A Tale of Two Industries

Germany's advanced biogas industry, the result of efficient policy mechanisms, has set a high bar for the U.S., which is still in its infancy.

By Anna Simet | January 30, 2014

It was the best of times for Germany's biogas industry when the country passed its Renewable Energy Resources Act (EEG) in 2000. The act set the stage for the huge success of the country's biogas industry, which today has more than 8,000 installations. Other countries—including the U.S.—are now looking at Germany as a role model while they work to take advantage of the many, versatile advantages that biogas offers.

The EEG established a distributed energy generation model that fixed a purchase price for each type of renewable energy generation, and guaranteed a connection to the electrical grid. This really ambitious policy framework has really transformed its energy system from one that was more centralized—electricity generated by four main power companies—to a distributed generation model where individual home owners and businesses are creating their own energy and also selling it, says Amanda Bilek, energy policy specialist with the Great Plains Institute.

Policy Impact

At the turn of the 21st century, Germany had approximately 850 facilities, a number that grew to approximately 2,700 by 2005 and 6,000 by 2010. This explosive growth can be attributed to a few factors, but chiefly the EEG, points out Kyle Goehring of Eisenmann Corp. "[The EEG] incentivized small- to medium-size systems, and as a result, most of the early installations were quite small," Goehring says. "The incentive structure, based on electrical power output (kilowatts) changed over time, and construction of larger installations began. The incentives were rated on the kilowatt output of the connected generators, but paid on the kilowatt hours delivered to the grid. The incentive structure also favored specific feedstock combinations. This is why a majority of the biogas systems in Germany operate on a blend of maize and manure."

Currently, there are manure and small systems bonuses, and a biowaste bonus if done with composting, adds Eberhard Viet of Eisenmann. "There is a requirement that thermal energy must be used, and the latest is a bonus if systems can be used for peak power, which requires a large biogas storage capacity so that the power companies can turn your combined heat and power (CHP) on and off, based on power demand."

In essence, the EEG is responsible for the growth of the biogas industry, Goehring emphasizes. "It led to investment in the biogas space from engineering companies, financial institutions and prompted innovative individuals to research and develop new technologies," he says. "Without this act, Germany would not have nearly the number of installations."

The EEG has undergone several revisions, the most recent in December 2012 which extended the share of renewable energy. "The EEG is updated every three years, and it rocks the industry every time," Veit says. "It shifts the incentives or lowers them, and some vendors benefit from it, while others hurt. Companies have to adapt to it. Some incentives go away and others are created, and this impacts various technology suppliers differently."

The EEG has also uniquely shaped the ownership model of the biogas industry, Bilek points out, as it has created an environment in which the cooperative ownership model is taking off. "Individual persons are partnering with neighbors in order to own renewable energy resources they are producing," Bilek says. "In the northern part of the country, there are a lot more centralized systems ranging from 10 to 20 MW, owned by several farmers or local citizens. In the southern part of the country, the industry is a little bit more slanted toward individual operation models, but overall it's pretty split between both."

The feedstock of choice for digesters has historically been purpose-grown maize, or corn, which still dominates today—but its widespread and abundant use has had some unintended consequences and has thus become an issue of contention, ironically similar to the use of corn for ethanol production in the U.S.

German Trends

"The whole plant, stalk to kernel, is chopped up into silage," Bilek explains. "It's used in digesters for the same reasons it's used for liquid fuel—it is very energy dense. Germany figured out early on that manure alone is not a very good feedstock because you don't get a lot of biogas, as it's already gone through digestion. Adding in maize became so profitable with the feed-in tariffs outlined in the EEG that the industry began to transition away from manure or residual food waste and more toward a feedstock mix with 80 to 100 percent maize."

Maize silage is an appealing feedstock, as German farmers are traditionally experienced with maize and make maize silage for animal feed. Veit points out: "They are very familiar with it, have the equipment to harvest and make silage, and all they had to do was add a biogas system," he says. "In conjunction with the high solids bonus, this was a very good proposition."

However, that bonus has since been removed. "In northern Germany where there are those larger biogas plants in the 10 to 20 MW range, they ran into the problem of being transported to plants from locations ranging greater than 200 kilometers (125 miles) away, and it has had some [negative] indirect land use changes," Bilek says.

With larger plants that have a harvest radius of more than 30 miles, transport costs play a big role and traffic is also an issue, Eberhard adds. "Also, as the farmers expanded maize production and could sell it at a good price to the biogas systems, the price for land leases went up and the farmers of other crops got shortchanged."
In addition, there's been controversy in regard to maize being grown for energy, rather than that land being used for food crops. "It's similar to the issues we have in this country, putting more of the corn crop into the ethanol market," Bilek says. "There's the question of whether food prices are being raised. In the U.S., there's this perception that corn isn't going back into the feed market, and similar constraints are being brought up in Germany. But in the U.S., you have a distillers grains product that goes back into the livestock market. In Germany, you don't have that livestock byproduct, but you do end up with a great fertilizer."

To encourage diversified feedstocks, German policy amendments now require a percentage of residual materials such as food waste be used in digesters. While the current situation in Germany has needed some adjustments, Bilek says that biogas projects in the U.S. shouldn't be scared off corn or other energy crops. "I do think it should be part of the feedstock mix—it produces a lot of energy and biogas, but trying to get more residual materials or waste materials in the digester in the U.S. should be an initial focus."

Outside of a slight movement away from sole reliance on maize, the German biogas industry is seeing other trends, one being biomethane upgrades, as most are set up for electricity generation. "A bonus payment has been put into place for biomethane upgrades, and there have been some specific goals set for biomethane," Bilek says.

While the upgrading trend isn't super strong yet, according to Veit, it is also based on the fact that biogas can be upgraded and stored in the natural gas grid and existing large storage systems, and then called upon from the grid during peak gas-to-electricity demands. "Gas can be stored," he points out, "and electricity is hard to store. Germany lacks storage capacity, and does not have the natural gas reserves of North America, so this has been a promising development."

Beyond trends within the country, due to a decline in domestic market conditions in 2012, German businesses have been focused more strongly on exporting technologies, particularly to the U.S. "German biogas companies are looking toward the U.S., due to the size of the country, agriculture roots, industry, population density, number of large cities, and the strength of the economy," Goehring says. "They are also looking toward other European countries that have modeled renewable energy policies off the German system. Some are looking toward the BRIC (Brazil, Russia, India, China) nations while others are not looking to develop there yet."

Veit says Italy is a hot country for development, due to a very high guaranteed green power price of 0.28 euros (38 cents) per kilowatt hour. "England is a prospective market, France and some eastern European countries," he adds.

As German companies eye the U.S. market, which has just a few hundred operating biogas energy projects, what can the U.S. do to grease the tracks for domestic developers? One move may be simplification and consistency of project permitting nationwide, as opposed to piecemeal, state-by-state regulation.

Moving the US Forward
"Transparent permitting of projects is another contributing factor [to Germany's success]," Goehring says. "German legislation has sought to simplify the permitting process for biogas installations. Unlike in the U.S., where each state, county and environmental districts—air, water, solid waste, etcetera—have their own regulations and the permitting process is time-consuming and costly, the German method allows for a project to become permitted quickly as it is prescriptive."

Consistency across the states could help drive the U.S. biogas industry, according Veit, Goehring and Bilek. "If a consistent permitting process could be developed for biogas projects, more financial institutions would be willing to finance biogas projects," Goehring says.

Public policy is incredibly important, Bilek adds. "If it wasn't for the EEG policy support or the broader energy framework, there wouldn't be 8,000 biogas plants in Germany. It's really up to policymakers to set the vision for the country. It doesn't have to be a feed-in tariff. Maybe a policy instrument focused on cleaning up the gas to get it into the natural gas network might be a better approach the U.S. could take."

Last but not least, the German public is generally supportive of renewable energy, seeks to conserve fossil fuels, and generally opposes nuclear power. "This is opposite of the U.S., where we only want our power to be inexpensive and reliable," Goehring says.

It may take many years before the U.S. finds itself mirroring anything close to what Germany has accomplished through its renewable policies. Its success has another dimension as well, Goehring points out. "Germany has a built a reputation as a country of brilliant engineers who have achieved remarkable success in multiple industries," he adds. "The attributes which led to this commendation are clearly visible in the biogas industry as well."

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