

Creating a Path for Cellulose

An Ethanol Across America White Paper

Summer 2011

Building upon Grain-based Ethanol

While ethanol is an efficient and clean burning fuel, the discussions surrounding it have been anything but efficient and clean. From the tax reform debate to supply chain misconceptions, talk of the renewable fuel has been down in the dumps lately.

Yet with oil prices on an upward rise and 90 percent of the world's oil owned and controlled by countries, not companies, we must continue to blaze a path for all alternative fuels, including ethanol. This is not only because ethanol is a superior performance fuel, but also because ethanol has delivered—it is the only meaningful non petroleum fuel on the market today and allows us to replace more than 14 billion gallons annually of largely imported fuel with a domestic, clean burning, job creating alternative.

Therefore, we must insert into the ethanol conversation a critical element that has been missing: that ethanol is a molecule, not something that comes from “food”. Unfortunately there is little distinction between grain-based ethanol and cellulosic ethanol, which is derived from a wide variety of abundant, non-grain biomass and waste materials. It is important to understand the differences so we don't throw the baby out with the bathwater and start from scratch in our effort to find a suitable replacement for petroleum.

Technologies used to create first generation and cellulosic ethanol might create the same output, but the feedstocks and technologies used to create the ethanol couldn't be more different. Traditional ethanol is derived from corn or sugarcane, while cellulosic ethanol is feedstock flexible and can be created from a wide variety of non-grain sources, such as woody biomass, purpose grown energy crops and municipal solid waste. There is an abundance of non-grain biomass and agricultural waste materials that are available each year, and will not put a strain on any one input material. Most importantly, it can now be produced at mass scale, and can compete without long-term government subsidies.

These differences are critical in recognizing the promises ethanol holds and without common understanding of the processes and distinctions, the public, government and investors unfairly discount ethanol. But the truth is that ethanol is a superior renewable fuel and has evolved significantly over the years, such

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that most of the concerns of first generation ethanol are addressed by cellulosic ethanol. Ethanol as a molecule, coming from biomass, has natural scientific advantages over other fuel molecules, and provides the ability to significantly reduce our dependence on foreign oil, while strengthening our economy and enhancing national security.

However, to enjoy these benefits, we must take bold action. Only through initiatives such as expanding infrastructure and consumer choice, supporting and financing facility development, and reforming current tax incentives will we unleash cellulosic ethanol's full potential.

An Evolving History

Ethanol has a long history of use as a clean alternative to America's oil dependence. First used in Henry Ford's Model T in 1908, ethanol has evolved significantly, enough to even be used in Indy Car and NASCAR today. Ethanol infrastructure is rapidly expanding and automobile manufacturers have successfully adapted their engine technologies to handle high ethanol gasoline blends. In fact, there are nine million flex fuel vehicles on the road today capable of running on blends of

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85% ethanol, and automakers indicated that at least half of the cars in America will be flex fuel capable starting in 2012.

Government commitment to ethanol, coupled with private investment and corporate interest, has led to extensive R&D and scientific advancements around the fuel, culminating in the creation of cellulosic ethanol. In 2005, the U.S. Congress established the Renewable Fuel Standard (RFS), mandating 7.5 billion gallons of renewable fuels and creating a market for renewable fuels and cellulosic ethanol. While these mandated numbers have changed to meet production levels over the years, the RFS's primary purpose has been achieved. It has expanded R&D for renewable fuels and most importantly, has paved the way for the next generation—cellulosic ethanol.

Benefits of Cellulosic Ethanol

Cellulosic ethanol is a shovel-ready technology with benefits that shouldn't be dismissed. Its ability to come from virtually any carbonaceous material allows for boundless geographic flexibility, making way for economic benefits and job creation in rural and urban communities alike. Plus, it can reduce our \$560 billion annual cost of foreign oil and compete economically with gasoline without long term subsidies.

Feedstock Flexibility

Cellulosic ethanol is created from a wide variety of non-grain, biomass, such as wood chips, energy crops, agricultural waste, and others. This feedstock flexibility allows for geographic flexibility, which can result in widespread production that will quickly alleviate our oil dependence.

Facilities can be built essentially anywhere in the world carbonaceous materials exist – in rural areas where energy crops and woody biomass grow, or urban areas where municipal solid waste collects. A joint study from the Departments of Energy and Agriculture in 2005 and a Sandia National Labs study in 2009 both found that there are currently over one billion tons of sustainable biomass in America each year, enough for approximately 90 billion gallons of ethanol to replace more than one third of petroleum use in the United States by 2030.

Specifically, in the Southeastern U.S. an abundant and sustainable supply of woody biomass exists. Experience gained in this region over the past 70 years, as well as a vacant infrastructure from the declining pulp and paper industry, allows the biomass supply to be developed and maintained to support a large increase in use for ethanol.

Cellulosic ethanol's feedstock flexibility is essential for appreciating its differences with first generation ethanol. Unfortunately, the public misperception that ethanol is contributing to our global food crisis triumphs. This misperception stems from the fact that ethanol from grains has been the dominant renewable

fuel source produced in America for decades. But with new technology, we're beginning to turn the page.

A Primary Liquid Fuel

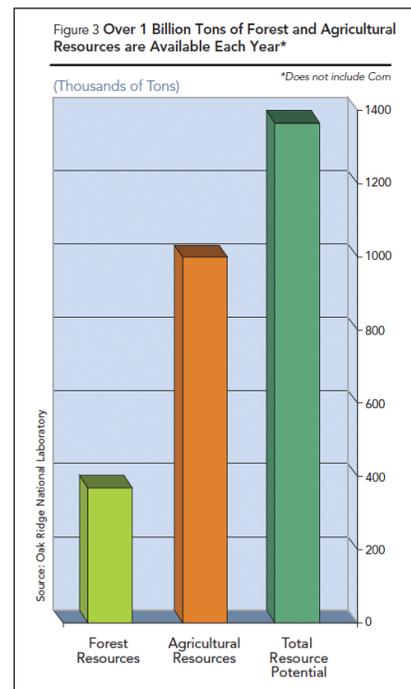
Often lost in the back-and-forth debate and public obsession with corn ethanol are the clear attributes of the ethanol molecule itself, especially when produced using non-food sources.

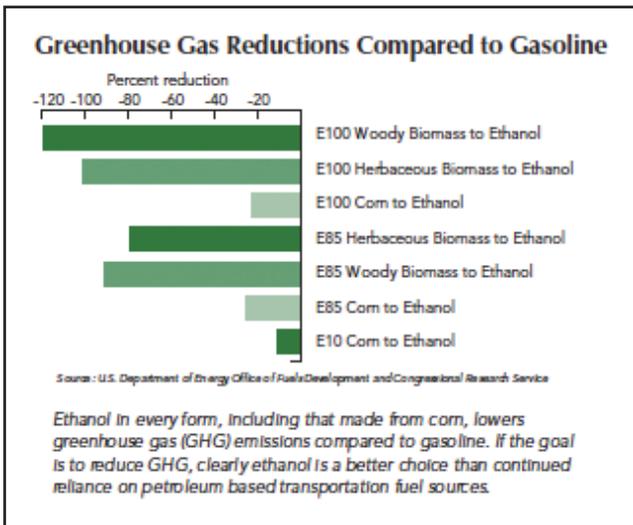
A recent study titled, "Ethanol – the Primary Renewable Liquid Fuel," highlights why ethanol is the most efficient and productive way to create renewable fuels from biomass. Published in the *Journal of Chemical Technology & Biotechnology*, the study found that due to the fundamentals of photosynthesis and the laws of thermodynamics, biomass-to-ethanol can achieve the highest yields and greatest greenhouse gas reductions of any alternative fuel option. The study demonstrates how, compared to other transportation biofuels, ethanol requires the least amount of carbon to produce and retains the highest amount of oxygen that exists in biomass. Retaining the oxygen in biomass, as cellulosic ethanol does, leads to greater yields, lower carbon intensity, and in many cases, lower operating and production costs.

Societal Benefits

Cellulosic ethanol is able to provide widespread societal benefits across the country and the world, such as job creation and rural economic development, the lowering of greenhouse gas emissions and the benefits that come with a reduced reliance on foreign oil.

More than any other alternative energy option, cellulosic ethanol can spur jobs and economic development wherever facilities are built. Current estimates put direct and indirect long-term job creation at more than 700 for a medium size commercial plant in the Southeast U.S. When multiplied by the hundreds, if not thousands, of facilities that would be built around the globe, the job creation becomes significant. In fact, according to a study from BIO Economic Research Associates,





full commercialization to meet just the Renewable Fuels Standard 2 (RFS2) has the ability to create nearly one million new green jobs in America. The geographic flexibility of these facilities will stimulate local economies across the country and have a positive ripple effect on the national economy as a whole.

Cellulosic ethanol also has the ability to greatly reduce greenhouse gases emissions compared with traditional transportation fuels. In fact, the EPA stated in the RFS2 rulemaking that cellulosic biofuels can reduce greenhouse gasses on a lifecycle basis by as much as 120% compared to conventional gasoline. Also, cellulosic ethanol has been able to greatly reduce water use compared with first generation ethanol and traditional gasoline and diesel fuels.

In addition to job creation and greenhouse gas emissions, the American economy as a whole can benefit from reducing its dependence on oil. In 2010, foreign oil accounted for \$265 billion of the total \$497 billion U.S. trade deficit. Advanced biofuels can and will provide long term deficit reduction to the United States. The homegrown fuel will embolden our national security and help reduce the \$400 billion we send overseas annually (to countries that don't share our economic or political interests), and instead re-circulate that money into the domestic economy. In fact, what we spend in one day protecting oil lanes abroad would fund five new biofuel refineries at home.

Government Action is Needed

This is an important time for our country and for the future of the biofuels industry. With oil going over \$100 a barrel twice in the past two years, it's clear we need a new solution to our energy needs. As long as America remains beholden to a fiscally and environmentally untenable source of fuel, we

should expect gasoline to cost four or even five dollars a gallon at the pump. And further instability in the Middle East will play a greater role in the fate of our domestic economy than ever before.

For decades our leaders have been promising energy independence through policies that have failed to initiate action in the private sector, for most alternative fuels. However, because of the progress of first generation ethanol and its success in taking 14 billion gallons of oil out of the U.S. market, we know that consistent and enduring government policy can deliver.

The cellulosic ethanol industry stands ready to produce commercial volumes, but it needs predictable and enduring government support that creates a biofuels infrastructure for the long term and sends a positive signal to the investment community that advanced biofuels will play a part in the future of the country's energy mix.

Continuing Current Programs

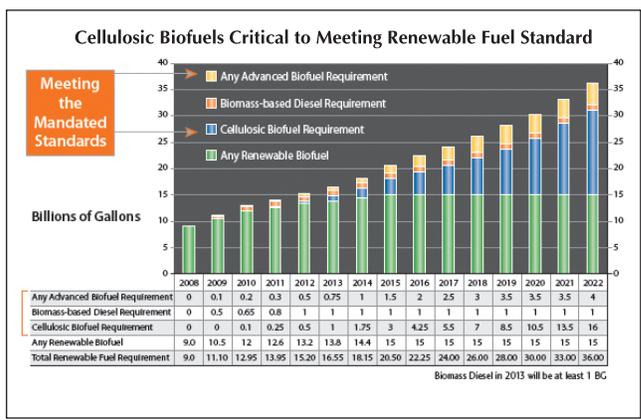
We must preserve the significant progress already underway for advanced biofuels and cellulosic ethanol. While the U.S. is facing serious fiscal issues, cutting programs will only lead the U.S. to fall further behind its global competitors and deeper into debt. In particular, the Renewable Fuel Standard must be maintained and biofuel loan guarantees supported.

Reforming Energy Tax Incentives

To motivate private investment, the advanced biofuels industry needs a level playing field with the wind and solar industries. The biofuel Production Tax Credit (PTC) must be extended to allow facilities in operation by 2016 to claim the credit for five years. In addition, the Volumetric Ethanol Excise Tax Credit (VEETC) must be reformed to save taxpayer money, and encourage the use of biofuels above 15% blend levels.

Enabling Market Access

We must expand our efforts to build a market for advanced biofuels and promote consumer choice at the pump. This



“Advanced biofuels hold the potential to transform America’s fuel supply, enhance our national security and energy security, reduce our carbon footprint, and foster economic growth in rural America. This is an enormous opportunity, and it will require the best efforts of many parties in many sectors—the federal government, national and university labs, state and local governments, and the private sector—to ensure that these multiple potentials are realized.”

—Dallas Tonsager, Under Secretary for Rural Development, USDA, Before the Subcommittee on Conservation, Credit, Energy, and Research, U.S. House Committee on Agriculture, October 29, 2009

includes workable open fuel standard mandates, the cost-effective deployment of ethanol blender pump infrastructure, and expanded government procurement programs for next-generation biofuels.

Conclusion

The advanced biofuels industry is working tirelessly to overcome the challenges it faces, including separating itself from a first-generation technology and changing perceptions. As the world develops many clean technologies to reduce our dependence on fossil fuels, only cellulosic ethanol can make a meaningful, near-term impact.

The benefits associated with cellulosic ethanol’s feedstock flexibility are unquestionable. It is the most efficient alternative fuel that can be created from the abundance of biomass found in this country. It provides for one of the most promising solutions for sustained job creation, economic growth, greenhouse gas reductions and lessening our dependence on foreign oil.

Yet, to reach this point of commercialization the industry needs support, both from the government and, perhaps equally important, the public. Developing a unified and enduring strategy, and quelling the myths is essential for the success of next generation fuels and the future of the United States.

This **“Creating a Path for Cellulose” White Paper** was produced and is distributed as part of a continuing series sponsored by the Ethanol Across America education campaign. The **Ethanol Across America** White Paper series provides an opportunity for public officials, industry, academia and others to express their views on issues relating to the development of ethanol and other alternative fuels. Interested parties are encouraged to submit papers or ideas to cfdcinc@aol.com.



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