Preventing or Curing Climate Change?

Commentary by Thomas Loerting, Massachusetts Institute of Technology

In order to assess scientific, technical and socio-economic information relevant to the understanding of climate change, its potential impacts and options for adaptation and mitigation, the Intergovernmental Panel on Climate Change (IPCC) has been established by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP). In 2001, the IPCC released its third and latest assessment report (avalaible at www.ipcc.ch) summarizing the cutting-edge work of numerous leading scientists. The report summarizes which climatic changes have already occurred, how well past and present climates are understood and which changes could lie ahead. It also mentions how over the past 50 years there has been an increase in the Northern Hemisphere's average surface temperature of approximately 0.7°C (1.3°F). According to tree ring and ice core reconstruction, as well as thermometer observation, this increase is unprecedented in the past millenium. Along with the increasing temperature , the hydrological cycle has been accelerated; there is 10% more water vapor per decade in the lower atmosphere since the 1980s and almost 1% more precipitation per decade on land. Furthermore, there is also strong correlation between the increasing temperatures and a loss of 10% of snow-cover and land-ice extent, including deglaciation, and Arctic Sea ice. The global sea levels have risen during the 20th century by 100-200 millimeters according to tide-gauge data.

Since all of the climatic changes observed in the last few decades are more intense than the natural variations observed in the last millenium, an anthropogenic influence is surmised. The world population was less than one billion people for more than 800 years during the last millenium. It has only exploded in the last three quarters of a century from less than two billion in 1927 to aaproximately 6.3 billion by January 2003. During the same period, countless technologies evolved and a great deal of the Earth's natural resources were consumed. Large amounts of energy were also generated. As a result, most of the energy produced in the world comes from burning carbon-based fossil fuels. The end-product, carbon dioxide or CO2, is emitted into our atmosphere in huge quantities.

Earth´s atmosphere is very thin in comparison to its diameter. It is like the skin of an apple. Therefore, it is understandable that the composition of the atmosphere is changing as a result of human influence. The mixing ratio of the trace gas CO2 in our atmosphere was constant at 280 parts per million volume (ppmv) in the period from 1000 to 1900 A.D., After this period, a steep increase of 30% to the present level of 366ppmv has been recorded. CO2 has the ability to hold back a portion of the infrared radiation coming from Earth´s surface and for this reason is referred to as a greenhouse gas. Without an atmosphere that can contain greenhouse gases, our Earth´s average temperature would be –18°C/0°F, which is similar to the average mean temperature on the Moon, rather than the actual average of +15°C/59°F. All oceans would be frozen and life as we know it would never have evolved. An increase in greenhouse gases, such as the man-made increase in CO2 we now have, causes an additional warming effect and is most likely responsible for the modest warming we have seen in the last few decades. Aside from CO2, other greenhouse gases have accumulated in our atmosphere per research that indicates that these other gases remained at approximately the same levels for many hundreds, and even thousands, of years. These include methane (130% increase), nitrous oxide (15% increase) and chlorofluorocarbons (CFCs). The latter have almost no natural sources and were not found in the atmosphere before the Industrial Revolution.

Computer models have been used to predict future global average surface temperatures. However, using these models as tools assumes that the scientist has foreknowledge of all the 'climate forcings,' especially the mixing ratios of all greenhouse gases in the future, of 'forcings' related to clouds and aerosols in the troposphere, and also assumes that the solar

energy output remains constant. According to various scenarios for population growth and economic development, especially in the developing world, the IPCC predicts an increase of the global average surface temperature of between +1.4°C and +5.8°C (2.5-10.4°F) by 2100 compared to 1990. Sea levels are expected to rise between 0.2 and 0.7 meters in the same time-frame. Considering that the last Ice Age was only 5°C colder than current temperatures, and North America was covered by an ice layer that was miles thick, these changes can certainly not be dubbed minor. Of course, no scientist is a fortune-teller and there are uncertainties in some of the assumptions underlying these predictions, as was recently pointed out in the news. However, the predictions represent the current voice of the scientific community.

The question of how to react or, indeed, whether to react at all to the current situation and these future projections does not fall within the realm of science. This is a question every person needs to answer alone. In particular, it needs to be answered depending on how much time, effort and money one is willing to spend in order to mitigate climate change for future generations. On an individual level, the focus is on using energy efficiently and thereby not producing unnecessary CO2. There is a huge potential for reducing CO2 emissions if individuals make an effort to reduce their reliance on cars and when possible find alternative modes of transportation, such as biking, walking, or using public transportation. Carpooling or shutting off the engine when the car is idling can help in situations where there is no alternative to using a car. Other simple energy-saving measures inlcude insulating your living area to reduce the energy necessary to heat or air-condition your home, putting a lid on a pot when boiling water, buying locally produced items rather than products that travel hundreds of miles on the highway to reach you or to buy products causing less waste or food and beverages in reusable containers.

In addition to every individual, governments and industries all over the world have to decide what action to take. A set of potentially effective measures was put forward in the Kyoto Protocol by the “The United Nations Framework Convention on Climate Change” (UNFCCC) in 1997. It was designed to control the emissions of six greenhouse gases, especially CO2. The commitment to reduce the collective emissions by at least 5% compared to 1990 levels by the period 2008-2012 is intended to stabilize the current trend of steeply increasing concentrations of greenhouse gases in the atmosphere. As of April 28, 2003, the protocol has been ratified or accepted by 108 nations accounting for 43.9% of world´s carbon dioxide emissions. The protocol will enter into force 90 days after countries accounting for at least 55% of emissions have ratified the agreement. The most prominent members of countries not on the list of current signees are Australia, the Russian Federation and the United States of America, the latter accounting for one quarter of world´s CO2 emissions alone and more than any other country in the world per capita and per year. Ratification by either Russia or the US would render the consensus legally binding. Russia has indicated willingness to back the protocol in the near future.

The current Bush Administration is reluctant to ratify this protocol and chooses instead to invest in research and development. It would rather wait until scientists have an even better understanding of our changing Earth before signing a protocol of this type and to negotiate for the right to buy emissions from developing countries. This is of course a legitimate point of view. Similarly understandable are fears of yet another slow-down in economic growth caused by the initial investment needed to change infrastructure after ratification. However, the fact remains that the Earth is currently at risk, and in my opinion, action should be taken as soon as the possibility of these changes becomes apparent – waiting for certainty could be more harmful than the consequences of the present concerns. And regarding these concerns, there is a previous example when industry was faced with the challenge of phasing out chlorofluorocarbons (CFCs) according to the Montreal Protocol on Substances That Deplete the Ozone Layer in 1987. Despite the initial reluctance of industry lobbyists, in a short time industry came up with new, better and even less costly alternatives to using CFCs, which ultimately will save our protective stratospheric ozone layer.

There is evidence that the potential already exists for a shift to sustainable and renewable energy sources. A fleet of hydrogen-powered cars and buses is on the road in California, laptops and cellular phones can be powered by hydrogen fuel cells, and techniques to

harness solar and wind energies are at our disposal. However, without the encouragement of law or governmental incentives, this potential remains untapped to a great extent. When forced by the Montreal Protocol to find an alternative to using CFCs, mankind proved itself to be creative, and the same would be true if we were forced to cut CO2 emissions. These climatic challenges present a great opportunity to establish new and better technologies that could ultimately revive the market and help developing countries grow in a more sustainable way than the presently developed countries did.

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