

# Barriers to Thinking New about Energy

Articles on energy have been popular with readers of *The Industrial Physicist*. We received a lot of letters about such articles by Jesse Ausubel, Paul Grant, and David Criswell, which favored nuclear energy and solar power. We have also received letters challenging us to think differently about energy, including the one below by Winston Crausaz. When we read the article he recommended, by Laura Nader, we thought it was worth republishing, in an edited format, with the permission of *Physics Today* and the author. The original may be found in *Physics Today* (February 1981, pp. 9, 99, 100, 102, 104) and online at <http://www.physicstoday.org/vol-34/iss-2/vol34no2page9-104.pdf>—*Editor*

A few years ago [in the 1970s], some people at the National Aeronautics and Space Administration asked me to attend a conference in Monterey, California, on energy systems. My immediate response was that they had the wrong Nader. The man at the other end of the line said, “We want an anthropologist at this conference.” So I went down to Monterey for five extraordinary days with different groups of professionals, mainly scientists and engineers. We talked about different scenarios for the future. We were told to think freely about them, but it became clear that there were already boundaries around those scenarios. You were to think freely—within those boundaries. When you went beyond them, someone would tell you, “You are off the track.”

At the closing session, I told these people what I thought, as an anthropologist, listening to them. Anthropology is a science as well as a humanity. One reason that I had gone into science was that I was curious; I believed that scientists encouraged curiosity. In Monterey, I found that, in fact, curiosity and the freedom to roam mentally were curbed among physical scientists and engineers.

The most striking observation was the number of taboos. Solar was never mentioned by anybody other than me. The possibility of dropping nuclear power as a future alternative was not even discussed. The social and political consequences of nuclear power were not discussed. Nobody used the word safety. The fact that we were making decisions that closed off options to the next generations was considered irrelevant.

After my talk, an engineer said, “Professor Nader, I would like to explain why we don’t talk about safety; we don’t talk about

safety because it is built into the design.” As an anthropologist, I found that statement interesting enough to write down.

My eyes were opened further at a lecture about breeder reactors at the Lawrence Berkeley National Laboratory. The same sort of group was there, mostly white, mostly male, and mostly scientists and engineers. The man who introduced the speakers said, “Because breeder reactors are the way we are going to go, we have brought two people from Atomics International to discuss the question.”

Who says that breeder reactors are the way we are going to go? There was no discussion of that question before or after the talk.

## Plea

Over 20 years ago, a physics major in my geology class threw an article from *Physics Today* on my desk with the comment, “Read this!” It was called “Barriers to thinking new about energy,” by Laura Nader. Not many articles that old ring true today. Consider just about anything from *Time* magazine written in 1981.

The American Association for the Advancement of Science has reprinted, as offprints, some of its classics. I have seen piles, several feet high, of reprints of Garrett Hardin’s “Tragedy of the Commons” from the journal *Science* in university bookstores.

Please consider republishing this. It would be good for *Physics Today*, the American Institute of Physics, and the country.

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The first question came from a young man in the front row, who said, “I find it incredible that you have talked for a whole hour about the breeder reactor and never raised the question of public safety.” He was John Holdren, a professor on the campus. Several questions followed, but the only ones about public safety came from graduate students. Not a single worker at the laboratory asked about public safety.

For the first time, I began to question how the work organization affects how scientists and engineers think. There are certain pressures, at that laboratory and others like it, that encourage people to think similarly, that, in fact, punish deviant thinking. In science, new ideas come from oddball thinking and freedom of expression.

I was soon involved in the Committee on Nuclear and Alternative Energy Systems (CONAES) project at the National Academy of Sciences. CONAES was divided into synthesis, supply, demand, and risk panels. I was a resource chairperson for the synthesis panel. My group was to describe what life would be like in the year 2010 under different levels of energy expenditure. I was intrigued by how people were working on the project. I noticed the earlier patterns in this group: a good deal of standardized thinking, a lack of respect for diversity, and an absolute taboo on the word solar. Their memos discussed nuclear, coal, and nonnuclear. Nonnuclear was solar.

I asked the co-chairman, “How come nobody ever uses the word solar around here?” He looked at me, rather surprised. “I don’t know. Solar has been an orphan child.” Somebody else piped up, “Solar is not very intellectually challenging.” Somebody else said, “What is solar? A bunch of mirrors.”

Some things said off the tops of people’s heads have much deeper meaning. The first observation was, “It is an orphan child.” When did it become an orphan child? The other observation: “Solar is not very intellectually challenging.” What is intellectually challenging to these people? They seem to relish something complicated, hazardous, difficult, and risky, something that requires high

technology and big money. I am not a psychologist, but I came as close to psychologizing during the CONAES study as I ever have.

I had on my resource team two physicists, a computer technologist, a sociologist, an economist, and an engineer—not many social scientists. They were willing to experiment with different futures. We started out with the idea that energy demand was not going to expand by 2010; it would remain at 70 quads. The challenge was, could you stay at 70 without changing amenities, in a way that people would not be disturbed or disrupted in their lives.

Staying at 70 quads was easy because there is so much waste in the system. So we decided not to go from 70 to 110 as directed, but down to 50 instead. We got some interesting reactions. Who ever heard of going down without going backward? Many people misunderstand the direction of change and the ways societies change. In the 50-quad scenario, most of the responses to problems are bottom-up. The reason that people cannot understand that scenario is because professionals in this country tend to think top-down. Our 50-quad society was a bottom-up change scenario. We may not even want to live in such a society, but we wanted to juggle people's thinking about what is possible. We wanted to point out, first, that it is possible to have a high-technology, low-energy society, and second, that change can come from more than one direction.

While we were working, no matter what we sent to Washington, we would be asked for more tables and less prose. We finally got an exasperated note that said, "More tables, less prose. These guys don't read." We know there is a literacy problem among the young, but less recognized is another serious problem: managers and planners do not read and they do not write. They hire people to do it for them. For people who want it all in tables, I ask: "How do you talk about freedom, democracy, about most of the things we care about in a table?"

I have worked among Indians in southern Mexico, Shiite Moslems in southern Lebanon, and in various places in this

country. CONAES was, by far, the most difficult work. It is important to understand why. People in technical areas work with objects or with numbers. They do not work with human beings. When you have people who never work with humans thinking

about our future, sometimes humans are treated like objects.

The kinds of statements that I heard at CONAES might not seem strange to you, but I want to repeat them because they are very strange. In the risk panel, a well-

After the publication of my *Physics Today* piece, I received more than 100 letters and calls from physicists and engineers. The letters from older, distinguished physicists indicated that the behavior I observed is selected for, learned, and transmitted from generation to generation. Many spoke about problems of expert knowledge and compartmentalization, stagnation in high places, unscientific attitudes in scientific places, and insecurities that produce new and powerful Luddites who stick to old technologies such as nuclear for fear of displacement. I published some of their responses in a collection, *Naked Science* (Routledge: New York, 1996; 333 pp.)

In searching for the roots of stagnation, I asked whether it was the workplace, laboratory science culture, bureaucratic indifference, a lack of imagination or creativity, or all of these things. These issues remained unresolved through the Reagan, Bush, Clinton, and now G. W. Bush White Houses. President Reagan went so far as to remove the symbolic solar panels from the roof of the White House. He discontinued solar-energy tax credits, and he had the tax-funded safe-efficiency car model, which ran 55 miles to the gallon, physically destroyed. Such public displays accompanied an energy policy that could only allow itself to be caught in “inevitability talk.”

In sum, those backing the sunset technologies (oil, coal, and nuclear) are the new Luddites. The nation that used railroads to forge a political entity is the least advanced of any industrial nation in the use of long-distance trains. Even at the turn of the 19th century, we had automobiles running on electricity and steam power as well as gasoline. And in 1902, the president of the American Chemical Society, Harvey Wiley, predicted that the United States would be running on solar by the 1970s. In Washington, reports become the means of argument. The economists disagree with the scientists; the physicists blame the economists for market-paradigm myopia. The reports are not contaminated by political content, paradigm assessment, or energy-company corruption. Taken literally, they produce unreal assessments—a form of denial.

Nevertheless, *unofficial* energy efforts are proceeding in the style of bricolage (construction by using whatever comes to hand)—finding solutions, and providing the truth in the observation that this country has more problems than it deserves and more solutions than it uses. During the past 30 years, as a result of alliances in business, science, and environmentalism working in the bricolage mode, some quantifiable, positive change has taken place. Automotive technology is surpassing the original model efficient car. Refrigerators (the appliance that uses 20–30% of the energy in homes without air conditioning) currently use half the amount of electricity compared with consumption figures from 1978. Wind power is taking off along with other renewables.

By 2002, headlines on Yucca Mountain nuclear storage, Enron corruption, scarcity, renewables, and international “terrorism” make it all the more strange that energy policy is treated as if it were untouched by its environment of political and economic power. The pretense of objectivity requires that social power discussions not be included, while Machiavellian power plays remind us that the idea of public power and democratic control is heresy for utility giants.

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known risk specialist, in reporting his conclusions, said, “Fifty-thousand people die in car accidents every year. We know how to build cars so that does not happen. There are X number of people who die in dam breaks, from household accidents, and from various other accidents. We know how to prevent those deaths. If we prevented those deaths, then we could afford to have a nuclear disaster.”

The absence of diversity leads to serious

problems. To start with, male professionals in this country are very macho. Something happens to same-sex groups; they vie with one another. You can see this in the nonhuman primate literature as well. Same-sex groups are very competitive. In this case, big is better. Hazardous is interesting and intriguing. I once learned in Los Angeles that conservation is considered feminine. That must make nuclear a very masculine endeavor.

After the CONAES study, I worked on

another study. The U.S. Department of Energy gave money to University of California groups to do a study of what is called soft-energy paths in California. Can we go to soft-energy paths, soft meaning non-nuclear, meaning decentralized, meaning usually solar? Again, I saw people’s methodologies getting in the way. They were using old methodologies that were appropriate to other problems, such as growth modeling, to see what it was going to be like with less in the year 2010. They were tripping all over their methods and coming out with fancy computer statements that had little credibility. Shamans would evoke more confidence.

As an anthropologist, I find this wedding to numbers fascinating. The belief is so strong; it is like numerology—the belief that numbers in themselves are useful. Numbers are useful, of course, but not in and of themselves. In a controversy, when one side gets a numbers man and the other side gets another numbers man and the two sides fight with numbers, and count coup, numbers have lost their utility. Both studies suffered from this belief that numbers in and of themselves add strength to an analysis of the future.

In the California study, we looked at two kinds of change: top-down and bottom-up. We looked at a mandated solar code; that was top-down. We looked at the possibilities of distributed energy, which was bottom-up. People could create their own wind and electrical systems and then feed it into the grid. I found myself looking at work patterns again. The solar code we looked at encouraged solar energy use, natural gas, insulation, glazing, and so forth. The people who wrote the code, I think, were inadequately aware of the human component. It became clear, however, in talking to the different people involved with this code, that certain people will determine whether or not that kind of a mandate works or does not work.

We interviewed a wide range of people from different interest groups: bankers, contractors, architects, building inspectors, lawyers, and realtors. Each type of worker belonged to a particular subculture, with an organization and value all to itself. They each had almost unique ways of looking at

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building codes. Architects, for example, see codes as a hindrance to their creativity. It was extremely difficult for anybody we interviewed, except members of the general public, to see the whole picture. Everybody saw the picture that impinged on their individual self-interest.

If I were an anthropologist from New Guinea, observing the energy efforts of the past several years, I would note a wide gap between what leadership says and what it does in this country. I would note that the government has no serious interest in solar. All the solar conferences that the government is sponsoring, I would see as rituals of reconciliation. In the absence of innovation and change, we have one conference after another. I would be struck by the presence of solutions in the absence of will.

We have gotten to the point in our society at which we can no longer entertain obvious solutions. This is where anthropologists come in. The coming era will require practical, general, earthy types of thinkers who understand problems and conflicting value systems. We need people who can look at mundane and straightforward problems, people who will not choose complicated solutions when simple ones are available.

The energy problem is not a technological problem. It is a social problem. We must build technologies that recognize human frailty. One thing that social science has documented is that people make mistakes. They are going to continue to make mistakes. Build that into the technology, and accept and reject technologies on that basis.

The toughest problem will be getting professionals to look inside themselves, to see what their mind-set problems are. What is it about my anthropological training that makes me see things in a certain way? What is it about your technical training that makes you see certain things and not others? No one is comfortable exploring these questions about themselves, but it is part of the job that has to be done. ■

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