Climate Change Shenanigans

BY GERALD E. MARSH

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YOGI BERRA—or was it Winston Churchill?—once said, "It's tough to make predictions, especially about the future." Actually, it was neither; the proverb apparently is of Danish origin. Climate models make predictions about the future and are the basis for the Intergovernmental Panel on Climate Change public policy recommendations. However, the current state of ocean-atmosphere general-circulation models used for predicting future climate are not a sound basis for public policy decisions. Since a new president will be elected in November, this is an important topic for the presidential debate; billions of dollars are at stake.

There are many different climate models used to predict the possible temperature rise by the year 2100. The predictions range from about 1.2°C to 5.8° from the base year of 1990. For individual models, the uncertainty is from 1.2° to 2.2°. This is an enormous variation, as the rise from 1990 to 2016 is only about 0.3° and natural variations over the last 10,000 years are about 2°.

The IPCC narrows the uncertainty in model predictions by using what is called "ensemble averaging." What this means is that one starts the various models with the same initial conditions and averages the output to get a single number. In doing this, the models implicitly are assumed to be statistically independent and unbiased; they are not, and therefore such an averaging is illegitimate. A single number may be useful for public relations, but the very large uncertainty does not go away by employing such shenanigans, and neither does the bias.

A second issue has to do with the second law of thermodynamics involving the quantity known as "entropy." As any physics student can tell you, the three laws of thermodynamics amusingly can be summarized as: you cannot win; you cannot break even; and you cannot get out of the game.

Sir Arthur Eddington, a physicist, mathematician, and astronomer of the early 20th century, put it this way: "The law that entropy always increases—the second law of thermodynamics—holds, I think, the supreme position among the laws of nature. . . . If your theory is found to be against the second law of thermodynamics I can give you no hope; there is nothing for it but to collapse in deepest humiliation."

However, according to a colleague who has done extensive work on the issue—none of the major climate models explicitly incorporate the second law of thermodynamics. Instead, the models only are constructed to satisfy the basic laws of physics that call for the conservation of energy, mass, and momentum.

Even if the second law were to be satisfied, it only would be by accident, and there is yet another problem: should the second law be satisfied by some fluke, there is no a priori guarantee that when these so-called balance laws are "discretized" for implementation on a digital computer, the digital model would preserve the first or second law, or that the discretized form even would reduce to the continuous form of these laws. Hence, the discretized model must be checked explicitly to make sure that such laws are not violated. Beyond mass and perhaps energy conservation, such checks are very seldom done.

Yet, the climate modeling community is very confident that its models are adequate to be a basis for public policy decisions, despite the illegitimacy of ensemble averaging and the deficiencies with regard to the second law of thermodynamics. Considering this state of affairs, the public might want to take into account playwright George Bernard Shaw's warning, "Beware of false knowledge; it is more dangerous than ignorance."

On the other hand, uncertainty goes both ways. Although climate modelers know that carbon dioxide only is a minor greenhouse gas, the overwhelmingly largest being water vapor, and that the sensitivity of the climate to a doubling of the carbon dioxide concentration is very uncertain, what if human activity really is contributing to the slightly higher temperatures we have seen in the last few decades? Should we take out some form of insurance policy?

The first thing to ask is, "Are people really serious about curtailing carbon dioxide emissions?" If so, they should start with the elephant in the room. Some 40% of the carbon dioxide emissions in the U.S. come from the burning of coal to produce electricity. This is in addition to coal's real pollutants, which cause tens of thousands of premature deaths in the U.S. alone. People subsidize the burning of coal with their health. (There also are the environmental hazards due to eliminating the enormous quantities of waste.)

Many believe that coal plants can be replaced by "renewables," within which the International Energy Agency lumps traditional biomass, commercial biomass, hydro, and "others." The IEA projects that "other renewables (including geothermal, solar, and wind) will increase most rapidly at 6.2% per year but, because they start from a very low base (0.5% share in 2003), they still will be the smallest component of renewable energy in 2030, with a share of . . . 1.7% of global energy demand."

There only is one available and environ-

mentally friendly alternative to coal—nuclear power, but what about the nuclear waste? The solution is simple: burn the used fuel in recycling reactors. The radioactivity of the small quantity of the remaining real waste falls below that of the original uranium ore in less than 500 years; for this period, geological isolation is trivial. By recycling the "spent" fuel, and using the uranium "tailings" left over from the enrichment of uranium, we get 99% of the energy in the original mined uranium instead of the one percent or less that we are getting now.

With recycling reactors deployed, there is enough affordable uranium to power civilization from here on out: nuclear energy is just as inexhaustible as solar energy, but more available—and the technology is well established. Nuclear power is a cheap insurance policy in the climate of uncertainty about global warming.

What about nuclear proliferation? Pres. Jimmy Carter renounced the reprocessing of "spent" nuclear fuel in 1977, citing proliferation concerns, and with the hope that other countries also would not reprocess fuel. This policy was a failure. Moreover, no nation spending the enormous amount of money needed to develop and deploy nuclear weapons would use reactor-grade plutonium. Everyone has easier options.

The nuclear technology cat was let out of the bag long ago. The U.S. and other nations have been training nuclear engineers from many developing countries for decades, and the world now is awash in plutonium. It is not the lack of technological know-how that prevents these countries from making simple nuclear weapons. Rather, some of them lack the money and the technological infrastructure, while others realize that they are better off when they and their neighbors do not have "the bomb."

Even if the politically difficult decision were to be made to replace coal-fired plants with recycling nuclear reactors, it would take decades to implement. Economic realities also would result in the replacement of coal with natural gas now widely available at reasonable costs due to advances in drilling techniques. While replacing them would benefit human health, whatever the U.S. may do about its coal plants, America no longer is the principal emitter of carbon dioxide. China now has that honor and, as of 2015, was building one coal-fired power plant every seven to 10 days.

Moreover, Japan has some 43 coal-fired power projects planned or under construction to replace nuclear power plants to be closed after the Fukushima nuclear accident. Never mind that there were no deaths due to the nuclear accident initiated by the tsunami, which killed some 20,000 people; yet, it was the accident that received the most press. Given these realities, it is very unlikely that carbon dioxide emissions will be significantly reduced for many decades.

Maybe a gradually warming world is a good thing. After all, there were very few Ice Ages until about 2,750,000 years ago when the Earth's climate entered an unusual period of instability. Starting about 1,000,000 years ago, the Ice Ages lasted about 100,000 years —separated by a relatively short interglacial periods like the one we are living in at present. Before the onset of the Ice Ages and, for most of the Earth's history, it was far warmer than it is today.

Warm interglacial periods generally last about 10,000 years, and the one we are living in already is almost 12,000 years old. Entering a new Ice Age would be catastrophic for the continuation of modern civilization. One only has to look at maps showing the extent of the great ice sheets during the last Ice Age to understand what a return to these conditions would mean. Much of Europe and North America were covered by ice thousands of feet thick, and the world as a whole was much colder.

The last "little" Ice Age started as early as the 14th century when the Baltic Sea froze over followed by unseasonable cold, storms, and a rise in the level of the Caspian Sea. Then came the extinction of the Norse settlements in Greenland and the loss of grain cultivation in Iceland. Harvests even were severely reduced in Scandinavia—and this was a mere foreshadowing of the miseries to come.

By the mid 17th century, advancing glaciers in the Swiss Alps wiped out farms and entire villages. In England, the River Thames froze during the winter and, in 1780, New York Harbor froze. Had this continued, history would have been very different. Luckily, the decrease in solar activity that caused the Little Ice Age ended and the result was the continued flowering of modern civilization.

Luckily, recent research has shown that moderately increased carbon dioxide concentrations, coupled with the small variations in solar insolation due to coming Milankovitch variations—which cause a wobbling of the Earth in its orbit around the sun—possibly could extend the current interglacial by some 50,000 years.

So, rather than call for arbitrary limits on carbon dioxide emissions, perhaps the best thing the United Nation's Intergovernmental Panel on Climate Change, and the climatology community in general, could do is to spend their efforts on determining the optimal range of carbon dioxide needed to extend the current interglacial period indefinitely. ★

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