SCIENCE

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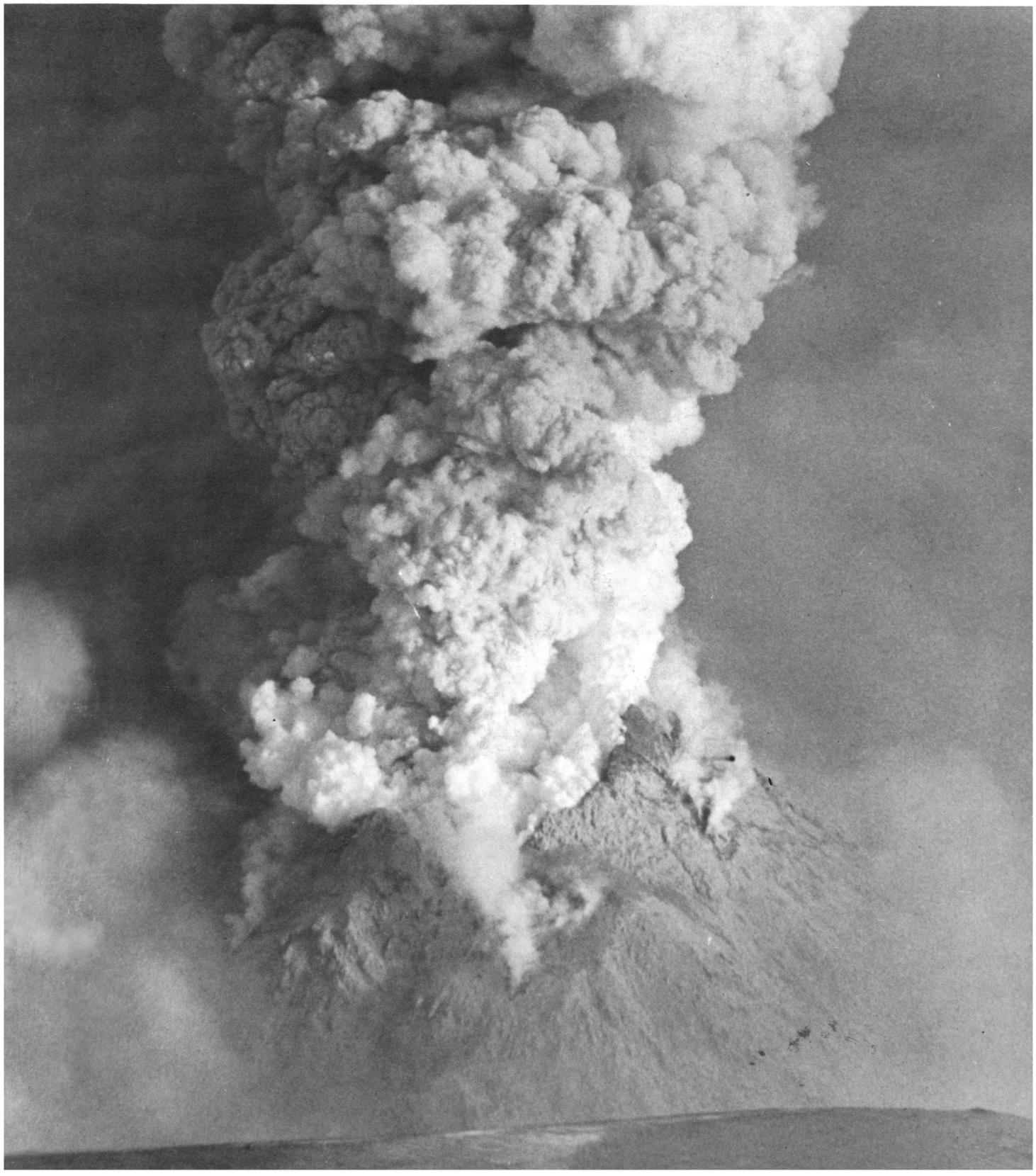
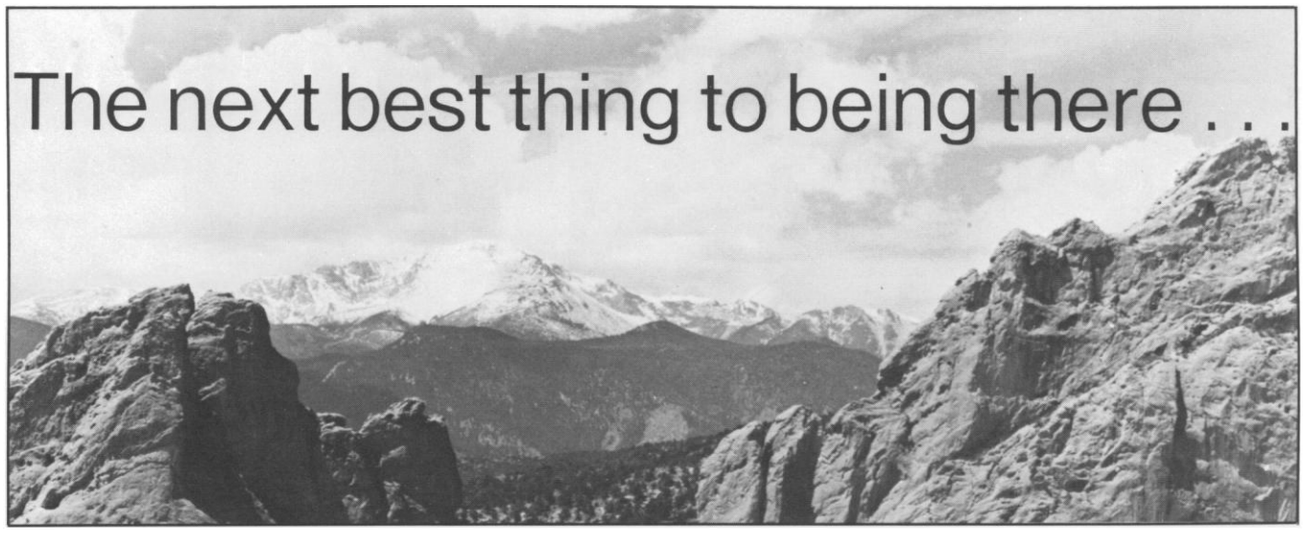
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORTS

COVER

St. Augustine Volcano (Alaska) in eruption, February 1976. See page 871. [Cloud Physics Group, University of Washington, Seattle]

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Unfreezing the Future

Many proposed solutions to the energy dilemma—liquid metal fast breeder reactors, fusion reactors, or some form of solar energy—have about them a curiously static quality. Not only are they seen by their enthusiasts as total solutions, which is itself a presumptive notion, but also they seem to be advanced as if a decision could be made now or soon about the most economical, clean, and safe way to provide energy for the next 1000 years. After research, development, and demonstration, all that remained would be to put the requisite number of facilities in place and turn them over to caretakers to keep them running.

Except that the world doesn't work that way. Human beings do not work that way, either as individuals or as societies, and perhaps Americans in particular do not. On the contrary, we can expect that all kinds of unpredictable dynamic developments will occur during the next 25 years, let alone the next 1000. Do we really think that we are at the pinnacle of human evolution and development, that all the most important inventions are past or within our grasp? It is possible, but evidence weighs heavily on the side of skepticism.

Moreover, we are too ignorant to make even semipermanent choices and commitments. We have no more than educated guesses about the economics of energy sources now in prototype or planning stages, and the affordability of those that exist only in the imagination is purely conjectural. Nor do we know much about safety, or carcinogenicity, or climatic effects. The solutions of 1985 could look like dinosaurs before we got very far into the next millennium.

Within a very few decades (the exact date does not matter), oil and natural gas will have become minor energy sources, and the several new sources in sight threaten to be more expensive, or dirtier, or more dangerous, or some combination of these. There have been, of course, past transitions from old to new sources of energy, but they have been pleasant—always to cheaper sources and usually to cleaner, more convenient ones. Moreover, these transitions were not mandated. They occurred. This time the transition promises to be painful and imposed. We are going to have to pay for energy, both in treasure and in undesirable side effects, and the sooner we let prices reflect this fact the better off we will be in the long run. The trick is to find answers that minimize some combination of economic costs, dirt, and danger.

Unfortunately, this search turns up a conflict in values that threatens to be irresolvable. Growth-oriented people give by far the greatest weight to cost; they think economic growth, high incomes, and jobs are worth the environmental side effects of what now promise to be the cheapest sources—coal and nuclear. But some people are gravely offended by dirt and what it will do to health and climate, which rules out coal. And many are concerned mainly about safety: "What do dollars matter when human lives are at stake?" They would eliminate the dangerous options before choosing the most economical among the rest. A subset of these would accept "normal" risks, such as those of coal mining, but find intolerable any increased risk of catastrophic damage, such as a war resulting from nuclear proliferation. They want to rule out the nuclear option unless we can devise safeguards far superior to any now in prospect.

Faced with various and changing notions of unacceptability, with ignorance and the knowledge that tomorrow probably will not resemble yesterday, it is imperative that we not freeze our future options, either in our minds or in our machinery. We must have a plan that can, and it probably will, be adjusted frequently as we learn. Our single clear criterion for the future is flexibility.—CHARLES J. HITCH, *Resources for the Future, 1755 Massachusetts Avenue, NW, Washington, D.C. 20036*

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