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SMART CITIES

HVAC SYSTEMS - CEM REFRESHER

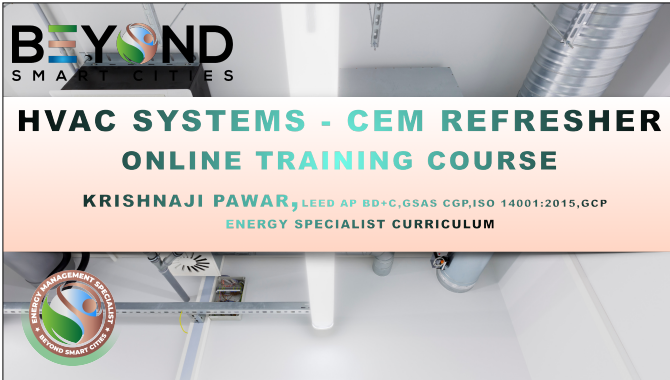
ONLINE TRAINING COURSE

KRISHNAJI PAWAR, LEED AP BD+C, GSAS CGP, ISO 14001:2015, GCP

ENERGY SPECIALIST CURRICULUM

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GLOBAL WARMING

FOR ENERGY PROFESSIONALS

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WHAT SHOULD YOU LEARN

Global Warming

Sources of Greenhouse Gases

Global Warming Potentials

Global Warming (Climate Change) Implications

Link between Biodiversity and Climate change



GLOBAL WARMING

Before the Industrial Revolution, human activities released very few gases into the atmosphere and all climate changes happened naturally. After the Industrial Revolution, through fossil fuel combustion, changing agricultural practices and deforestation, the natural composition of gases in the atmosphere is getting affected and climate and environment began to alter significantly.

Over the last 100 years, it was found out that the earth is getting warmer and warmer, unlike previous 8000 years when temperatures have been relatively constant. The present temperature is 0.3 - 0.6 °C warmer than it was 100 years ago.



GLOBAL WARMING +

The key greenhouse gases (GHG) causing global warming is carbon dioxide. CFC's, even though they exist in very small quantities, are significant contributors to global warming. Carbon dioxide, one of the most prevalent greenhouse gases in the atmosphere, has two major anthropogenic (human-caused) sources: the combustion of fossil fuels and changes in land use.

Net releases of carbon dioxide from these two sources are believed to be contributing to the rapid rise in atmospheric concentrations since Industrial Revolution. Because estimates indicate that approximately 80 percent of all anthropogenic carbon dioxide emissions currently come from fossil fuel combustion, world energy use has emerged at the center of the climate change debate.



SOURCES OF GREENHOUSE GASES

Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone (refer Figure 9.4). Certain human activities, however, add to the levels of most of these naturally occurring gases.

Carbon dioxide is released to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned.

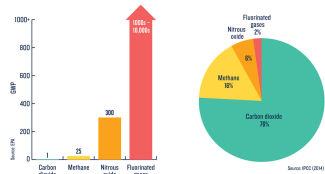
Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from the decomposition of organic wastes in municipal solid waste landfills, and the raising of livestock. Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels.



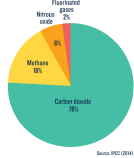
SOURCES OF GREENHOUSE GASES

Very powerful greenhouse gases that are not naturally occurring include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfurhexafluoride (SF6), which are generated in a variety of industrial processes.

HOW GREENHOUSE GASES WARM OUR PLANET



The global warming potential (GWP) of human-generated greenhouse gases is a measure of how much heat each gas traps in the atmosphere, relative to carbon dioxide.



How much each human-caused greenhouse gas contributes to total emissions around the globe.

Often, estimates of greenhouse gas emissions are presented in units of millions of metric tons of carbon equivalents (MMTCE), which weights each gas by its Global Warming Potential or GWP value.

GLOBAL WARMING POTENTIALS

Although there are a number of ways of measuring the strength of different greenhouse gases in the atmosphere, the Global Warming Potential (GWP) is perhaps the most useful.

GWPs measure the influence greenhouse gases have on the natural greenhouse effect, including the ability of greenhouse gas molecules to absorb or trap heat and the length of time, greenhouse gas molecules remain in the atmosphere before being removed or broken down. In this way, the contribution that each greenhouse gas has towards global warming can be assessed.

Each greenhouse gas differs in its ability to absorb heat in the atmosphere. HFCs and PFCs are the most heat-absorbent. Methane traps over 21 times more heat per molecule than carbon dioxide, and nitrous oxide absorbs 270 times more heat per molecule than carbon dioxide.

GLOBAL WARMING POTENTIALS +

Conventionally, the GWP of carbon dioxide, measured across all time horizons, is 1. The GWPs of other greenhouse gases are then measured relative to the GWP of carbon dioxide. Thus GWP of methane is 21 while GWP of nitrous oxide is 270.

Other greenhouse gases have much higher GWPs than carbon dioxide, but because their concentration in the atmosphere is much lower, carbon dioxide is still the most important greenhouse gas, contributing about 60% to the enhancement of the greenhouse effect.

GLOBAL WARMING (CLIMATE CHANGE) IMPLICATIONS

Rise in global temperature :

Observations show that global temperatures have risen by about 0.6 °C over the 20th century. There is strong evidence now that most of the observed warming over the last 50 years is caused by human activities. Climate models predict that the global temperature will rise by about 6 °C by the year 2100.

Rise in sea level :

In general, the faster the climate change, the greater will be the risk of damage. The mean sea level is expected to rise 9 - 88 cm by the year 2100, causing flooding of low lying areas and other damages.

GLOBAL WARMING (CLIMATE CHANGE) IMPLICATIONS

Food shortages and hunger :

Water resources will be affected as precipitation and evaporation patterns change around the world. This will affect agricultural output. Food security is likely to be threatened and some regions are likely to experience food shortages and hunger.

India could be more at risks than many other countries :

Models predict an average increase in temperature in India of 2.3 to 4.8°C for the benchmark doubling of Carbon-dioxide scenario. Temperature would rise more in Northern India than in Southern India. It is estimated that 7 million people would be displaced, 5700 km² of land and 4200 km of road would be lost, and wheat yields could decrease significantly.

LOSS OF BIODIVERSITY

Biodiversity refers to the variety of life on earth, and its biological diversity. The number of species of plants, animals, micro organisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all a part of a biologically diverse earth.

Biodiversity actually boosts ecosystem productivity where each species, no matter how small, all have an important role to play and that it is in this combination that enables the ecosystem to possess the ability to prevent and recover from a variety of disasters.

It is now believed that human activity is changing biodiversity and causing massive extinctions. The World Resource Institute reports that there is a link between biodiversity and climate change. Rapid global warming can affect ecosystems chances to adapt naturally. Over the past 150 years, deforestation has contributed an estimated 30 percent of the atmospheric build-up of CO₂. It is also a significant driving force behind the loss of genes, species, and critical ecosystem services.

LINK BETWEEN BIODIVERSITY AND CLIMATE CHANGE

✓ Climate change is affecting species already threatened by multiple threats across the globe. Habitat fragmentation due to colonization, logging, agriculture and mining etc. are all contributing to further destruction of terrestrial habitats.

✓ Individual species may not be able to adapt. Species most threatened by climate change have small ranges, low population densities, restricted habitat requirements and patchy distribution.

✓ Ecosystems will generally shift northward or upward in altitude, but in some cases they will run out of space - as 1°C change in temperature correspond to a 100 Km change in latitude, hence, average shift in habitat conditions by the year 2100 will be on the order of 140 to 580 Km.

LINK BETWEEN BIODIVERSITY AND CLIMATE CHANGE

✓ Coral reef mortality may increase and erosion may be accelerated. Increase level of carbon dioxide adversely impact the coral building process (calcification).

✓ Sea level may rise, engulfing low-lying areas causing disappearance of many islands, and extinctions of endemic island species.

✓ Invasive species may be aided by climate change. Exotic species can out-compete native wildlife for space, food, water and other resources, and may also prey on native wildlife.

✓ Droughts and wildfires may increase. An increased risk of wildfires due to warming and drying out of vegetation is likely. Sustained climate change may change the competitive balance among species and might lead to forests destruction

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THANK YOU

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