

Energy and Conservation  
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I want to thank the Ashoka Trust for Research in Ecology and the Environment (ATREE), the Ford Foundation, the T. N. Khoshoo Memorial Endowment Fund committee, and my good friends Dr. Ganesan Balachander and Professor Kamaljit Bawa for bringing me and my wife to India. It is a great honor to be here.

I am going to talk briefly today about a central issue in conservation, but one which has not received the interest it deserves. I will start with the United States and conclude with the relevance of our current experience to India.

I begin with two important ideas, which taken together help us understand the problem that America has created for itself and, unfortunately, for all other countries of the planet.

First, is an ancient idea, which was vividly expressed by the great eleventh century Spanish rabbi and philologist Jonah ibn Janah of Saragossa, although the thought was already at least a thousand years old when he wrote his version. This is what Ibn Janah said:

A man is held responsible for everything he receives in this world, and his children are responsible too.... This may be compared to a person who entered a city and found no one there. He walked into a house and there found a table set with all kinds of food and drink. So he began to eat and drink thinking, "I deserve all of this, all of it is mine. I shall do with it as I please." He didn't even notice that the owners were watching him from the side! He will yet have to pay for everything he ate and drank, for he is in a spot from which he will not be able to escape.

Eight hundred years later, in 1864, another linguist, the American geographer, diplomat, and father of ecosystem conservation, George Perkins Marsh, writing in his monumental work *Man and Nature*, put this in environmental terms. In words that had both moral and practical

content, he commented on the environmental damage he observed, and advised us to exercise more moderation and responsibility in our treatment of forests and fresh waters.

In our day, we have a saying that combines the warnings of Ibn Janah and Marsh: “There is no such thing as a free lunch.”

The second important idea is a contemporary one – it has been brilliantly set forth by the Nobel laureate economist, philosopher, and historian Professor Amartya Sen, who uses the American military euphemism of “friendly fire” to characterize it. Friendly fire is how our military and press sugar-coat the presumably accidental killing of soldiers in battle by their own comrades. In Dr. Sen’s words: “Sometimes the very institutions that were created to overcome disparities and barriers have tended to act as reactionary influences in reinforcing inequity.” One example he gives is the contrast between the immense government stockpiles of food here in India alongside the largest undernourished population in the world. He states: “The positive hopes of equity through high support prices of food and payment of subsidies have...tended to produce exactly the opposite effect.” This is friendly fire.

A number of years ago, in my book *The Arrogance of Humanism* I described similar examples which concerned the environment, including that of the Tennessee Valley Authority (the TVA) in the U.S. The TVA is a quasi-governmental organization created during the Great Depression of the 1930s with the noble goals of improving the navigability of the Tennessee River, providing for flood control, assisting reforestation and the improvement of marginal farm lands, and of bringing electric power to the poor, rural population of our southeastern mountains. The TVA fulfilled its mission of rural electrification, but it didn’t stop there, and has gone on with its dam-building to endanger rare species, root up wilderness, destroy Native American shrines and historic sites, and drown tens of thousands of acres of prime agricultural land beneath unnecessary reservoirs. More friendly fire. My friend Andrew Kimbrell, Director of the Center for Food Safety and of the International Center for Technology Assessment, in Washington, D.C., describes this destructive exercise of power by well-meaning people as “cold evil.”

What do the ideas of a free lunch and friendly fire have to do with the problems, especially the environmental problems, related to America’s energy crisis and the energy challenge facing a rapidly industrializing India? This becomes clear if we look at the possible solutions to the energy crisis. I group these solutions in two categories.

Category A I call technological solutions. This is not the place to go into them in detail, and I won't even mention the most preposterous ones. Of the more practical technologies, most have the same drawback: they are not as cheap or easy to employ as sticking a pipe in the ground and letting the oil flow out of a tap.

Nuclear power has its uses, but it takes a lot of fossil fuel to mine and process the uranium, build and maintain the nuclear plants, decommission the old ones, and store the waste. The potential for accidents is serious at all phases of the operation, and the only product is electricity. You can't fly planes or make plastic using electricity, although I have read that the U.S. Defense Department experimented unsuccessfully with an electric plane.

Biofuels can cost as much energy to produce as they deliver: the ratio of Energy In to Energy Out is often 1, or greater. And there is the serious issue of using forests or agricultural land to power automobiles.

Hydrogen fuel cells are an excellent – although not a new – technology, and are very useful for distributed energy production, but hydrogen is not a primary fuel; to make it, you have to use another energy source. That and many other problems, especially those related to the very low density of hydrogen, indicate that the much-trumpeted hydrogen economy of the future is not going to make the energy crisis go away.

Non-biologically based renewable energy sources are wonderful – solar, geothermal, tidal – but even taken together they are not up to the job of replacing oil in running a high-consumption, high-waste society, although (and you can see where I'm heading) they may be critically important in running a responsible-consumption, low-waste society.

Another technological approach, one of the best, is efficiency gains in producing, transmitting, and using energy. There is no denying the great importance of efficiency gains, but I have to point out that in America most of those advocating efficiency gains and the other new energy technologies are not suggesting any reduction in overall energy consumption. Indeed, the opposite is likely to be true – lower cost will encourage us to use still more energy, to go on pretending there is a free lunch.

Category B of proposed solutions to the energy crisis is much easier to describe. It is the conservation of energy based on a simple lifestyle. It means, for Americans, consuming less and reusing more.

America has opted for Category A: Technology. It's easy to see why. Our present economy is geared to constantly increasing consumption, and dependency on goods and services we no longer provide for ourselves. There is a deadly combination of a sense that we are entitled to all these goods and services, and a fear that we need them, we can't survive without them. We don't worry about the cost, because we haven't the faintest idea what it is. In fact, most Americans don't seem to know that there will be a cost.

Here is where the friendly fire idea comes into play. If we use the gains from our new energy technologies to continue to increase our consumption and waste, we will find ourselves in a vicious spiral that decreases resources and increases environmental damage, even as our energy technology improves. I will give an example of this friendly fire from marine fisheries.

Fossil fuels are the major energy inputs to the world's fishing industry. In the year 2000, fifty billion L of fuel, mostly diesel, were burned to land a little more than 80 million tons of marine fish and invertebrates – this amounted to 1.2 % of global oil consumption, about the same as used by the Netherlands, with an annual emission of 130 million tons of CO<sub>2</sub> into the atmosphere. The energy content of the fuel is about 12.5 times the protein energy content of the catch. Fleets catching luxury species – shrimp, tuna, swordfish – for the American, Japanese, and similar markets, have the highest energy consumption, 2000 L of fuel per ton of catch. Moreover, the energy efficiency of the fishing fleet has been declining steadily over time, because every year the boats need to fish longer hours and deeper in offshore waters as the over-fished populations progressively fail. So even if we improve the efficiency of diesel and gasoline engines by 10 or 20 percent, which is conceivable, energy consumption will continue to rise in most fisheries until the fisheries, themselves, collapse.

Similar examples could be given from global forestry – for example, the use of helicopters to assist in the logging of steep slopes in parts of North America. This insatiable demand for timber and timber products thus can result in permanent deforestation and soil erosion in mountainous areas.

And of course global trade transmits introduced diseases of humans, plants, and wildlife, and promotes the costly spread of exotic species. And there are other side effects: For instance, the importation from Mexico into the U.S. of luxury foods such as fresh green peppers, tomatoes, and string beans in winter is subsidized by huge inputs of energy for transportation and industrial agriculture. The side effects, regardless of whether the energy is sustainably produced or not,

include the poisoning of Mexican workers by pesticides, the ruining of Mexican soils, and the destruction of native Mexican cultures.

Here is another example: aquaculture is now providing a substantial amount of the fish consumed in the U.S. The aquaculture facilities, themselves, require heavy amounts of energy to run, especially in the case of fish such as trout and salmon, whose animal protein comes from fish caught by the same global fleets mentioned above. The side effects of aquaculture are heavy – these include genetic pollution of native fish stocks by escaped fish, global spread of diseases such as infectious salmon anemia (which is caused by a virulent virus that has adapted itself to intensive aquacultural practices and associated ship traffic), the destruction of the marine sea floor by bottom trawling, and marine pollution by food and wastes from the farms.

Ecotourism, which is usually dependent on cheap energy, is often a great boon to conservation. Yet even ecotourism has its dark side. The problem of overuse of sensitive ecosystems is obvious, but there are more subtle effects. For example, it appears that ecotourism may be responsible for the first recorded introduction of a primary human pathogen, *Mycobacterium tuberculosis*, into free-ranging, wild populations of banded mongooses (*Mungos mungo*) in Botswana and suricates (*Suricata suricatta*) in South Africa.

A further example is the so-called farming of sea turtles, particularly *Chelonia mydas*, the green turtle. I say “so-called” because it is not really farming by the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) definition – the “farms” are not fully closed-cycle systems completely independent of wild populations. The major operation, the Cayman Turtle Farm (CTF), is subsidized by Britain to support the tourist trade in the Cayman Islands (a British dependency), and consumes energy and money in significant quantities. The biology of a migratory marine animal that takes years, even decades, to reach sexual maturity, eats animal protein when young, has a poorly understood natural history, is disease-prone in captivity, and increases in size from a few grams to 100-200 kg, makes it utterly inappropriate for captive rearing. The profit-making ventures that preceded the current operation both failed (blaming their failure on conservation regulations). Yet the British persist with this popular tourist attraction, citing conservation as a rationale for the farm; and they release a few hundred young turtles every year, with great ceremony for the tourists, to show that they are helping the species.

The results: to gain extra income, CTF has promoted the sale of turtle products – meat, shell, stuffed hatchlings – which maintains the demand for these products and provides ongoing incentives to poachers who prey on wild populations, a much cheaper source of turtles than captive rearing. The released turtles, which have been raised in unnaturally crowded, sometimes unsanitary conditions, may be partly responsible for the terrible epidemic of papilloma virus which is now devastating wild green turtle populations. Fibropapillomatosis was reported to be widespread at CTF in the early 1980s. Moreover, the released turtles, originally descended from widely separated genetic stocks – if they survive and breed in the wild – will genetically pollute natural populations. This, too, is energy-subsidized friendly fire, not conservation.

And most of these consumptive uses of energy release greenhouse gases that work to alter global climate. Moreover, the increased exploitation of energy sources results in positive feedbacks that can add to the problem. Global warming, itself, is causing widespread melting of Arctic permafrost, with the release of methane, a powerful greenhouse gas, from saturated peat, and CO<sub>2</sub> from unsaturated peat.

As long as energy technology helps Americans keep their same consumptive lifestyle, we have friendly fire on a massive scale. If energy were the only limiting factor we face, perhaps this total faith in technology would have some justification. But there are many limiting factors acting within the highly interconnected economic system that controls all of our lives. Forests, soils, fresh water, climate, ecosystem balances, emerging diseases, the growing gulf between rich and poor, and other environmental and social variables are all approaching critical limits.

As I wrote in *The Arrogance of Humanism*, John von Neumann and Oskar Morgenstern showed, in 1947, that it is mathematically impossible within a closed, interlinked system, to maximize more than one variable at a time. In other words, even if we can maximize efficiency in production and use of energy, that does not necessarily solve the other problems – some, including the plight of environment and biodiversity, will be made worse by the continued availability of cheap energy.

What then is likely to happen? Ideally, the advances being made in energy technology would be employed in the U.S. in concert with positive changes in lifestyle – lower consumption and waste. This would have many positive environmental and social effects around the world, although it would admittedly cause at least short-term economic disruptions in our major suppliers of goods and services, India, China, and others. When this happens, you will have to

find more sustainable customers, especially locally and regionally. But at the moment, a positive change in lifestyle in the U.S. seems a number of years away, although economic circumstances must inevitably force the change.

India is a different matter. India, where the idea of a sustainable lifestyle has a long and honorable tradition, should be more likely to be able to use the new energy technologies in a way that protects biodiversity and the environment. Dr. T. N. Khoshoo, the late Secretary of the Ministry of Environment and Forests, played an important role in relating Mahatma Gandhi's thoughts about ecology, sustainability, and consumption patterns to the protection of biodiversity. This was undoubtedly clear to him long before the publication of his book: *Mahatma Gandhi: An Apostle of Applied Human Ecology*. Dr. Khoshoo, whose experience in botany gave him a deep appreciation of the importance of biological diversity, was thus one of the early scientists to understand that the Western model of development – perpetual growth in consumption – was the wrong model to follow. This is true not only here in India, but in the West as well. We can only hope that Dr. Khoshoo's ideas, and those of ATREE and the many distinguished conservationists now working in India will be understood and will prevail.

I conclude with a quotation from my recent book, *Swimming Lessons: Keeping Afloat in the Age of Technology*, “It will take a miracle for us to survive our crisis of spiritual and environmental health, yet miracles sometimes come to those who work and wait for them. What other choice do we have?”

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