WHY "SOFT" TECHNOLOGY WILL NOT BE AMERICA'S ENERGY SALVATION

Petr Beckmann

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By Petr Beckmann*

SOLAR ENERGY: THE ENERGY THAT NEEDS PUSHING

Make no mistake: Solar energy is a good thing. It is well suited for residential space heating and cooling, and for domestic water heating — certainly in Florida and the South-West, and to a certain extent in the rest of the US.

It can supplement more concentrated and more versatile sources of energy when only small amounts of energy are needed, especially in inaccessible places (such as repeater stations of microwave relay lines).

That is no small contribution to an energy budget that is being throttled by government interference and "ecological" obstruction. But it is not enough to provide the lifeblood of an industrialized society.

It is not even enough to supply the necessary energy to the solar energy industry itself (for manufacturing solar collectors and other components): Solar energy is not self-sustaining.

That this is so will be shown in a moment; but the technical aspects of solar energy are not what the current push for solar energy is about. Indeed, if solar energy were merely a technical question, it would make it on its own merits without any pushing.

When wood was pushed out by coal as the principal energy source, was it because 19th-century Jane Fondas and Lola Redfords intoned mantras to celebrate coal? When coal, in turn, was replaced by oil, was it because the President of the United States proclaimed a National Oil Day and asked for half a billion dollars to do research on oil drilling? In our own day, clerical and menial work of all kinds is rapidly being displaced by electronic data processing; is that due to bumper stickers exhorting "Switch to Computers"?

Obviously not; all of these things were good enough to make it on their own and did not need any pushing; what's more, people did not need the government to get involved in them.

Part of the reason why "soft" technology is being pushed is that it is not good enough to make it on its own; but the other part is that the pushers are not after technological quality anyway: They are motivated by ideology and visions of social engineering. The alleged technological and economic advantages of "soft" energy sources are merely a propaganda cloak wrapped round this deeper motivation.

That this is so is apparent not merely from the fact that the pushed technology needs pushing; it is also evident from the zeal with which the pushers seek to stamp out *other* power sources. There is not the slightest reason — other than gross inferiority — why "soft" sources should not coexist with centralized ones; indeed, if they are all Mr.

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Lovins promises they are, he could just sit back and gleefully watch them take over, because they are (he claims) so much better, cleaner, safer, more economical and more reliable. And if the world is too narrow-minded and set in its ways to appreciate these revolutionary techniques, Nader and Lovins could still withdraw to their own model communities to show an ignorant and biased world how superior windmills and solar collectors are to central power stations.

In fact, of course, it is obvious that Nader and Lovins are not so much pro-solar as they are opposed to central power generation, in particular, to its cleanest, cheapest and safest form, nuclear power.

But even though it is not the technological aspect of the "soft" energy sources what the controversy is really about, it is well to examine precisely these aspects first — among other reasons to see just how flimsy the propaganda cloak is.

"SOFT" ENERGY IS DILUTE ENERGY

What the proponents of "soft" energy sources most often mean by this term is either direct or indirect solar energy — indirect being wind, waves, biomass, and other ways of harnessing converted forms of solar energy. However, they oppose central solar energy conversion such as Ocean Thermal Energy Conversion.

Solar energy has one salient characteristic that will never change: Its flow is very dilute. It comes in at the rate of 1 kilowatt (kW) per square meter (about 11 square feet) at the best of times — when the sun shines unobstructed and perpendicular onto the collecting area.* That 1 kW/m² is a value that will never change upward; no level of technology, no amount of money, no genius of human inventiveness can ever change it.

One way of appreciating the diluteness of solar energy is to reflect on the three known methods of concentrating it in prodigious amounts. The effort of concentrating it, either by accumulation in time or by funneling it in space, is so vast that nothing as puny as man has been able to achieve it; only Nature herself has the gigantic resources in space, time and energy to do the job.

The first method is accumulation in time: Solar energy that has been accumulated over millions and millions of years is today concentrated in fossil fuels. It was the sun that supplied the energy necessary for forests and plants to grow; that energy came in day after day and was captured by the chlorophyl in the plants year after year, century after century, millenium after millenium. The energy, still held in the dead plant's chemical compounds, was carried by rivers into sediments where under burdens of further layers it was concentrated into hydrocarbons while the energy-poor constituents escaped in a process not altogether unlike the one used by ancient colliers to turn wood into charcoal. After millions and millions of years the accumulated sunshine resulted in fossil fuels such as coal or oil.

To get an idea of how concentrated the energy is in coal, and how dilute it is in sunshine, consider a lump of coal needed to make 1 kilowatt-hour of electricity. It weighs a little under a pound, and when held in the sun, its shadow (which is the intercepted cross-section of the sunbeam falling on it) would measure perhaps 15 square inches. How long would the sun have to shine on those 15 square inches to bring in 1 kilowatt-hour of energy?

For 1,000 hours of pure sunshine. In the Arizona desert, where the sun is out 12 hours a day, that is almost 3 months. For the average location in the US, our little lump of coal would have to be out for almost half a year to be struck by a total energy of 1 kWh. But only struck by it; if we wanted to get 1 kWh *out* from that sunbeam, we would have to

* This is the rate or *power* at which the energy comes in. The amount of energy is what accumulates: If the sun shines on a square meter of collector area for one hour, the energy that has come in (though much of it is reflected back into space again) is one kilowatt-hour (kWh).

divide by the conversion efficiency. For direct conversion from light to electricity, a great success has recently been attained, though as yet only in the laboratory: The efficiency hit a full 10%. So our 15-inch sunbeam would have to be harnessed for *five years* to yield the same energy as the little lump of coal blocking it will yield almost immediately.

That is how concentrated the energy is in coal, and how dilute it is in sunshine.

Nature also concentrates solar energy in space; we tap it as hydropower and may tap it in future by a method called OTEC.

In the case of hydropower, water rushes from a reservoir through a hydraulic turbine, which turns an electric generator. But it is the sun that ultimately gets the water from the lower river back into the reservoir behind the dam.

Hydroelectric plants can have very large capacities: Hoover Dam has 667 MW, and the Grand Coulee plants on the Columbia River will have more than 5,000 MW. But consider the energies involved in getting the water back behind the dam. They are not easy to gauge: the billions of tons of water raised by the sun from the sea by evaporation and rained down again back to earth, and the funneling of water through creeks, streams and rivers into an occasional reservoir with a puny little dam. The Missouri River, for example, drains 529,400 square miles of area and is harnessed to yield 3,370 megawatts of electric power. Draining 1/7th of the US land area will thus provide electricity for only about 1/70th of its people. (This is not drastically different from the overall figures: Hydropower is 14% of US electric capacity.)

The third method, Ocean-Thermal Energy Conversion (OTEC), has never been tried on a commercial scale, but is expected to yield electric power by the megawatt (a million watts) or even by the gigawatt (1,000 MW). It makes use of the small temperature difference, about 20 °C, between the upper layers and the deep water of tropical oceans by using a liquid with a low boiling point (such as ammonia) as the working fluid in a vapor turbine cooled by the water pumped up from the ocean depth. The temperature difference running the system is due to the sun, which warms the upper layers of the oceans.

All three cases of harnessing energy that was originally solar have some points in common. First and foremost, it is nature that concentrates it; man simply taps what nature has collected. The three cases not only show how dilute the original solar energy was, but what an effort, on nature's part, is involved in concentrating it. For hydropower, the effort of "getting the water back behind the dam" involves processes in the atmosphere which are loosely lumped together as "weather," and which involve truly gargantuan amounts of energy. A single hurricane, for example, unleashes the energy of 1,000 hydrogen bombs.

What is generally understood by solar power today, however, is the collection and conversion of solar energy by *man-made* gadgets. If this power were to replace fossil fuels and hydropower, as geniuses like Amory Lovins advocate, man would have to collect and concentrate that energy on roughly the scale that nature does it. It is an idea that is not exactly what one might expect from the admirers of the "small is beautiful" concept; for it is one of unparalleled megalomania and a fantastic overestimation of technology.

Second, all three cases can only give limited amount of energy in the US. That may not be quite true in the case of fossil fuels, whose abundance has not been tested under free-market conditions. But what transpires from various indirect inferences (in an energy economy acutely distorted by government price fixing) is that oil and gas production may have peaked in the US; and coal is a fuel that is inferior from the point of view of safety and public health. But certainly hydropower and OTEC are sharply limited in the US. Hydropower was decreasing as a fraction of total capacity even before the "ecologists" actively slowed or stopped its growth, simply because the US was running out

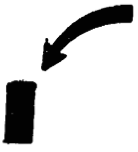
of suitable sites. The fraction of US hydropower is now down to 14% of electric capacity. Finally, OTEC, should it ever become economic, could be used only in tropical or subtropical seas, which limits it to waters off Florida, the Virgin Islands and Hawaii.

The third point the three cases of large-scale solar energy have in common is a very characteristic one: The "solar advocates" like Lovins, Nader, Brower or Hayden vehemently oppose them. When they say "solar energy," they mean a rich man's toy; energy by the gigawatt is not quite what they have in mind.

SOME CONSEQUENCES OF DILUTENESS

Dilute energy means little energy per unit volume or per unit collecting area. If there is little collecting area (such as the roof of a house), there will be little energy — enough to heat or cool a home perhaps, but only about 13% of the US energy budget goes for residential heating.

Conversely, to convert large amounts of solar energy for distribution to consumers needs enormous areas. A 1,000 MW coal-fired or nuclear plant needs about 25 acres of land, and that includes storage, security and all other auxiliary areas. But a 1,000 MW solar plant would need about 50 square miles.*



If this represents the area taken up by a nuclear or fossil-fired plant of given capacity, then the area of a central solar power plant with the same capacity is given by all of this 6 by 9 inch page. If the solar power is not produced centrally, but in many small facilities, the disproportion becomes even more lopsided.

The solar scholars have an answer for the land-use problem, of course; they dismiss it by pointing out that less than 1% of the US land area, if covered with collectors, would be sufficient to harness the entire present US energy demand.

Now 1% of the US land area is a cool 35,000 square miles, which the "soft" energy advocates seem to regard as chicken feed. Often they point out that no more area would be needed to satisfy US energy demand by solar power than is covered by the US road network.

No more, indeed! All of the US road network, that's all. It took more than two centuries to develop, and it represents an investment of untold hundreds of billions; and to "switch to solar" takes no more than that.

Granted, the idea of covering 35,000 square miles in the US with solar collectors is only economically absurd; it does not contradict any physical laws and is technically feasible. But the diluteness of solar power is also the reason why some cherished projects are unfeasible for technical reasons, no matter how much money is spent on them.

One of these is the solar automobile that runs on its own collectors. There is no technical reason why it should not be possible to run vehicles on solar energy that has been collected, converted and stored by other facilities (even though today the concept is not practical); but the solar automobile that runs on energy converted by its own collectors is a dream that can *never* work, no matter how much technology progresses. The reason why this can be stated with such confidence is again the diluteness of solar

* A 1,000 MW plant is one that can give 1,000 MW whenever required; if a solar plant is to give it on a cloudy day or at night, it must draw on its storage facilities, which must be replenished at several times the peak demand capacity of 1,000 MW. A pilot plant now under construction at Sandia Labs in Albuquerque, N.M., is one that will have 5 MW thermal, and therefore about 1.5 MW electric, from collectors spread over 10 acres. Allowing a 5 : 1 storage replenishment vs. capacity drain, this results in 50 square miles per 1,000 MW capacity. Photo-electric plants would, of course, spread over a larger area because of their lower efficiency.

The solmobile. Model A will run for 1 day after standing in the sun for 1 month. Model B, with 660 square feet of collecting area, will run whenever the sun is out. Both models assume unlimited progress of technology. With present technology, model A would have to stand in the sun for a whole year to do one day's driving.

energy, and anyone can check it out with a pocket calculator: The sun gives 1 kW/m² (when it is out and shines at right angles to the collector); even a small car needs some 25 HP (1 HP = 0.746 kW); it could have 2 m² (22 sq.ft.); the average length of sunshine in the US is a little over 6 hours per day; if the storage facility in the car (battery? flywheel?) is to take up energy 4 times faster than it is being drained — for driving on cloudy days or at night — this works out to letting the car stand in the sun for 1 month in order to do one day's driving. And we have assumed 100% conversion efficiency to account for the coming miracles of technology; with present technology it would have to stand in the sun for a whole year.

Alternatively, the car could be driven at any time the sun is out if it had a collecting area of 660 square feet (say, 22 by 30 ft), which would make for good driving over the Salt Flats in Utah. Small is beautiful!

There are other dreams that are not only economically absurd, but also technically false. Lovins claims, for example, that a relatively small chemical industry could produce, by organic conversion, enough fuel to supply one third of present US gasoline requirements. What he has in mind is running cars on alcohol (methanol or ethanol) gained by fermenting urban wastes, forestry and agricultural products. In his usual amateurish way he bases his figures on the present beer and wine industry; he fails to account for the water content of alcoholic beverages, which inflates his figures by 2000%, the customary Lovinsian error margin. All of which is merely *economic* absurdity, for technically it is indeed possible to run internal combustion engines on alcohol-gasoline mixtures, or if the engine is suitably modified, on pure alcohol.

What has, however, escaped Lovins' genius is that the beer and wine industry was meant to produce and sell beer and wine; as an energy conservation facility it has been a distinct failure. There is a lot less energy in whisky than in the rye it came from; this is not economic guesswork, but a simple outcome of calorimetry.

More specifically, for corn (the prime candidate) to be turned into alcohol as fuel, Prof. P.J. Reilly of Iowa State University's Department of Chemical Engineering gives the following figures: One bushel of corn will produce 2.6 gallons of ethanol (alcohol) at an energy cost of about 375,000 BTU; but when those 2.6 gallons of ethanol are burned, all they yield is 218,000 BTU (and even of that, only 20% are usefully converted in an internal combustion engine).*

The project is technically feasible — as a scheme to waste energy.

* For more detailed energy budgets see "Gasohol: energy mountain or molehill," *Chemical & Engineering News*, 31 July 1978. The energy balance could be favorable when the material to be fermented is a waste product (such as timber waste), but there is not enough of it to make the process significant; alternatively, suitable crops with low energy inputs, such as sugarcane and certain jungle plants (abundant in Brazil, but not in the US), could possibly result in a positive energy gain.

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HOW SOFT ARE "SOFT" TECHNOLOGIES?

The buzzword "soft" is meant to convey the idea of gentle measures that have little or no effect on the environment; the "hard" nuclear, fossil-fired and other centralized technologies are allegedly the ones that rape the earth and threaten the survival of man.

The sober figures of environmental impact and public health, however, tell a very different story. The vastly larger areas needed to generate electricity via solar power are only a small part of that story; the diluteness of solar energy reappears when the safety and the necessary materials for solar facilities are considered.

It has been shown elsewhere that the energy source that, per unit energy produced, costs less in human lives and human health than any other concentrated source (let alone one as dilute as solar energy) is nuclear power, and the point will not be repeated here.*

But solar energy is not at all benign in its environmental impact: To construct a 1,000 MW solar plant needs an excessive amount of materials: 35,000 tons of aluminum, 2 million tons of concrete, 7,500 tons of copper, 600,000 tons of steel, 75,000 tons of glass, 1,500 tons of chromium and titanium, and other materials.**

Why is this amount excessive? Because it is about 1,000 or more times greater than the amount of materials needed to construct a coal-fired or nuclear plant that will give the same power. Even in concrete, of which nuclear plants use a prodigious amount due to the massive containment building, a solar plant exceeds the needs of a nuclear plant of equal capacity by a factor of 500 : 1.

If the 1,000 MW are not converted centrally, but in many little domestic solar units, the material costs are, of course, even greater, for roughly the same reason as McDonalds' uses less oil to fry two tons of french fries than 8,000 housewives who fry half a pound each.

The excessive use of materials for solar facilities has two other consequences: waste disposal and energy use.

The manufacture of these large amounts of material and the immense energy use to produce them inevitably gives rise to wastes, many of them highly toxic and destined to remain forever in the environment. Only one kind of waste can be completely removed from the biosphere because they are minuscule in volume and their toxicity is only temporary: nuclear wastes.†

These vast quantities of materials do not come cheap, and that does not mean the dollar costs alone, but above all the energy consumed in manufacturing them: 75 million BTU per ton of aluminum, 56 million BTU per ton of steel, 18 million BTU per ton of glass, and 12 million BTU per ton of concrete, for example.

The energy that goes into the construction of a solar thermal-electric plant is, in fact, so large that it raises serious questions of whether the energy will ever be paid back. This

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* *The Health Hazards of Not Going Nuclear*, see inside back cover of this booklet. Since the book was published in 1976, several more studies have confirmed this conclusion, including a study by the Canadian government (*Risk of Energy Production*, Report AECB-1119, AECB, Ottawa, Canada, 1978), by the British government (*The Hazards of Conventional Sources of Energy*, Health and Safety Commission Report [of the British Govt.], April 1978), and by the American Medical Association (*J. of the A.M.A.*, vol. 240, no.20, pp.2193-95, 10 Nov. 1978).

** This is a conservative estimate based on "Review of the environmental effects and benefits of solar energy technologies," by K.A. Lawrence, Solar Energy Research Institute, Golden, Colorado, 1978. Higher estimates will be found in several sources, including *Transition*, Report by the Office of Energy Research and Planning, Office of the Governor of Oregon, January 1975.

† Talk about radioactive wastes that remain toxic "for millions of years" is misleading propaganda. After about 650 years the radioactivity of the wastes will have decayed to below the level of the natural ore they originally came from.

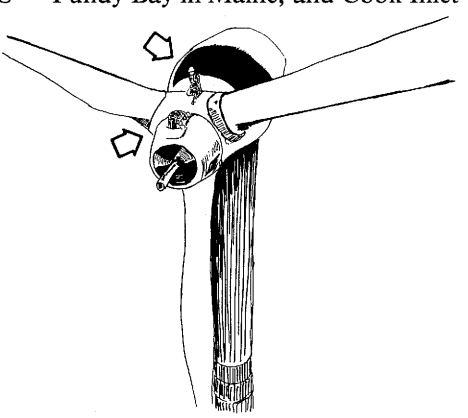
has been investigated in great detail by Dr. S. Baron, who finds that solar thermal-electric plants in the extreme Southwest (S.W. Arizona, southern Nevada and southern California) could repay the energy consumed in their construction in as little as 5 years, but that it is doubtful whether in the Northeast (where the insolation is three times lower) they would ever pay back their energy.* This is in agreement with estimates made in Europe, where solar energy is expected to pay off only along the Mediterranean. Perhaps surprisingly, the energy pay-back is even worse for solar heated homes, in part due to the loss of economy of size, but mainly due to the operating energy needed for the circulating pumps or fans.** The payback time for a solar heating system that is (optimistically) expected to run without replacement of any parts for 20 years ranges from 8.5 years in Phoenix to 17.5 years in Boston. Baron's estimates are in every respect on the optimistic side, so that quite possibly even solar space heating might turn out an overall energy waste.

Baron concludes, "Clearly the solar energy development program must concentrate on designs and technological developments that utilize less energy consuming materials if there is any hope of competing with present energy alternatives. A massive program of subsidizing solar heating as presently proposed by this administration will not achieve the conservation objectives based upon present technology. This premature commitment to solar heating, with its poor conservation and economic prospects, will very likely hurt the cause of solar energy."

SECONDARY SOURCES

The remainder of the "soft" or "appropriate" energy sources are principally secondary effects of solar energy — biomass, wind, and wave energy. Tidal energy could be used effectively in only two locations in the US — Fundy Bay in Maine, and Cook Inlet in Alaska; and it is grossly uneconomical in both. There is only one dark horse among the exotic energy forms, and that is geothermal energy: not from underground reservoirs of hot water and steam (because such places are few), but from the heat in the earth's magma layer which is present everywhere, though only at depths that make the practical harnessing of this energy on a large scale of little interest in this century.

Biomass — the growing of plants in sunlight in order to burn them directly or process them into other fuel — is an energy loser in the case of automobile fuel, and in other cases it seems to be at best marginal. However, the ultimate constraint on biomass is not energy balance, but land use. No one has yet found a better use of land



Arrows point to two workers atop a windmill with three 89-ft blades on a 175-ft tower in Denmark. (Drawn from a photo in Popular Science, *Jan. 1979.) This giant produces only 2 MW — when the wind blows.*

* S. Baron, "Solar energy — will it conserve our non-renewable resources?" Paper given at the annual meeting of the International Solar Energy Society, Denver, Colo., Aug. 28-31, 1978; reprinted in *The Public Utilities Fortnightly*, Sept. 28, 1978.

** Significantly, solar enthusiast and multimillionaire Robert Redford, who spared no expense for his solar home in Utah, still runs the pumps on electricity supplied by the local utility; to run them on solar power or on electricity obtained from windmills and somehow stored for use when needed is a major undertaking out of all proportion to the low power involved.

and solar energy than growing food; among other things, the US has done well in exchanging it for oil and petroleum products.

As for wind and waves, their power is even more dilute than that of the solar power to which they are ultimately due. Typically, the world's biggest windmill, to be constructed in West Germany in 1979, will have a double blade 333 ft across and is to be mounted on a tower 333 ft. high. But all it produces (when the wind blows) is 3 MW. More than 177,000 of these monsters would be needed to come close to the US electrical capacity. There would be outraged protests of "Visual pollution!" by the environmentalists, who are always enthusiastic supporters of every form of energy that has one saving grace — it must be unavailable.

Similarly, wave power is too dilute to substitute for fossil fuel and nuclear power — though, like all other secondary sources, it can supplement them a little. Britain, not surprisingly, is furthest ahead with development of this type of energy, with "Salter's Ducks" that nod as a wave sweeps past them, and "Cockerell's Rafts" that have generators on the hinges joining them in a chain riding the waves. But the chain would have to be 32 miles long to yield the same power as a single 1,000 MW unit of a conventional power plant.

Burning garbage for power is a great idea for getting rid of the garbage, but the power that comes from it is little more than needed to power the presses that print garbage about power from garbage. Methane digested from chicken manure and other agricultural wastes might not even do that.

The American people consume about 76 quads of energy per year; 1 quad is one quadrillion (10^{15}) BTU's, or 100 billion kWh (after conversion losses). Of this 28% is used to generate electricity, 28% for industry, 24% for transportation, and 20% for household and commercial needs.

That, as the anti-energy crusaders never fail to point out, is about one third of the world's energy consumption. What they fail to add is that it is used to produce about one third of the world's goods and services — and to produce more food per acre than anywhere else in the world.

Let us assume that half that energy could be conserved without abolishing the American industrial economy as we know it (an absurd proposition); that would still leave a demand for 38 quads per year, and there still would not really be anything to supply it but fossils, hydro and nuclear — the rest could help a little here and there, but it could never substitute.

THE FUTURE OF SOLAR ENERGY

Though solar energy has some serious shortcomings, in particular, the inherent and permanent handicap of diluteness, it should not be rejected out of hand as an energy source that will never be important. It has been important for many years in Israel, which has no fossil fuels or hydropower. But even Israel, with as much sun as anywhere on the globe and with its energy sources in hostile hands, has not been able to do more with solar energy than heat water in 25% of its homes.

Even so, solar energy does have its points, though they are difficult to recognize after they have been buried under mountains of naive humbug by the bamboozlers. At present, solar energy cannot hope to do much more than provide some fraction of residential space heating. But it could become an important source of energy (though never the all-embracing, only one), if some or all of the following can be achieved:

• the development of materials and processes so sparing in energy that solar facilities will repay their energy input in a year or two, instead of 10 or 20 as they do now — this is what their economy must ultimately be based on, no matter how the government may distort it by taxes, subsidies, price fixings and the other tricks in the politicians' arsenal;

• the development of a *cheap* material (probably based on amorphous semiconductors) that will convert light even when it is diffuse (under a cloudy sky), possibly storing the converted energy immediately as fuel (e.g., by producing hydrogen);

• a breakthrough in imitating chlorophyl, the catalyst that enables green plants to convert solar energy into chemical energy contained in starches, glucose and other storable compounds; in particular, the cultivation of a "gasoline tree" that would grow hydrocarbons in sunlight (much like a rubber tree grows latex);

These and other scenarios lie entirely within the realm of the possible, and some of them, such as the photovoltaic hydrogen producer, now seem quite probable. But no matter how far out the postulated breakthrough, solar energy can never overcome its inherent diluteness.

It is instructive to note that the reckless optimism with which solar energy is being advocated by the current tone-setters could be duplicated, perhaps with more justification, in the nuclear field: The mc^2 mass defect is present in the nuclei of almost all elements of the periodic table, yet we have liberated it only at the two ends of it — the high end with uranium, and the low end with hydrogen. Moreover, what we have liberated so far is only the mass *defect* — the tiny discrepancy between the entire nuclear mass and that of its components. There is no known physical principle prohibiting the mass of the nucleus itself being annihilated and converted to its equivalent energy. From that point of view the present methods of unlocking nuclear energy are like scraping tiny flakes off the tip of an iceberg.

But reckless optimism, by currently fashionable rules, is permissible only for solar energy.

NOT ECONOMICS, EITHER

It is prudent for the rational person to keep the technical facts of "soft" energy sources in mind, even though they are quite irrelevant to the motives of their most fervent advocates; technological improvement is not what they are after.

Nor is economics, though figuring prominently in the Lovinsian type of "analysis," germane to the real motives of the "soft"-technology advocates. Lovins' estimates of energy investments are in error by a cool two *trillion* dollars.* The various "proofs" by the pseudo-economists that less energy consumption means more jobs are simply laughable; what energy means to an industrialized society (and what the lack of it means to a backward one) is perhaps best illustrated by the correlation between per capita energy consumption and some hard indicators of the quality of life, such as longevity, infant mortality, and literacy, to name but a few studied in a most revealing study involving 130 countries over 75 years.**

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* See *The Economics of Amory Lovins' Soft Path* by I.A. Forbes, Energy Research Group, 1977. Lovins' infantile economics has also been demolished by numerous others: *Soft vs. Hard Energy Paths — 10 Critical Essays on Amory Lovins' Energy Strategy* (1977), C.Yulish Ass., 229 - 7th Ave., New York, NY 10011; *Multiple Paths for Energy Policy — a Critique of Lovins' Energy Strategy* by H. Perry and S.H. Streiter (1977), National Economic Research Ass., 80 Broad St., New York, NY 10004; and many others. — Lovins' indiscriminate and deceptive use of references to documents for data that they do not contain has been pointed out by P.L. Olgard (*An Experience from the Energy Debate — Mr. Lovins and Manipulations*, Dpt. of Electrophys., Technical University of Denmark, Lyngby, Denmark, June 1978), and J.M. Gallagher ("Lovins' Data Source," *Science*, 22 Dec., 1978, pp.1242-1243).

** *Health and Economic Development*, By L.A. Sagan and A.A. Afifi, Reports RM-78-41 and RM-78-42, International Institute for Applied System Analysis, 2361 Laxenburg, Austria.

There is little point in taking up the individual economic blunders preached by Lovins and the like-minded social engineers; it is sufficient to ask the obvious: If the economics of "soft" technologies is so good, why do they need Lovins to push them?

The answer is twofold: First, they are not all that lucrative, or greedy businessmen would have gone for them in a stampede, much as the consultants and proposal writers have gone for them — not to gain access to the consumer market, but to the spigot in Washington, now that it dispenses nearly $500 million on solar energy alone (see box).

And that is also the second part of the answer: Lovins & Co are not interested in the free market or the consumer; energy, energy sources and social structure is something the better people *legislate*, because they know what is good for the riff-raff.

This anti-democratic arrogance is clearly evident in their energy proposals. Why should the "soft" and "hard" paths be mutually exclusive, as Lovins claims? Why should they be antagonistic? Why should solar and nuclear not live in peaceful coexistence? Why should there be enough capital for one, but not for both of these paths?

Your report's conclusion that because the government seems intent on spending billions of dollars in this field in coming years there will be rapid progress in solar utilization is naive, to say the least.

Today we have a Solar Energy Research Institute in Golden, Colo., that doesn't even qualify as a paper mill. We have dollars being spent on solar satellites for no other reason than that the project keeps the National Aeronautics & Space Administration engineers on the government payroll. Literally thousands of consultants and proposal writers make handsome livings preparing totally useless solar studies and projections. Large corporations get contracts by the score for endless "demonstration" projects. And a gang of professional consumer-protection specialists, who have made solar their special concern, is comfortably drawing high salaries in state and federal agencies.

A solar boom? Sure—if your company has its nose in the federal bucket. But free-market types who sell solar products and real consumers who want to buy them need not apply.

Michael Silverstein
Jamaica Plain, Mass.

SOLAR BOONDOGGLE
Reader's letter to Business Week
(6 November 1978)

If the consumer and the free market decides, these questions have no answer. Millions of consumers vote with their dollars what they consider best, and millions of shareholders decide where best to invest their money. Such referenda by the million are not unanimous — not until one of the alternatives captures all of the market by its undisputed superior merits; that is why some would vote for solar, and some wouldn't, and none of the questions above make sense.

But they make good sense for the type of autocratic bureaucracy Lovins has in mind. When energy sources are *legislated*, they are legislated but one way, the money is appropriated accordingly (other people's money, not the decision makers'), and the bureaucrats move in to implement the one-sided decision. The consumer has no say; he may not vote with his dollars, for his dollars will be allocated to the energy source some bureaucrat or politician has decided on, whether the consumer likes it or not.

OTHER THEORIES TO BE DISCARDED

Apart from superior technology and better economics of "soft" energy sources, there are some other claims that can be dismissed out of hand.

Conservation? Quite the contrary: The Lovinsian energy conservers would waste several millenia's worth of fuel that can be bred from uranium and thorium.

"But that is only because nuclear energy is unsafe." False: the safety of energy sources is a hard number that can easily be assessed by comparing the dead, injured and diseased per unit energy produced. Study after study has shown that by far the safest of all energy sources is nuclear (see first footnote on p.6). It stands to reason (and the Canadian study has confirmed it) that distributed, small, domestic sources are far less safe than central sources of energy both per unit capacity (because the production of the sources is disproportionately large) and per unit energy converted (because so little energy is produced per domestic unit). There is not one serious study to dispute these results; only propaganda pieces by the far-out pressure groups that make up the anti-nuclear movement. Indeed, this is a point that shows the "soft" technologists not only hypocritical in falsifying (or more often evading) the safety and public health issues, but it also exposes their immorality in putting ideological and social ends above human lives and public health.

The danger of nuclear terrorism? This again is a pretext. Nader and all other "soft" technology advocates enthusiastically welcomed Carter's decision not to reprocess spent fuel rods, but to bury them in the ground in what will become (unless this folly is abandoned) an ever increasing number of plutonium mines all over the country. They vehemently oppose the breeder reactor, the only way to incinerate plutonium while extracting its energy into the bargain (and producing more or less plutonium, or none at all, by simple and changeable adjustments of the breeding ratio).

The absence of any merits in the alleged technological issues is also evident from the ritualistic sham-arguments used by Lovins, Commoner and other advocates of "soft" energy sources. "Using a chainsaw to cut butter" is a metaphor that is hardly ever absent from their harangues and that never fits the analogy they are trying to make. The reason why people do not use chainsaws to cut butter, or throw diamonds out of the window, or mismatch power sources to the load, is that they do not usually act against their self-interest; it is typical for the new aristocracy that it should feel called upon to legislate what is good for people, for they do not trust consumers, shareholders, engineers, or the free market in general to match sources to loads, or for that matter, to do anything else. (No free market in energy sources? But there is: Lovins & Co are perfectly free, and certainly sufficiently well funded, to establish communes that will show the rest of the country how superior windmills are to turbogenerators; but they do not practice what they preach.)

Some of the sham-arguments are so rattle-brained they may become historic in their absurdity. There is, for example, the thesis, originally due to Barry Commoner, repeated by Lovins, and parroted by a President of the United States, that "It doesn't make sense to develop a temperature of millions of degrees and to transmit the energy over hundreds of miles just to boil water."

The argument is both false and absurd. It is false, because there is no place, either in a nuclear reactor or a fossil-fired plant, where the temperature reaches a million degrees; it is absurd, because to burn fuel in one place in large amounts, and to transmit the energy (but not the smoke or dirt) over hundreds of miles in order to let a consumer heat water or use it in any other way he pleases, that surely is one of man's great achievements — our era may well become known to history as the electrical age.

It is also typical of Lovins as representative of a movement of overindulged children from affluent homes not to have enquired how his great-grandparents heated their water

on the occasions when they had the luxury of having any hot water at all. The would-be Ghandis who have grown up with thermostat-controlled home heating have heaved coal and split wood only as an amusement to kill their over-abundant leisure time; they have never done it as a necessity of life.

THE SOCIAL ENGINEERS

If "soft" technology is neither technically sound nor economically advantageous, why is it being pushed?

Because it is a convenient cloak in which to perform some social engineering which neither the ballot box nor the free market would ever approve of.

If one has the patience to listen to the advocates of "soft" technology a little more carefully, the point emerges with transparent clarity. Lovins and his colleagues are *not* merely opponents of nuclear energy, and they are *not* merely advocates of solar energy, no matter how economic or safe. Amory Lovins, the reader may not have known, is an admitted opponent of solar energy whenever it takes one of its relatively economic forms — central thermal-electric plants, ocean-thermal energy conversion, or any other form of central solar facilities that could give power by the megawatt.

The reasons why he opposes nuclear power are also political: "Even if nuclear power were clean, safe, economic, assured of ample fuel, and benign *per se*," he says (quite falsely implying that it does not have these attributes), it would still be unattractive because of the political implications. . ."*

It is, in fact, the safety, the ampleness and cleanliness of nuclear power that seem to bother Lovins and his disciples: Coal is unsafe and environmentally inferior; gas and oil are (supposedly) running out; only nuclear gives the crusaders against ample energy no quarters, so they attack it with redoubled vehemence and with all the scare tactics to which a little known new energy source is vulnerable. But beyond this point, their hostility is not really directed against nuclear energy in particular, but against abundant energy in general.

"It would be little short of disasterous for us to discover a source of clean, cheap, abundant energy because of what we might do with it," says Lovins in one of his more revealing moments. "We ought to be looking for energy sources . . . that don't give us the excesses of concentrated energy with which we could do mischief to the earth and to each other."**

There is abundant evidence that the "soft" technology advocates are against *any* kind of energy that can be converted on a large scale. It is not just nuclear plants that they oppose, but offshore drilling for oil, pipelines of any kind, hydroelectric dams, refineries, and even geothermal development. (In its energy platform, the Sierra Club "opposes geothermal operations within one mile of exterior boundaries of thermal pools, hot springs, geysers, fumaroles, and mud pots," evidently supporting them wherever there is no geothermal energy to be had.)

The energy stiflers are at their most hypocritical when it comes to coal. They do not object to it on environmental or public health grounds, presumably because they fear that attention might be drawn to the superior qualities of nuclear power on the very same grounds. Lovins' ostensible energy strategy, for example, is largely based on coal for transition to his utopia. In reality, however, the "soft" technology advocates are hamstringing coal not only by legislation against strip-mining and an almost impenetrable labyrinth of permits, but by requiring even Western, low-sulfur coal to be subjected to the same capital-intensive scrubbing procedures as high-sulfur coal: This has little effect on health (the scrubbers and precipitators are useless against the very fine

* *Soft Energy Paths*, Ballinger, Cambridge, Mass., 1977.

** Interview with *Mother Earth*, Nov.-Dec. 1977.

Judicial Incest
With their power positions in the executive bureaucracy and the judiciary, and with a number of supporters in Congress, the energy saboteurs are not only killing energy facilities, but also the constitutional Separation of Powers.

particulates, the only kind against which the lungs and bronchial tubes are defenseless, too), but makes Western coal uneconomical. Not enough of that, the NRDC and other sham-environmental organizations have invaded the lower echelons of the Carter administration (and in not a few cases, the higher ones, too), where they sabotage energy development with shady backroom deals that could never get past the "watchdogs" of the press if they were perpetrated by pro-energy officials. There have been cases where government lawyers have "defended" against suits that they themselves or their colleagues had filed as Sierra Club or NRDC lawyers before they moved into the Carter administration. Not surprisingly, they had little difficulty in "settling" such suits out of court in what has become an incestuous travesty of justice. Coal has been particularly hard hit by these tactics; President Carter's suggestion of doubling US coal production by 1986 under these circumstances is a political hoax that can dupe only the unreasonably gullible.*

It has been said, with much merit, that there are only two obstacles to making coal an abundant energy source: You mustn't dig it, and you mustn't burn it.

A CRUSADE AGAINST MAJORITY RULE

There is an ugly coerciveness about the "soft" energy philosophy; it is well hidden, but no less than totalitarian. Only occasionally does the mask slip to reveal it; but then it is unmistakable.

* See E. Guccione, "Why coal will not be America's energy salvation" [yes, that is what suggested the title for the present essay], *Reason*, Oct. 1977.

"Coercion by many governments will undoubtedly be required to control population growth," says David Brower, President not of some South American junta, but of the Friends of the Earth.

And it was not some SS-Sturmbannfuehrer, but Professor Paul Ehrlich, who wrote "Several coercive proposals deserve serious consideration, mainly because we may ultimately have to resort to them unless current trends in birth rates are rapidly reversed by other means."* (He does not say who is meant by "we.")

This same Professor Ehrlich warns that "giving society cheap, abundant energy . . . would be the equivalent of giving an idiot child a machine gun,"** expressing Lovins' idea quoted above somewhat more crudely and forthrightly.

Again and again one meets the old vocabulary of the new viceroys, gauleiters and kommissars. In an official publication of the Friends of the Earth, to which both Amory Lovins and David Brower contributed, we read a blueprint of the future they aspire to: "Perhaps some day childbearing will be deemed a punishable crime against society unless the parents hold a government licence. Or perhaps all potential parents will be required to use contraceptive chemicals, the government issuing antidotes to citizens chosen for childbearing."†

These, mark well, are the words of the great progressives, liberals (a word derived from "liberty"), and the fervent crusaders against big government.

But not only their words are totalitarian: They use stormtrooper tactics, they scale walls and fences of nuclear construction sites in deliberately planned quasi-military operations, they engage in criminal tresspass, they make films glorifying vandalism and violence, they approve of anti-nuclear terrorism in Europe, and will doubtlessly approve of it when it arrives in America. The reason why the stormtroopers must resort to such tactics in deeds and words is the same as always: Their philosophy cannot make it via the ballot box, because it is not attractive enough for a majority.

And the Lovins-Schumacher "soft" technology path is not only technologically and economically inept, but it is also diametrically opposed to the self-interest of every constituency save one.

It is against the self-interest of the young, who would be the first to run into the barriers of a closed upward mobility, the first victims of a dogged seniority system that must inevitably result from a shrinking economy, and the most desperate scavengers for any opening that might appear by death or retirement of someone born in livelier times.

It is against the self-interest of women, who will not want to send their children into a world without opportunities, let alone into wars over scarce energy sources.

It is against the self-interest of the blue-collar workers who would lose jobs in large-scale industries by the million and would be forced into cut-throat competition of cottage industries or into becoming maids, lackeys and footmen of the elitists who can afford 10-ft parabolic dishes to collect solar energy for a single household.

It is against the self-interest of the American farmer who uses energy-intensive fertilizers and machinery to produce the world's highest per-acre yields and to feed much of the rest of the world. (In fact, the important food exporters in the world are the US, Canada, Australia and New Zealand, all of whom have highly energy-intensive agricultures. The peoples living under socialist mismanagement or in primitive economies with decentralized energy sources are unable to feed themselves.)

It is against the self-interest of American business, no matter how obsequiously it tries to "adapt" and "live with" its own death sentence. The boutiques peddling trinkety junk and "No Nukes" buttons in college towns are samples of what business would be reduced to in the Lovinsian utopia.

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* *Population, Resources, Environment*, Freeman & Co., 1970.

** *An Ecologist's Perspective on Nuclear Power*, FAS Public Issue Report, May-June 1975.

† *Progress As If Survival Mattered*, Ed. Hugh Nash, Friends of the Earth, 1978.

It is against the self-interest of the armed forces, and hence against the self-interest of anyone who does not want to live under foreign domination. The "appropriate" technology of a de-industrialized and ruralized nation could arm them with little more than slingshots and water pistols.

It is against the self-interest of scientists, engineers, physicians and professionals — those who do not live off the taxpayer, but offer services to a free market that chooses them voluntarily. Lovinsian technology needs no more than Lovinsian "engineering;" there will be no field for able men.

It is against the self-interest of the poor in America for the same reason as it is against the self-interest of the developing world: Neither has been so overindulged with food, clothing, shelter, transportation, education, and the other ingredients of an abundant life that they can afford to play phony games of ecology. To tell the poor — and the Third World — that they don't really need automobiles, heavy industry or centralized energy sources is a form of racism, especially when such advice comes from well-to-do kids reared in suburban homes, their hearing impaired by over-powered hi-fi's and their understanding dulled by Mickey-Mouse college courses. It is more hypocritical, but not very different from the old-fashioned racism that did not conceal its ends of "keeping the niggers and chinks in their places."

CUI BONO?

Who, then is there left to benefit?

A narrow class of intellectualoids, highly skilled in interpreting, analyzing, planning, alloting, regulating and intriguing, but totally incapable of producing. Most of them are domiciled in one of three institutions: the media, the universities, and government.

In America, this unproductive class of meditators had comparatively little influence until the 1960's, when a few of its representatives were admitted into the Kennedy administration. Their adeptness in posing as moralists enabled them to gain more influence by exploiting a number of issues: the civil rights struggle, opposition to the Viet Nam war, the Watergate episode, the environmental crusade, and finally the campaign for "soft" energy sources.

As each of these battles was won, the influence of this group grew; but the "soft" energy issue promises to give them the ultimate power: It will destroy the industrial economy which they hate above anything else, since they are so utterly useless in it; but beyond that, it will give them the opportunity to plan, allot and ration scarce resources. It will at last satisfy their most desperate craving, the craving to be needed, if only to be needed for sitting on the planning boards. They will be "needed" for what they know best: to govern over those whom they consider inferior. Power! Power, at long last, for the professors of Buddhist mythology and transcendental economics.

They are already "needed" as consultants on how to make, and then live with, the regulations of the OSHA, EPA, ICC, FERC and three dozen alphabets of other agencies. They are "needed" to give advice on how to live with a hole in the head; the unasked question is what the hole is needed for.

WHY "SOFT" ENERGY SOURCES ARE A THREAT

The product being pushed is technically unsound, unwanted by a free market, and serving no other purpose than propelling a power-hungry elite to influence. Can a handful of social saboteurs really strangle an industrial giant by cutting off his energy sources?

In the long run, of course not.

Unless demand plummets due to an economic depression, the power will begin to run out in the early to middle eighties, with brown-outs and rotating blackouts in much of the country. Wonderboy Lovins will be hard-pressed to provide thousands of megawatts with windmills and chicken manure.

Alternatively, the country will be driven toward bankrupcy by the bill, mounting by advancing inflation, presented by the OPEC cartel. While America is still strong, but headed by a spineless administration, the Soviets are already pushing it around, as are medieval sheikdoms and assorted circus republics. What they will do when the country is genuinely weakened is uncertain; but there is no doubt that with their backs to the wall due to any or all of these crises, the American people will be in no mood to listen to the wonderboy's half-baked dissertations.

Yet the social saboteurs pose a real threat for two reasons: One is their dominating influence in the media, which tirelessly brainwash their audience with scare stories while imposing a rigorous censorship on themselves whenever there is anything favorable on centralized power sources to report. (Examples: How the country was saved by nuclear power on 11 January 1977; the tests of emergency cooling in Idaho; the British decision to proceed with nuclear fuel reprocessing and waste disposal; development of breeder reactors in France, Britain, Germany and Japan, let alone in the Communist world; and many more.)

The other reason is that the social saboteurs have met no significant opposition. Utilities are not used to fighting in the ideological field, and though many of them have put up a gallant fight, some do not yet understand what is happening to them. The social saboteurs have been working at no less than the destruction of central power, paralyzing the utilities in court, in demonstrations, in public hearings, obstructing every watt of new capacity and resisting every inch of transmission lines. But many utilities responded by "keeping a low profile," or "starting a dialog" or joining in the solar-windmill humbug; and Edison Electric Institute, their trade association, has provided leadership by occasionally murmuring dire warnings of what the world is coming to.

Business, with few exceptions, has been pursuing a servile policy of "please kick us harder." There are few business organizations that oppose government interference in a free economy as such; it is more expedient to try bending government regulation in one's favor, to contribute to the incumbent congressman's campaign regardless of his policies, and if really in doubt, contribute to the campaign of his opponent as well. In this atmosphere of "compromise," "realism," and "pragmatism," Atlantic Richfield's chief executive writes articles on "The Case for National Planning," Mobil warns of the dangers of deregulating oil and gas too quickly, Xerox Corporation goes out of its way to publish pitiful anti-nuclear horror stories, and when *Business Week* prints horror stories of its own (palming off the most rabid nuclear opponents as "experts") who foots the bill for the brainwash? The big-business advertisers; including, in the same issue, General Electric. Lenin was wrong in thinking that the capitalists will sell the rope that hangs them: They will grovel on their knees for permission to supply it at their own expense.

And yet there is hope. There is an awesome reservoir of goodwill toward centralized power sources in the country. It is harbored by people who understand that the "soft energy" elite is the same elite that taxes, inflates, spends recklessly on frivolous projects, sells out America's allies, and makes worthless deals with its deadliest enemies. That good will needs only to be tapped and given no-nonsense leadership.

There is hope, but no time to lose.

The "soft" energy fraud can be exposed by rational education.

Or it can be exposed by thousands frozen to death in one of the next six or seven winters.

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