FUELING THE FUTURE

The second generation of advanced biofuels is reshaping the way America thinks of biofuels. Innovative, renewable, and ready for today’s cars, trucks and buses, the promise of advanced biofuels is the promise of a greener tomorrow, better jobs, and an America independent of foreign energy.
The Next Technology Revolution Will Fuel The Future

By: Michael McAdams, President, Advanced Biofuels Association

As news moves instantly around the world at the click of a mouse, it is hard to imagine that not long ago the internet was a wonderful piece of science fiction. The advanced technologies of today have many of us wondering if there is anything left that will even come close to matching that cultural and economic transformation that followed the Internet.

The simple answer is yes. What can now be found in a test tube, will soon be in your cars and fueling our trains and planes through advanced biofuels.

Advanced Biofuels is not a singular product, but many derived from a number of technologies that will fuel the world’s Green economy while helping to preserve our planet for future generations. The various types of technology options which are currently being explored range from gasification, algae processes, catalysis, hydroprocessing, thermal depolymerization, fermentation, enzymatic hydrolysis, and thermochemical reactions. All of these work together to perfect the low cost, low carbon emissions fuels of the future.

Today, many companies are in a very competitive race to see who can deliver significant gallons of fuels which can be used in our transportation system. American ingenuity and entrepreneurship are proving to be the real winners in a Green economy.

One of the most important challenges for lawmakers on the state and federal level is to allow enough flexibility in our public policies to encourage competition in a technology neutral manner. There is no silver bullet to creating cleaner, more sustainable fuels; there are silver shots Affording a technology and feedstock neutral policy, as well as a level playing field in the area of subsidies and tax credits is vital to enabling all to freely compete and affords the maximum benefits to consumers.

It is important to evaluate the benefits of the various biofuels which will be available to Americans in the very near future. First, examine the type of technology which is being deployed and then, understand the feedstock which is being utilized by the technology. And lastly, understand the type of finished product or molecule which results from the process and the feedstock.

These new technologies must clear many hurdles before they become viable commercial fuel products. One of those challenges is ensuring the technology can sustainably produce enough volume. Another is providing appropriate infrastructure to transport, deliver and use biofuels, be it “drop-in” fuels that can use existing facilities or others that benefit from innovations or require adaptations. Environmental impacts of the fuel are important considerations. Is it friendly to air quality, does it emit greenhouse gases, etc.? Agricultural land or forests destroyed or used productively? Other challenges include giving consumers value for their money…can you drive as far as you did on the old stuff? And is the fuel affordable?

We can meet these challenges if we create a consistent and fair public policy framework to allow companies holding the promise of Advanced Biofuels to compete without choosing one alternative over another. Our tax policy, grant policy and regulatory policy must all be harmonized to provide a framework for companies to compete fairly without barriers to entry into the market. We are already seeing many Advanced Biofuels companies moving toward commercialization with their fuels. We need to continue to stay the course and extend our efforts to create an entire new industry and opportunity for significant job creation in our nation. The recent findings by an interagency working group tasked by President Obama are encouraging and well focused on the number of opportunities that are right around the corner.

Millions of dollars have already been spent to achieve the progress we have made to date. This is a journey that holds great promise to restore American ingenuity, create new jobs for our citizens, and diversity in our energy security. This is a journey worth traveling, and one that is not that distant in our nation’s future.
Grow, Baby, Grow!  Home-Grown Fossil Fuel Replacements

Did you know there is a homegrown source of renewable fuel that has reduced our oil imports by 1.6 million barrels/day? It’s the 10 percent ethanol blend sold at gas stations near you across the US. This ethanol has reduced carbon dioxide emissions from three to six percent compared to 100 percent gasoline, and has replaced the cancer-causing additive MTBE (methyl tertiary butyl ether).

We can—and must—do even better with advanced biofuels, that is, with liquid transportation fuels derived from low nutrient input/high per acre yield crops; agricultural, forestry, food processing or municipal waste; or other sustainable biomass feedstocks including algae.

Why? Because, according to the US Department of Energy’s Energy Information Administration, pure electric vehicles will have miniscule market penetration until long after 2035; meaning that all vehicles in the US will require liquid transportation fuel for a long time into the future. In addition, jets and other planes will continue to require liquid fuels. Advanced biofuels can provide a homegrown, low carbon lifecycle emissions, sustainably produced fuel substitute for ground transportation and aviation.

The Renewable Fuels Standard of the Energy Independence and Security Act of 2007 definition requires advanced biofuels to have at least 50 percent less lifecycle greenhouse gas emissions when compared to gasoline.

But why hasn’t it been done before? There are two great technical challenges. One is biomass recalcitrance (that is, "digesting" or converting cellulose biomass into sugars that can be converted to fuels). The bacteria in the guts of termites do this every day, much to our consternation. Fortunately for us, they do this slowly. If we want to make biofuels economically, we need to figure out how to speed up that process.

The second challenge: How can enough biomass be sustainably produced and transported to a biorefinery that can make reasonably priced fuel and assure a fair price to the grower and others in the value chain? Mark Gaalswyk, CEO of Easy Energy Systems, looks forward to hundreds of small-scale systems here and all over the world so that bulky biomass need not be transported far; and so that agricultural, forestry or food processing waste can be productively processed near where it is produced.

As Brent Erickson of the Biotechnology Industry Organization (BIO) said, "The key to the future of biofuels is biotechnology." Advanced biofuels, he explained, is at the cutting edge of technology. In the work being done in labs today we’ll find the keys to enable us to take the processes of nature and apply them to creating green gasolines out of renewable resources.

As is often repeated at advanced biofuels conferences and by the US Departments of Energy and Agriculture, there is no "silver bullet," no single solution to achieving energy security; instead we must explore myriad "silver shot" opportunities to make homegrown fuels.

Generations 1, 2, 3 and 4:
Talking about biofuels

Biofuels are classified by the type of feedstocks and technologies used to produce them. First generation biofuels are derived from food crops such as corn and soybeans. The fermentation technologies used to create ethanol are thousands of years old; transesterification processes for biodiesel production are also well established. These provide initial steps in our efforts to achieve energy security and to wean ourselves from fossil fuels.

Advanced biofuels comprise the next three generations of biofuels and encompass diverse feedstocks and innovative technologies.

Second generation fuels, commonly referred to as cellulosic fuels, are made from non-food plants, trees or agricultural residues. Cellulosic ethanol is the primary second generation fuel. Novozymes’ Cindy Bryant estimates we will be seeing it in our tanks as soon as 2011 and 2012.

The major advantage of second generation biofuels is that they can be more environmentally friendly and more economically sustainable than food-based biofuels. The primary technical challenge, however, is economically converting the cellulose, hemicellulose, pectin, and lignin contained in plant and tree cell walls into biofuels. This is harder than it first appeared.

Algae produces oils for third generation biofuels such as jet fuel and sophisticated biodiesels. These molecules often pack more energy per gallon than first or second generation biofuels. Algae can also produce ethanol and other alcohols for fuel.

Fourth generation biofuels, in the earliest stages of conception and development, are created “out of thin air.” They will not rely on photosynthesis. Instead, new chemical pathways will transform CO₂ directly into high-energy hydrocarbon fuels without creating intermediate sugars or oils.
Making Advanced Biofuels: Biomass To Building Blocks; Building Blocks To Fuels

Producing advanced biofuels requires two essential things—feedstock and technology; and a third important element—responsible scientific innovation.

Energy Feedstocks

The sun’s energy is stored in cell walls of plants and trees which are constructed from simple sugars and alcohols that are strung together into complex compounds called cellulose, hemicelluloses, and lignin. For example, some energy crops are perennial grasses such as switchgrass, miscanthus, energy canes; halophytes such as seashore mallow or spartina that can grow in brackish water; sorghum, jatropha, camelina, poplar, salicornia, and many others. These crops can be grown on marginal lands that are not so good for growing food, take little or no fertilizers and should not require irrigation.

In addition to crops, advanced biofuels can be made from agriculture or food processing waste and residues such as corn cobs, sugar beet pulp, citrus peels, nut shells, rice hulls, fruit pits, cotton gin trash, meat processing residues, and cheese whey, and restaurant wastes such as used fats, oils and grease, etc.

Residues from silviculture (wood harvesting) which might be left in dense forest creating forest fire fuel if not burned in controlled settings can be used as feedstock. These include thinnings, underbrush, limbs and tops, branches and leaves, dead or dying trees. Wood processing waste such as sawdust, bark, chips, sander dust, edgings, slabs and pulp/paper mill residues can also serve as feedstocks for advanced biofuels.

Some technologies can even turn sorted municipal solid waste into biofuel, including hard-to-get-rid-of items like vehicle tires, construction waste and otherwise unrecyclable plastics.

Overcoming Biomass Recalcitrance

If you’ve ever watched a tree bend but not break in a wind storm or seen tall grasses spring back up after a hard rain, you know how strong and resilient plant and tree biomass can be. This strength is produced by stringing sugars and alcohols into complex compounds called cellulose, hemicelluloses, and lignin. In trees, lignin is added. All these compounds are intertwined into a complex matrix. Unfortunately this well structured matrix does not easily deconstruct into the biofuel sugar building blocks. If we want to get to these sugars, one way is to learn the bacteria lifestyle, and let evolution help us find the solution.

Generally, technologies in today’s labs start with a pre-treatment step to loosen the chemical bonds in the matrix and separate out the lignin, if any. As George Huber and Bruce Dale explained in their Scientific American article, “Grassoline at the Pump.” “To be commercially viable, the pretreatments must generate easily fermentable sugars at high yields and concentrations and be implemented with modest capital costs. They should not use toxic materials or require too much energy input.”

Enzymatic Hydrolysis

Atlantic Biomass Conversions, Inc., in Frederick, MD is trying to “think like bacteria” by directing the evolution of bacteria that know how to break down sugar beet pulp so that the cellulose, hemicelluloses and pectin can be released from the matrix. The sugars contained in the pulp residue could be fermented into ethanol—or transported to a refinery as “green crude” for bio-plastics, biogasoline, bio jet fuel or other products.

Ammonia Fiber Expansion

Michigan State University has taken a different approach to converting the biomass in the matrix into sugars. They have developed the ammonia fiber expansion (AFEX) process which cooks cellulose biomass at 100 degrees Celsius with concentrated ammonia under pressure. Subsequently, enzymes convert the treated biomass to the building block sugars for biofuel production.

Gasification

Deconstruction of the solid biomass into smaller molecules can be accomplished with high temperature and pressure processes originally developed to turn coal and other fossil-based feedstocks into synthesis gas (syngas) in a process called gasification. Feedstocks are heated above 700 degrees Celsius inside a pressurized chamber with limited oxygen, turning them into a gas.

Renewable Energy Technologies

Rentechnologia, a Swedish company, developed a specialized gasification process for converting black liquor residues from pulp/paper manufacture into syngas for biofuels, particularly DME, and green liquor to return to the mill process.

Pyrolysis

A high temperature/high pressure/no oxygen process is pyrolysis. Here, however, the temperatures are lower than gasification (300-600 degrees Celsius) and the adjustable temperature and reaction rates contribute to product composition. Bio-oil, gas and biochar result. Although bio-oil can be used for heating buildings, water and in industrial processes, its use is limited by low energy content.

A solid foundation of home-grown fuels rests on sustainable efficient, effective building blocks. Today’s scientists need your support to make sure our future moves on environmentally, socially and economically sustainable fuels.
Fulfilling The Promise Of Advanced Biofuels: What Will It Take?

Scientists and engineers continue to work on transformative scientific discoveries, and on the practical aspects of putting it all together in an industrial/commercial environment to produce sufficient volumes of advanced biofuels most efficiently and sustainably.

Arian Novak of Emerson Process, biorefinery management systems specialist, works on implementing careful bench-to-pilot-to-demonstration plant-to-commercial scale strategies. Emerson Process understands that these innovations are not developed by giant oil companies familiar with manufacturing logistics. Rather, they are often developed in small research labs, universities and colleges. Experienced engineers help scientists bridge the gap between scientific discovery and product implementation.

Government also has a role. Government must carry the day for sustainable energy security as it has for other important public projects like landing on the moon, developing nuclear power, maintaining standing armed forces and a safe, reliable interstate transportation system. Specifically, until oil is again $150/barrel, government support is needed to bridge the gap from small proof-of-concept research to commercialization. With commodities markets affecting prices for both feedstock and end product; with plant construction costing hundreds of millions; with much of the value (environmental and social benefits) not monetizable; with credit generally unavailable; and with the oil companies’ refineries fully depreciated, private investment is waiting for someone else to act first, to learn from the mistakes, to refine the operations and processes.

That someone must be government or we will not be ready when the next energy crisis strikes. Wouldn’t we rather spend our financial resources developing a secure energy future here rather than contributing, through payments for oil, to the coffers of others who often work against American interests?

We need to encourage innovation in infrastructure that accommodate all the types of fuels that we will make: from equipment for delivery and dispensing feedstocks and fuels; to engines and fuels designed to take advantage of the full potential of both. We need to support development of exportable small scale production that means the needs of villages and towns, as well as large facilities that benefit from economies of scale.

As D. Hunt Ramsbottom, CEO of Rentech said, the US can be the leader in developing exportable advanced biofuels technologies. Rentech already has staff exploring international licensing opportunities for their innovations. Virent also anticipates world-wide use of BioForming® biomass into fuels. Easy Energy Systems sees creating manufacturing jobs in the US producing modular refineries for the world. Every community, from small villages to towns, cities, states and nations, will benefit from being able to sustainably provide for their own energy needs.

As Dr. Karl Sanford of Genencor emphasized, energy production is the largest industry in the world. The US can be the leader as this industry evolves into producing biobased products, providing sustainable fuels and jobs for generations to come.

This is the realm of American scientific ingenuity of the 21st Century. And it is essential to our sustainability and security.

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Algae And Company: The Underwater Habitat

The promise of algae-to-biofuels is in what these little “green machines” can make. They use sunlight to drive synthetic mechanisms (photosynthesis) to produce the various oils, long carbon chains, carbon-rings, and alcohols that are the building blocks of advanced biofuel versions of gasoline, diesel, and jetfuel.

On top of that, algae ponds can be located on land that is not being used for food crops. Potential locations include brownfield sites adjacent to coal-fired power plants.

As with many things that have great promise, there are challenges in achieving them. Algae, and their close relatives the cyanobacteria (formally known as blue-green algae), do not easily give up the packets of oil, paraffins, and other compounds they produce. They reserve the energy stored in those packets for when the sun doesn’t shine and to reproduce. In addition, although algae blooms are reported certain times of the year in waterways like the Chesapeake Bay, getting a population of algae or cyanobacteria to consistently produce desired products in commercial quantities requires a detailed management system for their micro-ecosystem. Too much decayed matter in the water can restrict sunlight or release chemicals that disturb the algae. Too little nitrogen can restrict growth. In cold water their photosynthesis systems become sluggish. These are the challenges that algae biofuel companies and university researchers are addressing.

Increasing production and maintaining ecosystems go hand in hand. The recent sequencing of the genomes of several algae species will allow researchers to identify genes responsible for the production of the oils and other hydrocarbons that algae use to store energy. Also, the genetics of how the organisms respond to environmental changes can be better understood. Using this information, not only can the rate of production be enhanced, but the organisms’ ability to grow in different conditions, such as with less nitrogen or more salt, can be enhanced as well.

Companies including Algenol, Aurora Biofuels, Bioalgene, Solazyme, and Sapphire Energy are currently testing new strains of algae.

Besides the organism approach, companies including Solix and PetroAlgae have developed proprietary micro-ecosystems designed to maximize microorganism growth with a minimum of inputs. One of the most intriguing aspects of some of these systems is the idea of using CO₂ produced by coal-fired electrical plants to increase algae production. Algenol has recently signed an agreement with Linde Gas to commercialize this approach. Implementing these systems would reduce CO₂ greenhouse emissions in two ways. First, the CO₂ would be captured and recycled by the microorganisms. Second, the biofuel produced by the algae would replace oil-based fuels that also produce CO₂.

Getting the oils past the carefully constructed cell wall of the microorganisms is probably even a greater challenge. The simplest way is to harvest the algae, dry it out and collect the oils and other hydrocarbons. The only problem is all the organisms are killed, meaning you have to start over.

Phycal, a Cleveland, Ohio company, is getting the oil out with a proprietary system based on the electro-shock principle used in microbiology labs. A slight electric shock opens pores in the cell walls long enough for the oil packets to flow out. Solix has recently agreed to test a similar system that was developed at Los Alamos National Laboratory. This is called an ultrasonic wave focusing system.

Dow Chemical Company to build a pilot biorefinery. We are also collaborating with The Linde Group to develop CO₂ capture and management technologies to increase biofuel production from algae. And with incentive funding from Lee County, Fla., we are expanding our local presence and bringing economic diversity and jobs to the region.

Algenol is part of the energy solution, but currently not all biofuels are treated the same. Equal treatment under the federal tax code and the Renewable Fuel Standard will allow us to create green jobs, keep America competitive in clean energy innovation and help break our addiction to oil.

And that will transform America’s energy future.

If you’re having lunch at Solomon’s Island or on a boat in the Chesapeake Bay and see a Navy F/A-18 Hornet streaking past, you could be seeing the future of jetfuels.

The Navy is testing camelina based biofuels in these “Green Hornets” at Patuxent River Naval Air Station for their forthcoming Great Green Carrier Group that is planned to be operational in 2016. Also by 2016 the US Air Force is gearing up to have 50 percent of its high performance JP-8 jetfuel come from green sources.

Commercial airlines are also working on getting bio-jetfuels into their inventories. Airlines, including Continental, Virgin Atlantic, Air New Zealand, and Japan Airlines have already tested different biofuel mixtures, and British Airways has recently signed an agreement with a UK biofuels firm to produce bio-jetfuel from municipal wastes.

Yes, airlines and the US military are both getting into the biofuel business in a big way. And they could be big customers. In the US, 20 billion gallons per year of jetfuel are used annually. Worldwide the total is about 60 billion gallons per year. The US military is the single largest customer of petroleum on the planet. Every day they use about 395,000 barrels of oil worth of fuel.

Airlines want bio-jetfuels for two reasons. First, it will enable airlines based around the globe to meet new emission standards going into effect in Europe in 2012 and elsewhere later in the decade. Second, reliable and sustainable sources of biofuels produced from a variety of biomass in a large number of countries would protect airlines from the rapid price changes in petroleum pricing. Biojetfuels could provide long-range price stability and maybe even lower ticket prices.

In 2009, The International Air Transport Association (IATA) showed the commitment of the airline industry by establishing a goal of carbon-neutral growth by 2020, and a 50 percent reduction in carbon emissions by 2050 compared with 2005 levels.

For the US military, it is not only a matter of cost, but of national defense. US and NATO forces currently rely on nations that are not allies and often adversaries for large quantities of fuel. In addition, portions of the US defense budget are needed to protect producers of oil and the shipping lanes to transport it. Stopping the dependence on these sources would greatly increase the national security of US and NATO countries.

As reported in Aviation Week in November 2009, much is happening in the Air Force and Navy to make bio-jetfuels a reality. The US Air Force (USAF) has begun a certification test program for a 50:50 blend of “hydrotreated” bio-jetfuel and petroleum based fuel. Sustainable Oils, Solzyme and Honeywell company UOP will supply 400,000 gallons of fuel to the Air Force and 190,000 to the Navy. Sustainable Oils will use camelina as the feedstock, Solzyme will use algae and UOP will use animal fat, or tallow, supplied by food producer Cargill. All three will use UOP’s processing technology.

The US Secretary of the Navy, Ray Mabus, is a strong supporter of both energy efficiency and biofuels. He is spearheading a joint biofuel development program with the Dept. of Agriculture and is pushing to get the Great Green Fleet operational. All planes and destroyers will run on biofuels.

“I’m asking all of us to meet an ambitious goal,” said Mabus. By 2020, he wants half of the total energy consumption for all ships, aircraft, tanks, vehicles, installations, etc., to come from alternative sources. “Right now I’m told 40 percent is a more realistic goal,” Mabus said. “But our Navy and Marine Corps have never backed away from a challenge.”

Besides these operational efforts, the Defense Advanced Research Projects Agency (DARPA), the same folks who brought out the Internet and GPS, is currently running an R&D project to drive down the cost of bio-JP-8 to something comparable to current petroleum based costs. Key to the success of this project is increasing the biomass conversion efficiency to over 60 percent and expanding feedstock sources to include cellulosic biomass, oil seeds, and algae. General Atomics is leading an algae based consortia, while SAIC and Boeing are leading cellulosic and algae based consortia. The members of these three consortia look like a “who’s who” of the advanced biofuel industry.

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Panel Of Experts

D. HUNT RAMSBOTTOM
CEO, President and Director
Rentech

Q: Why are advanced biofuels so important to the future of aviation?
Jet engines will not be electrified in the immediate future. Therefore we need synthetic Fischer-Tropsch derived jet fuels to eliminate jet fuel carbon emissions. These fuels, which Rentech makes, are the only alternative, scalable jet fuel certified for commercial aviation use. RenJet can be produced from 100 percent biomass or can be made from the clean use of fossil with carbon capture sequestration and biomass co-feed. Each of these feedstocks produces low carbon RenJet with lower tailpipe emissions than traditional jet fuel. The benefits of RenJet extend beyond its cleaner environmental profile. RenJet also provides protection to the airlines and its customers from extreme price volatility in crude pricing and provides higher payload than the use of traditional jet fuel. It’s for these reasons that 13 domestic and international carriers have signed an agreement with us to work towards a long-term RenJet fuel supply agreement from the synthetic fuels facility we are developing.

ALAN NOVAK
Director, Alternative Fuels
Emerson Process Management

Q: What is needed for the U.S. alternative fuels industry to reach commercially viable production levels?
A: Deliver premium, cleaner fuels. Whether a company is converting chicken fat to ultra-clean diesel fuel or using plasma gasification, a bioreactor system or a chemical process to make other molecules, what matters most is that the fuel at the end of the pipe can be produced economically. Compatibility with existing distribution and transportation systems is also a plus.

Leverage experienced partners. Plant design, infrastructure and automation of advanced biorefineries are highly complex, often utilizing highly sophisticated processes from the refining, chemical and pharmaceutical industries. Team-up with traditional gasoline and gas companies and process control experts who understand these complex processes can help optimize the engineering and automation of facilities, giving advanced biofuels companies a head start on commercial viability.

Deliver on the promise. Given that the cost to build a commercial-scale advanced biofuel plant may range from $200 million and $400 million, it is critical to apply process control technologies that provide repeatable, reliable and cost-effective outcomes as advanced biofuel facilities increase production from pilot to commercial-scale volumes.

LEE EDWARDS
President and CEO
Virent

Q: What trends are you seeing for renewable transportation alternatives?
A: Our nation seeks new energy sources that are clean, sustainable, and enhance energy and economic security. Fortunately, several innovative technologies meet these critical needs with attractive opportunities for commercialization.

PAUL WOODS
CEO
Algenol

Q: Why is algae a viable solution to the nation’s energy challenge?
A: America’s energy challenge is more urgent than ever. We need affordability, reduced reliance on foreign oil and cleaner air. The solution to all three is right here at home. Commercial production of algae biofuels will generate thousands of jobs, enhance our country’s energy security and reduce pollution.

Algae-based fuel technology has advanced at a breathtaking pace. We are turning algae, sunlight, salt water, and carbon dioxide into ethanol for transportation fuel or organic chemicals for plastics manufacturing. None of these inputs is tied to the world price of oil. The process does not depend on vital resources such as fertile farmland or freshwater, and it reduces CO2 concentrations in the atmosphere, giving algal biofuels the cleanest carbon footprint of any fuel.

The algae industry is optimistic that it will soon produce biofuel that is cost competitive with fossil-based fuel. As the market price of petroleum transportation fuels begins to reflect their total costs—including environmental costs—algal biofuels will only become more cost competitive with them.

Algae-to-ethanol technology is the technology of the future. Commercializing algae-based fuel will help us break our reliance on fossil fuel and the pollution it generates, create jobs and keep America competitive through clean technology innovation.

ADVANCED BIOFUELS

Glenn Tilton, the chairman of United Airlines, summed up the opportunity for advanced biofuels when he recently declared “we’re ready to be the first customers.” Like only a few product launches in recent times, advanced biofuels has A-List companies lining up to buy. Major oil companies aren’t opposing, they’re investing. Environmental groups aren’t criticizing, they’re applauding.

Why all the excitement?
Customers want alternative fuels that are sustainable—safe, reliable, and causing no disruption in the markets for other bio-based products. Advanced biofuels fit that description. Second, advanced biofuels offer the best opportunity for low-cost biofuels. Third, advanced biofuels, according to the EPA, are invariably carbon-reducing compared to conventional gasoline or diesel. Fourth, bioenergy jobs are high-paying and the income that is generated stays in the US.

How can you bring advanced biofuels to the market?
Encourage US lawmakers to create long-term policies for energy security. You’ll see how they can make a positive difference in your community.

Jim Lane is editor and publisher of Biofuels Digest, the world’s most widely-read biofuels daily.