changes on the earth and its surroundings last several decades. Various issues of pollution, natural disaster, global warming are the bane of this climate. Further, loss of biodiversity, pest and disease outbreaks are also major negative consequences of climate change. Such alterations are as severe as they are irreversible. Therefore, it is now time to act to prevent further degradation of the environment. Technological advancement has further aggravated the problem in terms of depletion of natural resources. Generation of various forms of pollutants, waste materials, toxic and hazardous substances along with drinking water contamination have become major issues of the post-modern world. Therefore, such events impose significant negative consequences over our health. Pollution of water, soil and air resources have altogether endangered and threatened the existence the human life, leave alone other forms of fauna and flora. Promoting green technologies across societies are thus need of the hour to address the various facets of environmental degradation [1].

Sectoral approach of Green technology

Among the various sectors energy, waste and resource recycling are the major challenges for green technology (Fig. 1). There is a huge knowledge and research gap in developing innovations across different sectors. [2]

Green building

Under this concept the type of building materials along with their location are the major aspects of construction. It aims towards sustainable approaches in construction activities along with effectivity of the green technology.

Green consumerism

Developing eco-friendly marketing and purchasing behavior through green consumerism approach is the major theme under this approach. This approach involves manufacture of eco-friendly products having least impact on the environment followed by promotion of green purchasing and consumerism by government bodies.

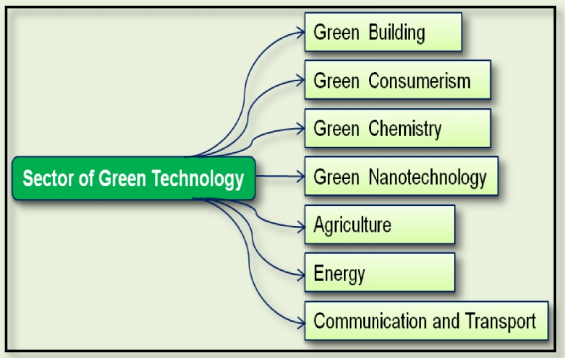

Fig. 1: Various sectors of Green Technology

Green Chemistry

It is a newer technology that aims towards designing green products as well as lesser generation of pollutants. It also aims towards reducing the steps of a chemical reaction following the principle of atom economy.

Green Nanotechnology

It is a technology which works at microscale level through manipulation upto nanometer level. This approach simply involves the principles of green chemistry and engineering approaches.

Agriculture

Agriculture is the largest sector and country like India is agro-based country. The level of pollution in the agriculture is gradually rising under the pressure of more production. Various eco-friendly farming practices are gaining more importance day by day in the upcoming times leading to adoption of green production system.

Energy

At present times energy crisis is the bane for modern civilization. Use of renewable source of energy in the form of hydropower, wind power, solar power has now gained considerable importance at present times. This was aimed towards proper utilization of Renewable energy technology for efficient use of energy resources.

Communication and transport

Transportation sector includes rail transport and use of Electric vehicle to reduce the load of atmospheric pollution.

Recent developments of green technology

Figure 2 represents various forms of research and scientific developments of green technology at present times.

Green architecture

Green architecture is the concept that reduces the consumption pattern of the urban set-up making it sustainable for long term basis. It focuses on proper space and light availability in the construction activities and therefore reduces the energy demand of the urban population. Most of the materials to be used for construction purpose should come from waste materials through proper recycling process. This would also reduce the various emissions [3].

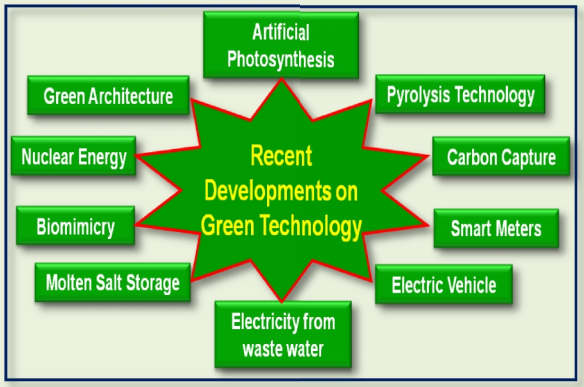

Fig. 2: Green technological developments of recent time

Electricity generation from waste-water

This is a new approach developed by the scientists of Oregon State University who have designed a generator capable of producing electricity from waste water. It has been conceptualized on the basis of microbial fuel cells and reverse electrodialysis process. The capability of the system is quite high to contribute towards the power generation. Such approaches are quite promising under the era of resource scarcity [4].

New source of nuclear energy

Nuclear energy has shown significant promise as alternative energy source recently. Radioactivity associated with it has been significantly reduced. Safety matters have been looked into. Generation of radioactive waste is still a big problem in relation to nuclear power generation. Traditionally, Uranium has been used for decades and is still useful. Thorium on the other hand proves to be a suitable alternative with lesser generation of radioactive waste. The availability of thorium in earth's crust makes it a cheaper source of nuclear energy. However studies reflect its lesser cost effectiveness in terms of nuclear energy. Future research may show the way of its proper use [5].

Waste-sourced Biofuel / Pyrolysis

Waste material in the form of biomass leads to production of biogas followed by ethanol.

Various pilot projects are running across different countries of the world. Municipalities across the world are working towards conversion of the waste material to biofuel production. Burning of the crop stubble mulches under controlled oxygenic environment leads to reduction in greenhouse gas emission and formation of charcoal – a process termed as pyrolysis [6].

Biomimicry

Biomimicry is an emerging design that follow the nature's best ideas and then imitates these designs and processes to solve human problems with environmental sustainability[7].

Electric vehicles

To reduce the vehicular emission the approach of green technology demands the use of electrical vehicles. Electric vehicles are the most suitable option for the mankind to reduce the level of vehicular pollution. Further, wireless technologies could help to promote remote powers to drive them through some electromagnetic system designed beneath the road. Such technologies are now presently under trial in South Korea [8].

Carbon capture

At present times, carbon capture is an important theme or issue in order to mitigate the effect of climate change. Amines and ZIFs are the two molecules which have shown significant promise towards carbon capture under natural condition [9].

Molten salt storage

Molten salt has shown significant promise towards storage of energy for its future use. The molten salt is used to store the excess heat of solar insolation coming over the earth surface. Molten salt by using its own captured heat energy is capable of running turbines, as well as lead to steam production [10].

Artificial photosynthesis

Photosynthesis is the physiological process in plants to produce sugar in presence of sunlight and chlorophyll molecule from carbon dioxide. A similar mechanism is used by scientists and technologists to produce energy by using carbon dioxide. Such approaches would help to reduce the atmospheric load of carbon dioxide along with fuel production. However the technology has some drawbacks in the form of efficiency of energy production on a large scale [11].

Smart meters

This is also a new development in the field of green technological applications. It would aim towards optimum use of energy and water resources. Smart meters would help to run our electrical appliances properly with optimum use of electricity. For example, we can arrange specific time period for running our washing machine during the less energy demanding time. Further, smart grids tend to reduce water leakages [12].

Conclusion

Green technology is the need of the hour which addresses various forms of environmental pollution and degradation processes. Innovative approaches in the fields of agriculture, energy, domestic production of clean products, reduction of greenhouse gases are the need of the hour. It also focuses on green consumerism and consumer awareness regarding purchasing of eco-friendly products. Various new technologies such as green nanotechnology, green chemistry, biomimicry, electric vehicles, biofuel technology are doing a lot of good for the earth's environment. Green consumerism, green marketing approaches are gaining importance day by day. In order to move towards sustainable world, the post-industrial world of the present century is adopting green technology day by day. Green technology is the future of the technological world.

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Green Technology-A promising way of sustainable life

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Introduction

Michel was sitting near a window watching a foggy and gloomy ambient outside his house. It was December 6, 1952; temperature was low other family members were gossiping in front of the fire place. The ambient fog was very common in London, but that time the fog was something special. The fog was combination of fog and smoke coming from fossil fuel burning. A new nomenclature "smog" was first coined by physician Harold Des Veaux in 1905 to describe natural fog contaminated by smoke at London. Now a days another new nomenclature has been popular to combat pollution from life which is popularly called as "Green Technology". It comprises different aspects of life, such as using clean energy, renewable energy, sustainable energy, waste management or wise use of waste materials and also conservation of non-renewable resources. It is too difficult to search the historyspecific for green technology. Green technology rather can be considered as environment and eco-friendly technology, which aims not to disturb our ecosystem and preserve natural resources so that it which lead to sustainable development.

Scientists refer green technology as environmental technology and clean technology which is intended to protect environment and mainly to conserve natural resources. Green technology is made upof different sectors of technology and research. Government takes initiatives to promote green technology and introduced many fiscal incentives that generate electricity from renewable source.

Green nano-technology comprises green engineering and green chemistry that can be applied for controlling environmental pollution and the waste management. It is true that Green nano-technology can give answers all the existing pollution abatement technology. It actually modifies waste pattern and regulates waste production in a way that it minimise harmful impacts on the planet and we maintain green living. The possible areas where this technologies can be applied including green energy generation, organic agriculture production, eco-friendly textiles manufacturing, green building constructions, and other manufacturing of related products and materials to support green business. Besides, other forms of green technologies in field of generation of energy are applicable using by solar power and fossil fuel. So, future generation can also be benefitted from them without harming the planet.

Green Technology is the development and application of products, equipment and systems use to conserve the natural environment and resources, which minimize and reduces the negative impact on environment by human activities. GreenTechnology refers to production of several equipments and machineries which fulfil the following conditions:

1. It minimizes the degradation of the environmental segments and natural resources;
2. It has zero or low greenhouse gas (GHG) emission is safe for use and promotes healthy and improved environment for all forms of life.
3. It preserves the consumption of energy and natural resources.
4. It enhances the use of renewable resources.

Implementation of green technology for a country is not common, it needs a few special requirements. The following are the goals of green technology which are now suggested by the policy makers. It actually depends on the '7 R' of any developmental project (Fig 1) but presently energy conservation, wastewater treatment and development of green building through sustainable living. The goals of green technology are followings:

- To meet and cater the needs of society in such a way without damaging or depleting natural resources on earth is the main objective of green technology.
- To meet present needs without making any compromises. Focus is being shifted on making products that can be fully reclaimed or reused. The important goalof green technology is to change patterns of materials production and consumption which ultimately encourageminimise waste production in manufacturing sectors.

It is essential to develop alternative technologies to prevent any further damage to health of human beings and other living beings

and its advantages and their disadvantages of the green technology.

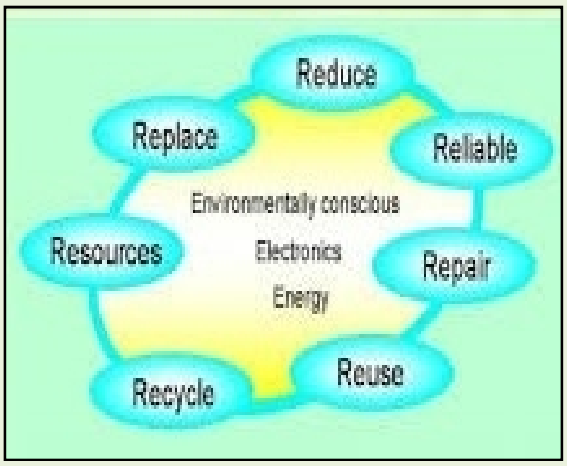

Fig 1: 7R of green technology (source: http://cpcbenvis.nic.in)

Green Technology in energy sectors of India

Application of green technology in energy sector reduces the carbon dioxide foot printas a whole. Energy sources include the sun, wind, moving water, organic plant and waste material (biomass), and theearth's heat (geothermal). Although some renewable energy technologies can have an impact on the environment. It is true green power is a subset of renewable energy and represents those renewable energy resources and technologies that provide the highest environmental benefit.

The projected estimation of global energy consumption demonstrates that energy consumption in India is continuously increasing and retains its position even in 2035/2040. The increase in India's energy consumption will push the country's share of global energy demand to 11% by 2040 from 5% in 2016 After independence China, India and Brazil have experienced a process of rapid industrialization followed by urbanization. These countriesbuy large volume of manufactured products from the developed countries whichultimately impact on global economy. The industrialised countries howeveruse non-renewable energy resources for their manufacture as a whole so that this populated demand huge energy for their living. As Indian population is 1.368 billion and it ranks second, of the most populous countries as of January 2019. The estimated yearly growth rate is 1.18% and carries almost 17.74% of the total world's population. The country is expected to reach more than 1.383 billion, 1.512 billion, 1.605 billion, 1.658 billion people by the end of 2020, 2030, 2040, and 2050,respectively. Each year, India adds a higher number of specific population of some of the states in India is equal to the population of many countries. The energy consumption of India's will be the fastest among allsignificant economies by 2040 where demand of coal based powerwill be higher among all othernonrenewable energy. In this way probably alternative energy may be the second most important source of domestic sectors, going by gas and then oil, by 2020.The demand for renewables in India will have a tremendous growth of 256 Mtoe (mega tonnes of oil equivalent) in 2040 from 17 Mtoe in 2016, with an annual increase of 12%. At present India has reached a fast and exceptionaldevelopment, energy is still short in supply. Exceptional economic growth in India is quickening the demand for energy, and new energy sources are needed to overcome therequirements. On the other hand increasing population and environmental deterioration, the country accepts the difficulties of sustainable development. The gap between demand and supply of power is expected to rise in the future. In 2018,the energy demand was 1,212, 134 GWh (Gigawatt hours), and the availability was 1,203,567 GWh, i.e., a deficit of − 0.7%. According to the International Renewable Energy Agency (IRENA), one forth of India's energy demand can be fulfil with alternative energy. The potentialincrease its share of renewable power will reach over one-third by 2030.

The estimated potential of wind power in the country during 1995 was found to be 20,000 MW (20 GW), followed by solar energy,bioenergy, bagasse cogeneration, and small hydropowerwas 5 × 1015 kWh/pa, 17,000 MW, 8000 MW, 10,000 MW respectively. In the year of 2006, the totalpotential renewable energy was estimated as 85,000 MW in which wind, solar,biomass/bioenergy and small hydropower was 4500 MW, 35 MW, 25,000 MW, 15,000 MW respectively.The annual report of the Ministry of New and Renewable Energy (MNRE) for 2017–2018, reported that potential of wind power was 302.251 GW (at 100-m mast height) followed by of small hydropower, biomass power, bagasse cogeneration, waste to energy (WTE) and solar energy 19.749 GW, 17.536 GW, 5 GW, 2.554 GW, 748.990 GW respectively. The

estimated total potential renewable energy was 1096.080 GW assuming 3% wasteland. As India is a tropical country and receives significant radiation, and hence the solar potential is very high.

➢ Solar energy

Solar photovoltaic celltransform sunlight into electrical energythroughsemi conductor modules. It is usedoften for meeting lighting needs, it can also be applied for pumping water, refrigeration, and charging dry cells. Solar photovoltaic cell has wide use as the agricultural energy source for pumping water, street lighting in villages, lighting in both rural and urban houses and also pest repelent. Till nowphotovoltaic cells are efficient and produces low-cost, powerful new generation of solar energy, which most affordable and efficient energy sources futuregeneration.

The National Solar Mission and the MNRE clearly reported the objectives of the solar gridthat the grid connected solar power projects from 20 GWand 100 GW by the year 2021–2022 and 2021–2022 respectively. It was just 6 MW in 2008–2009. A new project "Solar Impulse 2", has been initiated in Ahmedabad, India on March 10, 2015, which was a solar-powered airplane piloted by Bertrant Piccard, from Switzerland lands.

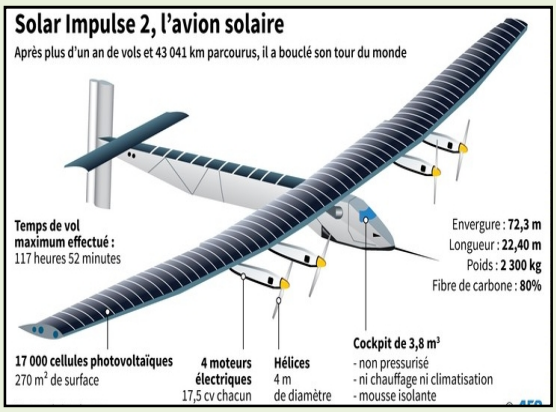

Fig 2: Aeroplane having solar panel (source: https://solarimpulse.com/; http://cpcbenvis.nic.in)

➢ Wind energy

Wind energy is in a boom cycle. It isvery significant project comparing the other energy resource; it produces veryalmost zero air pollutants or greenhouse gases. Wind power uses turbine for electricity. It is nothing but the mechanical power generation system and at present it is a standard and proven technology. Within 31st of December 2018, India hasinstalled total 35,138.15 MW capacity wind power comparing to a target of 60 GW by 2022. Currently India is in fourth position in the world for installed capacity of wind power (Fig 3).

Fig 3: Windmill at Ran of Kach, Gujrat (source: https://ejatlas.org)

➢ Small hydropower

The total estimated potential of Small hydropower is 20 GW, and the Indian target is 5 GW total production by 2022.

Hydropower plants are considered as equally important rural electrification, which has a major role in facilitating irrigation and increasing agricultural products. Hydro projects can be classified as large hydro, small hydro (2 to 25 MW), micro-hydro (up to 100 kW), and minihydropower (100 kW to 2 MW) projects.

➢ Bio-fuel

Bio-fuel as bio-ethanol and bio diesel has the potential to assume an important portfolio in the future energy platter. Caution is mandatory in evaluating bio-fuel as green agricultural technology. If we concern regarding food security, the risks to ecosystem and biological diversity are parameters that truly need to be accessed.It is necessary for conversion of the wasteland to farmland with suitable crop options which can be used in production of biofuel.

➢ Biogas

Themethanogenic bacteriaferment organic matters by the method of anaerobic digestion producing biogas. Bio gas utilizes organic waste products from agricultural and converts it to fuel and fertilizer. Biogas as well conserve fuel-wood, agriculture residue, livestock manure, and kerosene. It also input in soil fertility and crop production. Bio gas also solves the problem of indoor air pollution

and improves household or communal sanitation. India's bio gas potential is estimated to be 12 million bio gas plants.

India is one of the fastest emerging economies in the world. India is still continuing to be the front runner in generating green technology. India has been initiated one of the largest green energy projects that will generate 20,000 MW of solar power and 3,000 MW from wind farms on 50,000 acres in Karnataka.The first phase of the US$50 billion project had started in the year 2012.

That wasthey India's introduction of the Clean Energy into national budget. Government of India provides subsidies for green technology. TheNational Action Plan on Climate Change sets specific a few targets which will be utilise in the Himalayan eco-system.

Green technology in Wastewater treatment

Green technologies in wastewater treatment are now widlely used in India refering to a group of practical methodologies and materials using. The most important application of advanced green technologies deals with the environmental cleaning and remediation of ecosystem. This includes purificationof water and air, sewage treatment, environmental remediation, and waste management. There are some green physical and chemical processes which are employed to clean and remediate the environment without generating hazardous substances or toxic by-products.Wastewater treatment refers to the process of removing contaminants and undesirable components from domestic, industrial and polluted waters to safely return it to the environment for drinking, irrigation, industrial, and other uses. Today, the increase in ecological awareness and enhanced government regulation has made some conventional wastewater treatment systems questionable. To fill the gap left by less than adequate conventional technologies, green technologies are tested, and implemented as clean alternatives for wastewater treatment purposes.

Several steps are employed during any wastewater treatment process. The first consists of separating the solids from the liquid water. This can be achieved through gravity as solids are heavier than the liquid water. Other solid components like oils and woods which are less dense than liquid water could be removed from the water surface through the method of flocculating separation. Afterward, the liquid wastewater is subjected to filtration processes to dispose of any colloidal suspensions of fine solids, chemicals particulates, and impurities. The resulting filtered water is finally exposed to oxidation to reduce or eliminate the toxicity of any remaining pollutants and disinfect the wastewater before release it to the environment.

Currently, a number of advance methods are going toused for wastewater treatment either alone or in combination with other conventional methods in industries.

Bioreactors

The most common methodare used in is wastewater treatment is using a bioreactor. Basically, a bioreactor is a device containing bacteria and microorganisms placed or immobilized in/on: a moving bed biofilm reactor, deposited on a packed or fibrous bed, or attached to a membrane to form a biofilm. Bioreactors are usually contenta separators linked to sequential tanks and a mechanical separator which helps to accelerate the split of liquid water from the biosolids. Aerators for oxygen supply also presentwhich aims to speed up the biochemical reactions undertaken by the living microorganisms. The contact between the wastewater and microorganisms present in the bioreactor's platform help to promote biochemical reactions.At the end it helps to transform of pollutants to other less or non-toxic products. Bioreactors also removes metal from wastewaterafter applying sulphate reducing bacteria which produce hydrogen sulphide which precipitates the dissolved metals as insoluble metal sulphides that are recovered as valuable by-products.

Biofiltration

Biofiltration method utilise some selected species of bacteria and microorganisms that are grown on a biofilter to develop the biofilm. The wastewater is usually passed through the biofilm either upflow or downflow and in a continuous or discontinuous manner. The perfonmance of the process depends on the immobilized living microorganisms which speed up the degradation of organic matter and pollutants present in the wastewater. Other parameters like activity of the microorganisms, age of the biofilm, oxygen levels, temperature and water composition play key roles in the performance of the

biofilm. This method are commonly used for treatment of domestic wastewater and also has application for removal of heavy metals from industrial wastewaters.

Bioremediation

The bioremediation process uses living microorganisms to remove, augment and neutralize pollutants and hazardous species from contaminated wastewater. The goal of this metal is to yield less toxic or nontoxic materials after treating of wastewater. The process can be performed both *in-situ* or *ex-situ* conditions. Living microorganisms like bacteria, fungi are directly applied to polluted sites during *in-situ* remediation processes, and during *ex-situ* remediation wastewater are treated elsewhere from the polluted areas.

Generally, when wastewater comes to treatment of their pollutants and hazardous species, the applied living microorganisms, utilise the contaminant as their food for metabolism.Examples include heavy metals like copper, nickel, cadmium, lead, and mercury, among others. The other limitations are fulfilled using advanced green technologies including electrowinning and electrocoagulation.

Electrowinning

The electrowinning is a current passing between two cathode and anode dipped in an electrolyte solution. Metals, are deposited on the cathode,which has been electroextracted from their oxidized forms.Thus, metals including copper, nickel, silver, gold, cadmium, bismuth, cobalt and others can be recovered from wastewaters through electrowinning.Compared to conventional electrowinning where electrolytes in the bath are slowly circulated or entirely left stagnant, the 'electrowinning' uses a strong circulating flow of electrolyte. This efficientlyincrease the diffusion of metal species to the cathode, as a resultit increases deposition rates and ability to recover metals at a very low concentrations. Thus the use of electrowinning for wastewater treatment increases the amounts of metal extraction as well as yield of cleaner water. (Fig 4).

Electrocoagulation

Similar to electrowinning, the electrocoagulation GT also uses an electric current to remove contaminants from wastewaters. Cations generated from the sacrificial anode initiate physical and chemical reactions which can be discussed into three successive stages:

(1) Iron or aluminum anode are usedto hydratedcations whichproduced an electric current.

(2) The cations neutralize the surrounded charges of pollutant particles whichform micro-flocculants like unstable formation.

(3) These unstabilized particles start to coagulate and form macroscopic flocswhich can be easily separated from the wastewater.

The overall mechanism of green technology is a combination of ionization, electrolysis, hydrolysis, and free-radical formation which modifies both the physical and chemical natures of the effluents. It resultsthe net removal of pollutant and produce a clear treated water suitable for discharge.

Beside their environmentalfriendly aspect, advanced green technologies have many other benifitsthan the conventional wastewater treatmenttechnologies.

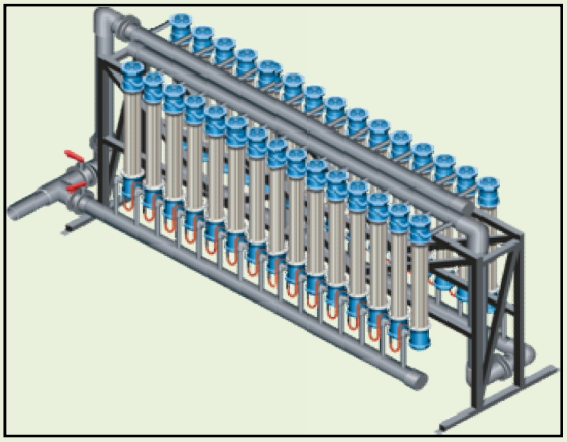

Fig 4: Model of Electro-winning for extracting metals (source: http://www.nmfrc.org)

Green building and green technology

A 'green' building is a building wherethe design, construction or operation process or reduces negative environmental impacts, and can enhance positive impacts, on both indoor and ambient climate and natural environment. Green buildings conserve natural resources and improve quality of life.

There are many features which construct a building 'green'. These include:

- Efficient use of energy, water and other resources
- Use of renewable energy, such as solar energy
- Pollution and waste reduction measures, and the enabling of re-use and recycling

- Good indoor environmental air quality
- Use of materials that are non-toxic, ethical and sustainable
- Consideration of the environment in design, construction and operation
- Consideration of the quality of life of occupants in design, construction and operation
- A design that enables adaptation to a changing environment

A green building needs special materials and systems to adapt sustainability compared with a conventional building. In India the increasing trend of green building constructionrequires green building materials. The green building includsnew design construction and operation of building project. The green materials are ecofriendly, biodegradable materials as they can reducedetrimental environmental impacts. Construction waste like rubbish, demolished brick and stones can be recycled and used in other construction. The using waste material in construction sectors is helpful to reduce the load at the landfill in urban sectors. Material if not reused or recycled will go to landfill or incinerators. This needs to be changed by green buildings. In India fly ash disposal is an important environmental issue.

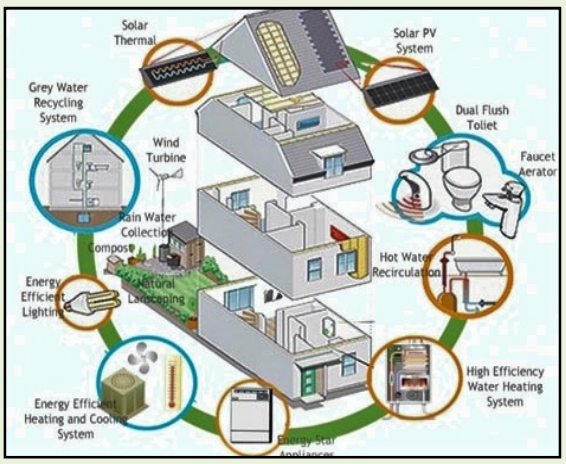

Fig 5: Integrated green building (source: https://www.weadapt.org)

The waste materials in construction that can be used are as under

- Partial replacement of clinker or Portland cement by slag, fly ash, straw silica fumes.
- Partial replacement of natural materials that require little processing such as pozzolanacalcined clays
- Use of rice husk ash in concrete
- Palm oil shell aggregate for light weight concrete

'Smart Ghar' has been proposed by the Rajkot Municipal Corporation's (RMC) housing scheme, where theyapply green technology design and awared'Indo-Swiss Building Energy Efficiency Project' certificate.The project is going to implement under Pradhan MantriAwasYojna and also supportedby Swiss Development Corporation (SDC) and Building Energy Efficiency Project (BEEP).

Now a days green architecture, wastewater electricity generator, new nuclear materials, waste-sourced biofuel / pyrolysis, biomimicry, electric automobiles, carbon capture and molten salt storage are the promising green technology. Still now all technologies are in the stages of research and development; consciousness and awareness among people are very less. In spite of all causes the cost of technology is enoughto popularise among common person. The environmental protection, resource conservation and addressing other socioeconomic aspects for sustainable development are essential. The green initiatives adopted for resource conservation, and environmental protection shall help sustain higher economic growth rate necessary to fulfil basic needs with some acceptable quality of life in the future. Now we can remember the initiation of this article where Michel was sitting in gloomy environment and due to fossil fuel pollution the atmosphere lost its visibility. But we are foot stepping a new era of ‘Green Technology’ where new generation will enjoy pollution free environment.

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FORTHCOMING EVENTS		
Events	**Date**	**Place & Correspondence**
2021 Asia Environment and Resource Engineering Conference (AERE 2021)	14th to 16th October 2021	Singapore http://www.aere.net/
2021 8th International Conference on Biomedical and Bioinformatics Engineering (ICBBE 2021)	12th to 15th November 2021	Kyoto, Japan http://www.icbbe.com/
Second International Conference on Marine Science and Technology (SICMST 2021)	30th to 30th March 2021	Aachen, Germany http://sustainableconference.science/aachen/
International Conference on Energy and Environmental Technology and Economics (ICEETE)	31st March to 2nd April 2021	Ilmenau, Germany https://www.iceete2020.com
3rd International Conference on Environment and Sustainable Development (ICESD 2021)	6th to 8th April 2021	Lahore, Punjab, Pakistan Website: https://gcu.edu.pk/icesd/

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