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# Biogas makes sustainable, reliable renewable energy possible

**By Jon H. Harsch**



A private German company is adding a 40 MW biogas plant to its current ethanol and biodiesel operations to create a massive biorefinery in the former East Germany. Nearby, scientists at the government-funded German Biomass Research Center (DBFZ) question the economics of the Verbio biorefinery which will connect to the national natural gas grid in December. Further away, in the former West Germany where farm sizes are much smaller than in East Germany, the German equivalent of extension agents at a Hesse state agricultural training center say the problem with the planned biorefinery is that rather than sell raw materials to giant corporations, farmers instead should build and run their own biogas plants to capture maximum value-added for energy crops at the farm level.

Despite disagreement about Verbio's prospects, there is one point of total agreement: that biomass energy is key to creating a sustainable, reliable renewable energy system for the Federal Republic of Germany. Researchers at the Fraunhofer Institute for Wind Energy and Energy Systems Technology (IWES) have done real-word testing which demonstrated that by using instant-response biogas-fueled turbines and pumped water storage to balance intermittent wind and solar power, Germany could provide 40% of its electricity needs with renewable energy by 2020, and a full 100% by 2050. IWES Project Leader Dr. Florian Schlögl admitted he was worried when running the final test with leading politicians and reporters present – and very relieved when "it all worked" as planned.

At the Verbio ethanol plant in Zörbig, shiny new digester tanks, biogas cleaning and compression equipment, and immense storage tanks still being welded are overshadowed by Verbio's towering wind turbines. Chemical Engineer Dr. Oliver Lüdtke says that with the completion of Verbio's first of two planned biorefineries, "We are optimizing the entire biofuel value chain from the farmer to the consumer and back to the farmer." That's because Verbio will buy the Zörbig region's main crop, rye, which normally yields surplus production dumped on world markets, and straw and other ag materials. The grain goes into ethanol. The residue from the ethanol plant, or stillage, goes into the biogas digesters along with the straw – and the residue from the biogas process goes back to farmers as high-value fertilizer.

Lüdtke explains that Verbio's "closed loop" process not only eliminates the problem of trying to teach cattle to like a DDG (Distillers Dried Grains) diet – but eliminates the problem of farmers being at the mercy of volatile fertilizer prices. Their N, P, and K is simply recycled, to be returned to them once their grain has been turned into ethanol and biogas. Further breaking the deadly link to world oil prices, "rye belt" farmers now are running their cars, trucks, and tractors on Verbio biodiesel.

Once Verbio's commercial-scale biorefinery starts pumping biomethane in December, Lüdtke expects to license the breakthrough biorefinery system for use in other countries such as the United States. Boasting of a "90% conversion of raw materials into energy," Lüdtke is confident of success after more than three years of pilot plant operations with rye, corn, wheat and triticale feedstocks. He's equally confident that farmers will love the new bioenergy system which is "totally sustainable" and "not correlated to oil prices" – and confident that environmentalists will love a system which is carbon neutral, with no net greenhouse gas emissions.

**Dr. Oliver Lüdtke, in blue jacket, standing in front of the black biogas digester tanks and stainless cleaning tank for Verbio's 40 MW biorefinery due to start pumping cleaned, compressed biomethane into Germany's natural gas grid this December. Photo: *Agri-Pulse*.**

DBFZ's Scientific Managing Director Dr. Martin Kaltschmitt isn't convinced. He points out that "digestibility isn't really solved. . . the challenge is to digest the stillage." He also predicts that any biogas technology developed in Germany may be difficult to export since "Germany has a very dense natural gas grid" which improves biogas economics while other countries almost certainly would face far higher distribution costs.

At Hesse's state agricultural training center, Renewable Energy Department Leader Klaus Wagner is convinced that biogas will become an increasingly important part of Germany's energy mix, offering a tremendous new income opportunity for farmers. His concern now is that if farmers don't build their own biogas plants either as individuals or

as cooperatives working together in the case of small farmers to take advantage of this opportunity, then major corporations like Verbio will grab the business for themselves.


**Klaus Wagner at the Hesse agricultural training center explains the biogas digester system which provides heat, electricity and fertilizer for the center's buildings and farmland – a system the center uses to show Hesse farmers how to build and operate their own biogas plants. Photo: *Agri-Pulse*.**

IWES' Dr. Bernd Krautkremer works closely with Wagner on the biogas plant at the Schloss Eichhof agricultural training center in Hesse. As a power engineer, he explains that farmers have to learn to act like a power station, to provide reliable power to a system which needs to match supply with actual load every second.

Just back from a trip to India to work on bioenergy issues there, Krautkremer uses the center's dairy herd to make a point about biogas. As a mechanical engineer himself, he says dairy farmers tend to succeed in running biogas plants because they understand that a biogas plant is much more like their cows than their tractors. They understand the need to be as careful in mixing the silage fed to their biogas digesters as the silage fed to their cows. The only difference, he says: you can see the center's 120 cows but you can't see the billions of microorganisms responsible for successful biogas production.

Collectively, German bioenergy experts like Krautkremer, Wagner, Kaltschmitt, Lüdtke, and Schlögl deliver a powerful message both to U.S. farmers and to the U.S. as a whole: Germany and other countries including China are moving ahead rapidly with renewable energy development. The Germans are  far too polite to draw conclusions. But with Germany apparently well on the way toward an economy no longer dependent on either fossil fuels or nuclear power, the obvious risk is that if the U.S. doesn't step up the pace,

it will be left where Wagner fears German farmers will be left: missing out on a bioenergy bonanza.

For information on Verbio, go to: http://www.verbio.de/en. For information on the Hesse state agricultural training center, go to: http://www.llh-hessen.de/. For information on the German Biomass Research Center, go to: http://www.dbfz.de/ For information on the Fraunhofer Institute for Wind Energy and Energy Systems Technology, go to: http://iwes.fraunhofer.de/.

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