BIOFUELS: A COMPLEX AND MORAL QUESTION

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In America and Europe there is a massive groundswell of interest in using biofuels as transport fuel. Americans see biofuels as part of the national effort to help make our nation independent of foreign petroleum and natural gas. Election of a new Democratic Congress in November has accelerated this thrust. While some call the interest in biofuels a meaningful environmental development meriting generous government funding; others call this an environmental catastrophe just waiting to happen.

Where do biofuels fit into the picture? Is this a cheap energy source from organic matter (cellulose, agricultural or sewage wastes), the cure-all for our energy crisis? *Bioenergy* (energy resulting from the combustion of carbonaceous materials) accounts for about fifteen percent of current world energy use (mostly cooking and space heating with wood); this bioenergy is derived from a number of biofuel sources (living organisms such as wood or their metabolic byproducts such as alcohol from corn or sugar cane). A biofuel is defined as consisting at least four-fifths by volume of materials derived from living organisms harvested within ten years of processing. In truth, a coal seam was plant growth tens of thousands of years ago, but could not be conceived of as "renewable" in the normal sense of a human lifetime scale. On the other hand, a tree that has stored energy in its trunk and branches is a short-term biofuel source; it can be replenished in one or so generations. More apropos, a field of soybeans or switchgrass can grow to maturity and can be converted into types of biofuel for use in months, through proper processing.

The European Union is making an effort to obtain two percent of its transport fuel from biodiesel in 2005, six percent in 2010, and twenty percent by 2020. With the new Congress we, in the United States, can expect major biogas-funded projects in a short time. The E.U., to reach its established goals, is reducing the tax on the fuel and giving enticements to farmers to grow the crops. George Monbiot in the *Manchester Guardian* (11/22/04) says that this adoption of biofuels would be "a humanitarian and environmental disaster" and that the cure would be worse than the disease. He predicts that, if biofuels from cultivated land pick up steam, most of the world's arable land will be used to produce food for cars, not people.

Claims Made by Biofuel Promoters

A number of claims about biofuels have surfaced in the past few years. Some of these are made by earnest people bent on reducing foreign oil dependence; others are due to vested interests wanting to develop pet projects and anticipating profits from government subsidies.

Nomenclature: Environmentally-conscious people favor fuel sources that are renewable. Wind, solar, hydropower, geothermal, and tidal power are commonly known as renewable sources of energy whereas oil, coal, natural gas and nuclear sources are regarded as the opposite. Characterizing bioenergy as renewable requires some qualification for, like the use of coal and oil, biofuel use results in carbon dioxide emissions. Merely having two categories (renewable and non-renewable) may not be sufficient when trying to categorize biofuels. The material used for biofuels can be regrown, but this does not make all biofuels environmentally benign. Some are dependent

on petroleum-based practices (use of tractors to cultivate soybeans or corn); the production may cause the logging of renewable forests where energy is stored for future use (carbon dioxide utilized for plant formation); and growth of corn or soybeans can cause croplands to erode and lose nutrients.

Income for farmers: No doubt the economic health of farmers is worthwhile. Having wind or solar farms on agricultural lands is praiseworthy and provides added income. Growing crops of beans and corn to respond to the enormous appetite for transport fuel may provide additional income sources for economically strapped farmers in the Midwest and on the Great Plains, but is it equally praiseworthy? The wind farm can also be used for livestock pasture. Today, in many developed countries, especially in Europe and North America, the cost of food is cheaper than that of fuel, so cropland is more profitably used to grow biofuels for vehicles than to grow food. Surprisingly, in some places central heating units are supplied by food-grade wheat or corn. However, increased farm prices mean increased food prices for the poor since the amount available for food will be more limited.

Biofuels can slash the pollution that causes global warming: This extravagant claim was made in 2005 in promotional literature from the Natural Resources Defense Council (NRDC). The NRDC says that biofuels would reduce greenhouse gas emissions by 1.7 billion tons a year by 2050. That is more than eighty percent of current transportation-related emissions. The unused petroleum is regarded as the saving. The combustion of the alcohol produces smaller amounts of carbon dioxide than does the combustion of petroleum, but the fuel content of each gallon of fuel is also less. Without quibbling as to relative carbon dioxide reductions, we know that the land used to produce

biofuels, if left in forest cover, would absorb a considerable portion of carbon dioxide emissions. Furthermore, if solar-powered electric vehicles were driven, no carbon dioxide emissions would result. As environmentalists advocate, wouldn't it be a better strategy to convert to electric vehicles that can run off current produced by renewable energy sources such as solar and wind installations?

Biofuels can provide major air quality benefits: NRDC stresses in its arguments that biofuels contain no sulfur and produce low carbon monoxide, particulate, and toxic emissions. The group says that using biofuels makes it easier to reach air pollution reduction targets than using petroleum-based fuels would. The US Department of Energy's Biomass Program adds that biofuels avoid use of MTBE or other highly toxic fuel additives. However, the biofuel is burned and that means some air-borne emissions are given off even though they are less than would result from equivalent amounts of petroleum-based fuels. Remember burning ethanol produces toxic combustion products.

Biofuels offer major land-use benefits: Here the argument moves from cropland, which can erode, be contaminated by excess nitrogen fertilizers and pesticides, and removed from food production, to land on which more naturally growing weed-type species such as switchgrass, an often touted source of cellulosic biofuel grow. Such vegetation as a potential fuel, requires no cultivation and fertilizing and uses non-productive land for plant growth. However, this land has natural "productivity" being potential forestland, wetland, or grassland that can serve as a natural sink for carbon dioxide that can be stored; furthermore this land can provide habitat for endangered species of plants and animals. Tropical forests are being cut for tree farms to grow palms that can produce four times as much oil per acre as can rapeseed, which has a higher yield

than does soya oil (though other portions of the soybean can be used for animal feed).

Furthermore, according to Michael B. McElroy of Harvard University, the substitution of ethanol for 60 billion gallons of US gasoline would necessitate harvesting cellulose from up to 225 million acres if we assume that an acre can produce as much cellulose as it can corn, i.e. four tons. However, the technology for separating cellulose from the lignin in grasses and trees and then extracting the fermentable sugars is only now in the process of development. Even if the technology is perfected, production of ethanol from cellulose will not occur to any appreciable extent for at least a decade.

The Indeterminate Economics of Biofuel

The temptation in energy policy matters is to get bogged down in tossing around statistics that bewilder policy-makers who settle for one or other expert source and omit others. Often the battle is over which expert with his or her array of literature citations is more legitimate, as though intellectual judgment comes solely through marshaled statistics.

In the area of biofuels economics a nightmarish series of disputed calculations arises because of the indefinite number of factors that are counted in production costs. These factors may include fuel and type of fuel for cultivating, harvesting, and processing the biofuel along with transporting and marketing it in some fashion; the energy (content) needed to make the machinery that processes the fuel; the content of the fertilizers and other agri-products used in cultivation of the fuel source; the security involved in

protecting fuel source and supply routes; and the marketing and management of the fuel system.

Should experts battle over the inputs for biofuel production, if they neglect to speak about the horrifying cost of security in the Middle East? Are not resources expended to stabilize petroleum sources rather than merely to introduce democracy into one or other Gulf state? If we attribute the military expenditures running into hundreds of billions of dollars to foreign oil sources, it can be argued that military defense affects the price of each barrel of domestic oil.

Biofuels may be used in an inefficient device such as a highly wasteful SUV engine. What is the significance of biofuel statistics when a highly efficient diesel tractor to cultivate a field of corn destined for fuel ethanol is included; but the end-use engine has a broad range of inefficiencies?

The economics of biofuels must like solar and wind and other renewables rest on a simultaneous consideration of resource conservation. No one would dare consider solar energy applications that are divorced from strict domestic conservation for they would be prohibitively expensive. We recall that, if resource conservation is neglected, photovoltaic panels, shingles or foil are far too costly, because, without it, the homeowner would expend valuable energy in an extravagant manner to light and heat a spacious interior environment. Similarly, the economics of biofuels needs to consider transport efficiencies or their lack.

Environmental and Social Justice Ramifications

A biofuels discussion devoid of ethical considerations is dangerous. Higher levels of food use such as meat, eggs or fruit demand more land than do whole grains. Nevertheless, rising standards of living in China and India, the two most populous nations, are calling for enlarging highway systems, building industrial parks, expanding residence opportunities, all at the expense of limited cropland. Destruction of Amazon and other tropical forests to grow crops for the rapidly expanding world market is proving disastrous to the forested areas—the lungs of our planet.

Unfortunately, an ugly set of alternatives is arising: available reasonably-priced food for the poor or cheaper biofuel for the affluent. Environmental justice and social justice are one, and for some of us the second is a sub-set of the first. An environmentally sound world must be among other things, one where all have enough food to eat, potable water to drink and basic housing, and where educational and medical needs are met. Since the failure to satisfy social needs weakens world community, the ecological structure of a socially dysfunctional world will be damaged as well. Social and eco-justice are united as a single whole. Poor people put enormous stress on the remaining wildlands, poach wildlife, gather excessive amounts of firewood, and must live where the air and water are contaminated

Food, not biofuel. Instead of focusing policy-making attention on energy (transport fuel) needs alone, governments should adopt a more comprehensive resource policy. Instead of assisting farmers to grow crops for biofuels, governments should subsidize soybean and grain growers to furnish a world food bank at strategic locations with safe stores of basic staples to meet famine needs when they invariably arise, and to furnish food supplements for school children and refugees in all parts of the world.

Such a global policy would enhance the income of grain and soybean farmers and yet not divert limited food into the biofuel industry. Diversion of cropland to biofuels does not alleviate social problems but actually may exacerbate them in such ways as driving up the price of basic foods and increasing air pollution through continued combustion of fuels. The fact that biofuels are more practically obtained from croplands than from cellulosic waste materials makes the situation worse..

Addictive behavior. The human family is becoming more aware of inequalities due to affluence-based selfishness and insensitivity. From the perspective of basic human considerations, cropland should be used for basic food needs first, but convincing affluent people of such a priority is an almost impossible task. The demand for abundant, low-priced fuel seems uppermost in American minds. Currently the per capita use of domestic sources of petroleum alone in America is double the average per capita use of petroleum worldwide. US oil production is 7.61 million bbl/day (2005) and U.S. oil consumption some 20.03 million bbl per day (2003) (CIA, *The World Factbook*). Total world production of petroleum is about 80 million bbl/day. Many Americans are incapable of distinguishing between needs and wants, and even President Bush among others calls this addictive behavior.

Pharisaism. One of the major problems in an affluent culture that also desires to be environmentally conscious is that certain acts of conservation are obeyed to the letter of the law (no wrappers dropped at the fast food place) but some of the major ways to conserve resources are overlooked or directly avoided. We often forget that energy conservation is a far better way to handle energy needs than producing fuel that is to be used wastefully. The ability to brag about what one does while neglecting far greater

means of saving resources is detrimental, because the boasters fail to learn meaningful environmental practices. The lack of US commitment to resource conservation and the failure to join the community of nations to curb greenhouse emissions will be exacerbated by large-scale biofuels development. Continue to waste and the world be damned.

Primary Energy Goal: Resource Conservation

The safest, cheapest, and most environmentally friendly way to energy independence is through resource conservation. We already drill about ten percent of the world's petroleum output each year to be consumed by five percent of the world's people. Can't twice as much as others be sufficient? The answer is certainly in the affirmative, but we are the second most wasteful country in the world—and that is the reason why in lighting changes alone the differences are utterly immense (forty large-scale power plants would be made unnecessary by the installation of five compact fluorescent bulbs in the five most used outlets in every home). However, energy conservation need not stop there but includes buying more efficient automobiles, cutting traffic speeds, improving electric appliances, curbing computer stand-by time, installing comfort zones for home heating and cooling, eating locally grown food, saving rainwater, and installing more insulation in homes.

Addressing domestic wastes. Good conservation includes reuse of waste in the most beneficial manner. Some wastes are appropriate for use as biofuels.

a) The classic case is the millions of gallons of waste cooking oil from fast food and other restaurants where large amounts of this oil must be discarded after

use. The waste itself is worrisome and yet it can be turned into a biodiesel that can be burned by buses, trucks and even small cars. However, if all of the cooking oil in the United Kingdom were recycled, it would amount to about one quarter of one percent of the needed transport fuel. The percentage would be even less in the United States. Enterprising souls have tapped into these waste sources and collected materials to furnish their vehicles with a clean-burning and low-priced (if labor costs are excluded) fuel source. These recyclers save restaurants disposal costs by picking up the waste materials at the door.

b) Agricultural wastes are often overlooked in discussion of biofuels. Nevertheless, they need to be taken into consideration. An insignificant amount of hulls, stalks and other such wastes are used for fuels as such. Some can be turned into cellulosic products for biofuels but more often the waste could be directly composted and could then serve as a valuable amendment to the cropland areas. In contrast, changing straw into cellulosic-derived fuels is a pie-in-the sky technique.

In the 1970s federal grants were available for collecting manure to be turned into biogas; these worked best with large feedlots and concentrations of manure. The inconvenience of such collecting, the lower quality of the gas generated, and the low cost of competing natural gas made many projects lapse. Bio-gas is a good source in some poorer rural regions of the world but the willingness to handle relatively small amounts of manure for cooking or heating operations does not appeal in lands with readily available natural gas and propane. Such concentrations of manure are already under severe criticism due to unpleasant odor and possible water contamination. Landfills are also sources of biogas and more and more are being tapped each year.

c) Forest wastes have been burned for fuel to supply wood processing facilities and that seems to be a reasonable use of biofuel. Some sawdust and scrap materials can be composted but the proper utilization depends on profitability in a rather marginal industry. For a long period in industrial history, wood was the preferred bioenergy source. However, as industry grew in volume in the middle of the nineteenth century, smelters and railroads demanded increasing amounts of limited forest products. Wood stopped being the fuel choice for industry and transportation, due to bulk and limitations of local supply. Although wood-burning is allowed for fireplaces and rural kitchen stoves, efforts are underway to make heating units more efficient through EPA-certification.

Secondary Goal: Use of Emission-Free Renewable Energy Sources

Biofuels passed the test for "green" approval because they are regarded as "renewable" in a two-category system lacking an intermediate category. A third and intermediate category would allow one to speak of "combustible renewable fuel," fuel that is grown in a relatively short time and burned, liberating its stored energy—along with emission products. Good environmental practice includes curbing the emissions from biofuels, as from petroleum; and facilitating the use of renewable energy sources with no emissions, namely, solar, wind, geothermal, tidal, and hydropower. Some of these renewable energy sources have associated environmental problems, but not as serious as air-emissions through combustion of fuels.

The rapid decline in wind power costs must be inserted into any discussion of the expansion of biofuel utilization. In fact, wind power, with quite efficient wind generators

approaching the amazingly low cost of three cents per watt, is rapidly becoming the renewable energy of choice. Only a portion of the urban population of this nation lies close to favorable wind zones, but government incentives should be directed to developing these favorable sites along with solar energy in order to increase their share of the total energy mix. With a concerted effort, solar and wind energy could account for twenty percent of fuel needs by 2020. Due to crystalline silicon costs, solar does not yet have the low-cost generating potential of wind; but prices are coming down to four to five cents a watt even for solar shingles, and, if these goals can be reached soon, solar will be highly competitive as an alternative fuel.

Sound Resource Policy

America desperately needs a sound resource policy not merely an energy policy. The key will be the acceptance of conservation as a global and national demand and a plan to work this into our own national lifestyle. Secondly cost effective wind and innovative solar energy applications are appearing quite rapidly. The nation can become energy independent through conservation and use of these renewable resources, along with continued use of plentiful supplies of coal and less plentiful oil and natural gas—all the while employing the latest clean technologies. To permit continued waste by the world's second most wasteful nation is like seeking to find weaker drug sources for the heroin addict. Our nation should be turning attention from wasteful use of financial and energy resources towards giving prime attention to energy conservation measures.

In conclusion, governmental and energy policy-making should concentrate primarily on resource conservation; secondly on renewable alternatives that have no

emissions; and lastly on use of biofuels where the products would otherwise be wasted or in geographic areas that lack renewable alternatives (wood for cooking and space heating).