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Golden Possibilities

Corn oil forges a link between ethanol and biodiesel production

By Holly Jessen | January 11, 2012

Ethanol producers are adding corn oil extraction to their technology arsenal in increasing numbers, providing an ideal opportunity for the ethanol and biodiesel industries to cooperate or even co-locate. On the cooperation side, the biodiesel producers, such as Renewable Energy Group, are already using corn oil produced at ethanol plants as a biodiesel feedstock. On the other hand, co-location of ethanol plants and biodiesel production hasn't yet gotten off the ground. While some wonder if it ever will, Mcgyan Biodiesel LLC is one company actively working to make it happen.

REG, the largest biodiesel producer in the U.S., currently operates one biodiesel plant that converts corn oil from nearby ethanol plants and has plans for retrofits at additional REG facilities. "As our industry grows, we are going to need to develop additional capabilities to use new feedstocks, and corn oil is the one growth feedstock that we see out there," says Dave Elsenbast, vice president, supply chain.

REG isn't the only biodiesel producer to turn to corn oil. The company, which owns/operates more than 210 MMgy of biodiesel production, closely tracks corn oil numbers for both the biodiesel and ethanol industries. By internal REG estimates, about 10 percent of biodiesel produced in 2010 was from corn oil. Although corn oil is an increasingly popular feedstock, with biodiesel production numbers increasing upwards of 800 MMgy in 2011, that percentage is likely to drop.

"Certainly the amount of corn oil being separated and being sold into the biodiesel market is up in 2011 vs. '10 but probably has not kept pace with the growth of the biodiesel industry in total production," he tells EPM.

On the other side of the equation, REG estimates that in 2010 about 35 percent of ethanol plants had corn oil extraction in place. By the end of 2011, Elsenbast estimates that number will rise to above 40 percent. "There is going to be rapid expansion continuing on into 2012," he says. "The inedible corn oil extraction technology offers great profit opportunities to the ethanol producers with very limited risk."

Notably, three top ethanol producers have installed back-end corn oil extraction technology at their dry mill plants. Green Plains Renewable Energy Inc. spent the past year retrofitting all nine of its ethanol plants and now produces about 120 million pounds of crude corn oil yearly. Valero Renewable Fuels Co. LLC, which operates 10 ethanol plants with a combined capacity of 1,110 MMgy, plans to add the technology to four of its plants by spring and has left the door open to corn oil at another five dry mill ethanol plants, saying it will "study the possibility" after installation at the first four plants is complete. Poet LLC has developed Voila, a trademarked, low free fatty acid corn oil. The company installed the technology first at its Poet Biorefining plant in Hudson, S.D., and announced in early December that it had been installed in four more plants. In all, the Poet plants have the capacity to produce about 100 million pounds of corn oil yearly.

The two largest markets for crude corn oil from ethanol plants are feed and biodiesel production, says Joe Riley, general manager of FEC Solutions, which markets corn oil for three ethanol plants. Some corn oil also goes into industrial, oleochemical and export markets. "We're always looking for new and higher value markets for the product," he adds.

While the market for corn oil is still shaking out, in general, it's a good feedstock for biodiesel producers because it's priced lower than soy oil. Ethanol producers want to sell into the biodiesel market because they can typically get better prices than for feed. "Feed is kind of the bottom rung of the food chain, so to speak," he says. "If you can't get rid of something, essentially, you will feed it to an animal. ... I think it's in the feed market right now because it hasn't found the higher value markets that it should be in."

Co-location Can-Do

It's a concept that's been batted around for a long time: Could biodiesel plants co-locate with ethanol plants that extract corn oil and thereby have an onsite feedstock source? Mcgyan Biodiesel says it's on the verge of getting it done. The Anoka, Minn., company has a letter of intent to build 3 MMgy biodiesel plants next to two ethanol plants, utilizing corn oil produced onsite, says Steve Rupp, president. Construction is expected to begin in 2012. "Conservatively speaking, they would start to come online at the beginning of 2013," he says, adding that although the modular system could be built in different sizes, 3 MMgy is ideal. "That size works very well with a 100 MMgy ethanol facility because that's about the right amount of oil that they would get out of their DDGS," he says.

The Mcgyan Biodiesel Process has been operating successfully since November 2009 at the 3 MMgy Ever Cat Fuels LLC facility in Isanti, Minn. It's a stand-alone operation that converts corn oil shipped in from ethanol plants. In addition, the biodiesel plant utilizes waste oils, such as used cooking oil from area restaurants. But that's not



Clayton McNeff holds up a bottle of biodiesel produced with waste cooking oil at the Mcgyan Biodiesel pilot plant. The Mcgyan process has been used to convert many oils including corn oil, to biodiesel.
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all. “We’ve tested probably over 50 different types of oil in our laboratory and we haven’t found any oils that we can’t turn into biodiesel using our process,” he says.

When working with an ethanol plant partner, Mcgyan licenses its biodiesel technology, which works with any of the existing back-end corn oil extraction technologies. The company then oversees installation of the modular system and trains the operators. In exchange, Mcgyan receives a royalty payment based on revenues, Rupp says. Although it depends on existing infrastructure, such as onsite holding tanks, a stand-alone Mcgyan upgrade to an ethanol plant would cost \$7 to \$8 million, he tells EPM. The project would have an estimated 18-month to two-year payback.

With investment in the Mcgyan system, ethanol producers can bring in higher profits for biodiesel than selling corn oil for feed, and add needed diversification. Producing biodiesel onsite at an ethanol plant could be particularly attractive to petroleum company owners, something that is becoming more common in the ethanol industry, Rupp says. Rather than purchasing renewable fuels or renewable identification numbers (RINs), these companies find it cheaper to produce their own renewable fuels.

The Mcgyan model will succeed because its biodiesel conversion process can handle the high content of free fatty acids contained in crude corn oil, he says, something the traditional biodiesel production process cannot do. “That’s really where we shine,” he says. “We have the ability, using our process, to handle any combination of free fatty acids and triglycerides. So you can take 100 percent food grade oil, you can take 100 percent waste product or rancid oil or you can take any combination of the two. It’s very flexible in terms of the feedstocks that can be used.”

Perhaps the biggest advantage, however, is that the ethanol plant would only need to hire a few additional employees to operate the biodiesel plant. The 3 MMgy Ever Cat Fuels plant, which runs 24/7, has a full staff of 12. A Mcgyan biodiesel plant integrates with the existing control system of the ethanol plant, requiring no new management positions and only about four operators and one laboratory technician. “[That] is going to reduce their biodiesel production cost,” he says.

Another possible synergy is that ethanol could be used in place of methanol for biodiesel production. With the current economic conditions, an ethanol producer can get much more out of selling its ethanol than producing biodiesel with the product, Rupp says. Still, the Mcgyan process does make it possible for the production of a “fully green biodiesel,” which could, in the future, command a premium in the marketplace. The company has also successfully produced biodiesel using butanol or propanol.

Finally, Rupp emphasizes that Mcgyan biodiesel plants wouldn’t be in competition with currently idled plants, as those facilities utilize soybeans and traditional process technology. The system could technically process soy oil, yes, but it wouldn’t make economic sense. “It’s not our mission to take food and turn it into biodiesel,” he adds. “We’re just taking nonfood-grade materials, waste products, low-level material that in the past may have been just burned and used for Btu value, like heating value, or just put into a landfill. Those are the types of feedstocks that we like to use.”

Not everyone looking at co-locating ethanol and biodiesel production has their eye on corn oil as a feedstock, however. One World Clean Energy Inc. wants to build integrated biorefineries that co-locate ethanol and biodiesel production as well as green natural gas and electrical power. The company is skipping over corn oil as a biodiesel feedstock, however, because it considers the single feedstock model a “short-term solution at best,” says William Bivens, CEO and founder.

The company plans to build plants in the U.S. and internationally based on a model that produces 10 MMgy ethanol, 10 MMgy biodiesel and 10 megawatts electricity, at an estimated capital cost of \$100 million. It recently added two additional designs—a 1/1/1 and 5/5/5 for total capital costs of \$10 million and \$50 million. Feedstocks for ethanol would be any starch crop or starch waste and for biodiesel any animal fat, waste cooking oil or vegetable oil. Electricity or natural gas would be produced from any organic waste. In October, the company announced it had secured its first memorandum of understanding to construct and commission a \$115 million integrated 10/10/10 biorefinery in South Africa.

Although co-locating biodiesel and ethanol plants hasn’t come to fruition yet, FEC Solution’s Riley believes it makes a lot of sense. He’s thinking about the more than 100 diesel trucks that are at the plant daily, dropping off corn and picking up ethanol or distillers grains. What if an ethanol plant were to put in a pump and sell the biodiesel it produces to those drivers? What if that ethanol plant put in a convenience store and also sold its own ethanol? So far, the industry hasn’t jumped on that idea. “It would have to be a rather entrepreneurial plant until it has been proven by somebody,” he says, adding that ethanol plants already get a good price for corn oil, so there isn’t a lot of incentive to go to value-added propositions.

As more ethanol plants add corn oil extraction technology, however, the price will be driven down. It’s called puking the market, Riley says, and it’s already starting to happen. “We’re getting closer and closer to it, so we’re starting to see substitute products’ value decrease,” he says. “They decrease for a lot of different reasons, but the pressure from corn oil is apparent in the feed market.”

Cooperation Model

REG doesn’t believe co-location of ethanol and biodiesel plants will happen—at least not with today’s technology and economic conditions. First, there is more than 2 billion gallons of biodiesel capacity today with a market size of only 800 to 1 billion gallons. Due to that overcapacity, the company doesn’t believe there will be any new large-scale greenfield biodiesel plants built anytime soon. “Technology is constantly changing and improving, so this is a question that needs to be asked quite often,” Elsenbast says.

Brad Albin, vice president of manufacturing for REG agrees. “We don’t think it’s probably rational to put in a small 1.5 to 3 MMgy biodiesel production facility when there is 2 billion gallons of capacity out there that is sitting there waiting.”

For now, REG believes the best model is what the company is already doing at its 60 MMgy Seneca, Ill., biodiesel plant—sourcing corn oil from nearby ethanol plants. Not only is REG Seneca strategically located to source corn

oil, but it’s two hours from Chicago where it can sell its biodiesel. For this, REG’s first corn oil-to-biodiesel plant, the technology was in place when acquired. “That’s, in fact, one of the main reasons we purchased that plant,” Albin says.

Another strike against the idea of co-location is the complexity of converting corn oil into biodiesel. “It is difficult to process into biodiesel feedstock and we certainly, over our time in history, have gone through our learning curve to perfect the conversion of inedible corn oil into biodiesel,” Elsenbast says.

Finally, there’s the evolution of ASTM specifications for biodiesel to consider. Plants looking to co-locate risk having to upgrade their biodiesel plant to meet new specs.

For now, REG believes ethanol plants will continue to maximize revenues by selling corn oil, not converting it to biodiesel at co-located plants, Albin says. The market for renewable chemicals, which REG will be entering in the very near future, will likely attract the attention of more ethanol producers than biodiesel production. “Today, I don’t think that you are going to just build a plant next to an ethanol plant for the sole reason of running corn oil through it,” he said. “I think the risks are too high.”

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