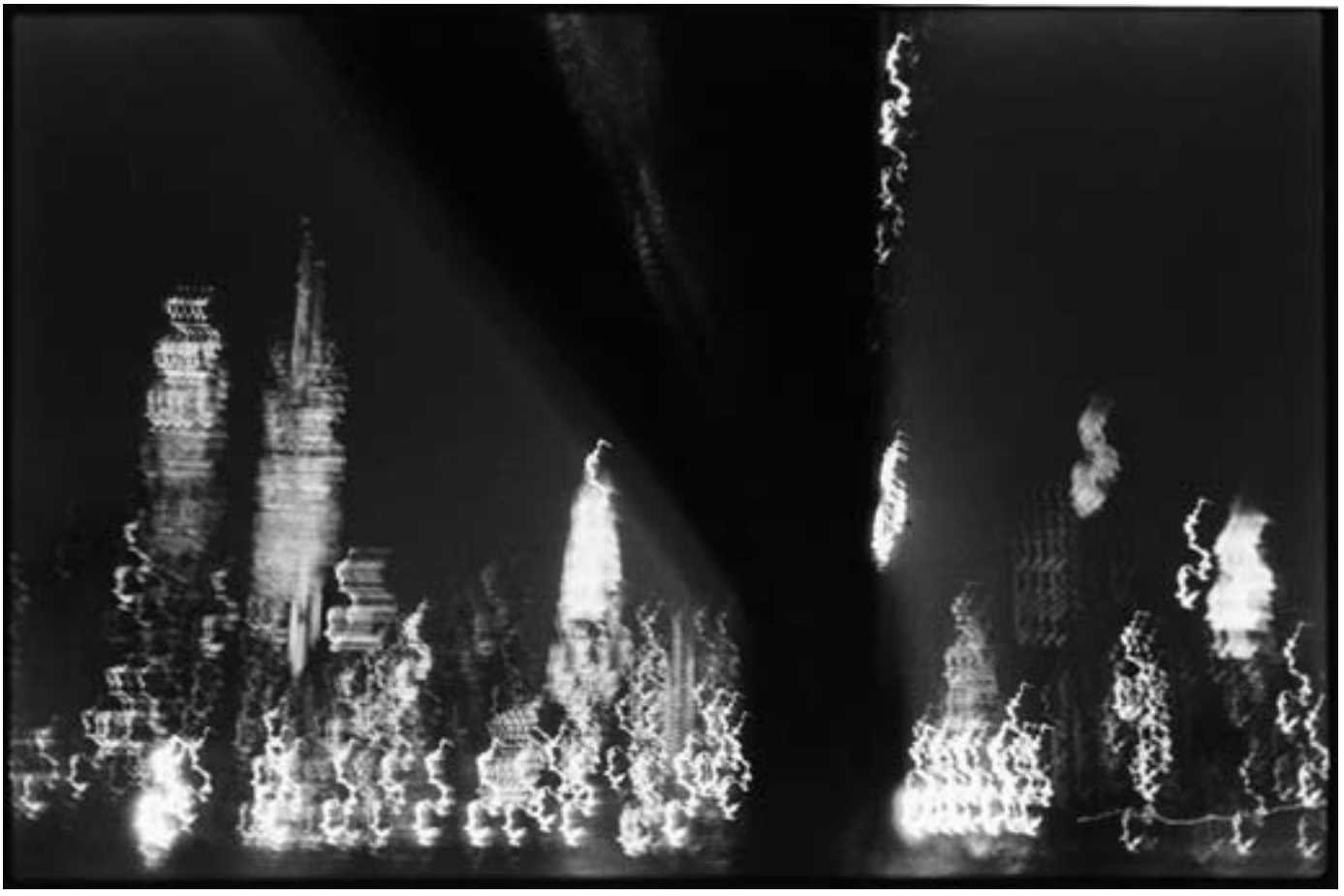
HOW MANY AMERICANS DOES IT TAKE TO CHANGE



THOMAS CLARK

A LIGHT BULB?

Joan Ogden On The Nation's Uncertain Energy Future

GILLIAN KENDALL

I first met Joan Ogden in 1976, when I became part of a long-standing communal household called "The Place" in rural New Jersey. Already a resident, Ogden introduced herself as a "hippie guitar player who does physics on the side." Actually my new housemate had a PhD in theoretical plasma physics from the University of Maryland and was doing postdoctoral research at Princeton University.

JOAN OGDEN

Living with Ogden improved both my social life — we threw great parties, and she took me to folk nightclubs — and my environmental consciousness. While I attended protests against nuclear weapons, she worked on developing alternative energy sources in her lab at Princeton. At home she used an old treadle sewing machine to make fabric-covered foam inserts for the windows to keep out the winter cold. She also installed a wood stove that heated our large, drafty farmhouse better than the open fireplace ever had.

After concluding that nuclear fusion — a less-contaminating source of nuclear power than the existing fission reactors — would not be feasible in her lifetime, Ogden shifted her attention to solar power, biofuels, and hydrogen. In 1985 she joined Princeton University's Center for Energy and Environmental Studies as a research scientist, and she went on to work at the Princeton Environmental Institute. She later traveled to Jamaica, Barbados, and Brazil to explore how to make fuel from sugar cane. In her free time, Ogden recorded a CD *and toured Eastern Europe with her "Balkan boogie" band, biked across France with her husband-to-be, and sailed around the Caribbean with her rock-and-roll band Hardly Tight.*

Ogden has won awards for excellence in research and development from the U.S. Department of Energy, and teaching and public-service awards from the University of California. She has written many journal articles about alternative fuels and is coauthor of Solar Hydrogen: Moving beyond Fossil Fuels *(World Resources Institute). She is now professor of environmental science and policy at the University of California at Davis, and codirector of the Sustainable Transportation Energy Pathways program at the Institute of Transportation Studies.*

Ogden lives with her husband and their two daughters in the Village Homes section of Davis, a twenty-five-year-old planned community devoted to environmental sustainability. The family bicycles to work, school, and the weekly organic farmers' market.

Kendall: Many people believe that General Motors and the other big carmakers have actually developed cars that use almost no gasoline, but they don't produce them. Is that true?

Ogden: Yes and no. Could the manufacturers produce cars that are much more efficient than what we have now? Without a doubt. Some cars on the market now are already quite efficient — most notably smaller, lighter-weight cars with hybrid engines, which operate on a combination of gasoline and battery power and can get fifty or sixty miles to the gallon. And the carmakers could push that mileage even higher by making the cars more lightweight, more streamlined, with a little less power. So, yes, these technologies exist, and the cost to put them on the market is not that high. The reason Detroit doesn't do it is that the carmakers think people want big cars — and, not incidentally, they make a lot more money selling an SUV than they do selling an efficient compact.

U.S. auto manufacturers turned their backs on hybrid technology in the early 1990s. They thought no one would want a hybrid car. The Japanese automakers, however, continued to develop it, and when they began offering hybrids in the U.S. around 2000, they found a ready market here — so ready, in fact, that for a while they couldn't keep up with demand. It seems there are plenty of people who want to buy "green" cars. The fact that this technology is popular with some consumers has caused U.S. automakers to offer hybrid vehicles as well.

Now, if we had political leadership that told us that greater fuel efficiency was our societal duty as good world citizens, then driving an SUV might come to be as socially unacceptable as smoking is now.

Kendall: But because the car manufacturers make more money selling larger, less-efficient vehicles, they market those vehicles more aggressively.

Ogden: Yes, but it's hard to determine to what extent the automakers have created the desire for bigger cars. I think that public opinion is shaped by more than advertising efforts. Think of cigarette smoking: the tobacco companies actually used to promote cigarettes as "good for you," but once the evidence got out that smoking is unhealthy, they couldn't do that anymore. Similarly, there's evidence that burning too much gasoline is unhealthy for us and our planet. At some point, when the social mores change, companies have to change, too, to stay in business.

Kendall: You've said that hydrogen-fuel-cell cars are the next step after hybrids. What's the difference between batteries and fuel cells?

Ogden: A battery is an electricity-storage device: you plug it in and fill it with electricity generated by some external source, such as a power plant or a car engine, which likely burns fuel in combustion. A fuel cell, on the other hand, makes electricity directly from fuel through a chemical reaction, without the need for pollution-causing combustion.

Hydrogen has huge potential. It's the most abundant element in the universe. It's not cheap to extract, but you can get it out of almost anything, including water, crops, and fossil fuels like natural gas. It can also be made by solar or wind power. Hydrogen storage is bulkier than gasoline but not as bulky as batteries. A hydrogen-fuel-cell system can use fuel very efficiently, with zero emissions; the only byproduct is nonpolluting water. The technology has actually been around since the nineteenth century, but interest in it hasn't been great until

recently, because combustion technologies have dominated the energy system.

Kendall: If we end up making hydrogen from natural gas, how does that help us with global warming and decreasing oil supplies?

Ogden: Making hydrogen from natural gas isn't ideal, but it would be better for the environment than burning gasoline. If you make hydrogen from natural gas and use it in a fuel-cell car, the greenhouse-gas emissions of the total process — from well to wheels — are about 10 to 40 percent less than those from a gasoline-powered hybrid car. And natural gas can be produced domestically, lessening to some extent our dependence on foreign oil.

But natural gas is a fossil fuel with supply constraints, so it should be seen as a transitional source of hydrogen, to be used only in the next few decades. Ultimately we'll need to move to hydrogen made from renewable energy sources.

Kendall: Very simply, what do you mean by "renewable energy"?

Ogden: Renewable energy is any energy derived directly or indirectly from the sun or the earth. This includes solar energy; wind energy; hydropower; biomass, which is energy produced by photosynthesis in plants; geothermal, which is derived from the heat in geological formations; and energy drawn from the ocean's tides, waves, and thermal gradients.

Kendall: People often think of hydrogen as volatile and explosive. Is it?

Ogden: All fuels pack a large amount of energy into a small space. This makes them useful — as well as dangerous. So safety is a necessary precondition for introducing any new fuel. Past studies have concluded that hydrogen has been handled with a good record in industrial settings, and could be made safe for consumer applications with proper engineering. One of the crucial tasks of ongoing hydrogen demonstration programs is assuring a level of safety comparable to that of today's fuels.

Kendall: Where will consumers get hydrogen?

Ogden: The system might include large central plants, or neighborhood — or even household — production, as well as traditional filling stations. In 2004 I participated in a group convened by the California state government to make plans for a "hydrogen highway." The idea was to build a network of fifty or more hydrogen refueling stations across the state, so that people who wanted to use hydrogen-powered vehicles would have somewhere to refuel. The project was put before the legislature, and now there is a request for concrete proposals to build the hydrogen stations. Certainly, putting fifty hydrogen-fueling stations in a state that has ten thousand or more gas stations isn't going to remedy the air quality overnight, but it could play an important role in demonstrating the technology, and the project is going forward.

In theory, all of this country's fuel demands could be met with hydrogen, but not in the immediate future. It will probably be another ten years before hydrogen cars are introduced into the marketplace. And it will take several decades more to build a hydrogen-based energy-supply system.

Kendall: Isn't hydrogen production an inefficient and expensive process?

Ogden: Not when you compare it with other energy-conversion processes we use. When you make hydrogen from a source such as natural gas, about 70 to 80 percent of the primary energy ends up as hydrogen. Compare this to electrical power plants, where only 35 to 55 percent of the primary energy ends up as electricity. And hydrogen costs about as much to produce, in dollars per unit of energy, as gasoline today.

Electricity generation could be termed an "inefficient and expensive process," too, but we use it because it produces something we want: a very clean and versatile form of energy.

Kendall: What do you make of President Bush's call for development of the hydrogen-fuel-cell car?

Ogden: I think he saw it as a long-term goal that would stimulate U.S. industry and inventiveness without requiring him to do much in the near term. I don't see it as a substitute for energy-efficiency standards, which the Bush administration has refused to implement.

Kendall: How do we know that other hydrogen proponents aren't, like the president, just putting off taking action about global warming?

Ogden: You have to appreciate the long time frames inherent in changing an energy system. Hydrogen will take a while to develop but could eventually enable deep cuts in oil use and carbon emissions. Working on long-term energy technologies with a big payoff — like hydrogen, biofuels, and electric cars — is only part of the strategy. In the near term, we should push energy efficiency.

In contrast, the Bush-Cheney energy policy is oriented toward increasing supply through expanded oil exploration and drilling, and it gives short shrift to improving energy efficiency. The administration's energy-policy document was developed essentially behind closed doors, without public comment, which is highly unusual. Clearly, the document was written to preserve the profits of energy producers, such as oil companies, whose representatives played a big part in its formulation. Although the document did mention renewable sources of energy and fuel efficiency, it did not stress near-term policies to conserve energy. There was nothing at all in it about increasing fuel-economy standards, which most analysts feel should be a first step.

In response to the Bush-Cheney document, groups from academia and industry stepped in and produced extensive reports and recommendations. One such group, a bipartisan panel called the National Commission on Energy Policy, came out in 2004 with a document called "Ending the Energy Stalemate."

To get to a truly sustainable society, where we are running almost completely on renewable energy, will take a long time, but there is nothing technologically holding us back.

TIM STEGMAIER

Kendall: Did the report have an impact?

Ogden: It did in that it gave people an authoritative document, signed by a collection of eminent people, to counter the Bush-Cheney policy.

In the meantime, many states, including California and some Northeastern states, have stepped into the breach with measures that are much more progressive than the federal recommendations: for instance, standards that require all major utilities to use more renewable energy each year.

Kendall: What about President Bush's statement in his 2007 State of the Union address that he wants Americans to cut gasoline use by 20 percent in the next ten years?

Ogden: He also spoke about our "addiction" to oil and mentioned hydrogen and biofuels, but in terms of actual policy, he hasn't followed through on those remarks. At the present time, the technology exists to bring the average mileage for all new cars up from twenty miles per gallon to thirty-five or forty miles per gallon, but there has been enormous opposition from the automotive industry to any attempt to regulate fuel-economy standards.

In the last twenty years, all technical innovation in automotive engines has gone into adding power. The average family sedan today has faster acceleration than the "muscle cars" of the past: twenty years ago, it used to take fourteen seconds to accelerate from zero to sixty miles per hour; today it generally takes less than ten seconds. And this is while cars have gotten bigger. One of my colleagues has estimated that if cars today had the same average size and performance of cars from the 1980s, we'd improve fuel economy by 25 percent.

Meanwhile, the car companies have sued California more than once for trying to pass regulations to reduce carbon emissions from cars. California wants the regulations because carbon in the atmosphere is a major cause of global warming. But the automakers argue that the state is really trying to regulate fuel-economy standards.

Kendall: What's wrong with that?

Ogden: Fuel economy is supposed to be regulated only at the national level. The debate arises because there are only two ways to reduce the amount of carbon that emerges from your tailpipe. One is by fuel economy: the less gas you use, the less carbon comes out. The other is to switch to a fuel that produces less carbon. And since low-carbon fuels are not widely available, the automakers claim that California's laws are, in effect, forcing them to improve fuel economy. It will be interesting to see if California's laws stand.

Getting back to the federal level: There is currently a suppression of politically unacceptable views on energy. For example, scientists who work on global warming are being told not to talk to the press. The Environmental Protection Agency issues an annual report on air pollutants and their impact. A few years ago, when the draft of the report included greenhouse gases — the kind that contribute to global warming — the information was pulled by the Bush administration.

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