from *Full Planet, Empty Plates: The New Geopolitics of Food Scarcity*, by Lester R. Brown

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Food or Fuel?

At the time of the Arab oil export embargo in the 1970s, the importing countries were beginning to ask themselves if there were alternatives to oil. In a number of countries, particularly the United States, several in Europe, and Brazil, the idea of growing crops to produce fuel for cars was appealing. The modern biofuels industry was launched.[1]

This was the beginning of what would become one of the great tragedies of history. Brazil was able to create a thriving fuel ethanol program based on sugarcane, a tropical plant. Unfortunately for the rest of the world, however, in the United States the feedstock was corn. Between 1980 and 2005, the amount of grain used to produce fuel ethanol in the United States gradually expanded from 1 million to 41 million tons.[2]

Then came Hurricane Katrina, which disrupted Gulf-based oil refineries and gasoline supply lines in late August 2005. As gasoline prices in the United States quickly climbed to $3 a gallon, the conversion of a $2 bushel of corn, which can be distilled into 2.8 gallons of ethanol, became highly profitable.[3]

The result was a rush to raise capital and build distilleries. From November 2005 through June 2006, ground was broken for a new ethanol plant in the United States

every nine days. From July through September, the construction pace accelerated to one every five days. And in October 2006, it was one every three days.[4]

Between 2005 and 2011, the grain used to produce fuel for cars climbed from 41 million to 127 million tons—nearly a third of the U.S. grain harvest. (See Figure 4–1.) The United States is trying to replace oil fields with corn fields to meet part of its automotive fuel needs.[5]

The massive diversion of grain to fuel cars has helped drive up food prices, leaving low-income consumers everywhere to suffer some of the most severe food price inflation in history. As of mid-2012, world wheat, corn, and soybean prices were roughly double their historical levels.[6]

The appetite for grain to fuel cars is seemingly insatiable. The grain required to fill a 25-gallon fuel tank of a sport utility vehicle with ethanol just once would feed one person for a whole year. The grain turned into etha-

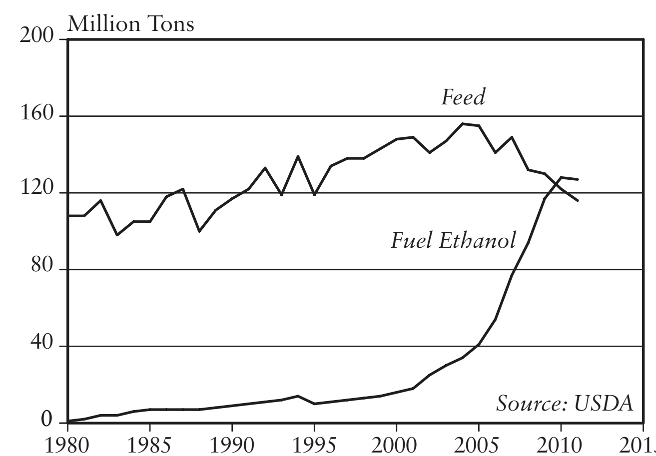

Figure 4–1. *Corn Use for Feed and Fuel Ethanol in the United States, 1980–2011*

nol in the United States in 2011 could have fed, at average world consumption levels, some 400 million people. But even if the entire U.S. grain harvest were turned into ethanol, it would only satisfy 18 percent of current gasoline demand.[7]

With its enormous growth in distilling capacity, the United States quickly overtook Brazil to become the new world leader in biofuels. In 2011, the United States produced 14 billion gallons of ethanol and Brazil produced under 6 billion gallons; together they accounted for 87 percent of world output. The 14 billion gallons of U.S. grain-based ethanol met roughly 6 percent of U.S. gasoline demand. Other countries producing ethanol from food crops, though in relatively small amounts, include China, Canada, France, and Germany.[8]

Most ethanol production growth has been concentrated in the last several years. In 1980, the world produced scarcely 1 billion gallons of fuel ethanol. By 2000, the figure was 4.5 billion gallons. It was still increasing, albeit slowly, expanding to 8.2 billion gallons in 2005. But between then and 2011, production jumped to 23 billion gallons.[9]

A number of countries, including the United States, are also producing biodiesel from oil-bearing crops. World biodiesel production grew from a mere 3 million gallons in 1991 to just under 1 billion gallons in 2005. During the next six years it jumped to nearly 6 billion gallons, increasing sixfold. Still, worldwide production of biodiesel is less than one fourth that of ethanol.[10]

The production of biodiesel is much more evenly distributed among countries than that of ethanol. The top five producers are the United States, Germany, Argentina, Brazil, and France, with production ranging from 840 million gallons per year in the United States to 420 million gallons in France.[11]

A variety of crops can be used to produce biodiesel. In Europe, where sunflower seed oil, palm oil, and rapeseed oil are leading table oils, rapeseed is used most often for biodiesel. Similarly, in the United States the soybean is the leading table oil and biodiesel feedstock. Elsewhere, palm oil is widely used both for food and to produce biodiesel.[12]

Although production from oil palms is limited to tropical and subtropical regions, the crop yields much more biodiesel per acre than do temperate-zone oilseeds such as soybeans and rapeseed. However, one disturbing consequence of rising biofuel production is that new oil palm plantations are coming at the expense of tropical forests. And any land that is devoted to producing biofuel crops is not available to produce food.[13]

Not only are biofuels helping raise food prices, and thus increasing the number of hungry people, most make little sense from an energy efficiency perspective. Although ethanol can be produced from any plant, it is much more efficient and much less costly to use sugar- and starch-bearing crops. But even among these crops the efficiency varies widely. The ethanol yield per acre from sugarcane is nearly 600 gallons, a third higher than that from corn. This is partly because sugarcane is grown in tropical and subtropical regions and it grows year-round. Corn, in contrast, has a growing season of 120 days or so.[14]

In terms of energy efficiency, grain-based ethanol is a clear loser. For sugarcane, the energy yield—that is, the energy embodied in the ethanol—can be up to eight times the energy invested in producing the biofuel. In contrast, the energy return on energy invested in producing corn-based ethanol is only roughly 1.5 to 1, a dismal return.[15]

For biodiesel, oil palm is far and away the most energy-efficient crop, yielding roughly nine times as much energy as is invested in producing biodiesel from it. The energy return for biodiesel produced from soybeans and rapeseed is about 2.5 to 1. In terms of land productivity, an acre of oil palms can produce over 500 gallons of fuel per year—more than six times that produced from soybeans or rapeseed. Growing even the most productive fuel crops, however, still means either diverting land from other crops or clearing more land.[16]

The capacity to convert enormous volumes of grain into fuel means that the price of grain is now more closely tied to the price of oil than ever before. If the price of fuel from grain drops below that from oil, then investment in converting grain into fuel will increase. Thus, if the price of oil were to reach, say, $200 a barrel, there would likely be an enormous additional investment in ethanol distilleries to convert grain into fuel. If the price of corn rises high enough, however, as it may well do, distilling grain to produce fuel may no longer be profitable.

One of the consequences of integrating the world food and fuel economies is that the owners of the world's 1 billion motor vehicles are pitted against the world's poorest people in competition for grain. The winner of this competition will depend heavily on income levels. Whereas the average motorist has an annual income over $30,000, the incomes of the 2 billion poorest people in the world are well under $2,000.[17]

Rising food prices can quickly translate into social unrest. As grain prices were doubling from 2007 to mid-2008, food protests and riots broke out in many countries. Economic stresses in the form of rising food prices are translating into political stresses, putting governments in some countries under unmanageable pressures. The U.S. State Department reports food unrest in some 60 countries between 2007 and 2009. Among these were Afghanistan, Yemen, Ethiopia, Somalia, Sudan, the Democratic Republic of the Congo, and Haiti.[18]

International food assistance programs are also hit

hard by rising grain prices. Since the budgets of food aid agencies are set well in advance, a rise in prices shrinks food assistance precisely when more help is needed. The U.N. World Food Programme, which supplies emergency food aid to more than 60 countries, has to cut shipments as prices soar. Meanwhile, over 7,000 children are dying each day from hunger and related illnesses.[19]

When governments subsidize food-based biofuel production, they are in effect spending taxpayers' money to raise costs at the supermarket checkout counter. In the United States, the production of fuel ethanol was encouraged by a tax credit granted to fuel blenders for each gallon of ethanol they blended with gasoline. This tax credit expired at the end of 2011.[20]

Still in place, however, is the Renewable Fuel Standard, which is seen by the U.S. Department of Agriculture as part of a strategy to "help recharge the rural American economy." This mandate requires that biofuel use ramp up to 36 billion gallons annually by 2022. Of this total, 16 billion gallons are slated to come from cellulosic feedstocks, such as cornstalks, grass, or wood chips.[21]

Yet for the foreseeable future, production of those cellulose-based fuels has little chance of reaching such levels. Producing ethanol from sugars or starches like corn or sugarcane is a one-step process that converts the feedstock to ethanol. But producing ethanol from cellulosic materials is a two-step process: first the material must be broken down into sugar or starch, and then it is converted into ethanol. Furthermore, cellulosic feedstocks like corn stalks are much bulkier than feedstocks like corn kernels, so transporting them from distant fields to a distillery is much more costly. Removing agricultural residues such as corn stalks or wheat straw from the field to produce ethanol deprives the soil of needed organic matter.[22]

The unfortunate reality is that the road to this ambitious cellulosic biofuel goal is littered with bankrupt firms that tried and failed to develop a process that would produce an economically viable fuel. Despite having the advantage of not being directly part of the food supply, cellulosic ethanol has strong intrinsic characteristics that put it at a basic disadvantage compared with grain ethanol, so it may never become economically viable.[23]

The mandate from the European Union (EU) requiring that 10 percent of its transportation energy come from renewable sources, principally biofuels, by 2020 is similarly ambitious. Among international agribusiness firms, this is seen as a reason to acquire land, mostly in Africa, on which to produce fuel for export to Europe. Since Europe relies primarily on diesel fuel for its cars, the investors are looking at crops such as the oil palm and jatropha, a relatively low-yielding oil-bearing shrub, as a source of diesel fuel.[24]

There is growing opposition to this EU goal from environmental groups, the European Environment Agency, and many other stakeholders. They object to the deforestation and the displacement of the poor that often results from such "land grabbing." (See Chapter 10.) They are also concerned that, by and large, biofuels do not deliver the promised climate benefits.[25]

The biofuel industry and its proponents have argued that greenhouse gas emissions from biofuels are lower than those from gasoline, but this has been challenged by a number of scientific studies. Indeed, there is growing evidence that biofuel production may contribute to global warming rather than ameliorate it. A study led by Nobel prize–winning chemist Paul Crutzen at the Max Planck Institute for Chemistry in Germany reports that the nitrogen fertilizers used to produce biofuel crops release "nitrous oxide emissions large enough to cause climate warming instead of cooling."[26]

A report from Rice University that carefully examined the greenhouse gas emissions question concluded that "it is uncertain whether existing biofuels production provides any beneficial improvement over traditional gasoline, after taking into account land use changes and emissions of nitrous oxide. Legislation giving biofuels preferences on the basis of greenhouse gas benefits should be avoided." The U.S. National Academy of Sciences also voiced concern about biofuel production's negative effects on soils, water, and the climate.[27]

There is some good news on the issue of food or fuel. An April 2012 industry report notes that "the world ethanol engine continues to sputter." U.S. ethanol production likely peaked in 2011 and is projected to drop 2 percent in 2012. An even greater decline in U.S. ethanol production is likely in 2013 as oil prices weaken and as heat and drought in the U.S. Midwest drive corn prices upward. For many distillers, the profit margin disappeared in 2012. In early July 2012, Valero Energy Corporation, an oil company and major ethanol producer, reported it was idling the second of its 10 ethanol distilleries. Numerous other distilleries are on the verge of shutting down.[28]

If the ethanol mandate were phased out, U.S. distillers would have even less confidence in the future marketability of ethanol. In a world of widely fluctuating oil and grain prices, ethanol production would not always be profitable.

Beyond this, the use of automotive fuel in the United States, which peaked in 2007, fell 11 percent by 2012. Young people living in cities are simply not as car-oriented as their parents were. They are not part of the car culture. This helps explain why the size of the U.S. motor vehicle fleet, after climbing for a century, peaked at 250 million in 2008. It now appears that the fleet size will continue to shrink through this decade.[29]

In addition, the introduction of more stringent U.S. auto fuel-efficiency standards means that gasoline use by new cars sold in 2025 will be half that of new cars sold in 2010. As older, less efficient cars are retired and fuel use declines, the demand for grain-based ethanol for blending will also decline.[30]

Within the automobile sector, a major move to plug-in hybrids and all-electric cars will further reduce the use of gasoline. If this shift is accompanied by investment in thousands of wind farms to feed cheap electricity into the grid, then cars could run largely on electricity for the equivalent cost of 80¢ per gallon of gasoline.[31]

There is also a growing public preference for walking, biking, and using public transportation wherever possible. This reduces not only the demand for cars and gasoline but also the paving of land for roads and parking lots.[32]

Whether viewed from an environmental or an economic vantage point, we would all benefit by shifting from liquid fuels to electrically driven vehicles. Using electricity from wind farms, solar cells, or geothermal power plants to power cars will dramatically reduce carbon emissions. We now have both the electricity-generating technologies and the automotive technologies to create a clean, carbon-free transportation system, one that does not rely on either the use of oil or the conversion of food crops into fuel.[33]

Data, endnotes, and additional resources can be found at Earth Policy Institute, www.earth-policy.org.