

OFF THE BEAT

Teller on technology in America: Success to uncertainty

Edward Teller, who has played a major role in the development of nuclear technology for the past 35 years, is a kind of stormy petrel in discussions of the direction science should be taking. Regarded by many of his colleagues as a consistent devil's advocate, he is renowned for shooting down popular positions. He had a perfect opportunity to do so recently as the opening lecturer at the 75th anniversary celebration of the National Bureau of Standards, where he expanded on his view of the history of American technology and his concerns about its present state.

He sees the United States as a country that has made efficient and sometimes even lavish use of technology throughout its history, but which has fallen into the grip of an antitechnological bias ever since dropping the bomb on Hiroshima. This attitude bodes ill for the future, Teller believes, for it may mean that the next important technological innovations, such as modification of the weather, may take place elsewhere, perhaps in Russia.

That's a strong statement for a man who describes himself as a pure scientist who only slowly converted to technology through a long residence in the United States. A University Professor Emeritus at the University of California and Associate Director at Large (emeritus) of the Lawrence Livermore Laboratory, Teller came to the United States in 1935 to escape the dictatorships of Central Europe.

Teller is particularly concerned about energy problems, but these are not new. Today, he says, "we are accused of indecently high per capita consumption of energy;" but in 1800, "our energy consumption was even more out of line." It was almost as high as it is now and amounted to 80 percent of present per capita energy consumption in Western Europe. Of course in those days it was mostly replaceable fuels: wood, and hay for horses.

Part of the reason for early high energy demands, he emphasizes, was that Americans made quicker and more intensive uses of new technology in transportation and communications, such as canals, railroads and telegraph, than Europeans did. Europe did not have the distance and development problems of America and had older means of doing things already in place.

In the early 1800s, for example, the governor of New York proposed to build a canal across the untenanted wilderness



in the western part of the state. He took the idea to President Jefferson and was told that it was a century premature and there would be no federal money. Then, says Teller, "the governor of New York discovered an invention of Adam Smith's—private enterprise. He sold bonds." The canal was dug in eight years and proved an instant social and economic success.

In passing, Teller also pays tribute to another great pioneer of American technology, Eli Whitney. "It has nothing to do with the cotton gin." Rather Whitney was an innovator in two important respects: He showed how to get contract money out of the Defense Department, and he initiated two important rituals of that activity by missing his delivery date and overrunning his budget. But while he was doing that, he developed a way to manufacture guns from interchangeable parts, the technique that lies at the basis of most modern production.

Throughout most of the 19th century science and technology had little to do with each other, but with the development of the electric and electronics industry the two began to come together, so that "today we can hardly speak of science or technology without mentioning the other." The real beginning of big science and its mating with big technology, however, came with World War II and especially the Manhattan District Project, in which Teller played a key role.

The program began almost naively. First came the famous letter signed by Einstein but instigated by Leo Szilard. When President Roosevelt referred the idea to the director of the National Bureau of Standards for evaluation, the latter called upon a panel for advice. Enrico Fermi was invited, and Teller was sent to New York to persuade him to come. Fermi refused. He had recently tried to sell a nuclear bomb idea to the Navy and had gotten a cold reception. He was fed up with the military bureaucracy, but he authorized Teller to present his ideas.

Besides Teller, the meeting included

"Szilard and [Eugene] Wigner, who believed in a nuclear bomb, and a colonel from Aberdeen, who didn't." Teller presented Fermi's advice that the project start by building a nuclear reactor (which was later done under Fermi's direction). They decided that to moderate the flux of neutrons in the reactor they would need pure graphite, which was in short supply. Teller estimated they would need about \$6,000 for the first year to obtain it. "Szilard almost murdered me," he recalls, for asking for so little.

The project that started with an annual budget of \$6,000 led to Hiroshima and a kind of American loss of innocence. A lot of Americans, especially academic types, began to believe that technology was bad. It's a silly attitude, Teller believes: "There is no invention, no new development, that is either peaceful or warlike. Anything can be used in a variety of ways."

To make the point, he chooses a less frightening example, nylon. Nylon was invented just before the war, and the major incentive for doing it was to provide a sheer and durable material for women's stockings and other garments. What could be more peaceful than enhancing women's sexual allure, Teller says; but the war came, "and the gals got no stockings." All the nylon production went into parachutes.

Still, American academics continued to badmouth science and technology. People think the postwar period was the age of big science, Teller says. Yet in 1947, when the Ford Foundation was being set up, a committee of scholars advised the trustees to invest the money in social sciences and stay away from natural science and technology. Professors began to steer students away from science and technology, and institutes of technology began to change their names to "University." The result, according to Teller, is that not enough young people are going into technology. Present-day technologists are getting older, and are not being replaced. He points out that the average age of the technical staff at the National Bureau of Standards rises by one-half year every year.

Teller thinks we need to reverse field and begin again to use technology as efficiently as we did in the past. He is disturbed by some current popular trends.

Solar energy is much touted now for making electricity. Teller says making electricity from solar energy is 10 times as expensive as other methods of making it, and the solar energy would be better used to make hot water and steam for domestic and industrial use.

Teller doesn't think much of breeder reactors either. He wants a nuclear program, but feels more attention should be paid to the possibilities of thorium-cycle reactors.

Too much needless attention is paid to
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