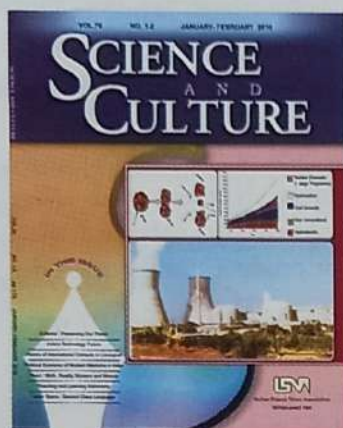


# SCIENCE AND CULTURE

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EDITORIAL

## PRESERVING OUR PLANET



Walking back from Gariahat Market, a stone's throw away from my house, I was sweating on a mid-December evening either due to global warming or due to the heat being generated at the Copenhagen Summit to reach a consensus on controlling emission of greenhouse gases. Suddenly the name of

Rachel Carson flashed in my mind—her book *Silent Spring*, published in 1962, first captured the attention of the general public and established public awareness of the impact of human action on environment. She envisioned that “birds had disappeared and the spring was silent” and raised her voice on the issue of impact of human activities on the environment. Carson's reasoned argument catalysed the collective consciousness of the world, leading to the creation of the Environmental Protection Agency in the United States, and setting the foundation for the periodic United Nations Climate Change Conference, the most recent one being held in Copenhagen.

Carbon dioxide ( $\text{CO}_2$ ), water vapour ( $\text{H}_2\text{O}$ ), methane ( $\text{CH}_4$ ), nitrogen dioxide ( $\text{NO}_2$ ) and a few other gases are known as greenhouse gases (GHG). GHG allow sunlight to enter freely into the atmosphere. Most of the radiation is absorbed by earth's surface and warms it up, but a part of the sunlight is reflected back in the form of heat (infrared radiation). In order to maintain the temperature of the planet constant, the amount of heat re-emitted and eventually lost to space must equal the amount gained from the Sun. But the energy out of the earth contains longer wavelength radiation than the incoming solar energy as the Earth is cooler than the Sun – and the greenhouse gases interfere with it strongly before it can escape to space. While some of this radiation passes through the

atmosphere, a portion of it is absorbed and re-emitted in all directions by these GHG molecules. However, the major components of our atmosphere (nitrogen and oxygen) do not absorb heat and do not contribute to the greenhouse effect. Without GHG the temperature of the earth would have been about  $-15^\circ\text{C}$ . Climate models suggest that carbon dioxide is the main GHG responsible for maintaining the normal atmospheric temperature even at times of low solar luminosity, and also for the recent rise in average temperature of the earth.

Since the Industrial Revolution started in Europe in the eighteenth century, there has been a steady increase of carbon dioxide in the atmosphere. The predominant view is that there is a direct relationship between the increase of carbon dioxide and the average global temperature. With modernisation, there is an ever mounting need for power, primarily originating from fossil fuels, which results in additional carbon dioxide in the atmosphere. Therefore from an environmental perspective, an efficient energy production system (with low carbon dioxide emission) and controlled human activity are the only means to save the environment. The most acceptable view of scientists is that an average global temperature rise of  $2^\circ\text{C}$  would lead to disastrous climate change leading to rise in sea levels, irregular pattern of rain and storm, and erratic weather leading to crop loss and diseases among other effects. However, there is also a group of scientists who believe that human activity has little or no contribution to increasing the temperature of the earth, and they were quick to pounce on the recent University of East Anglia disclosures as a vindication of their position.

Carbon dioxide is released to the atmosphere by a variety of natural sources, and over 95% of  $\text{CO}_2$  emissions would occur even if humans were not present on earth. Our ecosystem has evolved so that many of these natural sources also remove carbon dioxide from the atmosphere by physical and biological processes to maintain a balance. For example, some carbon dioxide is dissolved in sea water



while some are removed by plants during photosynthesis. It is believed that human activities add some amount of carbon dioxide every year which disturbs this natural balance. This addition (presently at a rate of about 3% of annual natural emissions) is sufficient to disturb the natural balance, and carbon dioxide has gradually accumulated in the atmosphere. The present concentration of carbon dioxide is 30% above the pre-industrial level.

The United Nations Climate Change Conference in Copenhagen was a meeting of representatives from 192 countries to devise strategies and methodologies to reduce or limit carbon dioxide emission in the years beyond 2012. One of the major conflicts between the developed (industrialised) and developing nations has been in agreeing to a uniform yardstick of control. Developing nations argue that the developed nations have polluted the atmosphere considerably during the process of industrialisation over the last two centuries, and using a common index to control carbon dioxide emission for all countries would be a hindrance to their development. Prior to Copenhagen, the most important conference where a guideline was framed for all nations was the Kyoto Protocol in 1997. This was an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC) which set a binding target of reducing greenhouse gas emissions by 5% against 1990 levels for 37 industrialised nations and the European community in the five year period 2008-2012. Understandably, it was a bitter pill to swallow for the industrialised nations and the US never ratified the Kyoto protocol, insisting that large GHG emitters like China and India should also reduce their emissions. It now stands as the eternal political conflict between rich and poor, a conflict of interest and moral responsibilities between the developed and developing nations.

According to some reports, China is the largest carbon dioxide emitting nation in the world, followed by the United States, the European Union, Russia and India. If expressed per capita, it is interesting to note that countries like Qatar and Bahrain emerge first and second, Australia being third and the US occupying the fourth position. India and China respectively rank second and fourth from the bottom. Quantifying carbon dioxide emission per capita depends on many factors such as population, use of energy, habits, efficiency of energy producing systems, as well as the misuse of energy. Categorising nations in terms of total amount of GHG emission or per capita by conventional definition is misleading.

What is more important and logical from an environmental viewpoint is the measurement of carbon

dioxide emission not only on energy production but also on energy used. After all, estimation of carbon dioxide per unit energy production is an indicator of efficiency of the power generating equipment, but it does not portray the efficiency of energy use as a society (such as avoiding wastage and encouraging long-term use of products). Many countries like India are traditionally more conservative about discarding items and continue using a product through repair and transfer of ownership, compared to many of the developed nations. Recycling of products is another means of conserving energy because it saves energy and resources.

Most of the human-originated (anthropogenic) carbon dioxide emission comes from energy production processes like combustion of fossil fuels such as coal, petrol and oil. Natural gas is the cleanest source of energy among all the fossil fuels as it produces the least amount of carbon emission, while coal is the highest producer of carbon dioxide. Unfortunately, more than 80% of the world's energy comes from burning fossil fuels. Nuclear and other renewable energy sources like hydroelectric, solar and wind power, on the other hand, do not produce carbon dioxide.

The current level of carbon dioxide is about 107 parts per million (ppm) above the pre-industrial level (*circa* 1750 AD) of 280 ppm. But do we know the optimum amount of carbon dioxide that is required to maintain a balance in temperature of the earth? If we knew this, it would be easier to cap the amount of carbon dioxide on the basis of the geographic area of a nation, and the vegetation it possesses. However, there is always a possibility of conflict arising from a nation's environment being influenced by its neighbouring countries.

There is no difference of opinion about the *need* to control GHG emission to save our planet from the hazards of increasing global temperature; it is the *means* that are still under debate. One of the biggest impacts could be derived by reducing the burning of fossil fuels. This would however require the concerted and sincere efforts of nations and laboratories to develop a technology that would prove a viable and scalable alternative source to fossil fuels. Until then, the present rate of carbon dioxide emission per unit energy production needs to be reduced by a third. Sadly, reaching a consensus about the strategy and moral responsibilities of each nation is a contentious and complex issue. We recommend an estimation of carbon dioxide emission cap per nation on the basis of energy consumption, and not on energy production. We also advocate technological developments to reduce the level of CO<sub>2</sub> in the atmosphere, not just limit emission of the same, as is done by Nature. □

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