Manure Power

GAS TO ENERGY

BY KEVIN MAAS

DURING THE PAST DECADE, AMERICAN farmers have built more than 100 anaerobic digesters to extract energy from livestock manure. Most of the farms use the methane-rich biogas produced by bacteria in the digesters to generate electricity; project capacities range from a few kilowatts to several megawatts. Each digester is sized for the host farm's animal population. In rough terms, fueling a kilowatt of electrical capacity requires the manure from five cows, 50 pigs or 500 chickens.

A recent study out of the University of Texas that was published in July in *Environmental Research Letters* estimates the total energy potential locked in American livestock manure. From the study's high-level perspective, feeding all manure to anaerobic digesters could replace 1 percent of the country's total energy consumption. If the raw gas coming from the digesters were burned to produce electricity, animals could supply at least 2 percent of American electricity demand; that is, we could have 10 gigawatts of manure-fueled capacity. Finally, redirecting the currently uncontrolled emissions from manure could reduce national greenhouse-gas emissions by roughly 4 percent.

There is no doubt that manure contains enormous untapped energy because a substantial fraction of livestock feed passes through animals undigested. Anaerobic digesters offer a proven way to convert manure slurries into methane-rich biogas. Best of all, as long as animals continue to eat, digesters will have the steady fuel supply needed to provide baseload power. However, barring a spectacular collapse in demand, livestock waste will never come close to providing 1 percent of American energy consumption. The reasons for this mostly concern the realities of agriculture rather than any failings within the energy industry.

In spite of a half-century of consolidation, American agriculture remains amazingly diverse. There are farmers who keep a handful of hogs on nearly self-sufficient farms in the upper

Cows at a western Washington dairy farm.

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Midwest; other farmers raise thousands of cows in Southwestern operations. Putting animals on pasture cuts feeding effort but makes collecting manure impossible. While one farm might be set up to handle manure as a solid, another one just down the road might flush out manure with enormous quantities of water. The larger a farm, the more likely it is to handle its manure in a digester-compatible fashion. However, the twin forces of rising input prices and consumer animal-welfare concerns are likely to combine to halt the trend toward enormous farms.

The most successful designers of anaerobic digesters have recognized the importance of fitting into existing manure management systems. Wisconsin-based GHD owes its emergence as the market leader to its attention to farmer needs. GHD's innovative U-shaped, horizontal mixed plug-flow system bears little resemblance to a municipal anaerobic digester. The design has been scaled from 500 cows to more than 10,000; 30 operating digesters have performed consistently in tough farm environments across the country. Other designers such as RCM Digesters in California have a long history of working with farmers and adjusting to the realities of on-farm operation.

Even with farm-friendly digester designs available, the economics of anaerobic digestion remain daunting to farmers not accustomed to energy investing. Digester costs are driven primarily by the volume of manure that must be handled, making it difficult to estimate an average per-kilowatt capacity price. Recent projects appear to run in the $5,000 a kilowatt range. At this price, digesters only pay for themselves where utilities have made clear commitments to supporting farm energy. Farmers in Vermont can receive a 4 cents a kilowatt-hour premium over wholesale prices for power they deliver to the grid, while some Wisconsin farms can receive as much as 15 1/2 cents per kilowatt-hour for producing electricity during peak hours.

For obvious reasons, Wisconsin and Vermont have recently seen more digester construction than anywhere else in the country. Unfortunately, most farms simply don't have the incentives necessary to risk millions of dollars on an anaerobic digester. The vast majority of our national manure resource may be quite difficult to access.

In the view of the digester community, the key to unlocking this resource is something called co-digestion. The only way that manure will meet its energy-supply potential is by combining it with other, more volatile sources of waste. Your nose might make you think manure rates high on the

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volatility charts, but the reality is that manure offers the lowest biogas yield per ton of any anaerobic digester feedstock. Digesters take manure primarily because of large volumes available. On the other hand, food-processing wastes can provide as much as 40 times more biogas, so even small amounts make a big difference. Co-digestion allows farmers to easily double the energy-production capacity of their digesters without handling more manure; they earn more money at low marginal cost.

Regulations often prevent the mixing of manure with off-farm waste. These shortsighted rules must be adjusted to allow low-risk feedstocks to be added to digesters. Farmers have enough livestock regulations to deal with already, so co-digestion should be presented as an opportunity with minimal additional inconvenience. Anaerobic digesters need a new partnership between high-yield, low-volume waste producers in town and low-yield, high-volume waste producers in the country. This partnership could fulfill the promise of manure and bring gigawatts of new renewable energy capacity to America's farms.

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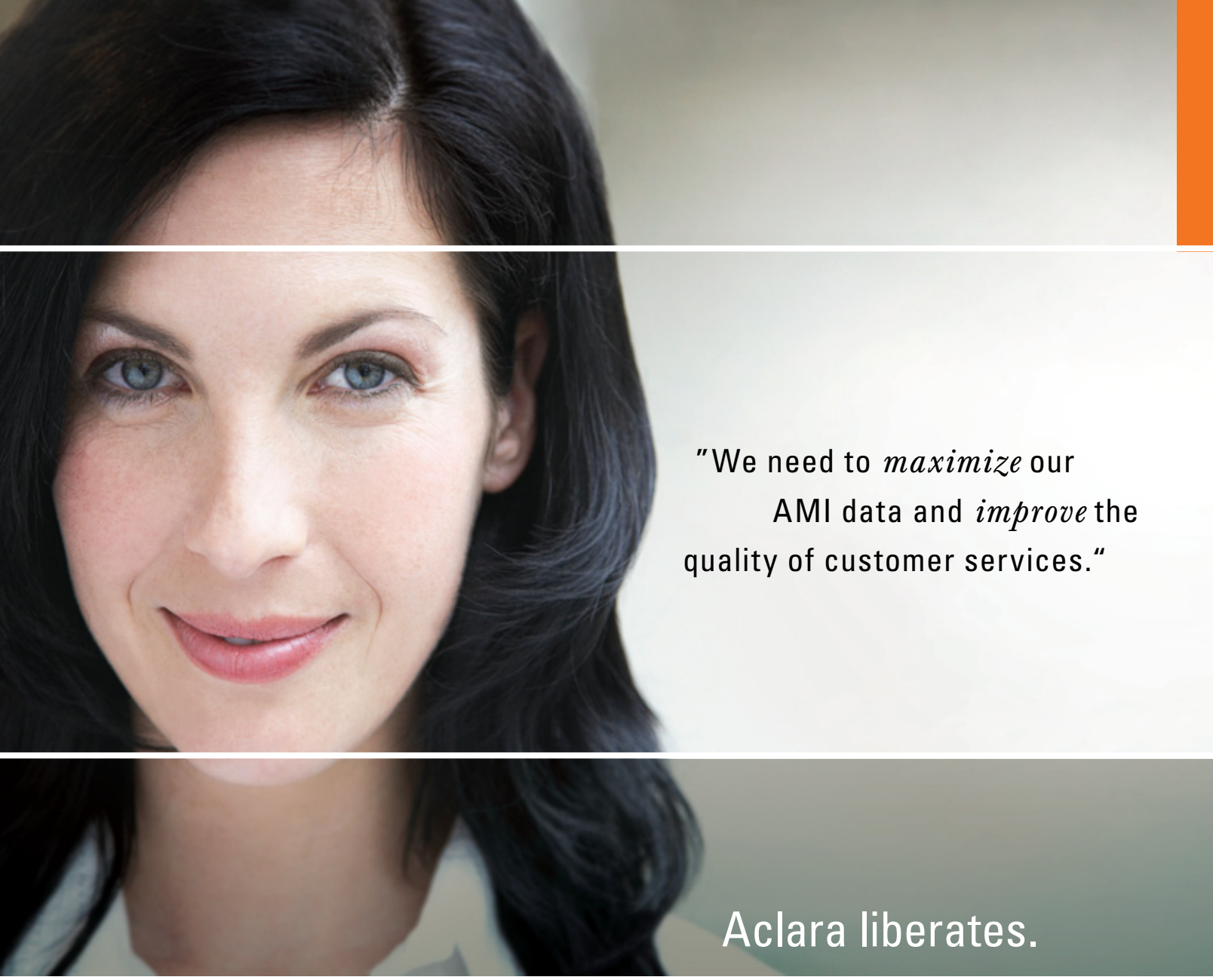

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