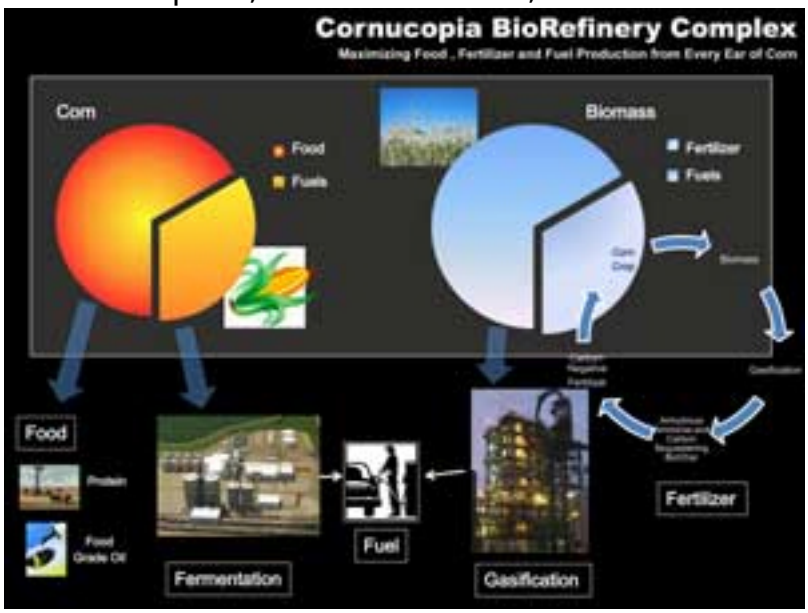
Food AND Fuel

Luke Simpson, Associate Editor, Chem.Info



A lot of great ideas are developed by imagining a magical black box through which you can process an input to produce a desired output. For example, what if you could take an ear of corn, feed it into a device and get food, fuel and fertilizer out of the other side?

This was the challenge given to SynGest engineers when the company set out to produce a system that efficiently utilizes all parts of the corn crop. What they came up with was an integrated biorefinery that produces a smorgasbord of end products:

- Anhydrous ammonia (nitrogen fertilizer and transportable fuel).
- Food-grade corn oil.
- High-protein food for human consumption.
- Riboflavin-rich dry stillage (animal feed).
- Butanol (drop-in fuel for internal combustion and diesel engines).
- Biochar (for conditioning and maintaining soil).
- Ethanol.

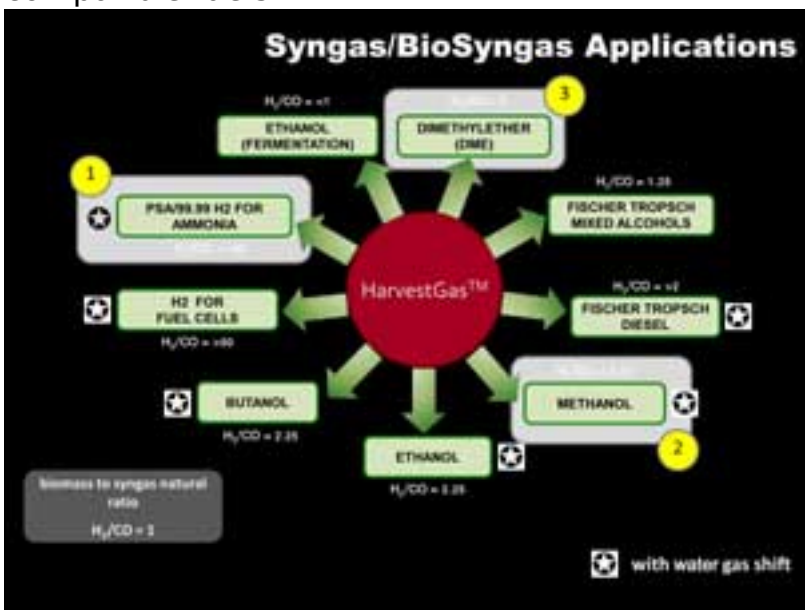
No Corn Hamburgers

The analogy used to describe the SynGest process compares a cow to the corn plant: It would be extremely inefficient if food processors ground up the entire cow to produce hamburger meat, when they could first separate the expensive cuts and sell them at a higher price as steaks. SynGest aims to use the corn plant more efficiently by implementing dry fractionation to separate the corn kernel into its three main components of starch, germ and bran.

The germ can then be used to produce corn oil, while the starch can be fermented to produce ethanol. But Syngest CEO Jack Oswald hopes to eventually produce

other fuels.

“Ethanol is not even close to the ideal fuel when fermenting starch or sugar. Today the blend wall exists because we don’t have enough flex-fuel vehicles. We want to produce a better fuel that doesn’t require flex-fuel vehicles — we want drop-in compatible fuels.”



Harvesting Syngas

The bran and leftover corn cobs — traditionally a waste product — become the feedstock in SynGest’s technological centerpiece: The Harvestgas™ fluid bed gasifier.

A traditional fluid bed gasifier converts biomass, waste and any carbon-containing material to a mixture of hydrogen and carbon monoxide gas, known as syngas. However, impurities remain in the gas mixture, requiring extra clean-up stages. By injecting oxygen into the system, SynGest achieves a much purer syngas in the first stage of the process.

To completely purify syngas, an oxygen-enhanced autothermal catalytic reformer is added to the gasifier, converting all of the tar and most of the other impurities into syngas. The result is a high yield of clean syngas without a waste product or inefficient clean-up stages.

“Our gasifier is specifically designed for biomass conversion for molecule production — to make a low-BTU syngas and convert as much of the biomass into carbon monoxide and hydrogen. From there, you have a lot of options for catalytic or other conversion processes to create products and fuels,” explains Oswald.

“We think that there are only a small number of molecules that make sense to produce: ammonia, methanol and dimethyl ether.”

Back to the Future

The idea is that existing corn-ethanol plants can eventually be retrofitted to produce

more efficient fuels, as well as food-grade corn oil and fertilizer. Initial calculations predict that a typical 110 million-GPY ethanol plant would produce 20 percent more fuel per year when retrofitted with this system — and that doesn't include the other products that are created in the process.

Pre-construction engineering is currently underway on the first commercial-scale plant, for which the state of Iowa has granted substantial funding. Proving that the SynGest technology works on a commercial scale is an obvious challenge, but an equally difficult task is convincing the public that food and fuel production don't have to be mutually exclusive.