The accident at Three Mile Island presented the U.S. nuclear power industry with very serious problems but, writes Commissioner Gilinsky, the industry was already in serious trouble.

VICTOR GILINSKY

The impact of Three Mile Island

Historically, America's nuclear policy—so far as the development of commercial nuclear power is concerned—was first an international policy, designed to encourage the technology and open up foreign markets during the middle 1950s. At that time, our fossil fuel resources were more than adequate and U.S. incentives for moving fast toward domestic development were relatively weak. By the 1960s, however, all that began to change, and the U.S. Atomic Energy Commission, with the encouragement of the Congress, worked hand in hand with American manufacturers and utility companies to build up commercial nuclear power at home. The groundwork was laid enthusiastically, with taxpayer's money, and it was not until recent years that serious questions began to be raised about that national commitment.

President Carter, commenting on questions of safety revealed by the accident at Three Mile Island and on the relationship of nuclear power to our overall energy situation, took a cautious approach towards the future of nuclear power. His view is that "there is no way our country can close down nuclear power plants" and that it "would be ill advised to terminate the construction" of those already approved. At the same time, he feels that to the extent conservation and "other sources of energy" can be developed, the need for an expansion of nuclear power beyond that now planned can be lessened.

This approach may well have been influenced by two important events of the 1970s, one of which affected projections of electrical demand; the other, our confidence in nuclear safety. The first was the oil price increase of 1973 and 1974, which had the effect of cutting the yearly increases in electric power use approximately in half. The other was the March 1979 accident at the Three Mile Island nuclear power station, whose primary effect on the public debate over nuclear power has been to shift the burden of proof from those who claim nuclear power is not safe to those who claim it is.

At the moment nuclear power is in the doldrums. There are those who claim the anti-nuclear activists are killing it, and others who claim it is going down because it carries the seeds of its own destruction—witness Three Mile Island. The truth is more mundane. Deflation began to afflict nuclear power several years before the events at Three Mile Island. The primary reason for this was the oil price increase followed by other fuel price increases. These, along with the associated effects of conservation and increased energy productivity (whose full impact is yet to be gauged) led to reduced growth in electricity use and thus to reduced demand forecasts. The utilities responded by slowing down construction and orders for new generating plants. Because nuclear orders tended to be among the more recent, they were the first to go. By December 1978, three months before Three Mile Island, *Business Week* opened its special report with the observation:

"One by one, the lights are going out for the U.S. nuclear power industry. Reactor orders have plummeted from a high of 41 in 1973 to zero this year."

Current Role of Nuclear Energy. Unlike the energy mainstays—oil, gas and coal—nuclear energy is used only to generate electricity. In 1978, about 13 percent of U.S. electrical energy was supplied by nuclear plants, a little less than that generated by falling water. Since electricity absorbs about one-quarter of our primary energy resources, this translates into about 3 to 4 percent of total U.S. energy consumption. Nuclear capacity, now about 50,000 megawatts, may double by 1985. Last February, Deputy Energy Secretary O'Leary said the Department of Energy's "realistic estimate" was that it would double again by the year 2000, a respectable and growing contribution, but still not one that will dominate the total electric energy supply. At the same time, there are regions of the country heavily committed to nuclear power: the New England states, the Southeast, and the Chicago area; the latter, for example, gets about 50 percent of its electricity from nuclear plants.

But whether nuclear energy continues to follow its current trend or shifts somewhat in one direction or another later in this century, it will have, for all practical purposes, a minor effect on our ability to replace imported oil. It will mainly affect our use of coal. About 10 percent of oil consumption is used in generating electricity, principally in the Atlantic and Pacific coastal areas. Some of this will gradually be replaced by coal or uranium, the practical

choices for some years to come.

To the extent that we build more nuclear plants, we will build fewer coal-fired plants. It is a difficult choice, given the public health and safety problems associated with the use of both these energy sources. But we would be in a worse fix if we had to depend entirely on one or the other; every additional energy source increases our flexibility in meeting demand.

An important flexibility would thus appear to be added by the nuclear capacity expected to be in operation by the turn of the century. Yet there is an odd tendency, among nuclear advocates and critics alike, to judge nuclear power's future on the basis of a comparison between present prospects and past expectations. Not much more than five years ago the government and industry, in what can only be described as a joint act of levitation, estimated nuclear capacities to the year 2000 at six times above what now appears on the horizon. What has happened is that those projections have now come down to a reasonable level from an artifically induced high. It is worth noting that nuclear power and coal are, at the moment, not too far apart in terms of electric generating capacity under construction or on order.

On the other hand, it is true that beyond what is now in the nuclear pipeline, no new plant orders appear to be immediately in sight. More importantly, some plants on the latest lists have already been cancelled or deferred, and some of what is left is not as firm as might appear. Whether these projects are completed will depend to a large extent on forecasts of how much electricity is going to be needed; and this applies with greater force to additions to the list. It is still too early to measure the effect on this situation of increases in efficiency in the use of electricity, but I suspect it is being underestimated. In addition, the backwash of the safety questions raised at Three Mile Island is bound to slow things down.

The Roots of Current Problems. The estimates of a few years ago for nuclear power growth are hard to believe. Nevertheless, it is against the inflated projections of the early 1970s that the industry is now assessing its progress and finding it bitterly disappointing. Not only were the earlier estimates based on a continued high level of growth in consumption of electricity, but they also assumed an enormous enterprise which nobody appears to have thought through: it almost looks as if the analysts blithely drew the curve of energy consumption upward to infinity. It also suggests that they thought they were dealing with a trouble-free technology and a passive public. Those earlier estimates implied unprecedented industry effort, huge capital investment, easy site selection, and the smooth functioning of all ancillary activities, including waste disposal, for which preparations were not being made. They were, in short, utterly unrealistic.

If nuclear power should fail to survive into the twenty-first century, it will be at least in part because 25 years of hard sell for an all-nuclear future got in the way of a commonsense consolidation of this new technology. While problems in existing plants cried for attention, industry and government pursued visions of even grander reactors. In my view, the romance with the plutonium-fueled breeder which was supposed to solve all our energy problems diverted attention from the hard business of mastering the commercial reactors we have been building and operating.

The size of nuclear plants increased so rapidly in the early 1970s that designers and operators outran their experience base. Government safety reviewers were thrown off balance by the large number of license applications for these new, increasingly complex plants. The size and sophistication of the construction projects taxed some utilities beyond their competence. Design and building problems multiplied in direct proportion, and construction times stretched out beyond reasonable limits. To make matters worse, the government failed to develop a firm approach to waste disposal and allowed uncertainty about radioactive spent fuel to run in circles for 20 years, one scheme replacing another without resolution.

These fundamental difficulties were ignored as the electricity demand forecasts, growing at 7 percent a year, fueled a steady stream of nuclear reactor orders. Business was

Victor Gilinsky has been a Commissioner with the U.S. Nuclear Regulatory Commission since it was created in 1975.

We can live with nuclear power only if we are willing to pay the price of living with dangerous technologies.

booming. The 1973–1974 oil price increases were at first assumed to make nuclear energy even more competitive with other fuels and thus to be a spur to nuclear orders. As we know, they have had the opposite effect. Higher energy prices reduced electricity demand growth and power plant orders—both nuclear and coal—were slowed to a mere trickle.

Then, in March of 1979, came Three Mile Island. The accident at Middletown added a new dimension to the uncertainties over the future of nuclear energy, bringing long-ignored reactor safety problems into sharp focus. The fact that things happened at Three Mile Island that weren't supposed to happen rocked the industry and the regulatory agency. And the American public, along with the rest of the world, was treated to a quick course on what can go wrong with nuclear reactors.

Machines failed and men failed. Features of the reactor design that had never come under close regulatory review because they were not regarded as "safety related" actually contributed to the accident. Control room instruments were inadequate. Operators made mistakes. Meters to measure the radioactivity leaving the reactor went off scale. Communications links failed to function, in part because phones were jammed, in part because individuals did not seem to understand what they were supposed to report. The power company didn't inform the Regulatory Commission, that first day, of dangerously high temperatures, or of a hydrogen explosion in the reactor containment. And it turned out that a warning flashed by a similar event at another plant a year earlier had been ignored by the Nuclear Regulatory Commission.

Many of the specific deficiencies in plant design and operator procedures can be corrected relatively easily; such corrections, in fact, were initiated immediately following the accident. Reactor systems that were not reviewed will be reviewed. New control room instruments are being required. A stricter program for operator training and qualification is underway. The NRC will require instruments to permit accurate measurement of offsite releases. Emergency planning for evacuation of those living near reactors will be required as a condition of reactor operation. Direct phone lines have already been installed. And safety information will be reviewed more closely and systematically by a new NRC office.

But the failures in the system for assuring public safety go deeper. Changes will certainly be made because they *must* be made—in the industry, in the operating utilities and among the government regulators—to eliminate the downright laxity up and down the line which was exposed during the accident and in subsequent reviews. Nuclear plants are not like ordinary power plants. They must be built and operated with meticulous and disciplined attention to detail and government regulators have to exercise tight control. Unfortunately, Three Mile Island has not yet fully driven that point home, at least not to everyone involved.

It is still too early to gauge the full effect of all this on the role nuclear power is expected to play in America's energy policies. If fewer nuclear power plants are to be built, it will be because we need fewer, or because we think coal is cheaper, or safer—all considerations we have not yet made up our minds about.

In the end we will return to the big questions of the 1970s: Can we live *without* nuclear power? The answer is yes. But we would be better off if we could find a way to take advantage of the increase in diversity, and therefore energy stability, that comes with this alternative energy source.

Can we live *with* nuclear power? The answer is again yes. But only if we are willing to pay the price of living with dangerous high technologies. That price is extraordinary care, discipline and superior craftsmanship. On the question of whether this would be too much for us, the jury is still out. □

WILLIAM J. LANOUETTE

The Kemeny Commission report

Like *The Bible*, the final report of the President's Commission on the Accident at Three Mile Island offers within its voluminous pages almost any message an attentive reader wants to find.

Floyd Lewis, chairman of the utility industry's study group on Three Mile Island for the Edison Electric Institute, concluded within hours of the release of the Kemeny commission report: "It is quite clear that the President's commission has given us and the American public a simple message on nuclear power: proceed, but proceed with caution." Richard Pollack of Critical Mass, the anti-nuclear group, quickly found another message: "We consider the Kemeny commission report a blistering indictment of the NRC and the nuclear industry."

Editorial writers also picked through the report for quotes that