What does the arcane art of utility accounting have to do with energy policy? Consider that CWIP makes up 20 percent of net plant investment and that the allowance for funds used during construction accounts for 35 percent of net income. Companies have to raise enormous sums of money and, for prolonged periods, pay out cash to the suppliers of the funds; but they receive only a bookkeeping entry as an offset. This puts tremendous pressure on the utilities. Furthermore, the longer the period of construction and the greater the capital cost of the plant, the heavier the burden. Nuclear units take the longest time to construct and have the highest first cost.

Adding CWIP to the rate base can be rationalized by claiming that the new plant is primarily for the benefit of current ratepayers (most growth does come from present customers), so they are not being harmed if they pay now. From a practical standpoint, regulators might prefer to deal with a larger rate base and give a lower rate of return, rather than to have to justify a seemingly high return on a smaller base. Certainly, there was a big push by the federal government and by the industry to add CWIP to the rate base during the post-oil-boycott turmoil. And, if energy policy is geared solely to producing more electricity, there are virtues to this attempt. However, there is another point to consider. As long as utilities can be assured of returns on CWIP, they will not have as much incentive to find ways of meeting power needs other than building new plants.

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Networks of Amateurs for Science

Deborah Shapley's intriguing article "Chinese earthquakes: The Maoist approach to seismology" (News and Comment, 20 Aug., p. 656) reports use in China of vast networks of amateurs in the earthquake prediction program there. Use of amateurs in science, if appropriately planned and applied, can prove a service to science, a learning experience for amateurs, and a means by which to sensitize citizens to scientific programs and needs.

It may be enlightening to point out a few instances of the successful use of large-scale networks of amateurs in science, particularly with regard to data or sample collection and monitoring. In the late 1800's, Joseph Henry, the first secretary of the Smithsonian Institution, orga-

nized laymen along the first transnational telegraph line to report local weather conditions. This network laid the foundation for the U.S. weather bureau. Oehser (*1*) recounts:

> Henry outlined his meteorological proposals in his annual report for 1848. The plan was to obtain weather reports from a great network of voluntary observers scattered over the country, particularly for the purpose of assembling long-range data on climate and weather from stations in every region. In this way, the studies would furnish a sound foundation upon which the science of meteorology could build. It was an original idea, and one that eminently illustrated the principle of cooperation in Henry's program. It gave the people in general a kind of grass-roots stake in this new Institution, about which most of them knew so little. . . .
>
> There would be, Henry said, three classes of observers:
>
> > One class, without instruments, to observe the face of the sky as to its clearness, the extent of cloud, the direction and force of wind, the beginning and end of rain, snow, etc. A second class, furnished with thermometers, who besides making the observations above mentioned, will record variations of temperature. The third class, furnished with full sets of instruments, to observe all the elements at present deemed important in the science of meteorology.
>
> By 1852, the voluntary observers reporting directly to the Smithsonian numbered about two hundred.

A fuller account of Henry's meteorological program appears in the first volume of the *Smithsonian Series* (*2*).

In the late 1950's, Fred Whipple, then director of the Smithsonian Astrophysical Observatory, organized amateur astronomers around the world in the world's first observational satellite tracking network, called Moonwatch. Parts of Moonwatch were operational just in time to track Sputnik. In a highly readable book on the satellite tracking program, Hayes (*3*) reports:

> Whipple's conviction proved to be correct. He had earlier insisted that the Moonwatch program be an effort of amateur astronomers and science enthusiasts, at a time when the military services and other Government agencies felt that amateurs could not be trusted to carry on such a complex and vital program. The unique success of Moonwatch demonstrated what amateurs could do when properly inspired and led. And it should not be overlooked that it was certainly the least expensive effort of the entire IGY [International Geophysical Year] program of the United States.

In 1973, two Smithsonian botanists, T. Soderstrom and C. Calderón, utilized a network of students throughout the United States to collect samples of bamboo in a study of the rare flowering phenomenon in the Ma-dake species (*Phyllostachys bambusoides*) (*4*).

A division of the Sigma-Aldrich Corporation has reportedly organized a network of sixth-, seventh-, and eighth-grade schoolchildren in 20 states to collect fireflies, whose luminescent substance is useful in medical research (*5*).

The Audubon Society has used networks of amateur ornithologists to count and track birds for years.

C. Barry Raleigh, of the U.S. Geological Survey, is considering organizing students and other volunteers in California to monitor the occurrence of events that may be precursors to earthquakes (*6*). Ralph Turner, professor of sociology at the University of California at Los Angeles, is urging that 4-H clubs be contacted so that members can observe any abnormal behavior in animals before earthquakes (*7*). Turner also has prepared a unique account of the Chinese experience in mobilizing the masses in China for earthquake prediction (*8*).

We are organizing a North American network of secondary school teachers interested in mobilizing their students to collect observational data and samples for scientists. The program, called Internet (the International Environmental Resources Network), is being developed in cooperation with the environmental education unit of the Unesco/U.N. Environment Program as part of a worldwide approach to environmental education. Internet will link together classrooms in the United States and Canada for the purpose of increasing student awareness of the range and complexity of worldwide environmental issues and assisting principal scientists to collect data and samples over broad geographic areas.

Scientists who could utilize a labor-intensive, unskilled, nontechnical network of enthusiastic students and teachers are invited to contact us to discuss the possibilities of using Internet as a tool for science. We are especially interested in hearing from scientists who are being, or have been, assisted by networks of amateurs, so that we may learn from, and perhaps contribute to, their experience.

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