Cellic® CTec3
FAQ

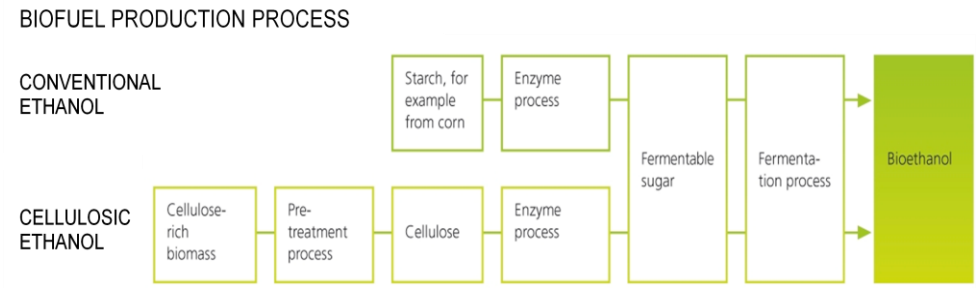
More info on news.novozymes.com and bioenergy.novozymes.com/sweet-spot

What is Cellic CTec3?

Cellic CTec3 is a multi-enzyme cocktail used in the production of advanced biofuel. It breaks down cellulose and hemicelluloses in biomass into sugars that can be fermented into ethanol. Cellic CTec3 has proven to work across a variety of feedstocks including corn cobs and stalks, wheat straw, municipal solid waste, sugarcane bagasse, wood chips and energy crops.

Cellic CTec3 performs 1.5 times better than the previous best product in the market, Novozymes' Cellic CTec2. Using Cellic CTec3, biofuel producers need only one-fifth of the enzyme dose compared to competing enzymes . It takes 50 kg of Cellic CTec3 to make 1 ton of ethanol from biomass. By comparison it takes at least 250 kg of a standard competitor enzyme to make the same amount of ethanol.

Cellic CTec3 is the most cost-efficient enzyme seen so far in the market and allows the cost of producing ethanol from biomass to approach the level of corn ethanol and gasoline.



What are advanced biofuels?

Advanced biofuels are a gasoline substitute produced from cellulosic material such as agricultural and forestry residues, energy crops, and municipal waste. It is produced by first breaking the biomass down into a pulp. Enzymes are then added, turning the pulp into sugar which can be fermented into fuel ethanol.

What's the status of advanced biofuels?

In 2012, the first companies will start commercial production of advanced biofuels. M&G will start up its 13 million gallons per year facility in Italy. Fiberight will start a small scale plant in the U.S. followed by a larger 6 million gallons per year plant in 2013. Companies such as Abengoa, BP, COFCO-Sinopec, DCE, POET and PRAJ will also follow in 2013-14.

If commercial scale up proves to be successful, we could see the next wave of commercialization start up from 2014-15 and onwards.
This technology creates the foundation on which to build a bio-based economy. That is the vision and what we are striving for.

What does it take to build

Bringing advanced biofuels to market takes a partnership, where the private sector provides the innovation and the capital to develop it – and

this industry?

the public sector provides consistent policy support to grow it and capital in the initial phase, when there is still a technology risk.

Doubts about biofuels policy hinders the confidence of investors, a confidence which is much needed to take this industry forward as a large-scale advanced biofuel plant often costs $200 million to build.

How much biomass is available?

According to a recent study by Bloomberg New Energy Finance, leading agricultural powerhouses such as the US, China, Brazil, EU27, India, and Argentina have enough agricultural residues to substitute more than 40% of their gasoline usage in 2030. This can be done using less than 20% of their agricultural residues, thereby leaving most of the available biomass for bioelectricity, husbandry and soil quality protection to ensure sustainability.

Add to this the availability of forestry residues, energy crops and municipal waste and you will have more than enough to substitute a significant part of the gasoline consumption globally.

What are the benefits of advanced biofuels?

Advanced biofuels have the potential to boost the economy while creating green jobs. Bloomberg New Energy Finance estimates that the advanced biofuels industry will create millions of jobs, economic growth, and energy security worldwide, using less than 20% of the available agricultural residues:

- **The US** could displace up to 16% of its gasoline consumption in 2030 and at the same time create 1.37 million jobs and revenue of $663 billion. This would also reduce CO_2 emissions from gasoline use in transportation by 11%
- **China** could displace up to 37% of its gasoline consumption in 2030 and at the same time create 2.87 million jobs and revenue of $779 billion. This would also reduce CO_2 emissions from gasoline use in transportation by 29%
- **Brazil** could displace up to 83% of its gasoline consumption in 2030 and at the same time create 1.25 million jobs and revenue of $662 billion. This would also reduce CO_2 emissions from gasoline use in transportation by 67%
- **The EU** could displace up to 68% of its gasoline consumption in 2030 and at the same time create 1.18 million jobs and revenue of 532bn USD. This would also reduce CO_2 emissions from gasoline use in transportation by 54%
- **India** could displace up to 100% of its gasoline consumption in 2030 and produce an additional 4 billion liters for export. This would create 910,000 jobs and revenue of $329 billion. This would also reduce CO_2 emissions from gasoline use in transportation by 80%