

# British Invasion: Why is America Producing Fuel for This WWII Airplane?

Maxx Chatsko - January 25, 2015

This is the famous Spitfire that defended the skies over Great Britain during World War II. Can you guess what's in the fuel tank?



Image source: [Wikimedia Commons](#).

No, the Spitfire wasn't fueled by traditional jet fuels. Instead, as with many British Royal Air Force planes at the time, it was fueled by butanol produced from bacteria that were fed potatoes. Really.

The most common process for producing biobutanol is called acetone-butanol-ethanol, or ABE, fermentation (named after the products produced), which is performed by several naturally occurring strains of *Clostridium* bacteria. The chemical is actually a low-volume byproduct of most fermentation processes, so you drink biobutanol in wine, whiskey, and beer. But shortly after WWII, petrochemical processes rendered ABE fermentation obsolete, since abundant crude oil derivatives could create acetone, butanol, and ethanol more cheaply.

Now over 60 years since losing its edge to petrochemicals, biology is fighting back to reclaim biobutanol production. America's cheap corn sugar will replace Britain's potatoes, but Britain is still supplying the technology -- just with a 21st century twist. United Kingdom-based industrial biotech company Green Biologics purchased an ethanol facility in Minnesota last December and just announced [\\$76 million in new financing](#) (link opens PDF) to retrofit it for renewable butanol and acetone production beginning in 2016. Instead of fueling Spitfires, the renewable products will be sold into more valuable chemical markets, perhaps finding their way into paints, nail polish removers, and foods.

Will it beat renewable oils producer **Solazyme** (NASDAQ: SZYM) in the race to become the first profitable industrial biotech platform powered by synthetic biology in the United States? And what does it mean for investors hoping Butamax, the joint venture between **BP** (NYSE: BP) and **DuPont** (NYSE: DD), would reign over biobutanol production?

### Biobutanol 2.0

Green Biologics began as a contract research firm (and was profitable for its first three years in existence) before pivoting to develop a novel industrial biotech platform of its own. Today it has deployed its technology on three continents: laboratory space in the United Kingdom, pilot and demonstration-scale facilities in the United States, and commercial scale operations in China (through technology licenses). The retrofitted Minnesota ethanol plant will become the company's first owned commercial facility.



Milton Park Labs

1-5 liter (bench)



Gahanna, US Pilot Plant

150 liter

550-1000 liter



US Demonstration Plant

4 x 40,000 liter



Chinese Commercial Demonstration

32 x 400,000 liter

Image source: Green Biologics.

The 21-million-gallon-per-year ethanol facility will be incredibly important for the future of Green Biologics and renewable chemical manufacturing in the United States. Proving next-generation strains and having complete control over the entire process -- both likely lacking from Chinese operations -- will allow the company to prove to investors, partners, and customers that its technology is profitable and reliable. That could pave the way for capacity expansion. After all, many corn ethanol producers are looking for more valuable and less volatile production platforms.

Failing to win the confidence of investors, partners, and customers has cost Solazyme dearly in the past 12 months. The company forged ahead in bringing two commercial-scale production facilities online in the United States and Brazil, but ran into several production, market development, and [perhaps technology hurdles](#). It's clear Solazyme management [hasn't been very honest with investors](#), either.

Green Biologics has avoided many of the mistakes of fellow industrial biotech companies. For instance, rather than initially targeting low-margin fuels as Solazyme and **Amyris** did to raise funding before pivoting to higher-value chemicals, the British invader has targeted higher-margin chemicals from the beginning while keeping a long-term eye on fuel markets. The first shipments of renewable butanol and acetone will go to the highest-value applications in markets that are already established and developed -- no lengthy sales pitch or subdued production volumes required.

Additionally, Green Biologics hopes that its novel production process will provide a boost over more traditional fermentation platforms. The company has engineered its host organism, a strain of *Clostridium*, to churn out over 50% more butanol than naturally occurring strains. More impressively, it uses a continuous fermentation process capable of producing chemicals for more than 1,000 hours, or 42 consecutive days. Batch fermentations are usually completed after seven to 13 days (although it depends on tank size), which means cleaning, loading, and maintenance costs represent a larger percentage of overall production costs.

When the efficient technology, business, and marketing strategies are combined, it wouldn't be impossible for Green Biologics to own the first profitable commercial-scale industrial biotech facility in the United States. But what does another biobutanol producer mean for the highly publicized Butamax platform?

### **Should BP and DuPont be worried?**

Butamax is going full-steam ahead to manufacture biobutanol for use as a fuel blendstock. Unlike ethanol, which is only approved for blends of up to

10% in gasoline, biobutanol is approved for blend rates as high as 18% in gasoline. It can even be combined with ethanol and gasoline to further reduce the amount of petrochemicals used. Furthermore, biobutanol has 98% of the energy density of gasoline, while ethanol boasts a lowly 67% that saps your fuel economy. Butamax even has a deal to retrofit a 50 million gallons per year ethanol facility -- ironically, also located in Minnesota -- to produce biobutanol.



The Highwater Ethanol facility in Lambert, Minn. Image source: Butamax.

But there's a catch.

While both Green Biologics and Butamax tout their biobutanol platforms, they actually don't produce the same chemical. Huh? It sounds confusing, but the devil is in the details. Yes, both are producing a biologically derived form of butanol, but Green Biologics manufactures the chemical n-butanol. Butamax produces isobutanol. And although they can be used in similar applications, the global market for biobutanol is more than large enough for multiple, successful companies.

Green Biologics and Butamax shouldn't meet in the courtroom (as Butamax and Gevo have done) because they use substantially different organisms and processes. However, they could compete for American

ethanol facilities to retrofit to produce higher-value biobutanol. Many smaller producers -- and even some larger ones -- have faced economic hardship imposed by volatile ethanol markets and would happily produce more valuable chemicals. Of course, with over 14 billion gallons of corn ethanol produced in the United States every year, the two companies have plenty of potential targets.

### **What does it mean for investors?**

The United States could become a biobutanol leader thanks to its cheap sugar resources and two United Kingdom-based companies, Green Biologics and BP. The former's ability to sell butanol and acetone into readily established markets from the first day of production in early 2016 should allow it to become the first profitable commercial-scale industrial biotech platform in the United States, besting even investor favorite Solazyme. Unfortunately, Green Biologics has no plans to go public anytime soon, although successful operations in Minnesota could change that. If you're interested in this space, then you'll want to keep an eye on the company.

### **The backdoor Holy Grail investment into "Oil Boom 2.0"**

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