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The Promise of Biofuels

A HOMEGROWN APPROACH TO BREAKING AMERICA'S OIL ADDICTION

by David J. Hayes, Roger Ballentine, and Jan Mazurek

Biofuels are all the rage these days. Clean-burning motor fuels made from homegrown crops are rightly seen as a potential policy twofer: An answer (or at least a partial one) to the twin problems of oil addiction and greenhouse gas emissions from cars and trucks. Even President Bush, a recalcitrant by any measure on energy and environmental policy, has lately been peppering his speeches with mentions of switchgrass, wood chips, and other possible ingredients in the biofuels of the future.

Who can blame him for jumping on the bandwagon? There are in fact myriad reasons to promote biofuels like ethanol, biodiesel, and the coming generation of so-called "cellulosic" variants.[1] *(See the glossary of terms on page 3.)* For starters, biofuels are *practical* alternatives to oil. Unlike, say, hydrogen fuel-cell vehicle technologies—which have only distant potential to be widely commercialized, and which would likely require a whole new service station infrastructure—expanded use of biofuels will require minimal market adaptation. Corn ethanol already accounts for about 3 percent of the American automotive fuel consumption. Most car engines, without any modification, can run on a blend of 90 percent gasoline and 10 percent ethanol. And carmakers have built 5 million "flex-fuel" vehicles than can run on an increasingly popular blend of just 15 percent gasoline and 85 percent ethanol, known as E85. Meanwhile, most diesel engines manufactured since 1992—including the big-rigs, tractors, and other machines that do most of the nation's heavy lifting—can run on biodiesel brewed from soybeans, peanuts, used cooking fats, animal fats, cottonseed, or canola.

Then, of course, there are the environmental benefits. Unlike gasoline made from oil, which releases carbon dioxide (CO_2) into the atmosphere when it is used in internal combustion engines, biofuels are "climate-neutral." Burning them does not add new greenhouse gases to the atmosphere, since the growth and destruction of the crops that biofuels are made from is part of the natural cycle of CO_2 absorption (during growth) and release (during destruction or decomposition).[2, 3]

Nearly all of America's farms, rangelands, and forests, moreover, have the potential to grow plants that can be converted into biofuels. This offers the possibility of injecting new life into the

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"One person with a belief is a social power equal to ninety-nine who have only interests."
—John Stuart Mill

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U.S. agricultural sector. Even more broadly, producing fuels domestically instead of importing them from abroad will keep the profits at home, spur new investments, and create jobs—not just in the farm sector but also in processing plants and distribution systems. Industry-led studies estimate that new demand for ethanol helped create 153,725 U.S. jobs last year—19,000 of which were in manufacturing.[4] Rural communities would stand to benefit the most from ethanol production because farmers own one-half of all existing ethanol refineries.[5]

The Progressive Policy Institute (PPI) shares proponents' enthusiasm about the great promise of biofuels. But PPI believes policymakers must temper their expectations with two important caveats, which should have a direct bearing on government initiatives.

First, there is a natural limit to the amount of corn that U.S. farmers can grow to produce today's standard type of ethanol. At best, it is estimated that America can produce about 14 billion gallons of biofuels from corn without seriously disrupting feed and food markets.[6] That would constitute less than 10 percent of the country's current annual motor fuel needs.[7] The real promise of biofuels will be realized when the next generation of cellulosic biofuels can be brought to market.

Cellulosic biofuels are functionally identical from a driver's point of view to the current generation of biofuels made from corn. But they can be produced from the left-over, non-edible parts of food crops, wild grasses, and trees—which require less fertilizer, water, and energy to grow and harvest than corn. In their current state of development, cellulosic biofuels cost more than twice as much to refine, but technological breakthroughs promise to change the equation.[8] Researchers believe they will soon be able to produce cellulosics in greater volumes, with less energy and at lower costs than corn ethanol, yielding greater net benefits in both energy and environmental terms. For now, government should certainly encourage increased production of the current generation of corn-based ethanol. But most experts agree that the real aim of such an increase in production should be to boost the supply and demand for biofuels generally, creating a ready market for cellulosic biofuels when they can be fully commercialized.[9]

Second, even when the next generation of cellulosics have arrived—which will take a number of years under any circumstance—biofuels will still not constitute a silver bullet solution to America's oil addiction. Lawmakers must also aggressively spur the development and commercialization of other fuel-saving transportation technologies that are currently

available or close at hand, such as hybrid-electric vehicles and plug-in hybrid-electric vehicles, a topic explored in a companion report to this one.[10] Plug-in hybrids with flex-fuel capabilities will be able to travel up to 500 miles on a gallon of gasoline blended with 5 gallons of ethanol. Widespread use of such vehicles would indeed amount to a radical break from the country's current oil dependency.

Owing to biofuels' great potential to help America address the steep economic, national security, and environmental costs of its oil dependence, Congress in 2005 created a new Renewable Fuels Standard (RFS). The standard—which currently applies mainly to ethanol—requires the production of 7.5 billion gallons of biofuels by 2012—and President Bush announced plans in his recent State of the Union address to push that target to 35 billion gallons by 2017. (Importantly, though, Bush seeks to add other "alternative" fuels in these totals, including liquids derived from coal, which do not offer the same carbon reduction benefits of biofuels). The RFS will help to further the production of ethanol from corn and sugar in the near-term as a way to help build investor confidence in cellulosic ethanol and other advanced biofuels.[11]

But there is more that government can do.

First and foremost, government can create the market conditions necessary for alternative fuels to compete with oil. That requires raising the price of oil to reflect its true cost to society. As it is, oil prices only reflect the direct costs of finding petroleum, pumping it out of the ground, refining it into usable fuels, and transporting it to consumers. Not included in the market price of oil are its external costs—most notably the environmental cost of *burning* it and releasing CO_2 emissions into the atmosphere. If those costs were more fully taken into account, biofuels would be much more competitive.

And there is another problem. Oil prices fluctuate wildly on global markets, to such an extent that they can undercut the appeal of alternatives. In the past year, as oil prices have at times soared past the $70 per barrel mark, biofuels have looked like a sound investment.

Biofuels: A Glossary

Biofuels	Non-petroleum fuels made from renewable sources of biomass, including agricultural crops, crop waste, algae, or manure. Common biofuels include ethanol, which can be blended with gasoline; biodiesel, which serves as an additive or substitute for petroleum diesel; and biobutanol, which to date has been used largely as a solvent but is viewed as a potentially superior motor fuel to ethanol.
Ethanol	An alcohol produced by fermenting plant sugars and starches. Ethanol can be blended with gasoline in concentrations of up to 85 percent. Most ethanol today is made from corn or sugar cane, but researchers are developing methods for producing it from the cellulose in other plants and organic materials that require less fertilizer, water, and energy to cultivate than agricultural crops. All varieties of ethanol have about two-thirds of the energy content of an equal volume of gasoline, meaning drivers get fewer miles per gallon of fuel when they use it.
Biodiesel	A non-petroleum motor fuel engineered for diesel engines. Biodiesel is not a fermented alcohol like ethanol. It is derived from vegetable oils or animal fats, not sugars and starches, in a chemical process called "transesterification." It is now most commonly produced from soybeans, cotton seed, animal tallow, and recycled cooking fats. Other sources of biomass that can be used to make biodiesel include the oils extracted from canola, corn, mustard seed, peanuts, sunflowers, and algae. Like petroleum-based diesel, biodiesel has higher energy content than gasoline, offering drivers better mileage per gallon of fuel.
Cellulosic Biofuels	Varieties of biofuels made from the tough, non-edible parts of plants or plant materials—including grasses, trees, and agricultural crop waste. The production process requires several steps, in which genetically modified enzymes are used to extract sugars that can be fermented into fuel. That is currently more costly and energy-intensive than the process of making ethanol from agricultural crops like corn or sugar cane, but technological breakthroughs promise to flip the economic equation.

But historical trends show that sharp price peaks can be followed by deep valleys—as was the case during most of the 1980s and 1990s, following the oil price shocks of the 1970s. This makes future market trends difficult to predict, and acts as a deterrent to long-term investment in clean energy, including biofuels. The volatility problem has triggered interest in the idea of setting a price floor on oil to mitigate against future market plunges.

Government should also focus greater attention on research and development efforts as part of a broader effort to spur the market for clean fuels. Researchers, working with public and private backing, are currently on the cusp of technical breakthroughs that will allow efficient production of cellulosic biofuels from switchgrass, algae, and other non-edible biomass sources. The government can hasten this progress by increasing its investments in critical research projects. In the meantime, government can also goose production of the current generation of biofuels by updating the RFS and strengthening tax incentives.

Finally, in order for ethanol to be a viable gasoline substitute, it must be as cheap and easy to distribute as gasoline. America's existing system of gas pipelines cannot be used for distributing ethanol, because ethanol can corrode metal and because pipelines are not completely impervious to water. (Unlike gasoline, ethanol can absorb water, and when that happens, it becomes unsuitable as a motor fuel.) Until these problems are resolved, the nation's already-congested rail and barge networks appear to be the most likely distribution method for biofuels. At the retail end of the supply chain, an increasing number of service stations offer biofuels, but the numbers must increase if biofuels are to displace a substantial share of the nation's current gasoline consumption. Government should spur improvements on both fronts.

To address those issues and realize the full promise of biofuels, PPI proposes the following plan:

- **Use price signals to drive the market toward clean fuels.** There are several ways to do this. One approach—long advocated by PPI—would be to use a "cap-and-trade" regulatory system to put a price on CO_2 emissions. Another approach, which many economists believe to be the simplest and most direct, would be to tax carbon consumption. A third approach would be to impose a price floor on oil. Preventing the price of oil from falling below $50 per barrel, it is argued, would give farmers, fuel producers, and distributors the market certainty they need to increase their investments in the biofuels industry.

- **Spur the nascent biofuels industry.** Congress should increase research and development on cellulosic biofuels by raising the $200 million in annual funding currently allowed under the Energy Policy Act of 2005 to at least $500 million. It should work with President Bush to raise the RFS to his proposed target of 35 billion gallons by 2017—with the overwhelming share of that supply to be met with homegrown and sustainable biofuels, or other yet to be developed non-petroleum, low-carbon fuels. It should strengthen production incentives for cellulosic biofuels and extend existing ethanol tax credits. And it should require that manufacturers offer a flex-fuel option for every model of car and truck sold in America by 2015.

- **Build a national distribution infrastructure for biofuels.** Congress should stimulate private investment to upgrade America's freight rail system in recognition of its strategic importance as an energy distribution network, and press the Department of Energy to determine whether or not it would be feasible to build a new pipeline system for biofuels. Congress should also use tax credits to help filling stations deploy ethanol and biodiesel pumps.

To underscore the imperative for this plan, the following discussion describes the present

state of biofuels development and the prospects for the future.

The Promise of Biofuels in the United States

Corn-based ethanol and soy-based biodiesel already are showing great promise as a bridge to a robust market for biofuels. But the next generation of biofuels holds even greater potential to achieve the national objectives of energy security and reduced environmental impact. Such next-generation fuels include biodiesel from algae and waste products as well as fuels made from the non-edible parts of plants grown specifically to produce energy, not food, or from farm or forestry waste—including poplar, straw, switch grass, corn stover, and sugar cane bagasse. Moving to the next generation of biofuels is a matter of necessity. Already, the United States has more than 100 ethanol processing plants capable of producing 4.4 billion gallons of ethanol from corn annually, with another 41 under construction.[12] Current ethanol production is taking between 13 percent and 15 percent of the current U.S. corn crop—or about 8 million acres worth—located primarily in the Midwest.[13] At best, experts estimate that the United States has enough corn to produce between 7 billion and 14 billion gallons annually—double or triple the current production.[14] That would represent less than 10 percent of total fuels consumed by all cars and light trucks in the United States today. If biofuels are to emerge as truly viable alternatives to gasoline, therefore, they must come from other plant sources in addition to corn.

The Switch From Oil to Grass

Most experts are betting on biofuels made from native, non-edible plants like switchgrass—a tall, fast-growing grass native to the North American plains. Cellulosic ethanol made from switchgrass promises a number of energy and environmental advantages over both corn ethanol and gasoline. Unlike corn, switchgrass doesn't require fertilizer to grow. In fact, it is a hardy perennial so it requires very little energy to cultivate, yielding a greater net energy benefit with less environmental impact. All told, the CO_2 emissions from producing and consuming cellulosic ethanol made from switchgrass are 85 percent lower than from gasoline.[15]

As energy crops, perennial grasses hold a number of other environmental benefits over conventional row crops that are normally grown for food. More so than row crops, the perennials' extensive root systems capture pollution from fertilizer and pesticides, and retain topsoil. And if they are grown and harvested using climate-friendly methods such as "no-till" harvesting—a process that also allows root systems to sequester CO_2—their environmental benefits are greater yet.

Cellulose is one of the most abundant materials on Earth. It is the main element in the cell walls of most plants—a complex carbohydrate that can be converted into sugar and then distilled into ethanol. But researchers face several challenges in making cellulose into ethanol on a commercial scale. The reason corn and sugar cane are commonly used to make biofuels—and alcohols such as whiskey and rum—is that their sugars are relatively simple to extract and ferment. By contrast, extracting sugars from the tough, stringy portions of plants like switchgrass takes several steps, each of which requires energy and advanced chemical reactions. Until the effectiveness of the genetically modified enzymes that are needed to trigger those reactions improves (and costs go down), making ethanol from straw or switchgrass will continue to cost about twice as much as making it from corn or sugar cane.[16]

For these reasons, productions of cellulosic biofuels remains for the most part in the experimental stage. Worldwide, only one commercial facility is currently producing ethanol from straw, alongside a conventional process to make ethanol from cereal grain. It is located in Northern Spain and commenced production of cellulosic ethanol in late 2006.[17] Nonetheless,

given the promise that new enzyme-based technologies hold for unlocking ethanol from its host plants, many scientists believe that a focused, well-funded research and development program can and will lead to the technological breakthrough needed to allow for the commercialization of cellulosic ethanol. Funding this research should be a top national priority for Congress and the president.

Assuming the technical challenges of making biofuels from plant cellulose can be overcome, questions remain about where and how the United States will convert land to grow energy crops. Some environmental groups worry that forests and other open space areas will be cleared to grow energy crops; while hunters, anglers, and outdoor enthusiasts worry about potential negative impacts on wildlife. Some farmers worry that conversion will reduce the supply and increase the price of livestock feed, or overstretch limited water supplies. To address several of these concerns, Congress asked the Departments of Energy and Agriculture to evaluate a hypothetical scenario in which biomass is produced in sufficient quantity by 2030 to displace about 30 percent of U.S. oil use.[18] By assuming relatively modest changes in agricultural and forestry practices, the agencies found that 1.3 billion dry tons of biomass could be available for large-scale bioenergy and biorefinery industries by the middle of this century—enough to meet the 30 percent target—while still meeting demand for forestry products, food, and fiber. These projections are encouraging, although there is no question that the ramp up would need to be managed carefully to avoid potential negative impacts on the environment.

While America has the capacity and the resources to produce biofuels in great quantities in many different regions of the country—using rice straw from California, soy and peanuts from the South, and native switchgrass in Northern Plains states—the country still lacks a comprehensive system to deliver and pump ethanol as readily as gasoline. Until oil pipeline operators are better able to address ethanol's water and corrosion issues, ethanol will be distributed by truck and by rail. Meanwhile, even though more and more fueling stations are offering ethanol blends, biofuels are a long way from being as readily available to motorists nationwide as gasoline.

Peanut Power

Just as ethanol holds great potential as a substitute for gasoline, biodiesel holds great potential as a substitute for petroleum diesel. Most biodiesel in the United States now comes from soybeans and recycled cooking fats, but those represent only a fraction of potential sources. Others include peanuts, canola, corn, cotton, mustard, sunflowers, lard, and algae. (In fact, the first diesel engine, unveiled by the inventor Rudolf Diesel in 1900, ran on peanut oil.) Like cellulosic ethanol, biodiesel recycles CO_2 through the plants grown to make it. The Department of Energy (DOE) studies taking that closed carbon loop into account conclude that buses using pure biodiesel emit 78 percent less CO_2 than those using petroleum diesel. Biodiesel, which has an energy content equal to or greater than conventional diesel, can also help clean the air of other harmful pollutants: Relative to petro-diesel, fumes from pure biodiesel contain 50 percent less carbon monoxide, 70 percent less particulate matter, and 40 percent fewer unburned hydrocarbons, all of which pose public health risks. Pure biodiesel also contains no sulfur, so it emits no acid-rain-causing sulfur oxides. In addition, power plants and generators that now burn oil or even natural gas can convert to biodiesel—a relatively simple proposition from a technical perspective.

Diesel engines built after 1992 can use biodiesel with essentially no modification. It can be used straight or blended with petroleum diesel. The most common formulation is B20, a mixture of 20 percent biodiesel and 80 percent petro-diesel. An estimated 25 million gallons of biodiesel were sold in the United States in 2003, up from a scant 500,000 gallons four years earlier. (By comparison, roughly 36 billion gallons of petroleum diesel were sold here in 2002,

representing about one-quarter of total U.S. vehicle fuel consumption.) More than 600 major fleets—including government, military, commercial, and school buses—now use biodiesel nationwide, according to the National Biodiesel Board (NBB), the industry's leading trade association in the United States.

Biodiesel's future in the United States has seemed inextricably linked to heavy machinery, big-rigs, and buses. Already, truckers can fill up on such blends as "BioWillie" a 20 percent biodiesel blend sold by country music star Willie Nelson in eight states including California, Texas, Oklahoma, Tennessee, and South Carolina.[19] Still, few diesel passenger cars and light trucks are currently sold in the United States because the sulfur content of diesel fuel has made it difficult for manufacturers to build engines that comply with clean air standards. But that is about to change.

New regulations requiring a 97 percent cut in the sulfur content of diesel fuel took effect in 2006. The reduction was coupled with new emissions standards for those vehicles that will be phased in between 2007 and 2010. Reducing diesel fuel's sulfur content allows vehicle manufacturers to use emission-control technologies that would otherwise be damaged by the sulfur. (Similarly, lead was banned from gasoline to keep it from ruining catalytic converters in cars.) The EPA rules are expected to reduce truck and bus particulate matter and smog-causing nitrogen oxide (NO_x) emissions by more than 90 percent. This will help solve one of the current drawbacks to biodiesel: In its pure form (known as B100), it produces 9 percent higher emissions of smog-causing NO_x than petro-diesel, while B20 blends produce 2 percent higher NO_x emissions. The fuel's promoters note, however, that the new federal mandates on petroleum diesel are speeding the introduction of engine technologies in the United States that will cut diesel NO_x and particulate matter emissions significantly, regardless of the fuel used. Meanwhile, biodiesel can also help with one of the drawbacks of ultra low-sulfur diesel—its reduced lubricity.

The prospect of cleaner-burning diesel fuel supplies has brightened the outlook for diesel cars here. German carmakers including Volkswagen, Daimler-Chrysler, Mercedes-Benz, and BWM are joining forces to introduce clean diesel cars under the trade name Bluetec in the North American market. If successful, the push means more passenger vehicles and SUVs will be available to run on biodiesel. And any advanced diesel engine offers climate change and security benefits, since diesel engines are significantly more efficient than their gasoline counterparts.

Biodiesel's biggest drawback is its price. With production still in its infancy and demand continuing to grow, biodiesel in its most popular B20 formulation now costs about 8 cents to 23 cents more per gallon nationally than conventional diesel, according to DOE's most recent Alternative Fuel Price Report.[20] That's roughly the same as the difference between regular and premium gasoline. Biodiesel prices also vary widely by region based on proximity to the Midwest, the nation's biodiesel production center. Nonetheless, as production expands, and more cars capable of running on diesel enter U.S. markets, biodiesel will become an increasingly attractive oil alternative.

Policies to Promote Biofuels

Substituting biofuels for a substantial percentage of the gasoline and diesel fuel that Americans use in their cars and trucks will make the country safer, more prosperous, and healthier. Biofuels must therefore be central to a 21st century energy policy. That policy must accelerate the pace of development of these next-generation fuels, with an eye on overcoming three central challenges: (1) making the market price of oil better reflect its true cost to society; (2) spurring the nascent biofuels industry; and (3) building a national distribution infrastructure for biofuels.

Measures to promote biofuels must be pursued in tandem with the agenda PPI has previously proposed to establish a mandatory national cap on CO_2 and other greenhouse gas emissions, and modernize fuel efficiency

standards.[21, 22, 23] Building on that agenda, PPI now proposes the following three policies to achieve the promise of biofuels:

Use Price Signals to Drive the Market Toward Clean Fuels

Making oil more expensive to burn is the sine qua non of any credible plan for energy security. It is the only way to create an economic incentive to use less petroleum and develop viable alternative fuels.

PPI has long advocated harnessing market forces in a so-called "cap-and-trade" regulatory system to put a price on CO_2 emissions.[24] In such a system, the federal government would establish a mandatory, economy-wide limit (or "cap") on CO_2 emissions, and companies would be able to buy and sell excess emissions credits. Companies that are able to hold their emissions below an allowable limit would be able to sell excess emissions credits to those that exceed their limits. The system would thus create a profit motive for using less fossil fuel. Auto manufacturers could be regulated based on the tailpipe emissions of their vehicle fleets. They would have a financial incentive to build highly fuel-efficient cars and trucks, because that would be the best way to limit carbon emissions.

Alternatively, there is an emerging consensus among economists that the federal government should simply begin taxing carbon consumption. That would be a very direct way of accounting for the environmental cost of CO_2 emissions—and a simple way to raise the price of gasoline, diesel fuel, and petroleum products, from industrial solvents to plastics. A carbon tax could be levied on all fossil fuel producers, who would then pass their increased costs along to their industrial buyers. For consumers, it would amount to a gas tax (and, more generally, a tax on all petroleum-based products), which the government could offset with income tax reductions.

Both of those approaches would target the environmental cost of oil use and raise the price of petroleum-based fuels in the process, thereby making biofuels more viable alternatives. But the carbon tax would be the most direct way to make the hidden costs of climate change immediately apparent.

A third option would be to establish a price floor on oil to ensure that the volatility of the global oil market does not prevent the biofuels industry from flowering. Crude oil prices have fallen from a high of $72 per barrel last summer to less than $60 per barrel at the time this report went to press. Preventing the price from falling below $50 per barrel would give farmers, fuel producers, and distributors the market certainty they need to increase their investments in biofuels.

When oil prices dip below $50 a barrel, virtually no biofuel is economically competitive.[25] For example, during the summer of 2006, when oil was around $70 a barrel and corn was selling at $2.50 a bushel, ethanol makers earned a profit of 86 cents a gallon. By January 2007, oil dropped to nearly $50 a barrel and corn rose above $4 because of increasing demand. At these prices, ethanol producers incurred a loss of 21 cents for every gallon they produced.[26] A $50 price floor on oil, coupled with a policy agenda that spurs the development of cellulosic biofuels from biomass sources that are cheaper to grow than corn, would create the conditions for a viable market for alternative biofuels.[27]

Spur the Nascent Biofuels Industry

❒ **Invest in research to commercialize cellulosic biofuels and other advanced, low-carbon fuels.** Congress should significantly expand support for cellulosic biofuels research, including research into viable raw material feedstocks, processing technologies (particularly advanced enzymes), and products. The Energy Policy Act of 2005 increases the federal biomass R&D authorization from $54 million to $200 million per year between 2006 and 2015, and includes grants to state research agencies. But while $200 million will represent a meaningful increase when it is fully allocated, the attainment of a biofuels-based future will require much more

substantial R&D investment. Congress should increase the annual authorization to at least $500 million per year and ensure that funds authorized are invested in research that focuses on the commercialization of cellulosic biofuels and other advanced, low-carbon fuels from plants that are not used for human or animal food (such as switchgrass and algae). More than doubling current spending levels is both necessary and appropriate, given the potential payoff in terms of reducing dependence on foreign, fossil fuel-based energy resources which are diverting as much as $28 billion per month in U.S. consumer dollars to overseas suppliers.

In addition to promoting technological breakthroughs in production, new incentives need to be put in place to help offset the current higher relative cost of cellulosic ethanol production until full commercialization can bring down those costs. In addition to existing tax credits for ethanol, the Congress should provide larger proportional credits to producers of cellulosic biofuels. So, in addition to the 51 cents per gallon excise tax credit for ethanol, Congress could consider providing a 75 cents per gallon tax credit for cellulosic ethanol. These credits would be phased out as cellulosic production increases and production costs fall.

Once the technology side has been addressed, the United States must align its agricultural support and conservation programs to encourage production of biofuel crops.

Currently, the secretary of Agriculture is allowed to permit managed harvesting of biomass and installation of wind turbines on certain lands enrolled in the Conservation Reserve Program.[28] PPI recommends that Congress in its upcoming agricultural bill deliberations expand the amount of land that can be enrolled in the CRP for biomass harvesting—particularly for cellulosic energy crops—but continue to exclude ecologically sensitive lands. PPI also proposes revitalizing and redirecting the Commodity Credit Corporation (CCC) Bioenergy Program. Between 2000 and 2006, when the program was discontinued, CCC provided $150 million to commercial ethanol and biodiesel producers that made biofuels from dedicated food crops such as corn, rice, and flaxseed as well as cellulosic sources such as switchgrass and farm and forestry waste.

❒ **Raise and revise existing Renewable Fuels Standards to drive the development of non-petroleum, climate-friendly fuels.** To further promote investment in the new technology necessary to commercialize production of advanced biofuels, Congress should expand the current RFS from 7.5 billion gallons to 12 billion gallons by 2012, and then to 35 billion gallons by 2017. Lawmakers also should add a biodiesel RFS of 1 billion gallons per year by 2014.

The RFS currently requires that 250 million gallons of cellulosic biomass ethanol be included in the nation's annual fuel mix by 2012, and allows a gallon of cellulosic ethanol to be counted as 2.5 gallons against the RFS requirements. Congress should strengthen those incentives for increased cellulosic biofuels production. Additionally, Congress should amend the RFS to include other yet-to-be-developed non-petroleum, low carbon fuel options.

❒ **Extend existing ethanol tax credits.** Congress should extend the existing 51 cents per gallon ethanol excise tax credit and biodiesel excise tax credit for a minimum of five years. This credit is available to marketers and blenders of ethanol or biodiesel (not producers). PPI also recommends extending the income tax for biodiesel for five years and equalizing the credit at $1 per gallon for all forms of biodiesel, including recycled waste biodiesel or algae biodiesel.

Congress should also expand the 10 cents per gallon production tax credits for ethanol and biodiesel, currently limited principally to producers of less than 60 million gallons per year, to producers of up to 100 million gallons per year.

❒ **Require manufacturers to produce more vehicles that run on biofuels.** About five million U.S. vehicles are already capable of running on high ethanol blends, such as E85, though

the owners often are not aware of that feature. Progressives should spur further growth of the market for biofuels by requiring vehicle manufacturers to alert owners of existing "flex-fuel" vehicles. And Congress should require that manufacturers offer a flex-fuel option for every model of car and truck sold in America by 2015—a modification that costs as little as $25 per vehicle.

Build a national distribution infrastructure for biofuels

❒ **Reinforce rail distribution systems and determine whether it would be feasible to build dedicated biofuels pipelines.** For the foreseeable future, rail will serve as the main biofuels "pipeline." But the nation's rail system already is strained with cargo that arrives from Asia and the rest of the world, and with domestic coal that is shipped to the country's boilers and power plants. Bottlenecks and delays are common. In order to get a reliable and affordable supply of biofuels to market, Congress should create a stimulus package as envisioned in House Majority Leader Steny Hoyer's Program for Real Energy Security (Progress) Act [H.R. 5965], which would upgrade America's freight rail system in recognition of its strategic importance as an energy distribution network. In addition, PPI recommends that Congress pass legislation requiring the DOE and other relevant agencies to report back on the prospects and merits of building a new, dedicated biofuels pipeline network.

❒ **Encourage filling stations to install more biofuel pumps.** With the exception of only the smallest retailers, Congress should push all new public filling stations to have no fewer than one E85 (or equivalent) ethanol pump—and, if the stations offer diesel, at least one B20 (or equivalent) biodiesel pump. The Energy Policy Act of 2005 gives fuel retailers an income tax credit for up to $30,000 or 30 percent of the cost of installing one clean fuel pump, whichever is less.[29] The credit is limited to the installation of a single pump per station, and it only applies to equipment placed in service before January 1, 2008. PPI recommends extending the window on the credit to cover equipment installed before January 1, 2010, and expanding it to cover two new pumps per station. Retailers would thus be eligible for a credit of up to $60,000 ($30,000 per pump), or 30 percent of the total cost of installing two new pumps. (The credit would not apply to new construction, but only to existing retrofits placed into service before 2010.)

Conclusion

Moving America off oil by substituting homegrown biofuels for a substantial percentage of current consumption would make the country cleaner, safer, and wealthier. Reducing dependence on oil and growing energy domestically can help rural economies and keep U.S. dollars at home rather than sending them to hostile regimes. Crops grown for fuel also have the potential to mitigate against global warming by keeping greenhouses gases sequestered in plants and soil rather than releasing them to the upper atmosphere where they trap heat. Despite budgetary concerns and the power of entrenched overseas oil interests, the clear and present benefits of using biofuels demand that Congress act now to spur the creation of a robust biofuels industry in America.

Notes

[1] Another promising biofuel is biobutanol, which can be produced in a fermentation process from biomass—including corn, sugar, wheat, and cellulosic materials—and used as a motor fuel.

[2] Thus, when biofuels are burned, there is no net contribution of carbon emissions to the atmosphere — in sharp contrast to burning otherwise-sequestered oil supplies, which introduces a completely new source of greenhouses gases into the atmosphere. While the production of biofuels and the growing of crops does consume fossil fuel and release greenhouse gases, all biofuels result in a net improvement over petroleum, and with the development of cellulosic biofuels the greenhouse gas advantage becomes very significant.

[3] Positive greenhouse gases come only from the production process of biofuels; and since cellulosic crops are either simple to grow and harvest (switchgrass) or the crops were grown for another purpose (food or feed) and the cellulosic portions of the plants were largely to be wasted, the greenhouse gas benefits of these fuels are very significant.
[4] Urbanchuk, J. "Contribution of the Ethanol Industry to the Economy of the United States," Renewable Fuels Association, February 2006.
[5] *Ibid*.
[6] Griffin, W.M. and L.B. Lave, "Cellulosic Ethanol in an Oil and Carbon Constrained World," in A High-Growth Strategy for Ethanol, the Aspen Institute, 2006, p. 26.
[7] U.S. gasoline sales/deliveries totaled 378 million gallons per day as of 2005, according to the U.S. Energy Information Administration. (See: *http://tonto.eia.doe.gov/dnav/pet/hist/c10000001A.htm*.) That is 138 billion gallons per year.
[8] Egan, Timothy, "Life on the Ethanol-Guzzling Prairie," *New York* Times, Week in Review, February 11, 2007. *http://www.nytimes.com/2007/02/11/weekinreview/11egan.html.*
[9] Urbanchuk, J. "Contribution of the Ethanol Industry to the Economy of the United States," Renewable Fuels Association,, February 2006, p. 26.
[10] Romm, J. and P.Fox-Penner, "Plugging Into the Grid: How Plug-In Hybrid Electric Vehicles Can Help Break America's Oil Addiction and Slow Global Warming," Progressive Policy Institute, March 2007, *http://ppionline.org*.
[11] In addition to the Renewable Fuels Standard, ethanol blenders receive a 51 cent per gallon tax credit. Small (less than 60 million gallons per year) producers also receive a 10 cent per gallon tax credit.
[12] Federal Trade Commission, "2006 Report on Ethanol Market Concentration," December 1, 2006, *http://www.ftc.gov/os/2006/12/Ethanol_Report_2006.pdf*.
[13] Griffin, W.M. and L.B. Lave, "Cellulosic Ethanol in an Oil and Carbon Constrained World," in A High-Growth Strategy for Ethanol, the Aspen Institute, 2006, p. 25, *http://www.aspeninstitute.org/site/c.huLWJeMRKpH/b.1697309/k.CE43/Ethanol.htm*.
[14] Griffin, W.M. and L.B. Lave, "Cellulosic Ethanol in an Oil and Carbon Constrained World," in *A High-Growth Strategy for Ethanol*, the Aspen Institute, 2006, p. 26.
[15] Argonne National Laboratories, "Ethanol: The Complete Energy Life-Cycle Picture," U.S. Department of Energy, Energy Efficiency, and Renewable Energy, N/D, *http://www.transportation.anl.gov/pdfs/TA/345.pdf.*
[16] Pacheco, Dr. M. ,Director of the National Bioenergy Center of the National Renewable Energy Laboratory, Testimony for the U.S. Senate Committee on Energy and Natural Resources, June 19, 2006,*http://energy.senate.gov/public/index.cfm?IsPrint=true&FuseAction=Hearings.Testimony&Hearing_ID=1565&Witness_ID=4427*.
[17] Dow Jones, "Spain to Open World's First Cellulosic Ethanol Plant," February 9, 2006.
[18] Perlack, R.D., L.L.Wright, A.F. Turhollow, and R.G.Graham, "Biomass as a Feedstock for a Bioenergy and a Bioproducts Industry: The Technical Feasibility of a Billion-Ton Supply," US Department of Agriculture and US Department of Energy, April 2005, *http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf*.
[19] "Where to Buy BioWillie Fuel?" Willie Nelson Biodiesel Company, *http://www.wnbiodiesel.com/locations.html.*
[20] "Clean Cities Alternative Fuel Price Report," U.S. Department of Energy, Office of Energy Efficiency and Renewable *Energy, June 2006, http://www.eere.energy.gov/afdc/resources/pricereport/pdfs/afpr_jun_06.pdf*.
[21] Mazurek, Jan, "A New Clean Air Strategy," Progressive Policy Institute, December, 2005, *http://ppionline.org.*
[22] Ballentine, Roger and Jan Mazurek, "Clean Cars: Kicking America's Oil Habit." Progressive Policy Institute. March 2004 , *http://ppionline.org*.
[23] Romm, J. and P.Fox-Penner, "Plugging Into the Grid: How Plug-In Hybrid Electric Vehicles Can Help Break America's Oil Addiction and Slow Global Warming," Progressive Policy Institute, February 2007, *http://ppionline.org.*
[24] Naimon, J. and D.S. Knopman, "Reframing the Climate Change Debate," Progressive Policy Institute, November 1999 ,*http://ppionline.org.*
[25] Ethanol has less energy content than gasoline, meaning that drivers get lower mileage per gallon of fuel when they use it, and have to fill up more frequently. Therefore, to be competitive on a cost basis, a gallon of ethanol needs to be less expensive than a gallon of gasoline.
[26] According to a Credit Suisse research report cited in the Wall Street Journal, "Heard On The Street: Who Is Hurt By Oil's Fall?" January 23, 2007.
[27] The price floor could be enacted in several ways, such as through an adjusting per barrel production tax, and/or an import levy, the revenues from which could be dedicated to further alternative fuel investment or deployment. Although it is quite possible that this mechanism would rarely be used and would not affect the price of fuel—since oil prices have recently been holding above $50 per barrel—the certainty that a price floor would provide would help draw the investment needed to build a robust and sustainable biofuels industry.
[28] The Conservation Reserve Program encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.
[29] Form 8911, Department of the Treasury, Internal Revenue Service, "Alternative Fuel Vehicle Refueling Property Credit," *http://www.irs.gov/pub/irs-pdf/f8911.pdf.*

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