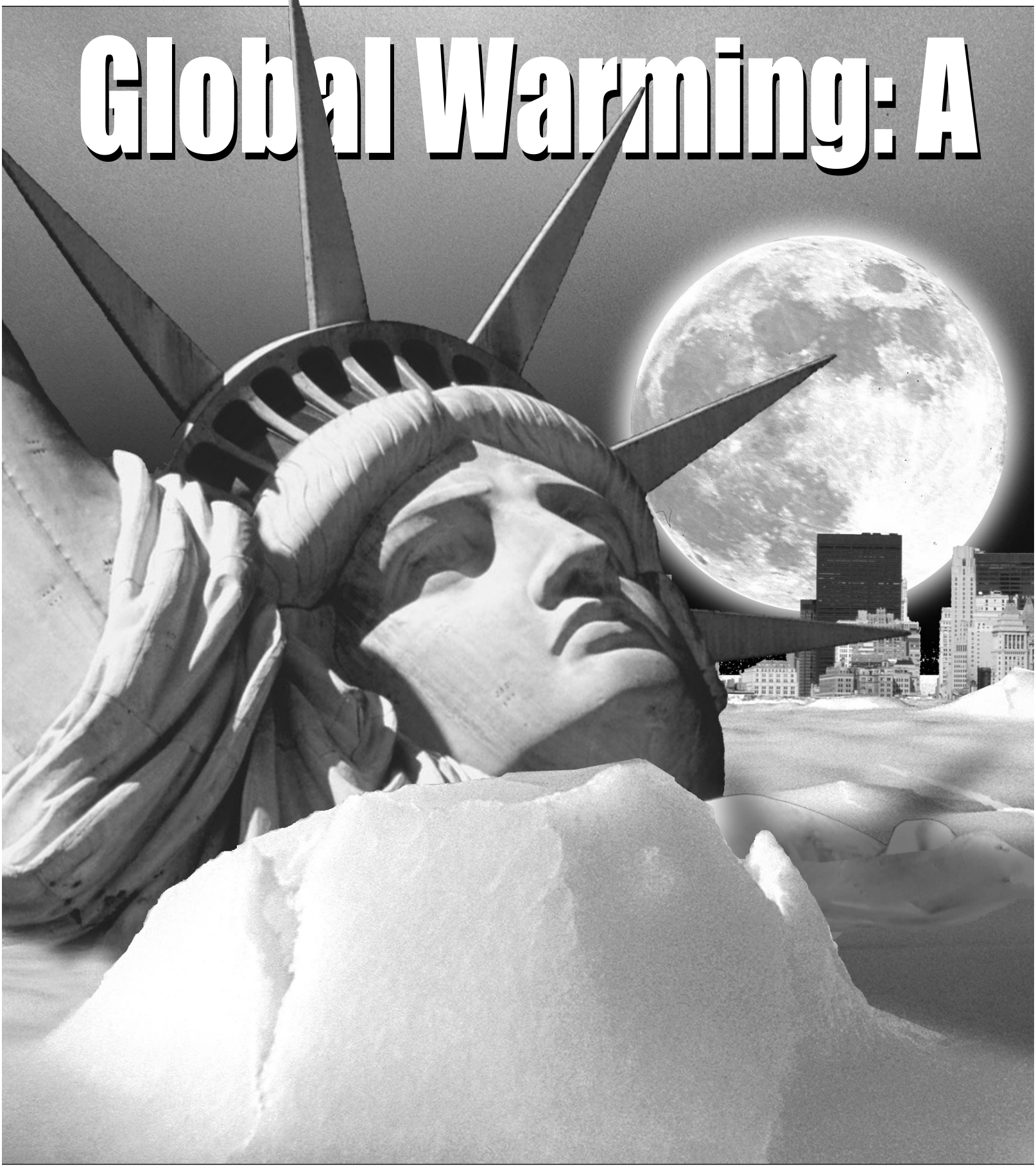
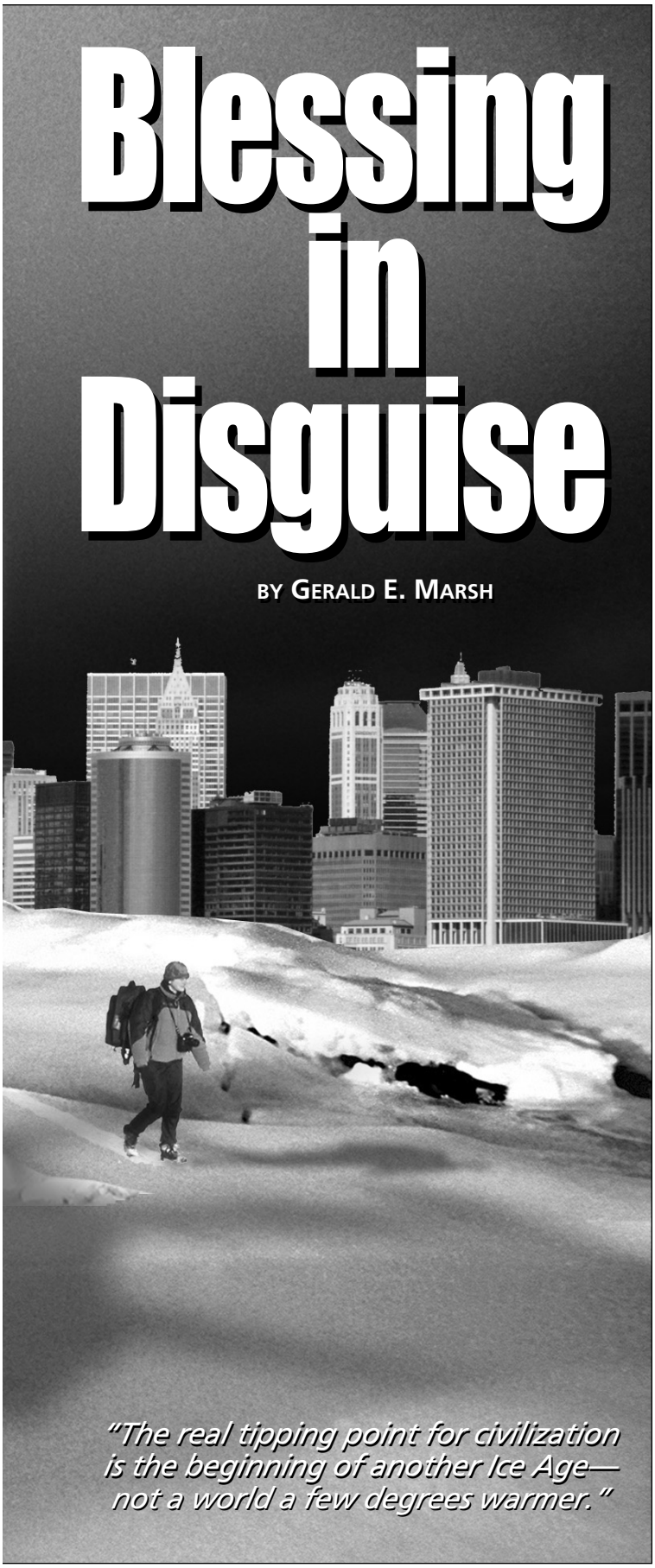
Global Warming: A



Blessing in Disguise

BY GERALD E. MARSH



"The real tipping point for civilization is the beginning of another Ice Age—not a world a few degrees warmer."

HOW OFTEN have you read something like "There is a growing scientific consensus that humanity is rapidly approaching a global climate catastrophe"? This usually is followed by the claim that we face this future because of human emissions of carbon dioxide driven by an economic model that requires continued growth, a consumer culture, and the global inequality of wealth distribution. The April 2007 ruling by the Supreme Court, which required the Administrator of the Environmental Protection Agency to make a determination as to whether carbon dioxide is a pollutant that endangers public health and welfare, has buoyed supporters of this view.

Since then, the EPA Administrator, under section 202(a) of the Clean Air Act, signed a proposal with two distinct findings:

- "The Administrator is proposing to find that the current and projected concentrations of the mix of six key greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)—in the atmosphere threaten the public health and welfare of current and future generations. This is referred to as the endangerment finding."
- "The Administrator further is proposing to find that the combined emissions of CO_2, CH_4, N_2O, and HFCs from new motor vehicles and motor vehicle engines contribute to the atmospheric concentrations of these key greenhouse gases and hence to the threat of climate change. This is referred to as the cause or contribute finding."

Although the EPA states that, "This proposed action, as well as any final action in the future, would not itself impose any requirements on industry or other entities. An endangerment finding under one provision of the Clean Air Act would not by itself automatically trigger regulation under the entire Act," one is left with little confidence that future actions—under pressure of the global warming juggernaut—will not impact economic growth severely and constitute a regressive form of taxation.

Carbon dioxide routinely is referred to as a "pollutant" even though without it there would be no life on Earth. One no longer hears about the real pollutants that cause tens of thousands of cases of morbidity and death each year. This is not a result of insensitivity to these issues, but rather public fear of the impending climate apocalypse that overshadows every other environmental issue. The "green" solutions proposed to prevent the coming catastrophe are technologies that the International Energy Agency and the Energy Information Agency project as having no possibility of being able to displace fossil fuels any time soon, if ever. All such sources of energy are expected to amount to less than two percent of the total global energy mix by 2030.

Is the rising concentration of CO_2 in the atmosphere actually the cause of the recent small temperature rise that is responsible for all the activity to restrict emissions of this gas? In spite of what often is claimed, there remain great uncertainties in the science. Temperatures began to rise after the cooling period between 1940-75. Although the temperature rise since 1975 resembles those of the general circulation models used to predict climate, it is hard to tell whether the small observed temperature alterations are due to increased greenhouse gases or part of a decadal-timescale variation in atmospheric circulation.

Changes in the North Atlantic Oscillation—a natural atmospheric mode—appear to be responsible for nearly all of the cooling in the northwest Atlantic Ocean as well as warming across Europe and Eurasia since 1975. Consequently, because changes in average global temperature are due primarily to temperature variations over northern landmasses, the recent warming trend in global temperatures is, to a large extent, also due to alterations in atmospheric circulation. Comparable variations in temperature during the Medieval Warm Period of the 11th to 14th centuries and the Little Ice Age of the 17th to 19th centuries also are thought to have been due to changes in the North Atlantic Oscillation.

Yet, even if one believes the recent warming is due primarily to human activities, the only two proposals that could have a significant impact on the rise of CO_2 levels are off the table. These are putting into place international policies that help curtail future population growth—even the current world population is causing enormous ecological damage on land and in the oceans—and replacing coal-fired electric plants with nuclear ones.

The only humane and proven way to achieve the first is economic development along the current model and, as for nuclear power, few leaders in the developed world are willing to take the political risk of supporting its wide-scale use because of irrational

public fears. (Even a cursory perusal of history shows that nuclear power is by far the safest and an environmentally benign way to generate baseload electricity.)

My intent here, though, is not to give a relative risk assessment of different sources of electricity. What will be argued instead is that rising carbon dioxide concentrations in the atmosphere could well be a blessing in disguise that may allow humanity to avert a real climate disaster—the coming of a new Ice Age. Although, as will be seen, this does not mean we should burn all of the remaining fossil fuel reserves.

At present, we live in an interglacial—a relatively brief period between long ice ages. Unfortunately for us, most interglacial periods last about 10,000 years, and that is about how long it has been since the end of the last Ice Age. How much longer do we have before the ice begins to spread across the Earth's surface? Is it less than 100 years or several hundred? Perhaps it will take 1,000 years. We simply do not know.

Even if the entire temperature increase over the last century is attributable to human activities, the rise has been a relatively modest one of a little more than 0.7°C—well within natural variations over the last few thousand years. If we were to have an additional global temperature rise of a few degrees over the next century or two, it would cause humanity to make some changes, but it undoubtedly would be within our ability to adapt. Entering a new Ice Age, however, 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 in many areas, and the world as a whole was much colder. Although a full-fledged Ice Age takes thousands of years to develop, even the beginning of one can impose great hardship. The last Little Ice Age started as early as the 14th century when the Baltic Sea froze over—followed by storms, unseasonable cold, 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 reduced severely in Scandinavia—and this was a mere foreshadowing of the miseries to come.

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

About 2,270,000 years ago, Earth's climate entered an unusual period of instability. Starting about 1,000,000 years ago, cycles of ice ages lasting about 100,000 years, separated by relatively short interglacial periods, like the one we now are living in, became the rule. Before the onset of the ice ages and for most of the Earth's history, it was far warmer than it is today.

Some 500,000,000 years ago, carbon dioxide concentrations were more than 13 times current levels, and not until about 20,000,000 years ago did carbon dioxide levels dip to a little less than twice what they are today. The reasons for the drop were the increasing brightness of the sun, rise of large vascular land plants (those having a vascular system like trees) some 300,000,000 years ago, and subsequent evolution of life.

Given that the real danger facing humanity is a return to a new Ice Age, it makes sense to ask what concentration of CO_2 would be adequate to stabilize climate so as to extend the current interglacial indefinitely. Some idea of the range of concentrations needed can be had from the observation that, over the last 570,000,000 years, consistent levels of CO_2 below 500 parts per million by volume are associated with the two glaciations of greatest duration—those that occurred during the Permo-Carboniferous some 300,000,000 years ago and the Cenozoic, within which we now are living. Cool climates were found to be associated with carbon dioxide concentrations below 1,000 parts per million, while no cool periods were associated with concentrations above 1,000 parts per million. For comparison, the current concentration of carbon dioxide in the atmosphere is about 386 parts per million.

Extending the interglacial

Could moderately increased carbon dioxide concentrations extend the current interglacial period? Insolation variations (here, the amount of solar energy reaching the Northern Hemisphere north of 65° latitude) due to changes in the Earth's position in its orbit around the sun are expected to be exceptionally small over the next 50,000 years. As a result, as reported in the journal *Science* in 2002 by André Berger and Marie-France Loutre, a carbon dioxide concentration of 750 parts per million could extend the current interglacial for this period. This is a rare opportunity; the last time it occurred being some 400,000 years in the past. They also found, however, that this level of CO_2 would not extend the interglacial beyond the next 50,000 years. In addition, it was found that concentrations of less than 220 parts per million would terminate the current interglacial, thus sending us into a new Ice Age.

Yet, one should not take these concentrations as the last word. The sensitivity of the climate to changes of CO_2 concentration could be in error. Since 1990, estimates by the Intergovernmental Panel on Climate Change (IPCC) for climate sensitivity implicitly include fairly rough estimates of key coefficients, as well as the effects of global cloud cover, and estimates of the effect of clouds notoriously are uncertain. If the actual sensitivity is significantly lower than current estimates, and that is by no means unlikely, the concentration of CO_2 needed to extend the current interglacial would be greater than 750 parts per million.

IPCC projections for carbon dioxide concentrations by the year 2100 depend on projections of social and industrial development in countries with large populations that currently consume small amounts of energy per capita. The highest concentrations projected are about 1,100 parts per million. This projection could be exceeded, though, if development in China and India accelerates and if other underdeveloped nations are able to overcome current impediments to modernization.

If development continues along its current trajectory, CO_2 concentrations are almost certain to fall in the range of 500-1,000 parts per million over the next century. This is because there are very good reasons to be pessimistic about current approaches to limiting emissions—they simply are not realistic, instead being the result of political, rather than scientific, considerations. This is an observation, not a criticism, since the current approach may be the best that is possible given existing international relationships and law, along with other aspects of political reality—and, while the likely failure to curtail CO_2 emissions over the next century could be a blessing, it would not be wise to continue burning fossil fuels indefinitely.

Unless the international approach to stabilizing CO_2 concentrations changes dramatically by including currently off-the-table solutions, the world will continue to depend on fossil fuels for many generations to come, and the burning of such vast quantities is bound to have a serious environmental impact both in terms of real pollution and global temperature rise. The developed world cannot legislate how the developing world will use these fuels, and history has shown that commercialization likely will be at the lowest cost to the producer, with the concomitant release of large amounts of pollutants and carbon dioxide. China is a perfect contemporary example. Yet, if the grinding poverty that most people in the developing world must live under today is to end through development along the Western model—and no alternative model has been shown to be viable—the required energy has to come from somewhere.

Resolving these issues is far beyond the purview of the IPCC, but that United Nations organization could have an important role in the future. The IPCC and the climatology community in general should devote far more effort to determining the optimal range of carbon dioxide concentrations that will stabilize the climate and extend the current interglacial period over the next 50,000 years, if not indefinitely.

The real tipping point for civilization is the beginning of another Ice Age—not a world a few degrees warmer. ★

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