

**UNIT-V: SUSTAINABLE DEVELOPMENT:** Definition of sustainable development, concept, sustainable development goals, threats to sustainability, strategies to achieve sustainable development. Introduction to green chemistry, green building concept. Activities: Worksheets, seminars.

## **DEFINITION OF SUSTAINABLE DEVELOPMENT**

**“Sustainable development is the development that meets the needs of the present (people) without compromising the ability of future generation to meet their own needs”.**

In other words it is improving the quality of life of the present generation without excessive use of natural resources, so that they can be preserved for the next generation

### **HISTORY:**

1970 –fears in unsustainable growth

1992- EARTH SUMMIT / UNCED (United Nations Conference on Environment and Development) Brazil

2002 – WSSD – World Summit on Sustainable Development in South Africa.

### **KEY ASPECTS:**

1. INTER GENERATIONAL EQUITY
2. INTRA GENERATIONAL EQUITY

## **Concept**

**The concept of Sustainable development is based on following principles :**

1. Integration of environment and economic decision
2. Humans work as the caretaker of the environment
3. Shared responsibility, accountability and decision making
4. Prevention and mitigation
5. Conservation
6. Waste minimization
7. Enhancement of productivity, capability, quality of nature and human life
8. Rehabilitation and reclamation

## **Goals towards Sustainability**

- ❖ To protect our Bio Diversity
- ❖ To prevent Soil Erosion
- ❖ To slow down Population growth
- ❖ To increase the forest cover
- ❖ To cut off the emissions like  
oxides of C , N , S and CFC's too
- ❖ To reduce the waste generation

Goals	Objective	Description
Goal -1	No Poverty	By 2030, eradicate extreme poverty for all people everywhere.
Goal -2	Zero Hunger	End hunger, achieve food security and improved nutrition by 2030.
Goal -3	Good Health and Well-being	Ensure healthy lives and promote well-being for all at all ages by 2030.
Goal -4	Quality Education	Ensure that all girls and boys complete free, equitable and quality primary and secondary education by 2030.

<b>Goal -5</b>	<b>Gender Equality</b>	<b>To achieve gender equality and empower all women and girls.</b>
<b>Goal -6</b>	Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all by 2030.
<b>Goal -7</b>	Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all by 2030
<b>Goal -8</b>	Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth.

<b>Goal -9</b>	<b>Industry, Innovation and Infrastructure</b>	<b>Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation by 2030.</b>
<b>Goal -10</b>	Reduced Inequality	Reduce inequality within and among countries by 2030.
<b>Goal -11</b>	Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient and sustainable.
<b>Goal -12</b>	Responsible Consumption and Production	Ensure sustainable consumption and production patterns.
<b>Goal -13</b>	Climate Action	Take urgent action to combat climate change and its impacts.

<b>Goal -14</b>	<b>Life Below Water</b>	<b>Conserve and sustainably use the oceans, seas and marine resources for sustainable development.</b>
<b>Goal -15</b>	<b>Life on Land</b>	<b>Protect, restore and promote sustainable use of terrestrial ecosystems, combat desertification and halt biodiversity loss.</b>
<b>Goal -16</b>	<b>Peace and Justice Strong Institutions</b>	<b>Promote peaceful and inclusive societies for sustainable development; provide access to justice for all.</b>
<b>Goal -17</b>	<b>Partnerships to achieve the Goal</b>	<b>Strengthen the means of implementation and revitalize the global partnership for sustainable development.</b>



The **greatest threats to the sustainable development on earth** are:

**1. Population Explosion:** world wide and nation wide—population stabilisation

**2. Consumerism :** - People - over population – LDC's  
Consumption – over population - Crazy consumerism

**3. Over- Exploitation of resources – MDC's**

- Energy use and global warming,
- Excessive waste generation and the subsequent pollution of soil, air, and water
- Transportation in cities,
- Limited supply of resources.

Many of them are interrelated. Let us now briefly discuss about these threats

## **1. POPULATION EXPLOSION:**

The world population in 2007 was estimated at 6.7 billion with an annual growth rate of about 1.2 percent. To put the recent growth in perspective, the world population in the year 1900 was only 1.6 billion and in 1960 it was 3.0 billion. According to UN, the world population in 2050 will be between 7.9 billion and 10.3 billion.

The amount of bio-productive land and sea available to supply human needs is limited. It is estimated that only one eighth of the surface of the Earth is suitable for humans to live on — three-quarters is covered by oceans and half of the land area is desert (14%) while high mountains constitute 27%.

Population has already exceeded the sustainable limit .

## **2. URBANIZATION**

Population growth coupled with **urbanization** results in significant impacts on the environment and other problems, which include:

- (1) increased ambient temperature
- (2) decreased air quality
- (3) increased water run-off,
- (4) decreased quality of runoff water
- (5) altered weather patterns,
- (6) loss of natural beauty,
- (7) reduction in farmlands and subsequent food shortage,
- (8) deforestation (Deforestation is occurring at a rapid rate, with 0.8 hectares of rain forest disappearing every second.

### **3. Energy use and global warming**

The energy consumption in India rose threefold, from 4.16 to 12.8 quadrillion Btu (British thermal unit) between 1980 and 2001, putting India next only to the US, Germany, Japan and China in total energy consumption.

Over one-third of human induced greenhouse gases come from the burning of fossil fuel to generate electricity. All fossil fuels are made up of hydrocarbons and they release carbon dioxide when burned.

*The principal greenhouse gases that enter the atmosphere because of human activities are:*

**Carbon dioxide (CO<sub>2</sub>):** Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas and coal), solid waste, trees and wood products and also as a result of other chemical reactions (e.g. - manufacture of cement). Carbon dioxide is also removed from the atmosphere (or sequestered) when it is absorbed by plants as part of the biological carbon cycle.

**Methane (CH<sub>4</sub>):** Methane is emitted during the production of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices apart from the decay of organic waste in municipal solid waste landfills.

**Nitrous oxide ( $\text{N}_2\text{O}$ ):** Nitrous oxide is emitted during agricultural and industrial activities as well as during combustion of fossil fuels and solid waste.

**Fluorinated gases:** Hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases (High GWP gases).

Based on a range of scenarios, the Intergovernmental Panel on Climate Change (IPCC) of the United Nations predicts that, by the end of the 21st century *climate change will result in the following:*

- A probable temperature rise between 1.8°C and 4°C
- A sea level rise most likely to be in the range of 28 - 43 cm
- Disappearance of summer sea ice in the second half of this century.
- A likely increase in heat waves.
- A likely increase in tropical storm intensity.

## **4. Waste management**

Waste management is the collection, transport, processing, recycling or disposal of waste materials.

The term usually relates to materials produced by human activity and is generally undertaken to reduce their effect on health, aesthetics or as an amenity. Waste management is also carried out to reduce the effect of the material(s) on the environment and to recover resources from them.

Various methods are used for waste management which include disposal (landfill and incineration), recycling (physical and biological processing), energy recovery, and avoidance and reduction.



# ***Strategies to achieve the Sustainable Development Goals***

The report presents key transformations needed to achieve the sustainable development goals in a manageable way, based on the major drivers of societal change, - includes the following :

- 1. Using Appropriate Technology:** ‘design with nature’ – which consumes less resource and generate least waste.
- 2. Reduce ,Reuse, Recycle approach:** (3 –R approach) to focus on minimization of resource use
- 3. Promoting environmental education and awareness:** Switching to earth centric thinking and transforming our lifestyles too.  
**‘If you plan for one year, plant rice, if you plan for 10 years, plant trees and if you plan for 100 years, educate people’**
- 4. Resource utilization as per carrying capacity:** 2 – components:  
Supporting capacity – capacity to regenerate  
Assimilative capacity – capacity to tolerate different stresses.
- 5. Improving quality of life** – social , cultural and economic dimensions:

# INTRODUCTION TO GREEN CHEMISTRY

**Green chemistry** can be defined as designing chemical products and processes that minimize or eliminate the use or development of hazardous substances. This is new revolutionary progress in the field of chemistry. Let's **'Go Green'** and learn about **green chemistry** which is full of innovations, new ideas, and of course, eco-friendly



## Green Building Movement in India



# **Concept of Green Building**

A green building is broadly defined as the building which is sited, designed and operated to **reduce negative environmental impacts** and has **a profound positive impact on natural environment**, economy, health, productivity and society over its life cycle.

## **Green Building Components**

Aluminum panels help regulate indoor temperature and prevent moisture and pests from entering.

Energy Efficient Windows.

Green Roof.

Solar Power.

Water Conservation.

Recycling.

Landscaping.

## **A) Green Building Materials**

- Should be eco friendly
- Should be recyclable (reduce GHG emissions)
- Should use reclaimed materials (from old buildings) such as bricks, doors, windows, frames etc (reduces the embodied energy and impact on environment)
- Materials like paints used are highly toxic in nature.- like coating materials contain pigments (Cd , Pb , Cr)
- Petro chemicals and solvents like C<sub>6</sub>H<sub>6</sub> , solvents, HCHO and VOC (volatile organic compounds) which are used as binder(to hold the paint) and carrier (to disperse the binder) – highly toxic in nature
- Preservatives, thickners, thinners and driers are also used.

**They cause Indoor pollution and are harmful to human health.**  
**Need to be replaced by eco friendly natural products.**

**Green roof has the following advantages:**

- Absorbs atmospheric CO<sub>2</sub>
- Improves energy efficiency.
- Causes cooling in summer and provides insulation in winter.
- Absorbs noxious pollutants, sound and noise from atmosphere.
- Absorbs rainwater which may otherwise flood the sewer lines.
- Preserves biodiversity, attracts butterflies, bees and local birds.
- Improves aesthetics of the building.

## B) Energy Considerations in Green Buildings

- Acc. to Energy Conservation Building Code (ECBC) norms-
- All commercial buildings is given load of 500kW
- Provides design for natural system (40% - 60%)
- Solar panels – meets the hot water requirements and lighting.
- Various insulating materials for noise and heat maintenance.
- Compact flurescent lamps can reduce current consumption.
- Materials like gypsum,clay can also be used for strong and breathable walls.

# Water requirements in green buildings

- Waste water –should be treated and used for gardening
- Permeable pavements and rainwater harvesting tech –helps in recharging ground water

## ***Health considerations in green buildings***

- Stale air is replaced by fresh one.
  - Non –toxic materials like lead free paints..
- Water soluble , natural or organic paints are risk free.
- Natural day light productivity is much improved abt (20% – 26%)



# Ratings of Buildings

**Few parameters basis which certifying agencies rate a project in India.**

- Efficient use of resources like energy and water. ...
- Use of renewable energy. ...
- Pollution and waste reduction measures. ...
- Good indoor air quality. ...
- Use of non-toxic materials.

## **IGBC Green Factory Building Certification Levels**

<b>Rating</b>	<b>Points</b>	<b>Recognition</b>
<b>Certified</b>	<b>51 - 60</b>	<b>Best Practices</b>
<b>Silver</b>	<b>61 - 70</b>	<b>Outstanding Performance</b>
<b>Gold</b>	<b>71 - 80</b>	<b>National Excellence</b>
<b>Platinum</b>	<b>81 - 100</b>	<b>Global Leadership</b>



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