

Climate and Environment Changes – A Warning for Global Warming

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ABSTRACT: *'The Earth'*, one of our planets in the solar system possesses life of all kinds since millions of years. At present, there is a need for retention of life for the future generations protecting the planet, from the surrounded variations in the atmosphere and environment, namely- *green house gases* – deeply rooted under water and on the surface, as well as on the lower/ upper atmosphere of the Earth. These pollutions or emissions like carbon dioxide (CO₂) and methane (CH₄) are responsible for the changes in the *seasonal climatic variations* and earth's temperatures resulting global warming. Few indications and symptoms for climate change are variable rainfall pattern, melting of glaciers, increased temperatures, excessive flooding and water scarcity. The causes behind this phenomenon are nothing but the generated phenomenal actions by the living beings on Earth, disrupting the existing gifted Nature, drastically into unbearable fearful situations, causing severe losses to the living conditions of human beings and their healthy environments. Control, prevention and elimination of these emissions are possible through the implementation of *carbon-free technology systems* replacing existing fossil fuel and coal based devices. Full utilization of solar radiations incident on Earth along with the sources of water, for multiple applications like energy, power and fuel (H₂) production is inevitable. Major and critical procedures recommended for adoption are highlighted, formulated and analyzed in this paper, indicating the feasibility of methods to save the planet Earth assuring security, safety and protection from global variations.

Key words: *green house gases, seasonal climatic variations, carbon-free technology systems*

1. INTRODUCTION

The year 2008 is declared as the International year of Planet Earth with the designated significances on the dates 22nd April and 5th June as The Global Earth and The Environment Days respectively. The entire world has shown anxiety and expressed deep growing concerns to save the Earth. Recently, the 13th Conference of UN Framework Convention on Climate Change (UNFCCC) held at Bali, Indonesia on December 3, 2007 participated by 190 countries, laid down a set of principles and resolutions for implementation. Now the visible appearances of the Earth have become a test ground for evaluation of climate and environmental changes from all corners [1]. Day by day climate change concerns, in the developing countries economics, like India, turns as a major challenge. To overcome these situations, the two pronged approaches, based on maximization of efficiency in energy conversion process and hybridization of low carbon energy resource, develops and assures near zero emission power devices with safe disposal of green houses gases [2]. The present paper describes technology based few carbon free based technology systems suggesting few critical innovative proposals for speedy implementation on low carbon technologies, discussed the areas in particular utilization of solar radiations and developments in the nuclear power related programs to protect the Earth from Global Warming.

2. GREEN HOUSE GASES

The presence and behaviour of certain chemical compounds in the atmosphere are known as green gases. When sun light passes through on these gases, short wave energy (visible and ultraviolet portions of the spectra) heat the surface while longer wave energy (infrared) heat reradiated to the atmosphere.

Gases like carbon dioxide, methane and water vapour occur in the atmosphere where as others chlorofluoro carbons (CFCs), hydrofluoro carbons (HFCs) and perfluoro carbons are man-made

2.1 Green house effect

The temperature of the Earth is very less compared to the Sun and it radiates at longer wavelengths. The radiations emitted by the land and oceans are absorbed by the atmosphere including clouds and reradiates back to the Earth. This is called greenhouse effect. This effect warms the surface of the Earth to a large extent. In the absence of this effect, the average temperature of the Earth would be below the freezing point of water. This effect comes from molecules of water vapour, which is the most important greenhouse gas. The principle of greenhouse effect is shown in Fig. 1.

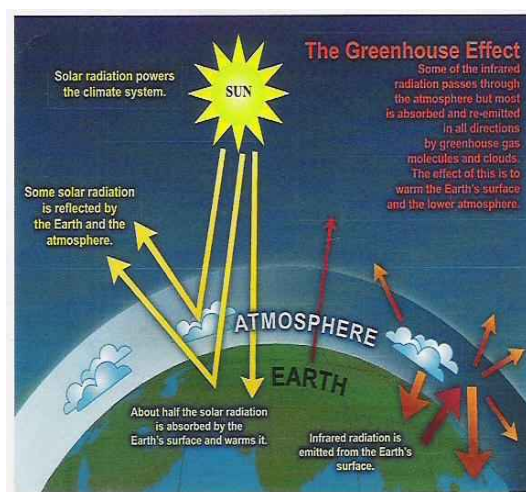


Figure 1: Green house effect

2.2 Water vapour

Water vapour is the most abundant green house gas identified in the atmosphere. When the temperature of the atmosphere raises, more water on or under the surface of the ground like lakes, rivers, oceans and under ground water is evaporated turning the atmospheric air hot. Thus the relative humidity becomes higher forming water vapour. If the water vapour concentrates more, it will be able to absorb more thermal

infrared energy radiated from the Earth warming the atmosphere.

2.3 Carbon dioxide

Carbon dioxide exists in the Earth's atmosphere at standard temperature and pressure. This gas is toxic at higher concentrations, does not have the liquid state and commonly known as dry ice. The gas is produced by animals, plants, fungi and micro-organisms during respiration. It transmits visible and absorbs strongly in the infrared wavelengths. It is generated by the combustion of fossil fuels and also present by volcanoes and hot springs. Carbon dioxide during the 4000,000 years has a rapid rise subsequent to industrial revolution (Fig.2). These variations are due to the changes in the Earth's orbit around the Sun, volcanic emissions as well as greenhouse gases.

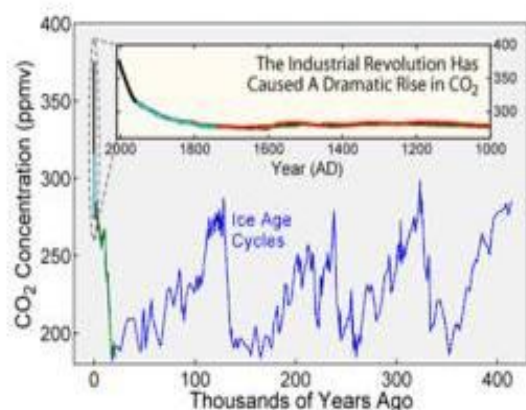


Figure 2: Concentrations of Carbondioxide

3. CLIMATE

The observations of climate over 200 years have emphasized the complexity of the planetary system regionally and globally. Climate involves variations in which atmosphere is influenced by and interacts with other parts of climate system and external forcing. The interactive components in the climate system are the atmosphere, the oceans, sea ice, the land and its features (including the vegetation, albedo, biomass and ecosystems), snow cover, land ice and hydrology (including rivers, lakes

and water, surface and subsurface water (Fig.3). The source of energy that drives the climate is the radiation from the sun. The average amount of energy incident on a level surface outside the atmosphere is 342 W/square meter. If integrated over the Earth this amounts to about 175 Peta Watts. Peta is 10^{15} .

3.1 Climate variations

The climate is constituted by the three surface variables such as temperature, wind and precipitation. The climate system is driven by solar energy producing the motion of the atmosphere through the non-uniform heating of the earth's atmosphere and earth's rotation. The climate change is a variation and a shift in climatic conditions over space and time occurred at different scales and magnitudes resulting warm, cool and dry climates.

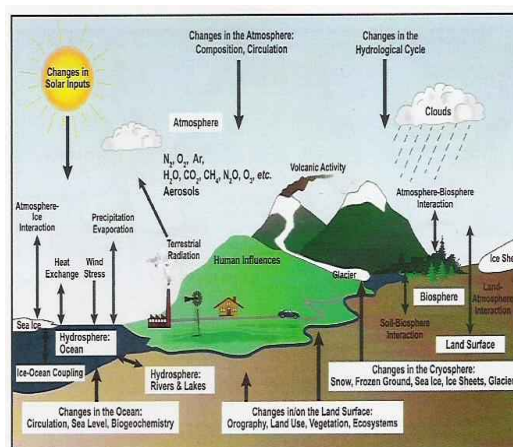


Figure 3: Schematic view of climate change components and their interactions

3.2 Sources for climate change

Coal burning power plants, automobile exhausts, factory smokestacks and other waste vents of human environment contribute about 22 billion tons of carbon dioxide and other greenhouse gases into the Earth's atmosphere every year. Animal agriculture manure, natural gas, rice paddies, landfills, coal and other sources contribute about 250 million tons of methane every year. This led to an increase of atmospheric

concentrations of carbon dioxide and methane to the order of 31 %.

4. ENVIRONMENT CHANGES

Environmental changes are caused by Nature. This has an impact on inhabitants. The primary causes are temperature, rainfall, wind, seasonal changes, erosion, weathering and earthquakes. Adverse hot and cold surface temperatures affect our environments by changing the weather pattern. Systematic and cumulative environmental changes are linked via complex feedback processes, the most of them are land- atmospheric interactions. They involve changes in quantities such as heat and moisture fluxes, rainfall, vegetation cover, soil erosion and aerosols. Abnormal seasonal changes lead to immigration. Severe rain and wind cause changes by wearing away Earth's soil by erosion. Weathering breaks big rocks, freezing water and extract deep and huge roots. Tropical cyclones and severe mid latitude storms are the two extreme conditions of weather. Their frequency and severity are changing, but detectable. During the end of 19th century in United States, 2.3 hurricanes per year were recorded causing heavy landfall [3].

4.1 Sea levels

Over the many centuries the rise of sea level increasing by order of several meters. Thereby the global mean sea level is also increased. The future predictions of sea level rise for the rest of the century, estimates of the past and instrumental recorded data are projected [4]. Recent scientific analysis reveals that the two main causes of global sea level rise are the thermal expansion of the oceans and the loss of land- based ice due to increased melting. The 26th December 2004 earthquake in the Andaman and Nicobar Islands affected the total costal zone by Tsunami raised Andaman by about 0.8m and sunken Nicobar by about 1.8m [5].

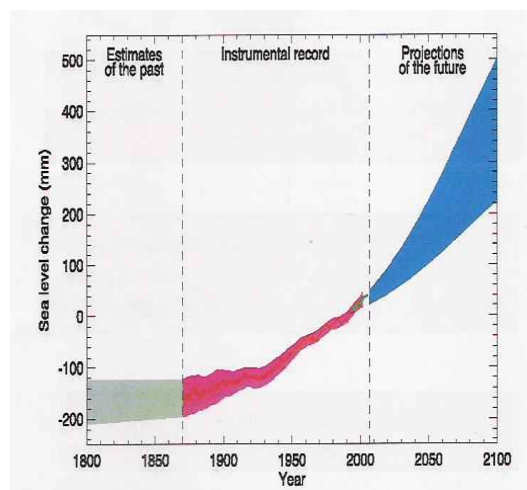


Figure 4: Sea level rising

The grey shading shows the uncertainty in the estimated long term rate of sea level change (Fig.4). The red line is a reconstruction of global mean level from tide gauges and red shading denotes the range of variations from a smooth curve. The green line shows the global mean sea level observed from satellite altimetry. The blue shading represents the range of model projections assessed from the existing observations. Beyond 2100, steps are to be taken to control the emissions for protecting the environment, to reduce the global mean sea variations

5. GLOBAL WARMING

Global warming refers to an average increase in the Earth's temperature which in turn causes changes in climate. A warmer Earth may lead to change in rainfall patterns, a raise in sea level and a wide range of impacts on plants, wild life and all living beings including humans. The Earth has warmed about 1 degree F in the past 100 years. The global mean temperatures during the periods 1860 and 2005 clearly indicated a steady rise of the temperature with the rate of increase during the last 150, 100, 50 and 25 years to be increasingly steadily with a value of about 0.177° C per decade in the last 15 years (Fig.5). Weather stations, balloons, ocean buoys and satellites tell us

the Earth's temperature today very accurately.

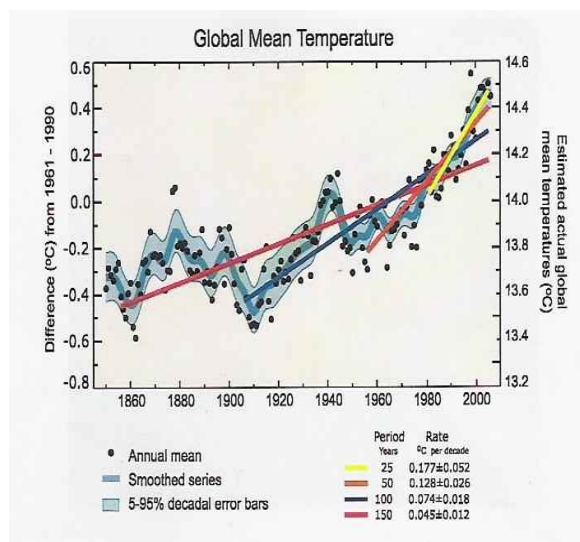


Figure 5: Earth's temperature variations

Observations indicate that the cause is due to the gradual increase and concentration of the Green House Gases (GHG). The cause of global warming is also attributed to human activities such as burning fuel, oil and natural gases responsible for carbon dioxide, methane and other Green House Gases in to the atmosphere. This turns into a major change in the climate as well as environment rapidly advancing to human crisis threatening millions of lives. The concentrations of carbon dioxide are 379 ppm (parts per million) and methane is greater than 1,774 ppb (parts per billion). The increase of these changes renders severe adverse effect globally causing

- Risk of extinction up to 30% in the world's natural species by 2020.
- Natural disasters- such as floods, wild fire and storms.
- Mortality from hear waves, droughts and cyclones.
- Destruction of coral reefs, melting of polar regions and rising of sea levels, tidal waves and tsunamis.
- Health hazards due to un controllable emissions from industries and factories .

CARBON FREE TECHNOLOGIES

There are multiple paths to undertake carbon free technology projects to eliminate man made emissions pertaining to climate changes. The following steps are to be taken care, to retain a long term safety, security and stability during implementing to control the carbon emissions:

- Replace petroleum with hydrogen to fuel all motor vehicles, aircraft and domestic needs.
- Replace coal and natural gas with renewable energy sources to generate power at all National levels.
- Utilize solar radiations for an economic production of Hydrogen, disintegrating water at very low temperatures, less than 500°C for uninterrupted electricity generation.
- Build nuclear power plants in large scales assuring safe disposal of nuclear wastes.
- All types of buildings shall be designed and integrated with solar devices for heating, cooling, power and fuel needs.

6.1 Low carbon energy technologies

These technologies include a range of renewable technologies along with hydrogen and fuel cell technologies, intelligent grid management and carbon abatement technologies. The concepts of these technologies are as follows:

- Hydrogen and fuel cell technologies support the development of new materials and systems for hydrogen storage capable of high volumetric and gravimetric hydrogen content with low cost and high energy efficiency. Also proposes to design, construction and evaluation of low cost hydrogen production systems for on site vehicle refuelling.
- Intelligent grid management technologies proposes to maximize the utilization of existing transmission and distribution assets, to facilitate the timely connection of new generation, to

minimize the impact of energy losses, to achieve the cost effective integration of both onshore and offshore generation and to design, operation and control of low carbon network equipment.

iii) Carbon abatement technologies facilitate to develop carbon dioxide compression and handling technologies for transport and bulk storage applications, CO₂ capture technologies to handle large volumes of emissions and gasification technologies for oxy-fuel firing [6].

7. NEED OF NUCLEAR POWER

Generation of electricity from fossil-fired power stations contributes to 40% of total CO₂ emissions. As on May 2006, nuclear power generation in the world was 369,374 MWe which had lessened the contribution of CO₂ into the atmosphere by an amount of 2600 million tons each year as per World Nuclear Association. The hurdles that come across in the development of technology have to be eliminated at a faster pace. This is where the support and cooperation should come from the developed countries for an easy procurement of uranium. The sustainability of nuclear power based on fuel cycle should not only be made possible, but also economically made viable. This is the challenge, in the reduction of CO₂ emissions while meeting the energy demands of the emerging economies that can pave the way for lessening the climate change and its consequences on the planet. The nuclear power's contribution could triple or quadruple to more than 30% of global generation mix in 2030. Any country excluding or phasing out is raising the overall cost of meeting emission reduction costs. This runs counter to economic objects of sustainable development. Globally many countries reduced carbon emissions by implementing nuclear devices for the production of electricity.

Few countries details are projected in Table: 1 where the nuclear programs are implemented for power generation as a sustainable energy resource.

Table 1: Carbon dioxide emissions avoided by Nuclear energy program.

Country	kWh Billion	M We	CO ₂ million tonnes
USA	780.2	98054	780
France	430.9	63473	430
Japan	281	47700	280
Germany	154.6	20303	154
Korea	139.3	16840	139
Russia	137.3	21743	130
UK	75.2	11852	75
Chinese			
Mainland	50.3	7587	50
Taiwan	38.4	4884	36
Finland	22.2	2676	22
Spain	54.7	7442	50
India	15.7	2993	15
Pakistan	2.4	425	2

Sources: From WNA May 2006 for electricity production

8. CONCLUSIONS

Focus on the achievement of energy efficiency, the heart of the three critical environmental problems: climate change, resource degradation and pollution

Replacement of traditional methods by high technology processes with low carbon and low- impact alternatives are into be integrated into life cycle.

Development of knowledge based devices for full utilization of solar radiations for electricity generation, to have a good quality of drinking water availability of pollution free air for a long healthy life and economic production and utilization of hydrogen gas as fuel for multiple applications are to be adopted globally.

ACKNOWLEDGEMENT

We do hereby extend our gratitude to Sri A.S. Chinnaswamy Raju, President, Sri Krishnadevaraya Educational Trust, Bangalore-562157, India for granting permission to publish this paper. We also render our acknowledgements to Dr Viresh K. Basalalli, Principal, Sir M. Visvesvaraya Institute of Technology, Bangalore-562157, India for his constant encouragement and timely support.

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