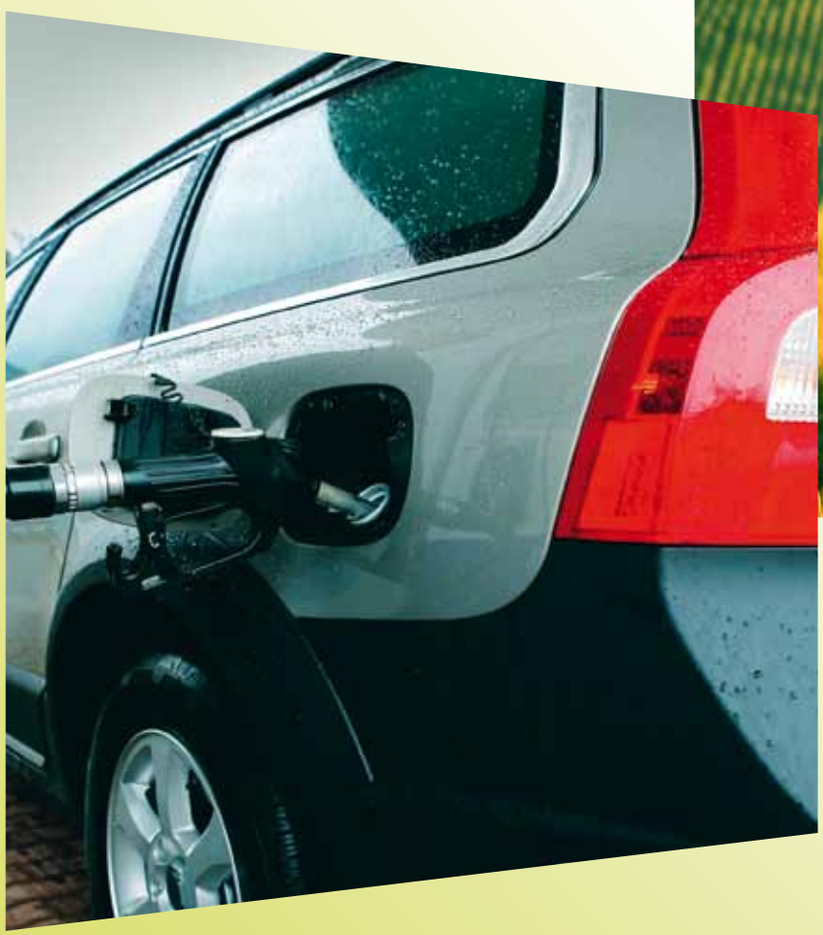
PUMPING EVEN MORE EFFICIENCY INTO THE BIOETHANOL INDUSTRY



As you stand on the great plains of Nebraska, it can be difficult to see beyond the rows of corn looking back at you. But Novozymes sees great potential here: a future with more efficient biofuel production.

In addition to supplying the biofuel industry with enzymes for fuel ethanol (bioethanol) made from corn, Novozymes is also manufacturing enzymes that, from 2010, will start to be commercially viable for producing bioethanol from materials that right now we only see as waste. Leftover crop residues after harvest, the shrubs and underbrush you just cleared from around your property... even your garbage could be in line.

Looking to the future

Biofuels not only help reduce greenhouse gas emissions in the transportation sector, but countries that adopt biofuel production can also become more energy independent, and this is an attractive prospect for many nations.

Vehicles using ethanol blends produce lower carbon monoxide (CO) and carbon dioxide (CO_2) emissions, lower levels of hydrocarbon and nonmethane hydrocarbon emissions, and fewer evaporative emissions, because ethanol has fewer volatile components.[1]

Biofuels currently provide at least 50% greenhouse gas savings when compared to their petroleum-based alternatives[2] like gasoline, and in the future biofuels will be able to provide at least 70% savings. "In 2007, the use of bioethanol, which is frequently blended into gasoline at up to 10% in the US, saved at least 10 million tons of CO_2 – the equivalent of taking 3 million cars off the roads," says Jack Rogers, Regional Marketing Manager for Fuel Ethanol at Novozymes.

The production of biofuels is poised to become even more efficient as the technology evolves. Petroleum, in contrast, is expected to continue to become less efficient on many levels, as "easy crude" becomes less readily available, and countries resort to more environmentally damaging and riskier sources for crude oil, such as oil sands and deep sea drilling.

Rethinking tomorrow

Biofuels are seen by many as a home-grown, independent, and readily available source of energy that will only continue to become more efficient as production technologies are being refined. In the US, for example, bioethanol is currently produced primarily from starch sources such as corn, but it can also be made from traditionally less useful biomass sources such as corn cobs, woodchips, or municipal waste. This "next generation" of bioethanol processing also involves enzymes used to break down the tougher cell walls (cellulose) of the biomass into component sugars, which are then converted by yeast into fuel ethanol.

Novozymes is investing a lot of resources in research and development of more efficient and cost-effective enzymes for both starch-based and cellulosic bioethanol, and is planning for this future by building a centrally located enzyme production facility in the US Midwest Corn Belt.

Choosing a "hub" model

The two primary models of enzyme production are "on-site" enzyme production at individual biorefineries, and larger "hub" facilities located

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> "Novozymes is planning for the future today by building an enzyme production facility in Nebraska."
>
> Cynthia Bryant, Global Business Development Manager for Biomass at Novozymes

close to the biorefineries. There is much discussion in the industry about which is the best way to deliver the needed enzymes to ethanol production plants; the idea behind a hub model is to centrally locate the enzyme production facility close to a dense population of biofuel refineries in order to optimize economies of scale, production capacity, and product implementation.

"On-site enzyme production is relatively inflexible in accommodating technological and market changes," says Christopher Veit, Marketing Manager at Novozymes. "Hub enzyme production facilities are more easily adaptable to these changes, and are then able to easily distribute enzymes to nearby bioethanol plants."

The new hub facility in the Midwest will provide a freedom in production not possible with on-site enzyme production. "As the efficiencies of bioethanol production continue to emerge, Novozymes will already be there for our customers," says Cynthia Bryant, Global Business Development Manager for Biomass at Novozymes. "We believe it's important to have a centrally located, larger enzyme-producing facility where any technological changes to enzymes used in biofuel processing can be quickly and efficiently implemented prior to distribution to bioethanol plants."

The ability to focus resources on new enzyme development and production optimization is imperative for the bioethanol industry to develop and grow – and all signs point to imminent and strong growth. Enzyme product and process improvements can give the industry a large boost, often by reducing production costs, but only when done so in a timely manner. These types of improvements, which can fundamentally change the effectiveness and quantities of the enzymes needed for conversion, are much more difficult to distribute to numerous on-site production facilities, which is why the centralized hub system will be a great investment for the benefit of the many bioethanol producers in the Midwest.

In the heart of corn country

Novozymes' 200-million-dollar enzyme production facility is currently under construction at Blair, Nebraska, in the Corn Belt. Upon completion, the facility will produce enzymes for existing starch-based bioethanol and, in the future, will also produce enzymes for cellulosic bioethanol production. This new facility in Nebraska is one of the initiatives that will help grow the American biofuel industry.

"In addition to supplying enzymes to existing biorefineries, the Nebraska plant will come online in time to supply enzymes to a new generation of Midwestern biofuel plants, which are expected to begin operating in 2011–2012," explains Cynthia Bryant.

Bioethanol continues to show great outcomes and even greater potential as a home-grown way to reduce dependence on foreign energy while reducing CO_2 and other greenhouse gas emissions from transportation. The American biofuel industry recognizes the importance of this opportunity, and is growing quickly; Novozymes has taken steps to match that growth by planning and growing now, in order to boost the necessary capacity to grow together with it.

The initiatives being implemented right now are key to preparing for the inevitable requirements of tomorrow's biofuel production needs – not just in the plains and fields of Nebraska, but worldwide. ■

1. For more details see Renewable Fuels Association's website: http://www.ethanolrfa.org/resource/facts/answers/
2. A. Liska: Journal of Industrial Ecology, 2008, http://ncesr.unl.edu/docs/09-1_improvementsincornethanol.pdf

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