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From seed to tank: The never-ending biofuels debate

Replacing higher volumes of gasoline with ethanol seems like wise environmental policy. So why is the way forward so hazy?

BY JESSE SNYDER

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On October 8, 2013, the American Petroleum Institute filed a lawsuit against the Environmental Protection Agency for tabling what it claimed was an “overzealous” ethanol fuel mandate. It’s doubtful anyone was surprised by the move. The lawsuit marked the fourth time the API had sued the EPA over ethanol fuel blends in as many years.

The API sued for two reasons. First, the 2013 mandate was announced well after its stipulated release date, in August 2013 rather than November 2012. Second, the association claimed the goals laid out in the mandate were unrealistic. Under the mandate, 15.1 million liters of cellulosic ethanol, derived from the stocks and foliage of corn plants rather than the grain, would need to be blended into U.S. gasoline over the course of the year.

The tumult over biofuels mandates in the U.S. is something of an annual event. Every year the EPA sets a mandate for ethanol fuel blends, and every year the two sides of the biofuels debate clash. The Renewable Fuels Association (RFA) quickly rebutted the API’s lawsuit. “All stakeholders have been producing and blending at levels that will unquestionably meet the 2013 requirements,” Bob Dinneen, president and CEO of the RFA, said in a statement. “This is a lawsuit in search of a problem.” The American Automotive Association, for its part, warned that too-high ethanol blends would damage engines unequipped for a higher ethanol-blended fuel.



Most gasoline consumed in the U.S., as in Canada, is E10 fuel (1:9 ethanol-to-gasoline blend). But there is a push to raise those numbers aggressively. Under the Energy Independence Act of 2007, the U.S. aims to raise biofuels consumption to 136 million liters per year in 2022, up from 34 million in 2008. The conversation over gasoline blends in Canada is more subdued. Mandates are set automatically as a percentage figure, and are based on anticipated demand. Lobbyists ply their trade less aggressively. Yet, as industry and government in Canada face pressure to curb carbon emissions, there is corresponding pressure to increase biofuel consumption. The question is by how much.

A lot is at stake. Canadian motorists burned 40 billion liters of gasoline in 2012. Even a subtle shift to E15 fuel, an idea some provinces have floated, could cut emissions significantly, according to proponents. Major, mostly tangible, obstacles loom, namely infrastructure requirements and the still-uninspiring EROEI (energy return on energy invested) of biofuels in general. A widespread shift to heavily ethanol-weighted gasoline like E85 is still a long way off.

But perhaps the largest hindrance to increasing both corn-based and cellulosic ethanol consumption is more abstract. The question may be whether the two sides can find some semblance of common ground to begin a discussion. Currently, it appears neither side can agree on basic facts over the economics and environmental credibility of ethanol, among other biofuels. Somewhere caught in between is the correct path forward.

Because of the lighthearted optimism biofuels tend to evoke, many people are positively predisposed to them. The conveyed image of biofuels has an earthiness to it, with green pastures and lush bundles of crop and weathered farmers toiling under the sun. To some they are regarded as a white knight that will guide humankind out of today's fossil fuel-dependent world toward a green future. But the biofuels industry has incurred more setbacks than its boosters care to mention.

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Tropical Fuel 716,000 square kilometers of cultivated land would be required for jatropha to meet global jet fuel demand annually

Biofuels can generally be categorized as either ethanol, derived from sugarcane, corn, rapeseed or other crops; or biodiesel, derived from plant oils. Those crops can take up very valuable arable land. In recent years the environmental credibility of corn-based ethanol in the U.S. has been brought into question after rising global food prices was blamed in part on a new and intense focus on the production of biofuels, and especially of corn ethanol. Roughly 40 per cent of corn grown in North America goes to ethanol refineries, which are typically powered by natural gas.

Over the years, new plant types have been successively heralded as leading to breakthroughs

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in biofuel EROEI, but as of yet none have completely lived up to the fanfare. Robert Bryce, the author of *Gusher of Lies* and *Power Hungry*, and senior fellow at the Manhattan Institute, says the latest craze is jatropha, a tropical flowering plant with oil-bearing seeds. In an article in the *National Review Online* Bryce argued that 716,000 square kilometers of cultivated land would be required were jatropha to meet the world's 2010 jet fuel demand of 1.9 billion barrels – an area larger than the province of Alberta.

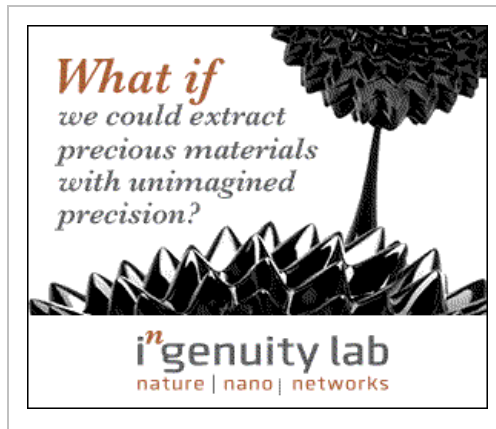
“You can look at the U.S. market, the Canadian market, the international market – biofuels are going to be an infinitesimal player, and the reason for that has nothing to do with the market power of the oil companies or anything else. It all comes down to basic physics,” Bryce says. “The power density of biofuels is too low; they simply require too much land, and that’s their fundamental problem.”

On the other side of the argument, a different story is told. Jatropha could soon be genetically modified to enhance the crop’s energy density. Advocates acknowledge ethanol is no silver bullet, but it still looks like a worthwhile endeavor considering the head-spinning challenge of cutting carbon emissions. In certain reports, a lifecycle analysis of ethanol, from seed to tank, provides a 60 per cent reduction in greenhouse gas emissions. Often overlooked is that much of Canada’s potential biofuel energy could come from biomass, or cellulosic ethanol, which doesn’t compete with food-production because it uses non-arable land.

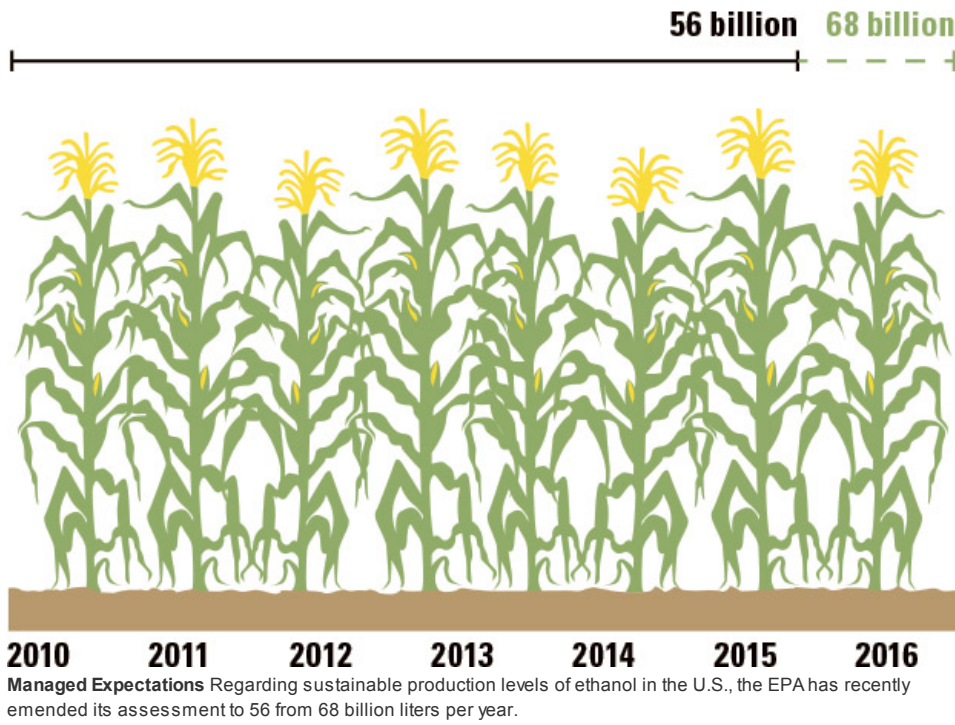
In Canada, corn-based ethanol production is part of a well-established industry. Ethanol already blends well above the current mandate, set at five per cent for ethanol-blended gasoline. Increasing those blends will take time. The Canadian Renewable Fuels Association (CFRA) is applying to raise the biodiesel mandate to five per cent and hopes to be there by 2020.

The whole of Canada currently produces about 1.8 billion liters of ethanol fuel per year, and consumes 2.8 billion liters; the balance is imported from the U.S. Canada does presumably have the ability to scale up its ethanol consumption markedly, says Scott Thurlow, president of the CFRA, whose association would like to see ethanol blends reach E20 in coming years. Canada should certainly strive for that, he says, especially considering the Corporate Average Fuel Economy, an automotive regulation in the U.S. and Canada aimed at increasing fuel economy, is putting pressure on manufacturers to develop lighter, lower-emissions engines.

But increasing the production – and, to a greater degree, the consumption – of biofuels will require work. Take the recently published report from Chatham House, a London-based policy institute. If the United Kingdom is to meet its EU renewable fuels obligation, which requires 10 per cent of its total transportation fuel mix to be supplied by renewable fuels by 2020, motorists could be on the hook for a total of \$2 billion in additional costs. Carbon abatement costs for transferring to biofuels, the report found, would be between \$165 and \$1,100 per tonne. Around \$87 per tonne was deemed to be economic.



“The power density of biofuels is too low; they simply require too much land, and that’s their fundamental problem.”



Again, there is uncertainty about what levels of blends can be reached under what time frames. The concern in some circles is that raising ethanol or biodiesel blends could damage engines not properly equipped for a higher-octane fuel. Mark Nantais, president of the Canadian Automotive Manufacturers' Association, says the debate about raising ethanol blends has been around for years, but has recently waned as hybrid and battery-powered vehicles grow in popularity.

Meanwhile, an attempt to shift toward E85 is taking place in the U.S. and in Canada, where one million cars have engines that can run on this high octane fuel. The widespread adoption of E85 fuel will also require billions of dollars in investment in order to construct the required fuel pump stations. "Regulators need to ask other questions – which many other people are asking as well – like what's the impact on the regular gasoline pool, where is the ethanol going to come from and at what price," Nantais says.

From an energy-return-on-investment (EROI) perspective, there is little consensus on whether biofuels are truly economically justifiable. Some commentators in the U.S., where the debate rages on at a high pitch, have called on the EPA to eliminate the ethanol and biodiesel mandate altogether. The likelihood of that may look slim now, but in the mercurial world of energy and transportation the permanent role of biofuels is still far from assured.

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