



Union of
Concerned
Scientists

EXECUTIVE
SUMMARY

THE BILLION GALLON CHALLENGE

Getting Biofuels Back on Track

Biofuels hold out the promise of reducing two major problems: oil dependence and global warming emissions from transportation. Yet despite numerous government programs and subsidies, biofuels are not yet measuring up to their potential.

Corn ethanol production has more than tripled in the last five years, driven by mandates for biofuel consumption, tax credits, and other programs. While this support has launched a major industry, it has also had unintended consequences. Most important is that the increased demand for corn is straining the agricultural system and environment. Food prices have gone up, water supplies have been put at risk, and habitat and biodiversity have been sacrificed, all without making any progress toward reducing the emissions responsible for global warming. Moreover, with almost a third of the U.S. corn crop now going to ethanol, the continued growth of biofuels can no longer rely on making food crops into fuel. Instead, growth depends on the successful and timely commercialization of the next generation of biofuels: *cellulosic* biofuels made from grass, wood waste, or even garbage. Unfortunately, this nascent alternative is stalled, a victim of inadequate policies and the global economic downturn, which have dried up investments.

This report lays out a plan for accelerating cellulosic biofuels to commercial scale and for cleaning up *all* biofuels. The first part of the plan is to establish “The Billion Gallon Challenge,” which would provide investment tax credits and loan guarantees to support the first 1 billion gallons of annual cellulosic biofuels

production capacity. The second part is to replace existing biofuels tax credits, as they expire, with a Biofuels Performance Tax Credit that supports all biofuels based on their performance in replacing oil and reducing global warming emissions. With smart policy choices like these, the United States could get biofuels back on track toward reducing oil dependence and cutting global warming pollution without breaking the bank or damaging the environment.

Key findings from our report include:

- Extending current tax credits would cost almost \$100 billion (2009 dollars) over the next 10 years, with more than 60 percent of this sum supporting mature (“conventional”) industries such as corn ethanol and soybean biodiesel.
- Investing \$4 billion in loan guarantees and investment tax credits would support investment in the 10 to 20 new commercial-scale facilities needed to reach the first billion gallons per year of cellulosic biofuels production capacity.
- Successfully commercializing cellulosic biofuels and meeting the Renewable Fuel Standard (RFS) mandates would reduce global warming emissions by 45 million metric tons a year, compared with status quo projections, by 2022.





Photo credits (clockwise): ©iStockphoto.com/Dan Driedger, ©iStockphoto.com/Michael Krinke, ©iStockphoto.com/Jon Meier

- Replacing current biofuels tax credits with the Biofuels Performance Tax Credit would save \$20 billion between 2011 and 2014 (compared with extending today's tax credits), while providing an incentive for cleaning up all biofuels.
- By rewarding improvement over today's corn ethanol, the Biofuels Performance Tax Credit would motivate corn ethanol producers to adopt the latest clean technology and qualify for a tax credit of up to \$20 million a year.¹
- Upgrading the technology at all existing corn ethanol facilities could reduce global warming emissions by more than 20 million metric tons a year.
- The Biofuels Performance Tax Credit would also provide an incentive for advanced and cellulosic biofuels producers to exceed the minimum thresholds of the national RFS—specifically, to reduce global warming emissions an additional 30 million metric tons beyond the standard's basic requirements.
- Together, the Billion Gallon Challenge and the Biofuels Performance Tax Credit could reduce global warming emissions almost 100 million metric tons a year by 2022, equivalent to taking some 15 million of today's cars and light trucks off the road that year.

Cellulosic Biofuels Could Be an Abundant Source of Clean and Sustainable Fuel

Scientists, engineers, farmers, foresters, and entrepreneurs around the country are ready to tap the potential of cellulosic biofuels, which present us with several important opportunities:

Cellulosic biofuels could avoid the competition between food and fuel. Cellulosic biofuels can be made from grasses or trees grown on land poorly suited to agriculture; they can also be made from waste products such as wood chips or post-recycled municipal waste. Perennial grasses could add diversity to our agricultural landscape and offer economic opportunity to regions outside the Corn Belt. A shift to cellulosic biofuels could minimize the damaging consequences—including rising food prices; pollution of our air, water, and soil; and global warming emissions from land-use changes—of relying solely on conventional biofuels such as corn ethanol.

Cellulosic biofuels could cut global warming emissions by 80 percent or more when compared with the equivalent energy delivered by gasoline. According to data from the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board, cellulosic biofuels could deliver significant reductions in global warming emissions. Conventional biofuels, on the other hand, offer limited opportunities to reduce global warming emissions, and much of the biofuel produced today is actually more polluting than gasoline.

For cellulosic biofuels to realize their potential, farmers must make wise use of land and water resources when growing new crops. While cellulosic biofuels can be produced in a sustainable manner, they could also compete with existing food crops, leading to many of the same problems as conventional biofuels or to

new and currently unforeseen problems. Policies beyond the scope of this report will need to differentiate among the sustainable sources to avoid such problems.

Unfortunately, current production of cellulosic biofuels is falling far short of government targets because entrepreneurs have not been able to raise the capital to build commercial facilities. The RFS consumption mandate of 100 million gallons in 2010 was recently reduced to just 6.5 million gallons, based on an EPA assessment of current production capacity. Other analysis by the U.S. government indicates that cellulosic biofuels production capacity may be as much as four years behind the 2013 target of 1 billion gallons. These delays demonstrate that the current set of policies is not working and that a new approach is needed.

Policy Recommendations

The Billion Gallon Challenge: Launching the Cellulosic Biofuels Industry. The Billion Gallon Challenge, an overhaul of government support for biofuels, is designed to give the industry a chance to deliver on the potential of cellulosic biofuels. A billion gallons of annual capacity would require the construction of 10 to 20 new facilities around the country. Along the way, workers would learn new skills while engineers enhance the technology to improve efficiency and reduce cost. Operators of the biofuel facilities would develop relationships with farmers and foresters, among others, to supply millions of tons of biomass and develop the infrastructure and logistics for collecting, delivering, and storing these feedstocks. Such learning could only begin in earnest when production reaches a meaningful commercial scale at a significant number of facilities around the country. Until these initial challenges are met, more ambitious targets beyond a billion gallons are out of reach.

Bringing cellulosic biofuels out of the laboratory and pilot plant and up to commercial scale at numerous facilities would provide concrete data for evaluating different feedstocks and fuel-production technologies. Armed with such valuable information, we could pursue the best alternatives and avoid dead ends. In particular, a billion gallons per year would be sufficient to assess commercial production but not so large as to drastically alter agricultural landscapes and fuel markets. Meeting the Billion Gallon Challenge would be a necessary step on the way to truly sustainable low-carbon biofuels and well worth the investment required.

Current biofuels policy is costly and ineffective, leaving cellulosic biofuels stalled at the starting line. But with smart policy choices we can launch the cellulosic biofuels industry, clean up existing biofuels, and save billions of dollars.

Financing the Billion Gallon Challenge. We propose a package of capital-support programs for the first billion gallons of capacity, including a 30-percent investment tax credit and loan guarantees to help pioneering investors bear the costs that come with going first. The investment tax credits would help investors with their initial capital costs—as opposed to current biofuels tax credits, which are paid years later, provided they have not expired. Loan guarantees would offer crucial help to investors in getting the loans to build their facilities.

The Billion Gallon Challenge would rapidly phase out all capital support once the industry reached a capacity of 1 billion gallons a year, thus creating an incentive for early investment. The tax credit, of 30 percent for the first billion gallons, would be reduced 6 percent for each additional billion gallons, ending entirely after the industry reaches an annual capacity of 5 billion gallons. At that level we would have some 50 to 100 facilities nationwide making cellulosic biofuels, which is about where the corn ethanol industry was in 2006. Government should then vacate the driver's seat, allowing different companies and technologies to compete on the basis of their ability to deliver clean, cost-effective cellulosic biofuels.

The Biofuels Performance Tax Credit: Cleaning Up Current and Future Biofuels. At the same time that we invest in next-generation biofuels we also need to make the most of conventional biofuels. In setting the RFS, the EPA established assessments of life-cycle global warming emissions that provide an essential yardstick for separating the best biofuels from the rest. These assessments show that there is a major opportunity to clean up corn ethanol, but current policy provides no incentive to make investments in this area. Instead, billions of dollars in tax credits are paid to oil companies and other fuel blenders merely for complying with existing law.

A performance-based tax credit, in contrast, would provide incentives for making all biofuels as clean as possible by rewarding fuel producers that surpass the standards set in the RFS. The performance-based tax credit would also save money, thus freeing up scarce resources to invest in next-generation cellulosic biofuels. In other words, focusing resources on the best biofuels while providing performance incentives for *all* biofuels would make the most of our investments and get biofuels on the right track.

We propose a Biofuels Performance Tax Credit of \$10 per million Btu, based on the extent to which the biofuel replaces oil and reduces global warming emissions. The maximum tax credit works out to \$1.15 per gallon of gasoline replaced. But to qualify for the whole credit a biofuel must have zero global warming emissions on a full life-cycle basis. All biofuels would be eligible, but they would get partial payment in proportion to how much their global warming emissions performance improves over today's typical corn ethanol.² Typical corn ethanol (rather than gasoline) is the baseline for emissions because the Biofuels Performance Tax Credit pays for improvements beyond what is already mandated. Structured this way, the tax credit is complementary to the RFS and delivers additional benefits at a much lower cost to taxpayers than today's tax credits.

The actual tax credit a particular biofuel receives would depend on its energy content and life-cycle global warming emissions. Representative numbers are included in the table below.

Fuel	Global Warming Emissions Reduction vs. Typical Corn Ethanol	Energy Content per Gallon vs. Gasoline	Biofuels Performance Tax Credit
Typical Corn Ethanol	0%	66%	N/A
Improved Corn Ethanol	27%	66%	20¢/gallon
Cellulosic Ethanol	85%	66%	65¢/gallon
Soy Biodiesel	44%	100%	50¢/gallon
Waste Grease Biodiesel	89%	100%	\$1.03/gallon

The Biofuels Performance Tax Credit would provide a powerful incentive for corn ethanol producers to adopt clean technology. For example, a typical 100-million-gallon-a-year corn ethanol facility retrofitted with biomass-fired combined-heat-and-power systems would qualify for a \$20 million a year tax credit—enough to pay for the retrofit within two years.

For the fledgling advanced and cellulosic biofuel industries, the Biofuels Performance Tax Credit would provide incentives to design facilities from the start with the cleanest technologies, which in surpassing the minimum thresholds of the RFS would allow companies to claim the largest possible tax credits. Overall, the Biofuels Performance Tax Credit would build on the RFS rather than duplicate it, delivering additional benefits in exchange for the tax credit's additional support.

Conclusions

Biofuels have an important role to play in launching a clean energy economy and addressing global warming, but their progress is presently stalled. We cannot afford to stay on this path, though with some sensible reforms we could redirect resources to get the cellulosic biofuels we need at affordable prices. The Billion Gallon Challenge laid out in this report would help to put the cleanest cellulosic biofuels on track, reduce oil dependence and global warming emissions, and contribute to making the United States a technology leader in cellulosic biofuels. At the same time, by adopting the Biofuels Performance Tax Credit in place of today's existing biofuels tax credits, we could save money, fund the Billion Gallon Challenge, and clean up all biofuels.

ENDNOTES

1 A 100-million-gallon-per-year natural-gas-fired corn ethanol facility that upgrades to a biomass-fired combined-heat-and-power system could qualify for a tax credit of \$20 million a year.

2 The baseline corn ethanol would be natural-gas-fired dry-mill corn ethanol with dry distillers grains, as described in the RFS final rule (Federal Register: 14669–15320. March 26, 2010)

©Union of Concerned Scientists, May 2010

The full text of this report is available on the UCS website at ucsusa.org/smartbioenergy.

The Union of Concerned Scientists is the leading science-based nonprofit organization working for a healthy environment and a safer world.



**Union of
Concerned
Scientists**

National Headquarters
Two Brattle Square
Cambridge, MA 02238-9105
Phone: (617) 547-5552
Fax: (617) 864-9405

Washington, DC, Office
1825 K St. NW, Suite 800
Washington, DC 20006-1232
Phone: (202) 223-6133
Fax: (202) 223-6162

West Coast Office
2397 Shattuck Ave., Ste. 203
Berkeley, CA 94704-1567
Phone: (510) 843-1872
Fax: (510) 843-3785

Midwest Office
One N. LaSalle St., Ste. 1904
Chicago, IL 60602-4064
Phone: (312) 578-1750
Fax: (312) 578-1751