

Some call it the only sustainable way to drive into the future, while others deem it harmful to world society and the environment – the debate about the benefits of biofuel or fuel ethanol is raging around the world. Novozymes develops bioinnovative solutions to help produce biofuel cost-effectively and efficiently – and clarifies its position in this debate.

TAKING SIDES – THE BIOFUEL DEBATE

Is biofuel good or bad? This is a complicated assessment.

Traditionally, Novozymes' enzymes have been used in industries and applications where the benefits clearly outweigh any other concerns. In the biofuel industry, the production and use of biofuel presents both opportunities and risks, and is the subject of extensive debate and reports. Novozymes supports taking a critical look to ensure that biofuels are produced and used in a responsible, beneficial, and sustainable way.

"Novozymes' enzymes are used extensively in the making of fuel ethanol, but as clear as the benefits of using enzymes to produce fuel ethanol are, the benefits of biofuel itself are under discussion and it is important to establish the facts and take a stand," says Karen Margrethe Oxenbøll, Head of Eco Efficiency Assessment at Novozymes.

Food versus fuel

The most prevalent debate is food versus fuel. It is difficult at times to justify putting good old corn in the gas tank while the UN is pleading for hunger relief in Sudan. Can tanking up a 4x4 with biofuel for a joyride be more important than feeding a starving child? But is this a fair question?

"The issue of food scarcity is highly complex. Hunger is essentially a matter of income distribution; global food production is more than enough to feed the world population. Most of the world's 800 million undernourished people live in rural areas, and are dependent on agriculture. The increased demand for agricultural products may allow them to sell their crops at a decent price. These people have been hurt by decades of declining agricultural prices; a trend which apparently has stopped now," says Thomas Odgaard, Analyst at Novozymes. "There is no reason to believe that use of biofuels will lead to general food shortage."

Recent data (from July 2007) from the US Department of Agriculture show that farmers in

the United States are on track to grow their biggest corn crop ever, nearly 12.8 billion bushels (approx. 325 million tons), which will limit the increase in corn prices.

"The increasing price of food around the world has also been blamed on biofuel," says Thomas Odgaard. "But increased use of biofuels is only part of the explanation. Increased demand for food, especially in India and China, and poor global harvests are other important factors. Further, it is important to remember that the costs of agricultural products only account for a small part of the commercial price of food; a 50% increase in agricultural price only results in a 5% increase in the cost of bread."

Food makes up a declining share of household budgets in Western countries because food is at its historically cheapest level and incomes have increased. Sixty years ago, an average British family spent one-third of their income on food; today the figure has dropped to one-tenth.

The next-generation biofuel, known as cellulosic ethanol, will be made from what is deemed as waste matter, including corn stover, bagasse, other agricultural and industrial by-products, but also energy crops like switch grass, which binds more carbon and requires less fertilizer than traditional crops. The technology is still new and it will take some years to make it commercially viable. This second-generation biofuel will offer a more sustainable solution than biofuel made with feed starch like corn and wheat, making the food versus fuel debate moot.

Nature versus the future

The question is quite simple: Is Mother Nature smiling because biofuel-driven cars emit less greenhouse gases (GHG) or is she frowning because of the contamination of agricultural land with too much fertilizer?



"The GHG savings from substituting gasoline with ethanol are undisputable, as long as it is based on sustainable production of biomass. The savings in CO₂ emissions range from 20% for first-generation technology as commonly practiced to about 80% for second-generation technology," says Peter Halling, Marketing Manager in Biomass at Novozymes.

In addition, integration in energy production may provide CO₂ emission savings of up to 70% for first-generation technology. The magnitude of fossil fuel savings ranges from about 25% for first-generation technology as commonly practiced to about 90% for second-generation technology.

However, since biofuel is based on agricultural production, it is connected with environmental loads in terms of acidification and nutrient enrichment; to a large extent because of the application of high levels of fertilizers.

"The impact of the nitrification is local and the general consensus is that this concern is outweighed by the greater positive contribution biofuel makes to climate change and resource depletion," says Peter Halling.

Implementation of second-generation technology may also cause additional risks in terms



Novozymes believes that biomass provides a viable option and realistic means to replace fossil fuels.

Thomas Odgaard, Karen Margrethe Oxenbøll, and Peter Halling analyze the pros and cons of biofuel.

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of soil erosion and reduced levels of soil organic carbon. However, with the use of the residual materials from corn and sugar production, such as corn stover and bagasse, less land is needed for biofuel production. Other perennial grass energy crops like switch grass need less fertilizer, pesticides, and water – and can enrich soil nutrients and provide ground cover to reduce erosion because it is mowed instead of plowed.

Show me the money

Government subsidies put in place to support the fledgling biofuel industry in the EU and the US, are widely criticized.

“Subsidies are vital in the early stage of market development. Demand is ensured through government mandates and standards, and governmental incentives are needed along the supply chain to provide supply,” says Thomas Odgaard.

Once the industry is commercially viable without government support, the subsidies will be phased out, as is the case in Brazil.

Biofuel subsidy critics believe that biofuel offers no energy savings as it takes more energy than in a gallon of ethanol to produce a gallon of ethanol.

However, the US Department of Energy and the National Academy of Sciences have endorsed the claim that there is a positive modest energy gain when using biofuel instead of fossil fuel.

It is also relevant to consider that the current use of biofuels can prepare us for the time when oil prices rise sky-high due to reduced supply. There is good reason to believe that the total costs of shifting energy resources will be lower the earlier and more controlled the shift is.

It has also been argued that the increase in the use of biofuels is often partly justified by positive job creation effects and to some extent positive contributions to economic activity.

“The use of biofuels only has a positive effect on the economy if the people hired in the industry were previously unemployed or earned lower salaries in their previous job,” says Thomas Odgaard. “Hence this is a weak argument for promoting biofuel in high-income regions with low unemployment, like we have in Denmark, compared to low-income regions with high permanent unemployment, like in developing countries and some rural areas.”

Increased use of biofuel will mainly create jobs in rural areas. Biofuel will build local economies

as most pretreatment and conversion will take place close to the feedstock production centers.

Eat the corn, drive the cob

Many forms of cellulosic biomass can contribute to the production of bioethanol, including agricultural waste, forestry waste, industrial waste and by-products, municipal urban waste, and energy crops. These cellulose-containing natural waste products are widely abundant and can be sustainably produced.

But let’s face it – the biomass-to-fuel industry is in its infancy. While the industry holds a huge amount of potential there still exist many barriers to overcome before the high targets that are set by governments and forecasts in the media are met.

“Biomass is a key focus area for Novozymes. We believe that biomass provides a viable option and realistic means to replace fossil fuels. We have substantial investments in the industry in close cooperation with large industrial players, and we will encourage governments to do more to help develop second-generation fuel ethanol and ensure that the biomass used as raw material is produced in a sustainable manner,” says Peter Halling. ■

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