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Climate and the Chemical Engineer

Not a day goes by that I don't see something about climate change cross my desk. So, what is our role in the climate change space?

I don't think it's our place to determine whether or to what degree anthropogenic global warming is or is not happening, or to debate that issue. There are several facts that are not in dispute. First, the Earth's climate does change naturally, both in the short term (over decades and centuries) and over the long term (millennia). Second, concentrations of carbon dioxide in the atmosphere are higher now than they were a few hundred years ago, and with emissions trending upward, CO₂ concentrations are not likely to decrease.

The big uncertainty is: *How and to what extent will increasing CO₂ emissions affect what would otherwise occur naturally?* I don't have an answer to that question, and I suspect you don't either. Furthermore, as the Critical Issues article, "Climate Change — What Does the Research Mean?" (pp. 20–25), points out, even the peer-reviewed scientific literature contains inconsistencies.

Our life on Earth is a grand experiment. We are both the researcher and the lab rat. We don't adequately understand the control. And we probably won't be around to see how it turns out. How will we conduct this experiment?

Should we reduce emissions of CO₂ and other greenhouse gases (GHGs), and if so, by how much and in what time frame? What is the best way to do that? Can we continue to use fossil fuels without increasing atmospheric CO₂ concentrations? What is the best mix of energy sources? What (if any) short-term sacrifices are we willing to make in order to realize possible long-term benefits?

An article in *Science* ("Risk Communication on Climate: Mental Models and Mass Balance," Oct. 24, 2008, pp. 532–533) by John Sterman, a professor in MIT's Sloan School of Management and director of MIT's System Dynamics Group, offers an important perspective. After discussing a 2007 survey that found a majority of U.S. respondents (54%) favor a "wait-and-see" or "go slow" approach to emissions reductions, he points out that wait-and-see works in simple systems with short lags. However, he explains that there are "substantial delays in every link of a long causal chain stretching from the implementation of emissions abatement policies to emissions reductions to changes in atmospheric GHG concentrations to surface warming to changes in ice sheets, sea level, agricultural productivity, extinction rates, and other impacts. Mitigating the risks therefore requires emissions reductions long before additional harm is evident."

The arguments for not acting until we have scientific proof of the causal link between CO₂ emissions and any impacts center on money. The technologies need to be developed and proven at full-scale, which will be expensive and will increase our energy bills. Some say it will bankrupt our industries and our nation and will waste huge amounts of money that could be better spent elsewhere.

Who better than chemical engineers to work on this grand experiment? We are smart and resourceful. We know how to deal with dynamic systems. If the target moves, our efforts and investments will not be wasted. We will find other uses for the knowledge — much like the hundreds of products and technologies that have come out of the space program. We might not know where we will end up, but I believe our creativity and ingenuity can get us wherever we need to go.

Cynthia F. Mascone, Editor-in-Chief