

Green Biologics inks Iowa demo plant deal with Easy Energy Systems



Green Biologics heads for scale - pilot complete, demo ready in 2014. The race for n-butanol from cellulosic materials is on.

The prize for a transformative breakthrough on n-butanol's cost, performance and sustainability? Could be millions. Could be billions.

By Jim Lane, Biofuels Digest

In the UK, Green Biologics announced a collaboration and planned investment in facilities with Iowa's Easy Energy Systems. The collaboration will result in the modification of Easy Energy's ethanol demonstration plant in Emmetsburg, IA to produce renewable n-butanol and acetone. In mid-2012 GBL successfully produced butanol and acetone from corn mash at the Emmetsburg facility in Iowa at a 40,000 liter fermentation scale.

“We ran three separate batches in July 2012 which matched results in both total solvent production and n-butanol yields that were achieved in our U.K. laboratories and at our Columbus, Ohio pilot facility,” says Sean Sutcliffe, CEO of Green Biologics. “From these demonstration runs we have validated fermentation performance at scale meeting our commercial targets.”

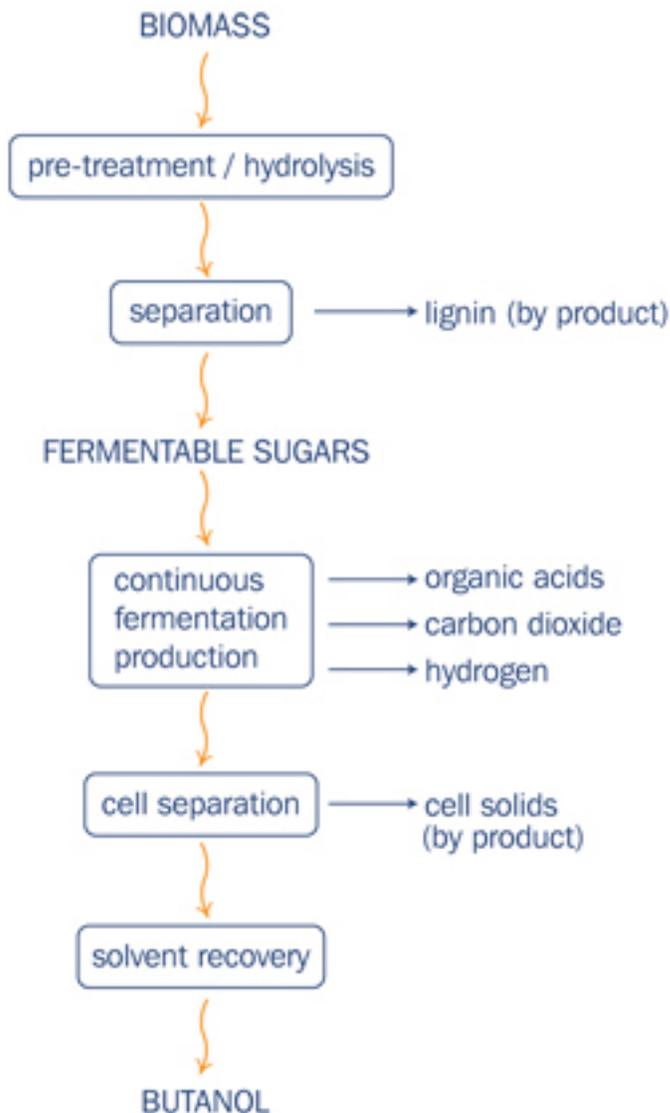


Distillation unit at Emmetsburg

In May 2013, Green Biologics successfully demonstrated its advanced fermentation process at pilot scale in Gahanna, Ohio. “This technology capitalizes on the unique characteristics of Green Biologics’s advanced biocatalysts and provides a doubling of butanol production productivity compared to existing processes with a modest incremental capital investment,” said Patrick Simms, Chief Operating Officer for GBL’s North American business. “We are now scaling to 80,000 liters in Iowa.”

In today's Digest, we go back to butanol school for a primer on isobutanol and n-butanol, look at cellulosic biobutanol, the Iowa project, scale-up in China to date, and plans for a first commercial project in the US - plus the bottom line, by following the page links below.

Back to Butanol School



For those less familiar with the 4-carbon butanol (as opposed to 2-carbon ethanol), it's been widely tipped for years to ultimately be the molecule of choice for the US Corn Belt. It's been a much tougher technology puzzle — but the business case for producing fuels and chemicals using a four-carbon platform is solid. On the chemicals side, there are a range of \$5 per gallon applications, or even higher prices. On the fuels side, though the prices are lower, the blending rates are much higher for butanol with gasoline, the energy density is much higher than ethanol, and there's no need for a flex-fuel vehicle to run, in terms of vehicle operation, a 50-50 blend of butanol and gasoline. So, lots of upside relative to ethanol.

The problems have been two-fold. First, a fermentation process with sufficient yield. Two, a process that can utilize cellulosic material.

Now, to complicate matters just a little, there's isobutanol and n-butanol —

the former is better for fuels, the latter is better for chemicals. Gevo and Butamax have been working on isobutanol, and have made substantial progress towards scale — especially Gevo, which is now operating at its first commercial facility in Luverne, Minnesota.

C5s and corn waste

On the n-butanol front, there have been Cobalt Technologies and Green Biologics. Not only are both focused, primarily, on chemicals — they both are focused on cellulosic waste as a feedstock (Gevo and Butamax, for now, are producing from corn starch). Turns out that producing n-butanol from C5 sugars (found in cellulose and hemicellulose) is much easier than doing the same for isobutanol.

A differentiating point between Green Biologics and Cobalt has been the feedstock of focus. Though Cobalt is a US company, it has lately been focused on sugarcane bagasse and its ambitions are rightly pointed towards Brazil. By contrast, Green Biologics has been working on grain residues — corn stover, generally — and has been aimed at the US and China.

The plant and expansion

The current breakthrough announced by Green Biologics takes the company well down the route to scale — at the 40,000 liter mark, aiming for 80,000. By contrast, Cobalt has been reporting that it has passed the 100,000 liter scale in producing down at the LS9 facility in Okeechobee, Florida. But this work by Green Biologics is really turning the chase for n-butanol into a horse race.

Ultimately, companies that are successful, financially, will need to reach much later fermentation scale — anything between 500,000 liters and the million gallon scale that Gevo is now successfully operating at. So, there's a step up of 12X-30X required here — and overall, a reference plant for Green Biologics, featuring multiple fermentation units, would involve a 50-100X scale-up from this level.



Green Biologics pilot plant in Gahenna, Ohio

So, more steps to come — but it's an interesting combination with Easy Energy. As Green Biologics CEO Sean Sutcliffe noted, the Easy Energy deal provides Green Biologics with significant demonstration capability at a fraction of the cost of a green field demonstration plant.

“We plan to make significant investments in feedstock preparation, processing and product storage as well as process control” said Sutcliffe, “but more importantly, we plan to scale our proprietary (patent pending) advanced fermentation process at demonstration scale. In addition the facility will have the capability to allow us to scale and demonstrate the use of cellulosic biomass as a sugar source for renewable butanol production.”

The Easy Energy plant

For those familiar with the old Renewable Fuel business on the south side of Emmetsburg (a few clicks from POET-DSM's Project Liberty, the 25 million gallon cellulosic plant now under construction) this is the same building, substantially enhanced with Easy Energy's investments.

At the time EES was founded, they were focused on developing an ethanol production process that worked at small-scale. The company's Modular Energy Production System self-contained, fully automated, ethanol biofuel refinery that is pre-fabricated and tested in a factory and can be shipped anywhere worldwide in container-sized modules that can be field installed much like plug-and-run LEGO® bricks. The MEPS comes in 1M Gallons per Year, 2MGPY and 5MGPY configurations. [More their technology here.](#)

Scaling in China

At the same time, scale-up work at Emmetsburg complements commercial scale demonstration work already achieved in China. In 2011, Green Biologics partnered with Laihe Rockley Biochemical Ltd. in Songyuan, China and in 2012 produced the world's first commercial scale cellulosic n-butanol from residual corn waste (corn shells, corn cobs and stover). The Chinese commercial trial run was completed in June 2012 at 3.2 million liter fermentation scale in one of three 50,000 tonne/year production units. In Nov 2012, Green Biologics imported 55 tonnes of cellulosic n-butanol to the U.S. and is now marketing the material for chemical applications.



Site of Green Biologics' China project

"We've been demonstrating in China using corn waste," Sutcliffe explained to the Digest. "We've been working towards this for a year, running a C5 only stream for four weeks recently that was robust, and delivered the quality we were all looking for. On the back of that, the Chinese are investing in the capabilities to run C5 and C6 fermentation, and we are

looking to run that at full scale this year."

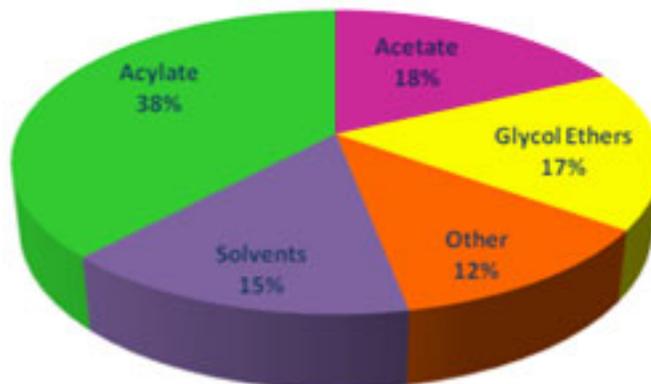
US is focus for first commercial

If the samples and drums all came to the US from that China production run, it was because the US is the target for the company's first commercial plant, and samples were distributed to undisclosed potential customers. The timeline for the first commercial plant is, as yet, unclear.

"We're focused now on getting the China and Iowa demonstrations up and running," said Sutcliffe, "then we'll focus on the first commercial. But we are talking to major strategic investors about that," Sutcliffe added. Green Biologics has engaged with Morgan Joseph TriArtisan, to perform the capital raise that in part will fund the build out of the demo unit. They project to have the demo fully operational by mid 2014.

Markets for molecules

The company's core focus is n-butanol, a chemical precursor for paints, coatings, adhesives, inks, plastics, pharmaceuticals, household cleaners and personal care ingredients with global markets exceeding \$10 billion.



The global n-butanol market, n-butanol

"Globally, 80% of n-butanol goes to butyl acrylates and butyl acetate for paints, coatings, inks, and adhesives," Sutcliffe told the Digest.

"But there are host of high value apps," added Green Biologics North American president Joel Stone, "especially interesting are flavors and fragrances. Approximately 20% of the market is solvents and specialties that include personal care applications, food flavors and extractants, specialty cleaning applications, vitamins, textile swelling agents, aviation brake and hydraulic fluids, and fire retardants.

The bottom line

With the demo plant expected to be ready in mid-2014, it's mid-decade for Green Biologics in terms of a first commercial plant. Limiting factors will be, as with all cellulosic plays, the cost and logistic of aggregating affordable feedstock. Interesting that they are working up in Emmetsburg, along those lines., With all the work done by POET Biomass in support of logistics for the POET-DSM Project Liberty, north-central Iowa is, for sure, one place that has come far in terms of learning how to handle biomass.

Learn more about Green Biologics via this [free, downloadable 2-page summary, here.](#) The company's [website is here.](#)

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