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Carbon Dioxide Emissions

Two recent reports have dealt with the climatic effects of increasing amounts of atmospheric CO_2. The tone of the reports is less panicky than that of earlier statements. This is particularly true of the study conducted under the auspices of the National Research Council (NRC).* Earlier predictions were based on the then current rate of increase in combustion of fossil fuels. This amounted to 4.3 percent per year and would have led to a doubling of the concentration of atmospheric CO_2 in about 57 years, with an estimated rise in global temperature of 3.0°C. Estimates of average annual rates of increase in CO_2 emissions to 2030 range from 1 to 3.5 percent. Using a rate of 2.0 percent gives an estimated doubling time of 88 years. Perhaps more important are some considerations about possible societal impacts. The NRC report pointed out that human societies are flexible in dealing with new situations provided sufficient time is available. As an example, the great changes that have occurred in this century were cited.

The NRC report was careful to outline uncertainties in the predictions. The possible temperature rise is based on model studies which may or may not be valid. The projected rise is necessarily to be superimposed on unpredictable natural climatic trends. More controllable, but still unpredictable, is the rate of burning of fossil fuels. For nearly two decades ending in 1973, consumption expanded at a compound rate of 4.3 percent per year. During the past decade the rate of burning has been static. If present trends continue, the doubling time for CO_2 will be 220 years.

Whatever the rate of increase of CO_2 content and corresponding change in temperature, ultimate melting of a large Antarctic ice mass seems highly probable. This would lead to an estimated rise in sea level of 5 to 6 meters and to flooding of highly populated areas. Can such an event be delayed or even forestalled? The answer is that it probably can. Continued effort to increase the efficiency of energy use could lessen demand. A number of measures could be employed to slow the rate of increase of CO_2. One method for decreasing net emission of CO_2 is close to commercial feasibility. It has the potential advantage of curtailing the emission both of CO_2 and of gases responsible for acid rain. In an electric power plant now being built at Cool Water, California, coal is gasified and impurities such as sulfur are captured. Following the combustion of fuel gases, the CO_2, being present in high concentration, could be easily removed. Later it would have a market value for injection underground to promote tertiary recovery of oil.

A transition to greater dependence on renewable energy would also be helpful. It is useful to be reminded that energy consumption by humans amounts to only 0.1 percent of the solar energy falling on the earth. Recent progress in tapping some of this energy by improving the increased production of biomass is large. With good management and superior choice of vegetation, CO_2 fixation might be increased fivefold or more. The product would be sufficient to sustain a prosperous civilization. Any surplus fixed carbon could be stored. Correspondingly, the amount of CO_2 in the atmosphere would be reduced.

The advent of fusion energy would change energy usage drastically. It would reduce demand for fossil fuels to produce electricity. It would make possible a hydrogen economy that would require no net use of carbon. Some of the fusion energy could be used to capture CO_2 from the atmosphere for injection into geological formations. Alternatively, the energy could be used to convert CO_2 into solid carbon.

When the environment is altered on a global scale, major problems can arise. Careful monitoring and study of the trends in CO_2 is desirable, together with efforts to develop contingency alternatives. The process of providing adequate energy need not lead to catastrophic consequences.

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**Changing Climate*, Report of the Carbon Dioxide Assessment Committee, National Research Council Board on Atmospheric Sciences and Climate (National Academy Press, Washington, D.C., 1983).