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SOCIAL THOUGHT & COMMENTARY

The Harder Path—Shifting Gears*

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Introduction

This essay deals with old science practices and the development of innovative practices that are a mixture of theory, research, and practicality. Americans have an extraordinary record in starting up projects, but they have trouble shifting gears. Some say we have created a world where everything changes, but nothing moves. Professional mind-sets, crises, incremental change, and leapfrogging are part of the story. So too is culture—science culture, political culture and the production of knowledge.

In a book about the biological constraints on the human spirit, anthropologist Mel Konner (1982: xii) opened with the following observation: “The problem is not that we know more about less and less. The problem is that we know more and more about more and more, and although we will never know everything about everything the time will come when we know so much about so many things that no one person can hope to grasp all the essential facts...needed to make a single wise decision. Knowledge becomes collective in the weak-

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est sense and science becomes like men and women in a crowd, looking for one another, each holding a single piece of a very expensive radio.”

A. L. Kroeber said much the same about just plain people in 1948 (p. 291): “As the total culture is thereby varied and enriched, it also becomes more difficult for each member of the society really to participate in most of its activities. He begins to be an onlooker at most of it, then a by-stander, and may end up with indifference to the welfare of his society and the values of his culture. He falls back upon the immediate problems of his livelihood and the narrowing range of enjoyments still open to him, because he senses that his society and his culture have become indifferent to him.”

Such Kroeberian observations stem from an anthropological frame of reference that reaches deep into the human past in order to comprehend the moment in which we live. A long time perspective includes recognition of cumulative knowledge, knowledges gathered in real life conditions (Nader 1996). As others have noted, the inventors of myth also invented fire, and the means of keeping it. They domesticated animals, bred new types of plants, kept varieties separate to an extent that exceeds what is possible in today’s scientific agriculture. They invented rotation of fields and developed an art now sought after on the western market. They crossed oceans in vessels more seaworthy than modern vessels of comparable size, and demonstrated a sophisticated knowledge of navigation. Native Americans maintained a continuity of occupation in California and Nevada for over 8000 years, and as my colleague Robert Heizer reminded me, no complex civilization can make such a boast, not yet anyways.

Anthropologists have learned that civilizations are fragile. We have achieved an individual life expectancy, but social life expectancy—that is a more elusive accomplishment. Anthropologists understand that civilizations rise and collapse which indicates of course that sciences too wax and wane. The evolutionists know that in the history of human existence we are but a tiny speck in time. However, we also live in an era in which the technological capacity to obliterate the whole chain of human evolution by catastrophe or by cumulative action is a possibility. Yet, if we look around us, there seems to be little urgency. When a long time perspective is absent, humility is often in short supply.

The capacity of the human species to change the entire globe in irreversible ways was limited until recently, and decisions impacting on group survival must have been shared for most of our existence. We evolved and survived as hunters and gatherers for some 1.5 million years; there’s not much hierarchy among hunters and gatherers. Those who think about this

long past wonder, will civilizational society be able to survive for 1.5 million years? Throughout most of human existence when people made disastrous environmental decisions the scale of destruction was relatively small, even if at times overwhelming for individual groups. The future will not be an extrapolation of the past because there has been a qualitative transformation of the human world. Human technology has moved at breakneck speed, and in modern cultures people do not have the necessary cultural knowledge to routinely participate in choosing technologies though they may want to. It follows that as a species we are unprepared to deal with events unrelated to first-hand experience. Instead we depend on experts.

The cultural dimension in the field of anthropology complements recognition of the global, the unrestricted time perspective and moves us to examine unexamined assumptions of the modern period. Along with other critical thinkers, we subject to inquiry the dominant thinking—that large scale system-centered complex technologies are more likely to spread the good life than small scale man-centered simpler technologies. Rooted in the belief that more is always better lies a system, an ideology, an expertise, a hubris, perhaps, that needs to be subjected to critical analysis, one that needs to be recognized as a controlling process that normalizes such beliefs, leading us to accept them as natural.

This paper reflects on old concerns about dilemmas inherent in expert knowledge and compartmentalization—dilemmas that are in the case of energy associated with stagnation in high places, unscientific attitudes in scientific places, insecurities that produce new and powerful Luddites who stick to old technologies for fear of displacement, with the production of indifference in scientific laboratories, and towards work on new technologies (Braun 1995). My research deals with old science practice and the development of new practices which in the energy field is a mix of theory, research, and practicality, what French anthropologist Claude Levi-Strauss in another context describes as “bricolage,” enlightened tinkering done by people who can see with different eyes and utilize what exists.

I first began to work on energy in the mid-1970s as part of the National Academy of Sciences CONAES Project (Nader 1980). I found a strange field, one characterized by innocence and ignorance, by idealists and impresarios, by pessimists and optimists, by secrecy and wild predictions, by an ethic of waste and recklessness, and across the board by a truncated time perspective. The strangeness was undoubtedly exacerbated by my being the only anthropologist of the 300 or so participants, as well as the only woman.

Also in the mid-1970s someone sent me a prepublication copy of Amory Lovins's famous potboiler "The Path Not Taken" that later appeared in *Foreign Affairs* (1976). Lovins contrasted soft paths and hard paths in energy policy. For Lovins the soft energy path was one full of alternative possibilities and central among them were renewable energy sources. The soft path would make use of the potential in various solar technologies; small is beautiful in the soft path. The hard path would be a continuation or elaboration of technologies such as nuclear, which would be centralized, authoritarian, controlling and not friendly to the democratic process—such distinctions being versions of Lewis Mumford's (1970) earlier dichotomy between man-centered and system-centered technologies. Lovins was seen as an ecofreak, an idealist, a tree hugger, or an impractical dreamer fast on the calculator. In a word, "The Path Not Taken" was heresy.

At the time I did not understand why his work caused controversy. For an anthropologist it was obvious there were different possibilities. It was equally obvious that all energy choices would be linked with if not determinative of other socio-political choices; lifestyles was a favored word. I learned later that Margaret Mead had cautioned young Amory never to use the word "soft" if you're trying to persuade Americans to take seriously a different path, because soft has feminine connotations while hard is masculine and indicative of powerful possibilities; soft paths...well, "caves and candles." In the 1970s every new alternative idea was dubbed "caves and candles," meaning that it was backwards thinking.

Experience was to prove Margaret Mead correct. Soft energy paths were considered feminine and weak by leading energy experts, while hard energy paths with their accompanying high risk possibilities were perceived as intellectually challenging, a test of the mettle of scientific man. On hindsight, my advice to Amory Lovins would have been of a different sort than Mead's, although it would not have changed the substance of his argument. The harder path *is* the soft path, because it is the path that changes the status quo. It requires new institutions, new technologies, science statesmen rather than technician scientists, and engineers who remember the first principle of engineering—keep it simple. Creativity, drive, and a dramatic realignment and disaggregation of scientists and their publics are also necessary ingredients for Lovins' harder or more difficult path.

The harder path is what I wish to call attention to in what follows. I chose this focus because over the years I notice serious students anxiously trying to understand how to change what does not change. I also call attention to the

harder path because it appears that while Americans have a clear and extraordinary record in starting large-scale projects—witness the Manhattan Project—once we have started up we have trouble shifting gears. We have created, as David Noble (1977 xvii) puts it, “a world where everything changes, yet nothing moves.”

There are also interesting and opposing theories of change that need to be addressed. There are those who argue that change in American culture only accompanies crises—like war or depression, the Arab oil embargo or some sort of catastrophe like the Greenhouse effect—while others document the incremental processes of change that transformed American society from an agricultural to an industrialized society (Noble 1977). Other models of change may also need to be examined—the leapfrog approach (a term I believe first coined by Brazilian physicist José Goldemberg) whereby third world countries jump the first world into new technology rather than following a linear evolutionary path of wood, coal oil, nuclear to the new technologies, or the absence of leapfrogging. And of course, chaos theory has generated still other models. More about models later.

First Contact—Discovering Science Practice

As I mentioned at the outset, in the mid-1970s interdisciplinary research on energy was often characterized by ignorance and innocence. I myself was both innocent and ignorant, innocent of how so-called hard science works in practice, and ignorant of the relevant workings of energy technologies, their economic justifications, and above all how an anthropologist might contribute to “solving the energy problem.” Permit me a brief review of my socialization into the culture of energy experts.

When anthropologists are in strange lands and amongst people whose cultures they do not yet understand they often make mistakes, by which I mean they violate cultural rules. Part of our methodology requires that we review such mistakes as a way to begin to profile the culture under study. While doing the energy work I recorded in my notebook instances of such rule violation, and my responses. Words that frequently appeared in my journal were bizarre, out of touch, impervious to evidence, unscientific, trapped. It was culture shock.

I came to realize that energy discourses were often one of “no option.” The inevitability syndrome I called it. Whatever path was being proposed was a “have to path.” For example, “we have to push nuclear because there are no alternatives.” Such a coercive frame was limiting to say the least, especially

since other options were what was being examined. Method was also part of the problem. For example, growth models—that took for granted increasing per capita energy consumption—were disabling when economists (even Nobel economists) were examining less is more options. Also striking was the omnipresent model of unilinear development (a concept that anthropologists had left in the dust decades earlier), with little general understanding of macro-processes. For example, the recognition that civilizations arise but that they also collapse was missing from the thinking about the present. Prevalent was the nineteenth century belief that technological progress was equivalent to social progress. In such a progressivist evolutionary frame science too could only rise and not fall or wane. Furthermore, the possibility that experts might be part of the problem was novel to the expert who thought that he stood outside of the problem. The idea that the energy problem had human dimensions, that it was a human problem, slowly began to sink in, although such realization was rarely attributed to social science sources. Many of my commentaries were adamantly opposed in those years, to put it mildly. Colleagues rejected the idea that the science bureaucracies had a limiting effect on definitions and solutions, and also a framing effect on cultural outlook. This view was adamantly opposed by directors at Lawrence Livermore Laboratory, and by those who believe that science is autonomous and culture free.

In his thoughtful book on the *Social Production of Indifference* Michael Herzfeld (1992) explores the symbolic roots of Western bureaucracy. Herzfeld cautions us not to dismiss bureaucracy simply, as inhumane or inefficient, as did Weber and Marx. Lumping all bureaucracies together means accepting a kind of determinism. He calls for more utopian consideration—critical considerations, what he called a “productive discomfort to the certainties of bureaucratic classification.” Herzfeld understands only too well that, “the real danger of indifference is not that it grows out of the barrel of a gun, but that it too easily becomes habitual. (ibid: 184).”

It was that habituation among energy scientists that pushed me even further to suggest that American scientists were not as free as they thought. It followed that standardization and conformity were incompatible with the possibility for excellent ideas in science to flourish. The most shocking realization was that the most conformist of these energy experts exhibited profiles of reckless experimentation. Distanced as they were from the social fabric, they could easily speak of mass deaths in percentages. Their utterances of disdain, totally unselfconscious utterances, were indicators of the prevalence of group think, and a deep disregard for human life.

To my surprise, after the publication in *Physics Today* of my essay “Barriers to Thinking New About Energy” (Nader 1981), an avalanche of responses from scientists and engineers working on energy questions agreed with many of my critical observations and even expanded on them. They commented on censorship, the predominance of group think, the educational process in science that does little to enhance original thought and a great deal to stop it, the irrationality among energy specialists. They too noted positions that were value laden, macho, unimaginative, self-serving, and unscientific. Such reflections from some of the leaders in the science and engineering fields argued for hope and for disaggregation. Not all scientists and engineers were alike. There were varieties of them. Let me list a few: the scientist who has retained a capacity for critical thinking, the technician scientist who does what he is told without thinking, the impresario, the lobbyist, the propagandist, the conformist, the creative problem-solver. The standard scientific textbook does not describe varieties. On the contrary—the ideal science performer is idealized, essentialized.

Of course, there is a function, to making differences between scientists disappear. It serves to contrast scientists with non-scientists. The light and the dark of such contrast are profiled regularly in the pages of *Science* magazine, thereby ignoring serious differences of opinion among scientists, differences which may be as great or greater than that between the scientist and the lay person. Chemists and physicists have different profiles, as scientists; and each of them from the biologists, the evolutionary scientists, etc. The idea that there is a standard way of thinking scientifically has been questioned by scientists themselves. One need only read Richard Feynman, for instance. Yet a recent *Science* essay (Augustine, 1998) continues the unenlightened tradition of essentializing science to expose the problems scientists have in dealing with “ignorant” lay people. On the other hand, such formulation suggests that scientists are not that different from anybody else in that they observe, make decisions, and ask questions on the basis of cherished values.

Although I had not started out to look at science practice, that was what I was doing. The more I looked at science practice the more it became clear that different actors were caught in different nets. First, the workplace of scientists—the institutions and bureaucracies that hire scientists and organize science work—seemed to expect creativity but to require conformity, standardized thinking and compartmentalized expertise, all within a well defined level of permissible dissent. Behavior is selected for, learned, structurally and culturally transmitted. Beyond the workplace there are the technological

imperatives that drive the actors, imperatives that are enmeshed in particular technologies. A physics colleague recently referred to Los Alamos scientists as “high price, high tech, not good at practical things—shiny and high tech” he repeated.

To understand what anthropologists could contribute to the energy debates I had to understand science practice. This work has since taken anthropologists like Sharon Traweek (1987) and Hugh Gusterson (1996) and others into U.S. national laboratories to study the science culture that C.P. Snow (1964) had written about earlier in his *Two Cultures* book. Such work also involves knowledge of science networking outside of laboratories with industry and government agencies (as in Schwartz in Nader 1996); it examines the symbolic importance of science exhibits denied or modified at the Smithsonian (Vackimes 1996), and includes interviewing interested parties, e.g. about radioactive waste on Native American reservations (Ou 1996). In all this work there seems to be a disparity between the ideal scientific method and its use in ordinary life, between the scientific spirit of free inquiry and censorship. The ideal scientific enterprise shows less than perfect congruence with actual practice because of so many intervening variables like funding and bureaucracies in both civilian and military contexts, or the needs of private industry. How else can we explain the diffusion of civilian nuclear energy before energy experts had written even one article or report on decommissioning a nuclear plant, and before they knew what they were going to do with nuclear wastes?

We had to know all of this if we were to understand why so many energy scientists were unable to shift gears, to even imagine new technologies other than the same old ones they were elaborating and calling “new.” Was it their workplace, was it the laboratory science culture, was it bureaucratic indifference, was it lack of imagination or creativity, was it censorship, was it the government’s welfare program for science, or all of these things?

The Energy Decade—What Happened?

The 1970s was the energy decade. Since then and even with the end of the Cold War the issue is once again nuclear weapons as indicated by the yearly billion dollar budgets targeted for Livermore and Los Alamos for “new” weapons. In the Reagan, Bush, and Clinton years the focus has not been on nuclear energy but on nuclear weapons. Under Clinton/Gore there was not one major talk about civilian energy policies. After the dissolution of the Soviet Union there

was a possibility that peacetime conversion might alter the direction of the national laboratories. There was at least talk that national laboratories might move ahead on new energy research such as solar, hydrogen, or photovoltaic. Alas, the laboratory leadership could not shift gears, and although there were some innovators valiantly working for conversion inside the national labs, peacetime conversion failed, and we were back to business as usual.

Philosopher of science Paul Feyerabend, himself trained in physics, published an irreverent book in 1978 in which he asked “What’s so great about science?” He asked this question to point out that today science stands unopposed, and for Feyerabend that is one of the problems. In the 19th century there were fierce debates about the worth of science between proponents of religion and proponents of science, but in the 20th century, particularly in the latter part of the century, to criticize scientific practice exposes one to Gross and Levitt (1990) type silencing accusations. There is a difference between anti-science positions and anti-bad science and technology critiques. Public opinion on science as if people mattered, or an interest in how science is practiced is necessary for the nourishment of an unopposed science. Physicians, like John Gofman who is also a physicist, have spoken out against the “expose the people first, learn the effects later” syndrome. Gofman was thought to be an extremist by some, while public utterances like Sigvard Eklund who was general director of the International Atomic Energy Agency, were apparently not extremist. As noted in Brown and Brutoco (1997:25). Eklund says that “the problem of the nuclear power industry is that we have had too few accidents...It’s expensive, but that’s how you gain experience.” When statements like that pass for “normal” it makes one think that Feyerabend is on the right track—science is being treated like the religious phenomena it fought a century earlier, impervious to doubt, and reckless as well.

Some Recent History

After the Cold War, justification for nuclear research was replaced by new justification—the rogue states of Iraq, North Korea, Libya, etc. Business as usual continues. Since the 1990s, in the United States nuclear power is being revived and described as a new generation of safe, clean plants, and we still do not know much about decommissioning or what to do with nuclear waste. Bureaucratic intermingling of civilian energy needs and national security needs at the DOE weakens possibility for conversions at the labs. As David Noble says “everything changes and nothing moves,” seemingly at least.

After dropping the atomic bombs on Hiroshima and Nagasaki in 1945, the public debate was about nuclear military power. Later Sen. McCarthy branded scientific dissidents on the subject guilty of treason. In 1962 Linus Pauling won the Nobel Peace Prize for his work to stop the atmospheric testing of nuclear weapons. Scientific dissent about the health, safety and environmental impact of nuclear energy surfaced in the late 1960s with the research of Gofman, and Tamplin, and Sternglass. In 1971, nuclear engineers and physicists of the Union of Concerned Scientists questioned the safety of nuclear power claiming arrogance, expert elitism, and stacked AEC proceedings. There was a national movement against nuclear. At the same time, however. President Nixon expanded support for nuclear energy, which was in some small measure reversed by President Carter. For some Carter had authority; he was after all a nuclear engineer.

In the Carter years there was an expansion of coal, synthetic fuels, alternative energy and conservation. In the same period, anti-nuclear activist Karen Silkwood was killed in a car accident leaving people wondering about stakeholders. There was the 1975 fire at the Browns Ferry nuclear plant. Four reactor engineers defected from the industry to speak out. 1977 brought anti-nuclear protests at the Seabrook and Diablo Canyon plants. In 1979 the accident at 3 Mile Island happened and in 1986, Chernobyl. But it was the Reagan revolution that decisively ended the energy decade and shifted the discourse once again from nuclear power to nuclear war and weapons. President Reagan branded anti-nuclear activists as modern-day Luddites. With Presidents Reagan and Bush, down went credits for renewables, down went the Solar Energy Research Institute (SERI) and solar energy subsidies, down went government research and development and on energy options. President Reagan took President Carter's symbolic solar panels off the White House, discontinued solar energy tax credits, and had the safe efficiency car model that had been developed by a father and son team in Santa Barbara with tax dollars and which ran over 55 miles on the gallon physically destroyed, thereby adumbrating the real Luddites.

Shifting Gears—New Alliances

It is worth paralleling these political happenings with other happenings that were not making big headlines. An alternative energy paradigm of the sort that Amory Lovins had written about in 1976 was moving forward. A coalition of business executives, consumers, environmentalists, scientists, labor lead-

ers and legislators brought about a conservation revolution in some of the nation's largest electric utility companies. The conservation revolution was an alternative to building new base-load nuclear or coal plants. At the same time a generation of energy entrepreneurs and solar scientists were demonstrating viable alternatives. American ingenuity was creating new technologies that challenged the old technologies. They demonstrated the potential to transform the energy system through renewables such as solar, light weight electric cars, super efficient light bulbs, giant wind farms- showing that a handful of innovators, private citizens, and business executives can effect an un-official public energy policy through organizational work, and activism.

People began to remember history and an expanded time horizon. Those living during the 20th century will be seen as having been on a drunken oil binge. From a geological time perspective, oil took millions of years to create; spending it was a brief aberration in world energy history. Oil and coal fuels are sunset industries, but the society is still a hydrocarbon society. 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 nineteenth century we had automobiles running on electricity, and steam power, as well as gasoline (Montague and Bird 1971). In 1902, the President of the American Chemical Society, Harvey Wiley (1902) who was both chemist and physician, predicted that the United States would be running on solar by the 1970s.

A few examples of how an un-official energy policy was chartered would include breakthroughs mobilized by green utility executives, free market regulators, independent power producers, demand-side efficiency experts, renewable energy innovators and solar entrepreneurs. In California, several of these people have become well-known public figures. They took the harder path and came up with some interesting results. John Schaeffer, who was inspired by the 1970 Earth Day, graduated from the Berkeley Anthropology Department in 1971. He got into the rural revitalization and independent living movements, developed a business in renewables despite the miserable level of federal investment in renewable research and development. While new energy technologies were being mothballed in Washington, Schaffer's *Real Goods* was operating 3 successful retail stores plugging into the sun (see also Berman and O'Connor 1996).

The anti-nuclear and environmental movements were making alliances with progressive utilities, once seen as the enemy. Unusual people like David Freeman, author of *Energy: The New Era* (1974) which brought him to the attention of President Carter, energized the Sacramento Municipal Utility

District (SMUD). Freeman claims to have been educated by a group of activists who were fighting a nuclear power plant in New England, and was inspired to join the race for survival of our high energy civilization. At SMUD he ran a tight ship strictly on economic criteria. As Freeman explains, it was a competition with Japan as a high tech leader in the solar and hydrogen energy and transportation fields. He recognized obstacles to the great industrial opportunity of the future to capture the automobile and energy markets: the nuclear power industry discredited on the grounds of economic malpractice as well as safety problems, the Exxons, the Texacos, the anti-Progress status quo which includes the federal government. The rules of the present energy economy were established to favor systems in place. There is an obvious inconsistency between free-market policies for the economy, and the state supported policies for science of an industrial relevance. But that did not stop David Freeman.

The Sacramento Municipal Utility District (SMUD) began moving in 1984 when Sacramento residents voted to close Rancho Seco, a nuclear power plant plagued with technical problems. SMUD moved quickly into renewable energy. They built two of the world's largest, utility-owned photovoltaic power plants—twenty acres worth—that surrounded the defunct Rancho Seco Plant. Not much, but a start. In 1994 SMUD opened its Hedge Solar Station. Solar collectors were mounted on customer's rooftops and the rooftops of 5 churches. SMUD is harvesting wind and a host of other initiatives such as mini-power plants and co-generation; and using trees in lieu of air conditioning. Currently SMUD produces over half of its energy from renewables and conservation in such items as refrigerators, and has even developed electric transportation. Freeman aimed to create a new federal industrial policy. In 1994 he was appointed president and chief executive officer of New York State Power Authority, taking with him the view that we are awash in power and don't need the large dams planned for Quebec. Freeman referred to himself as an electric repairman. The ecofreaks of the 1970s were innovating, while those backing the sunset technologies are the new Luddites, bureaucratic technicians afraid of being work displaced or downsized.

The alliances and cross-linkages have been extraordinary. Would we have imagined in the seventies the Royal Dutch/Shell group buying into Lovins' "Road Not Taken"? The nuclear cycle is a nightmare—from the uranium mines, to the dumping of tailings, to the transportation of radioactive materials, to the spent fuel rods, to the plants as national security problems, the ambiguously labeled low level waste and high level waste. There are also

worries about the Greenhouse effects. John Brown of British Petroleum and European insurance executives are taking global warming seriously.

As Amory Lovins put it—before buying a bigger bathtub because the water keeps running out, go get a plug! Bricolage is attractive. Southern California Edison's John Bryson (Lerner 1997) pointed out there's no need to mention nuclear, environmental threats, etc. Small is beautiful and profitable...nothing futuristic, nothing experimental, nothing technically faulty, they made more money by saving. A small amount of leverage can produce a powerful effect. Conservation and alternative energy, Bryson noted, could replace at least 9 out of 10 big plants the company has on the drawing boards. In the meantime the nuclear and oil industries continued to argue that renewable energy technologies are idealistic and futuristic, but they were speaking less and less about Luddites, or anti-progress eco extremists.

Consideration of the past 25 years in energy is instructive. Mundane changes were a reality by the time the National Academy CONAES report was published in 1980, even though the mainstream expert savants said it couldn't happen by the year 2010. They were way off in their predictions, 30 to 40 years off. We have automobiles that run more miles per gallon of gas (albeit alongside gas guzzling utility vehicles), and refrigerators that use less energy without reduced functionality. Refrigerators marketed in 1972 consumed 14 watts per cubic foot, compared to 6 watts for the average refrigerator sold between 1925 and 1950. Wasting power replaced prudent use. In 1978 the average refrigerator used 1,663 kilowatt hours per year as compared to 819 kilowatt hours per year in 1994. The energy savings from refrigerator efficiency alone roughly equals 36,000 coal-bed methane wells (see Hawken, Lovins and Lovins 2000). The Europeans have moved even faster. Denmark's Gramm is over twice as efficient as the best American built refrigerator. For homes without air conditioning, refrigerators use 20 to 50 percent of electric power consumed. It has taken about 50 years to surpass the performance of the average refrigerator sold between 1925 and 1950. Efficient compact fluorescent lamps consume only one fourth the energy of common incandescent lamps. It is important to remember that the U.S. is the world leader in energy consumption and production of Greenhouse gases.

The economists who coupled economic growth and energy consumption were wrong about the futures they predicted. It is possible to have economic growth with reduced energy consumption. Brazil taught us about the problems of producing alternative fuels like ethanol, but they continue to move ahead. Russia provides a dismal example of an undiversified energy policy

dependent on nuclear power. The coupling of technological progress with social progress is held as erroneous at least since Jefferson's time. Evolution is not necessarily linear nor built on technological progress.

But the irony of the last 25 years is also in our headlines. Although there has not been a new nuclear plant ordered for well over a decade in this country, the US nuclear industry has produced nuclear plants for Asia (Cole 1998). Asian waste, as part of the sales agreement, now in the form of spent fuel rods is sent to the United States. The waste from other countries was not part of the civilian scenario but rather part of the military non-proliferation agreements. Nevertheless, the reality is that the beautiful states of Idaho, South Carolina, Kentucky and elsewhere, for the most part not known to the general public, are becoming dumping grounds for nuclear fuel rods and other forms of waste, from other countries.

Washington Will Be the Last to Know—Why?

The phrase "Washington will be the last to know" appears frequently in the literature on un-official energy directions. There is little question that environmental policy has been affected by the oil, coal, and chemical companies, by the power of the automobile companies, by national security interests. Energy involves technology and profit making, as well as a number of other things that are subject to fierce bidding such as the forms of energy technology and who should profit. When as part of the 1980 National Academy CONAES' study, mathematical sociologist Otis Dudley Duncan asked, "How did we get into this mess anyway, and are the people who got us into this mess still in charge?" he was referring to a legacy of corporate and government bodies that decided on the modes of technology and the energy choices, and on the economic organization surrounding these modes. The gravity of the issues, i.e., safety, renewability, scarcity, intermittency, international crisis, civil liberties and inflation, make it all the more strange that energy policy was treated as if it were estranged from its environment of political and economic power. The fact that the phenomenon of power, corporate and government power, has been excluded from most analyses of energy policies has made it difficult to understand the conflicting positions of the groups involved and the contradictory nature of official energy reports. The pretense of objectivity requires that social power discussions not be included. The most recent study on Greenhouse gas projections provides an example. One might argue that we don't need more reports to tell us what government needs to do.

On the other hand, these reports serve as ritual face-saving devices, or sometimes as forms of non-violent dueling or status quo maintenance. In preparation for meetings on reducing emissions of Greenhouse gases, Clinton Administration economists were arguing that complying with any international agreement on Greenhouse emissions was too expensive, thereby endangering U.S. cooperation. A 5 lab report (Chen 1998) examined carbon-reduction strategies. The report served to counter the position of the market economists thereby allowing the U.S. to move slightly in the direction of reducing carbon dioxide output in the United States before the meeting in Kyoto in spite of Administration economists predicting that such action might harm the economy as much as the oil shocks of the 1970's. Incredible as it might seem, the choice was between the chance of a recession in the next few years and the near certainty of drastic environmental change within 50 years (McKibben, *New York Times*: 8 March 1997, p. A19).

In Washington the economists disagree with the imperatives of the Greenhouse scientists; the physicists blame the economists for market paradigm myopia. And reports are the means of argument. The reports are not contaminated by political content, nor are they contaminated by paradigm assessment, and taken literally they produce unreal assessments. A form of denial. Meanwhile the unofficial energy efforts are proceeding unabated in the style of bricolage, while in other countries governments are achieving dramatic success. Germany and Japan are two success stories. Germany passed the United States to become the world's leading wind energy producer in 1997. In less than a decade, Germany achieved 10% of its total electricity demand through wind power. Japan's experience with photovoltaic also in the 90s decade moved the country to become the world's largest producer and user. Japan has three times as much photovoltaic capacity as the United States. And as others have noted, "It is difficult to claim that something is impossible once it has already occurred" (Swain 2004).

Crisis, Bricolage and Models of Change

People who operate with the crisis theory of change usually model change as a series of punctuated events. A period of stability is interrupted by a period of rapid change, followed by another period of stability. This parallels a model in biology of change operating in a nonmonotonic manner and suggests that cultural change may often operate in this manner, rather than in a steady monotonic drift. Energy scientists and government commissions commonly

operate with the crisis theory of change. Things only change when there is a crisis. They point to the 1971 crisis in oil, the 1973 oil embargo, the hot summer of 1988 which stimulated the interest in Greenhouse effects now viewed as a crisis. In this model crises are what make things move, and one does not worry about things not moving while waiting for the next crisis, or the third flood as one scientist predicts.

Those who work with the incremental model of change visualize change as happening bit by bit, even if it is two steps forward and one step back, confident that things are quasi-reversible. People working in the bricolage mode press on from one pioneering task to another. The eco-pioneers see themselves as preparing for the future in this manner, and so do many energy conservationists. The Germans and the Japanese see the incremental model as a win/win solution to jobs, environment, and energy independence.

Yet others work with linear models of development or whatever they define as progress, a models which postulate that anything that might interrupt unilineal movement is either not feasible, or anti-progress. They are the “can’t turn back people.” For them things are not even quasi-reversible. They are the experts working on nuclear power, the new Luddites some call them, science workers who fear displacement, and therefore fear the new energy technologies. Their whole life work is threatened. Those who think unilineal development is inevitable might read Noel Perrini’s (1979) wonderful book *Giving up the Gun: Japan’s Reversion to the Sword* indicating that “progress” is not an inexorable force outside of human control.

The crisis model is useful for governments and corporations. Crises serve as justification for shifting gears and shafting people. The incremental model is used by people and groups with more flexibility, more slack. They make alliances in unexpected places. Those who espouse the linear model perceive themselves in one lane. They look for shortcuts to maintain or extend their power.

In 1984, a business executive, Harold Willens, wrote a book titled *The Trimtab Factor—How Business Executives Can Help Solve the Nuclear Weapons Crisis*. He starts out: “In the world of business, unexamined assumptions, justifications, and self-deception can become prescriptions for bankruptcy. Successful executives, managers and entrepreneurs must be objective, open minded, and flexible. They must know when it is time to cut losses and move in a new direction (ibid:23).” Willens then introduces architect R. Buckminster Fuller’s notion of the “trimtab.” Fuller made use of the analogy with large ships that in days past had a second, smaller rudder—the trimtab. By exerting

a small amount of pressure, one person could easily turn the trimtab. The trimtab then turned the rudder, and the rudder turned the ship. Thus, the trimtab factor demonstrates how the application of a small amount of leverage can produce a powerful effect. Willens saw the trimtab factor, in this case the leverage of business leadership, as changing our direction in the nuclear-weapons crisis. I think it significant that a business man, a sane and sensitive business man, profiled the trimtab factor in relation to business mobilization on issues of nuclear war. His criteria for what a good business man might do would have been good advice for the nuclear industry to heed, had they been subject to market principles rather than welfare principles of the federal government. Furthermore, thinking about how trimtabs actually work sensitizes us to the likelihood that, like almost any control mechanisms, trimtabs are double edged. Witness utility deregulation in California and the disastrous results between 2000 and 2001.

Machiavellian Power

I noted earlier that most of the discussion and reports on energy needs do not contextualize the issues in terms of another kind of power—corporate power. I conclude with reference to the utility deregulation that started in California with the unanimous passage of AB1890 in the California legislature in 1996. The bill demonstrates the complexity of cross-interests which built into a crisis that not all energy players were prepared to deal with—the restructuring of the \$212 billion-a-year power industry. Willens was right—business has clout in the government; in contributions to state legislators the utility lobbyists are second to none. Although AB1890 passed unanimously some legislators certainly had second thoughts by the year 2000.

Those for deregulation advertised, in the March 22 Sunday Chronicle and Examiner supplement on “Energy After Deregulation” (1998), that deregulation increases choice, a choice of power companies, suggesting that competition of electric service will provide large dividends, better service, and more innovation responsive to consumer needs. They described the CTC or Competitive Transition Change as “the means by which state law allows the electric utilities to recover the reasonable costs of their uneconomic power plants and high-cost purchased power contracts” and reminded the reader not to be “misled by those with political agendas.” The headlines were meant to call attention to novelty: “PG&E to offer ‘Green Power,’” “New Entrants Now Free to Compete,” “Fuel Cells Have Potential as Important Electricity Source.”

As they indicated, the supplement was an advertisement. Division and double talk are the themes.

The other side of the picture looked a bit different. Consumer groups warned that deregulation will drive prices down for big industrial users, up for homeowners, renters, and small businesses. Unions claimed that deregulation was a thinly veiled move to de-unionize the utility industry. Environmental groups that originally thought deregulation might be the way to shut down nuclear reactors were divided with NRDC and utilities on one side and the rest who thought deregulation will prop up dying nuclear plants while diminishing advances in renewables, conservation, and pollution control. We were in an oil and gas glut, at that moment. Furthermore there was the outrage that state legislatures are helping utilities with a “strained cost” of \$135 billion in bad reactor, investments—stranded costs translates as imprudent investment and the gift of utilities as corporate welfare. As one public citizen advocate put it “What California has defined as deregulation means that the big utilities will get the public to pay for their nuclear plants, and then establish a network of nonunion unregulated monopolies.” Indeed there does appear to be a merger frenzy (Wasserman 1998).

The NRDC claimed that AB1890 provided some \$872 million for conservation and another \$540 million in subsidies for renewable energy industries—merely drops in billion dollar buckets. There was a referendum brewing in California. The challenge was how to explain the complexity in a sound bite. A senior advisor to Greenpeace (Wasserman 1998) put his finger on the ultimate threat to private utility giants—the idea of public power: “Those municipalities that fought through mountains of legal red tape to win their own utilities have enjoyed far cheaper rates and better service.” He continues: “In 1989 Sacramento’s Municipal Utility District became the first to vote to close a reactor and replace it largely with solar and wind power to increase efficiency, a transition that has brought worldwide attention.”

AB1890 was a happening, an event, what anthropologists might refer to as a social drama. There was no pretense—the players and their interests are all out there. All the powers—raw corporate power, social power, environmental power, and the power of renewables—all there for us to see. The agenda was a broad one. Some say it was about reforming our largest industrial sector, an issue which takes us back to the real reason why Amory Lovins’s 1976 paper was considered heresy—democratic control. Human-centered or system centered was the issue, and as such was not an issue for experts—unless the expert is the person downwind from a nuclear reactor. This was an issue for

citizens. By 2004, the California energy crisis of 2000-2001 is being fought out in the courts as an energy conspiracy, a conspiracy by means of a series of schemes known within Enron as Death Star, Get Shorty, Ricochet, and others (Corporate Crime Reporter, vol. 18, No. 32, Aug. 2004).

Concluding Comments: A Blind Eye

In the 1950s James D. Conant, one of the 2 overseers of the Manhattan Project and president of Harvard University, thought that by the end of the century solar energy would be “the dominating factor in the production of industrial power” (Hershberg 1963:595). He had in mind a vast technical undertaking modeled after the Manhattan Project. Conant the chemist also referred to “our friends the atomic physicists” as the modern alchemists. Casks that are inches thick won’t leak, but they do. Hanford is leaking into the Columbia river. Nuclear waste is being transported back to the US through the Bay Area for national security reasons, but there is a security problem in that very transport. The Titanic couldn’t be sunk, but the unsinkable sank. The inability to see past a short span of time means we can’t see what kind of a world we have created. A new world has spawned multigenerational technologies whose very interconnectedness generates cost and security problems as a break in the chain will reverberate throughout the society. We need an answer to Otis Dudley’s question, “Are the people who got us into this mess still in charge? If so, why?” And how is it that the Germans and the Japanese can accomplish in a decade what the United States has not been able to achieve in several decades? If knowledge is power, anthropologists have their work cut out for themselves.

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