Small-scale Biofuels

Easy Energy Is Ready to Demonstrate Its Technology

Mark Gaalswyk has a dream: "Fuel the World."

That's the motto of one of Gaalswyk's companies, Easy Energy Systems, Inc., which designs, manufactures, operates, and sells its patented Modular Energy Production System (MEPS®) for the production of alternative liquid biofuels from organic waste streams. MEPS come in one-, two-, and five-million-gallons-a-year (MMGY) units.

Easy Energy Systems has executive offices and manufacturing in Welcome, MN; additional manufacturing and prototype building in Truman, MN; and a full-scale modular demonstration plant in Emmetsburg, IA. Easy Energy's MEPS can be built on an assembly line at one of its manufacturing facilities and shipped as a fully-automated self-contained module anywhere in the world, Gaalswyk stated. "Our mission is to innovate and bring to the market new solutions and technology that will reduce the dependency on fossil fuels, reduce pollution, and improve the lives of people throughout the world," according to Easy Energy Systems' website. "We intend to become the worldwide leader in distributed, small-scale bio-waste to energy systems, with our corporate motto, Fuel the World®."

Mark Gaalswyk, CEO and founder of Easy Energy Systems, left, stands in the middle of the demonstration plant being started up in Emmetsburg with Shane Sundeen, production manager, center; and Lyle Larsen, project manager, right.

Long-term Vision

Gaalswyk has a long-term vision of selling the small-scale plants globally. "What Apple did to the computer world, we want to do to the energy industry by building small-scale facilities," he told *BioFuels Journal* on April 21, during a tour of the Emmetsburg facility.

Gaalswyk's vision, which he started to develop in 2006, is to manufacture the container-sized modules on an assembly line so they can be shipped via containers and assembled on-site like LEGOS®, using whatever feedstock is available to produce whatever kind of biofuel is desired.

Easy Energy Systems has a three-part marketing strategy, Gaalswyk said:

- Building and selling MEPS.
- Contract testing on a small scale for ethanol producers and other biofuels companies at its Emmetsburg facility.
- Developing new concepts, such as licensing an autothermal pyrolysis technology and adapting a new way to distill ethanol using nano-bubbles.

Easy Energy has built and is commissioning a demonstration unit in Emmetsburg's industrial park, which is located a short distance west of POET's corn starch and cellulosic ethanol plants.

The site was a beehive of activity on the day *BioFuels Journal* visited, with contractors and Easy Energy Systems' employees scurrying to put the final touches on the commissioning of the demonstration unit. "Everything in this demonstration plant is automated so companies can bring their ideas and technologies here and test them to see if they work," Gaalswyk noted. "We can develop and build everything for them."

In addition to ethanol, the modular system can produce renewable normal butanol (n-butanol) and acetone. That capability comes from the construction of a pilot plant that was built at the Emmetsburg site in 2013 to test the technology of Green Biologics, Inc., which has since been deployed on a commercial scale at Green Biologics' Central MN Renewables plant in Little Falls, MN.

Gaalswyk told *BioFuels Journal* that he has combined his training in mathematics, computer science, and physics to build an understanding of the mechanics of biofuel production technologies.

Easy Energy Systems has built a working one-MMGY biofuels pilot plant to demonstrate that Gaalswyk's modular production system works. "Now, we need to get the demonstration plant up and running," Gaalswyk said. The demonstration plant has been running in a batch-production mode and is in startup trials for operating in continuous production.

Easy Energy Origins

Easy Energy Systems has grown out of Gaalswyk's original business, Easy Automation Systems, Inc., which sells automation systems and software for feed mills. Gaalswyk's son, Christopher, is running Easy Automation's day-to-day operations.

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- Mark Gaalswyk, Easy Energy

Top photo: Iowa State's Robert C. Brown, left, explains the autothermal pyrolysis technology to Karen Fletcher, CEO of the RAPID Institute for manufacturing; and Mark Gaalswyk, CEO of Easy Energy Systems, during a recent tour of the BioCentury Research Farm. Bottom photo: Jordan Funkhouser, pilot plant specialist at Iowa State, works with the autothermal pyrolysis reactor. Photos by Christopher Gannon.

Gaalswyk has applied the automation concept from his feed mill technology company to Easy Energy. "We put a lot of technology and artificial intelligence into Easy Automation," he said, "and now we're doing the same thing with the MEPS, a small-scale system that is very automated. We're trying to do to the biofuels industry what we did to the feed mill industry by introducing a disruptive technology."

Testing Location

In addition to showcasing Easy Energy's small-scale units, Gaalswyk said the Emmetsburg location is being developed as a place to test feedstocks and the technologies to process them so companies interested in developing a technology for producing biofuels don't have to build their own demonstration plants.

"I believe that testing on a small scale is the key to successfully making biofuels and bio-products," Gaalswyk stated. "This solves a problem for the biofuels industry, which is, what comes first, the building of the plant to create demand for the feedstock or the availability of the feedstock to supply the plant?"

The demonstration plant at Emmetsburg is currently processing corn into ethanol but Easy Energy has tested 41 different feedstocks, including sugar beets and waste paper, both of which hold great promise as feedstocks for biofuels, Gaalswyk stated.

Licensed Technology

Easy Energy has also licensed Iowa State University's autothermal pyrolysis technology, which Gaalswyk wants to use to build a plant that can process 50 tons a day of corn stover or woody biomass into sugars that can be processed into biofuels at the Emmetsburg plant.

A prototype of the Iowa State system is being built at Easy Energy's Truman facility, which is located next to a waste collection facility that serves two counties. "We want to show that we can run the Iowa State technology on organic waste, especially paper," Gaalswyk ▶

Matt Harms, shift lead, runs tests on the Emmetsburg demonstration plant.

said. The prototype should be completed this fall, he noted.

Stine Seed Farm, Inc. is a collaborative partner in the demonstration project.

Easy Energy also has licensed a nano-bubble technology, which Gaalswyk said can replace a traditional distillation system to remove water from biofuels. The nano-bubble system turns the water into tiny bubbles, which can more easily be removed from the biofuel, reducing energy by as much as 75% from a conventional distillation unit.

A full-scale model using the nano-bubble technology is being built at the Truman, MN facility.

Shipping Container Size

Each MEPS unit is about the size of a shipping container, Gaalswyk said, so a single module or a number of modules can be assembled on-site based on what feedstock is available, the amount of feedstock that can be procured, and the end product desired.

"We can take all kinds of inputs, run it through different modules, and produce all kinds of outputs," Gaalswyk stated. "We envision linking all of these modular units together with regional, rural cooperatives to add value to the local crops and other feedstocks, such as corn stover. These are automated units with a centralized data collection system, which means more operators and fewer managers, just like Easy Automation did with the feed mill industry."

The small-scale biofuels plants are especially adaptable for developing countries, Gaalswyk stated.

"My dream is to have a bunch of modules on a train headed across Africa, with the combination of modules necessary to fit the supply of feedstocks available at a site."

Closer to home, Easy Energy is very close to finalizing several modular deals, Gaalswyk said. A group of 130 large family farms in Illinois, Michigan, and Indiana plans to install a MEPS production facility in the spring of 2018. The farmers' focus is on pooling their resources into a multi-farm cooperative effort.

"This can bring a lot of income to a lot of small communities in the Midwest," Gaalswyk stated.

The LEGO® Concept

To demonstrate his concept of small-scale units producing biofuels around the globe, Gaalswyk uses a set of LEGOs to show how several modular units can be stacked together, just like LEGOs "We're building new color LEGOs," Gaalswyk stated. "We're a LEGO developer, tester, manufacturer, and marketer."

Jerry Perkins, editor

Emmaly Marcum, lab technician, shows Mark Gaalswyk how the ethanol operating procedure is performing at the Emmetsburg demonstration plant.