FACT SHEET: Ethanol Biorefineries

Energy Justice Network

Ethanol Basics

The primary feedstock of ethanol is corn.[1] Currently 38% of the U.S. corn crop[2] and 15% of the sorghum crop goes into ethanol production annually.[3] The U.S. annually consumes 142 billion gallons of gasoline[4] and now has the capability to produce a record 7.2 billion gallons of ethanol per year.[5] The Energy Policy Act of 2005 mandates production of 7.5 billion gallons per year by 2012[6] and the Energy Independence and Security Act of 2007 creates an impossible goal of producing 36 billion gallons of renewable fuels, including 17 billion gallons of corn ethanol by 2022.[7]

Achieving this will require approximately 83 million acres[8] — almost 90% of the current corn production in the entire U.S.[9] This is spawning a massive growth in proposals for noisy,[10] polluting ethanol biorefineries, but will do little to cut oil imports. A 1997 congressional report concluded, "ethanol's potential for substituting for petroleum is so small that it is unlikely to significantly affect overall energy security."[11]

As of Jan 2014, there are 210 ethanol plants in operation and 7 being expanded or under construction.[12]

Industrial Agriculture

Of all crops grown in the U.S., corn demands the most massive fixes of herbicides, insecticides, and natural gas-based fertilizers, while creating the most soil erosion.[13] 90% of U.S. corn is genetically engineered.[14] Ethanol is increasingly derived from biotech corn varieties.[15]

Biotech corn comes in two main varieties: one where the corn produces Bt toxin to kill the European corn borer, and one that enables the corn to withstand higher doses of herbicides like Aventis' Liberty or Monsanto's Roundup,[16] with Roundup having been found to be more toxic than previously thought.[17] Both Bt and herbicide-resistant corn can lead to the development of resistance in bugs and weeds. Bt is a soil bacteria used as a pesticide of last resort by organic farmers because Bt resistant bugs are a major problem. Both methods also risk genetic pollution, spreading the biotech attributes to nearby crops and wild plants.[18,19]

The U.S. only has 2.263 billion acres of land, and soil depletion is already a critical issue. Topsoil is being lost from corn plantations about 12 times faster than it is being created.[20] The Corn Belt has already lost about 70% of its wetlands from being drained to produce surplus corn.[21]

Energy (in)Security

Ethanol is promoted in “energy security” terms, yet our ability to grow corn is increasingly dependent on foreign sources of essential fertilizer nutrients nitrogen, phosphorus, and potassium.[22] Nitrogen for commercial use is primarily recovered from the air as ammonia (NH_4), which is produced by combining atmospheric nitrogen with hydrogen derived from natural gas.[23] Rising natural gas prices have contributed to a 172% increase in the cost of U.S. ammonia production between the fiscal years of 1999 and 2005.[24] Between 1991 and 2007, nitrogen-based fertilizer imports tripled, from 14% to 44%[25] and many of the ammonia fertilizer plants in the U.S. have shut down due to high natural gas prices, moving production overseas.[26] More recent, temporarily low gas prices (due to fracking) are bringing nitrogen fertilizer production back to the U.S.

Factory farming practices utilize phosphorus to produce corn for ethanol and production depends on the availability of this mineral for the viability of the soil. In 2007, U.S. phosphate production slipped below 30 million tons for the first time in over 40 years.[27] With the decline in production and increased usage from more corn planting for ethanol we are increasing our dependence on foreign sources to sustain our phosphorus needs. USGS estimates that aside from the U.S., the world’s largest phosphate rock stores exist in China, a budding superpower and geopolitical rival, and Morocco, a region of increasing unrest and attacks.[28]

Potash is the major source of potassium. In 2007, the U.S. imported over 80% of the potash consumed, with 85% of all potash sales going directly to the fertilizer industry.[29]

Increased global fertilizer demand, the weakening of the dollar, rising cost of inputs, and diminishing natural resources have all contributed to a stark rise in nitrogen-based fertilizer prices in the U.S. USDA data indicate that in June 2008, average fertilizer prices stood 286% higher than their 1990-92 level.[30] Clearly, the idea that industrial agriculture could achieve “energy independence” for the United States is nothing but a political farce.

Polluting BioRefineries

Ethanol production is very energy intensive, requiring mini-power plants to produce the steam they need. Some proposed ethanol plants have sought to locate next to existing trash incinerators, coal or waste coal power plants or other industries capable of sharing steam with their new industrial neighbors. This may save energy, but it results in the concentrating of polluting industries in already poisoned communities. Most ethanol plants have their own power production facilities, usually burning natural gas, but some have been coal-powered. Around 2005, when coal was cheap and gas was costly, it was forecast that most new ethanol facilities would burn coal.[31] Some of the proposed ethanol plants are seeking to install gasification-style incinerators capable of burning anything from trash, tires, plastics, construction and demolition wood waste to lesser contaminated wastes like animal, crop and food production wastes and forestry residues. All of these fuels have their own set of contaminants that would be released into the community through air pollution and the production of toxic ash. Since facilities can earn more money taking waste, this economic incentive could encourage these plants to become *de facto* waste incinerators.

Other parts of the biorefinery’s process also release pollution, notably a variety of toxic hazardous air pollutants and volatile organic compounds such as acetaldehyde, acetic acid, acrolein, ethanol, formaldehyde, methanol and

furfural. State environmental regulations are very weak and air pollution permits fail to require that these emissions be monitored on a continuous basis.[32]

The older ethanol plants were notorious for their excessive emissions, odor complaints, permit violations and fines.[33] Although the industry "solved" this problem by installing "thermal oxidizers" (incinerators) that burn off their gases, the emissions still come out, but in a chemically-altered form – one that destroys many (but not all) of the compounds, and can create new pollutants in the process. Even after installing new equipment, neighborhood residents continue to complain of odors and ill health effects, partially because emissions still continue through "fugitive" sources (dust from grain handling, offgassing from storage tanks and unprocessed emissions via vents used to bypass pollution controls during mishaps).[34]

Water Use and Pollution

For each gallon of ethanol produced, about 2 to 4 gallons of water is consumed, depending on irrigation amounts [35] and produce 12 gallons of sewage-like effluent in the fermentation and distillation process.[36] Syrup, batches of bad ethanol and sewage are dumped into streams, threatening fish and plants with chloride, copper and other wastes which deprive waters of oxygen when they decompose. A state inspector in Iowa reported that a creek by the Sioux Center ethanol plant was milky and smelled like sewage.[37]

The Fuel

Ethanol contains only 60% as much energy per gallon as gasoline and evaporates faster than gasoline.[38] So, while gasoline reformulated with ethanol may release less carbon monoxide, the blend not only contains less energy than pure gasoline, but also releases more volatile organic compounds, hydrocarbons, and nitrogen oxides. You will get more vapor emissions when you're refueling and when your car is sitting in a parking lot on a hot summer day. Furthermore, ethanol is known to be corrosive and can degrade systems in cars/boats, causing more fuel leaks.[39]

Current technology requires ethanol to be blended with gasoline, however, ethanol absorbs water and gasoline does not; therefore, ethanol cannot always be transported by regular petroleum pipelines. Instead, it's often shipped separately and mixed on-site. About 75% of ethanol is carried by rail, and the majority of the remaining 25% is carried by truck.[40] Shipping by truck, rail car, or barge is far more expensive than pipelines,[41] and also carries a much higher risk of incurring accidents during shipping.

Fires, Spills and Explosions

Ethanol fires are exceedingly difficult to put out. Water merely spreads the blaze, and the firefighting foam that has been used for almost half a century to put out gasoline fires is ineffective against ethanol fires. A new foam for fighting ethanol fires has recently been developed, but it costs about 30% more than traditional firefighting foam. Even with this new foam, firefighters must receive additional training on how to tackle ethanol fires in order for the foam to be effective.[42]

Numerous fires, explosions and spills have occurred at ethanol plants and in shipping.[43] In February 2004, a tanker carrying 3.5 million gallons of ethanol exploded and sank off of the coast of Virginia. Only six of the 27-member crew survived.[44] In October 2006, nearly two dozen ethanol tanker cars derailed on a bridge near homes in New Brighton, PA, spilling 485,000 gallons of ethanol in a fiery wreck that burned for days and left the park and river contaminated a year later.[45] In June 2007, 24 train cars derailed in Plumas County, CA spilling 30,000 gallons of ethanol that had contained 5% benzene, causing fish kills, skin lesions in local residents, and leaving ongoing odors at the spill site 4 months later.[46] In multiple cases, communities were told that just one or a few railcars contained ethanol. The true numbers didn't come out until months later.

Ethanol Storage Tank Blaze, Port Kembla, Australia

Magnets for Corporate Factory Farms

Among the waste by-products of ethanol production is a corn mash known as distiller's grains. As an added source of income, ethanol plant operators have sought to use these grains as animal feed for feedlot operations attracting corporate factory farms. This partnership adds insult to injury for communities bearing the burden of housing ethanol plants. Iowa – the nation's #1 state for ethanol plants – has seen a large influx of corporate dairy operations. Furthermore, a study published by Kansas State University researchers in December of 2007 found an increased prevalence of the deadly E. coli 0157 bacterium in the hind-gut of cattle fed distiller's grains.[47] This strongly suggests a link between the increased use of distiller's grains by the beef industry and the increased prevalence of nation-wide beef recalls due to E. coli 0157 contamination.

Billions in Subsidies

Ethanol is subsidized to the tune of $1.10 to $1.30/gallon, with $67 to 82 billion dollars allocated from 2006-2012.[48] This money could go much further if invested in the transition to conservation, efficiency, wind, and solar. The need for combustible fuels in transportation can be eliminated with the use of electric cars (and plug-in hybrids in the short term), using wind-powered electricity, at a cost less than $1/gallon gasoline equivalent.[49]

Increasing the average mileage of passenger cars and SUVs by 3-5 miles per gallon would dwarf the effects of all possible biofuel production from all sources of biomass available in the U.S. Inflating passenger car tires properly *today* will have more impact on the energy independence of U.S. than the 2012 ethanol production requirements.[50]

References available in the web version