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BACKGROUNDER

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Understanding Carbon Dioxide (CO_2): Future Trends in Emissions and Emissions Control

Understanding CO_2

At the heart of the global climate change issue is the concern that increasing levels of greenhouse gases in the atmosphere could cause an enhanced greenhouse effect (a warming of the global climate beyond what might occur naturally) or "global warming." Scientists are monitoring carbon dioxide (CO_2) and several other greenhouse gases to determine their roles in the greenhouse effect. Water vapor (which is responsible for most of natural greenhouse warming), methane, CFCs and nitrous oxide are the other significant greenhouse gases.

Carbon dioxide is not a pollutant. It is a by-product of human, plant and animal respiration, a product of combustion, and a vital component of photosynthesis. Of the CO_2 that is emitted as a result of human activities, about half remains in the atmosphere, while the other half is removed by "sinks," which naturally absorb CO_2. Sinks for CO_2 include the ocean, soils and vegetation. Currently, our understanding of these sinks is limited, adding to the uncertainties surrounding predictions of the climate impact of rising CO_2 emissions.

Some scientists believe that man-made emissions of carbon dioxide are significant enough to cause an enhanced greenhouse effect. However, atmospheric water vapor and clouds play a far more active role in affecting climate change, and scientists agree that much more research is needed on the atmospheric interactions of clouds and oceans. Even so, CO_2 has been the primary target of efforts to reduce greenhouse gas emissions. Such efforts include proposed emissions limits, targets and timetables for reductions, and taxes on carbon or other energy sources.

Historical and Future Trends

Understanding the historical data on CO_2 emissions provides clues to determining whether there is a relationship between increased atmospheric CO_2 levels and observed changes in global mean surface temperature. The computer models that have been used to simulate the relationship of CO2 and climate change are still evolving and do not fully agree or explain all of the observational evidence now available (e.g., from satellites and Arctic temperature data).

Carbon dioxide levels have varied widely during the Earth's history. Since the mid-1700s, atmospheric concentrations of CO_2 have risen 25 percent. This increase is largely a result of industrialization, the increased burning of fossil fuels as populations grow, and increases in living standards. The greatest increases in CO_2 emissions occurred after World War II. For example,

between 1950 and 1988, the United States' annual CO_2 output roughly doubled. Interestingly, most of the observed increase in global mean temperatures occurred before 1940, (i.e., before significant increases in manmade CO_2 emissions).

Many forecasters agree that greenhouse gas levels could double sometime in the next century as a result of a number of factors, including: population growth, increased use of fossil fuels and increased economic activity in developing countries. Yet scientists disagree on whether the increased atmospheric concentrations of CO_2 will cause any significant climate change.

Future Sources of Increased CO2 Emissions

According to the International Energy Agency, as much as 85 percent of the projected increase in manmade global CO_2 emissions will come from developing countries and countries with economies in transition (e.g., Eastern European nations). In fact, the U.S. contribution of manmade CO_2 is less than 22 percent of total CO_2 emissions worldwide and has significantly declined over the past twenty years and will continue to decline. The reduction of America's contribution to global CO_2 emissions would reduce potential warming by only a fraction of a degree, and the result of any stabilization of CO_2 emissions in all the developed countries would be relatively insignificant in the context of reducing global greenhouse gas levels. The costs of controlling CO_2 emissions would be higher in the United States than in most other countries as a result of the greater per capita energy use due to geographic and socio-economic patterns, (i.e., transportation of people and goods). Adopting more expensive CO_2 controls will, therefore, impose a disproportionate penalty on U.S. industry and will give foreign competitors a competitive advantage over U.S. producers.

Policy Efforts to Control CO_2 Emissions

Most industrialized nations, including the United States, already have policies and programs in place that will help reduce emissions of CO_2. In the United States, some studies show that existing programs (such as EPA's Green Lights Program) and policies (such as the Clean Air Act and the National Energy Policy Act of 1992) will come close to reducing CO_2 emissions to 1990 levels by the year 2000.

Some economists believe that carbon dioxide emission reduction policies (i.e., carbon and other energy taxes) will only provide an incentive for carbon intensive industries to migrate to regions without such a tax. They say this movement to developing countries, where environmental regulations are significantly less stringent than the U.S., will result in more greenhouse gas emissions, not less.

As developed nations make progress toward reducing their emissions over the next decade, the greatest opportunities (and needs) for controlling the growth in CO2 emissions will be in developing countries and countries with economies in transition. International policy efforts will need to be aimed at making the most of these opportunities by encouraging these nations to incorporate clean technologies into their economies.