

He Uses Manure To Power Tractors, Truck

By Jim Ruen, Contributing Editor

Danny Kluthe runs his farm truck and tractors on methane produced from hog manure. After years of using biogas from his manure digester to power a generator, he learned to compress and purify it to use as a diesel fuel alternative. Working with his partner Kevin Kenney, the two have developed a compact system for others to use and are marketing it under the name Grass Roots Energy Nebraska.

"Every livestock operation or anyone producing organic waste can make their own fuel for vehicles or for generating electricity," says Kluthe. "Methane is a natural resource, and the byproduct is a clean smelling fertilizer."

The methane produced by Kluthe's digester is essentially the same as natural gas. Using a process patented by Kenney, Kluthe runs his Chevy Duramax 3/4-ton truck on a mix of 80 percent compressed methane and 20 percent diesel. He runs his White diesel tractor on 90 percent compressed methane and 10 percent diesel.

"If I am away from the farm and need to refill my tanks, I can simply use compressed natural gas (CNG)," says Kluthe.

The methane fuel is produced largely with equipment used by the CNG industry, notes Kenney. It's stored in tanks at 3,600 psi. The two are working with investors to further develop the system.

"If you have a digester, we can build a compressor system to match it," says Kenney. "Depending on the amount of gas being

produced, the systems range in price from \$5,000 to \$20,000."

Kenney suggests a \$5,000 system could process 10 cu. ft. of biogas per min. to produce 2 gal. of diesel fuel equivalent per hr.

Kenney has designed and built 4 of the compressor systems and is ready to build more. The lack of digesters is one factor holding up adoption. Another is converting equipment to run on methane. He points to new tractors in Europe that are designed to run on CNG and tractors in the U.S. in the 1950's designed to run on propane.

"We aren't given the alternative in the U.S. today," he says. "Danny had an older White diesel tractor that was easy to convert, but modern tractors require an algorithm change."

Kenney says the companies have the algorithms needed to run alternative fuels but refuse to release them. He suggests that income from maintenance may be one reason. He points out that an advantage to methane is a lack of particulates. He notes that particulate filters required on Tier 4 tractor and combine engines clog up and have to be cleaned out with high-pressure steam at considerable time and expense to the owner.

Kenney is doing what he can to bypass these companies. His patented system (U.S. Patent 8826888) for mixing and using alternative fuels with diesel fuel meets Tier 4 emissions. In the meantime, he encourages livestock farmers to consider adding a



Danny Kluthe came up with a way to compress and purify biogas from manure to use as a diesel fuel alternative. He runs his White diesel tractor on 90 percent compressed methane and 10 percent diesel (above). He and partner Kevin Kenney are now marketing the system.

digester to their operations.

"I really see a lot of potential, but we have to get people to put in digesters," says Kenney. "There is no good argument against using methane."

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Wind-Powered Machine Produces Anhydrous Out Of Thin Air

By Lorn Manthey, Contributing Editor

Canadian inventor Roger Gordon has patented a process that makes anhydrous ammonia out of air and water, using wind power. He then uses it as fertilizer and also to power his F-350 pickup and Ford tractor. The system, which is about the size of an upright freezer, produces up to 125 gal. of anhydrous ammonia (NH₃) per day.

"I converted my truck and tractor to compressed natural gas (CNG), which I use as a starting fuel and then switch over to 97 percent anhydrous," says Gordon. "NH₃ has about 80 percent the Btu's of diesel fuel, but driving down the road I get closer to 90 percent equivalent mileage."

Gordon has converted more than 20 engines to using NH₃, later converting some back. They include gas, diesel and even a jet engine as proof of concept with Pratt and Whitney. He uses onboard tanks that hold NH₃ at only 150 psi.

He suggests that NH₃ is a superior "green" fuel to either propane or CNG. As it contains no carbon, it produces no carbon dioxide. He adds that it is safer than either of them or hydrogen (H), although NH₃ has its own safe handling requirements.

"By itself, NH₃ is non-combustible and non explosive," he says. "Siemens is developing NH₃ as a storage system for renewable energy. China is working on developing it as a fuel source, and Japan is funding engine R&D."

Gordon has been working on his system since 2008, developing the right volumes, pressures and timing to pull nitrogen (N) and H out of air and water, and then convert it to NH₃.

His U.S. patent (8,778,293) was issued in mid 2015, and he encourages people to access and review it. He uses electrolysis to produce the H. A pressure-swing adsorption process is used to pull the N out of the air. Both the N and H are compressed and stored separately.

They are then mixed together and compressed in a third cylinder, where they are heated in the presence of a catalyst to react with the N and H and turn them into NH₃.

"I am still adjusting the system manually, but once it is computerized, sensors will find the sweet spot for production and adjust inputs for the best output," says Gordon. "The only regular maintenance is to add a catalyst, like a handful of metal filings, about every 3 months."

Gordon adds that not only are N and water the only byproducts of combustion, NH₃ can be used in fuel cells without combustion to produce energy. The process to make the NH₃ is an exothermic reaction producing free heat, which could be captured and used.

In order to use the NH₃ as a fuel, he did need to adapt his engines. Gas engines with injectors are started on gas and switched over to NH₃, much as with a propane conversion. Diesel engines require the addition of a spark plug and a catalyst to ignite the NH₃ in cylinders. That requires finding diesel engines with room to add a spark plug.

"An F-350 with a plastic intake can be adapted in about half a day," says Gordon. "The hardest part is mounting a 20-gal. propane tank to hold the NH₃. Converting a Ford tractor requires the head to be milled."

Gordon continues to refine the system, which he estimates could be built and sold for around \$10,000. It is a process, he says, that will soon be even more economical to operate.

"We have a new process for making hydrogen at about half the current cost of electrolysis, which is about 7¢ per liter," he says.

While his system seems to have everything going for it, Gordon has had trouble interesting the Canadian government or domestic investors. He suspects the current tax system may play a role.

"We have a carbon tax in most of the provinces that is estimated to bring in as much as \$160 million to Ontario alone," he says. "We have asked for certification that we are not a carbon based fuel, but they say they don't have a program to cover it."

While he is confident anyone could own and produce NH₃ with his system, he feels the real savings would be for remote installations

such as mines in northern Canada. However, he suspects the systems may end up being built elsewhere.

"I've spent nearly \$2 million to develop the process," says Gordon. "We have 2 groups from the Middle East very interested in it."

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Wire roller pins onto tractor drawbar and plugs into tractor's hydraulic outlets. It's operated by the hydraulic motor off an old swather reel.

Handy Wire Roller Made From Car Wheel Rim

Rolling up electric fence wire is an easy job for Harvey Nielsen, who built a wire roller out of an old car wheel rim.

The roller mounts on the tractor drawbar with one pin and plugs into the tractor's hydraulic outlets. It's operated by the hydraulic motor off an old swather reel.

The motor is bolted to an angle iron bracket that bolts onto the rim's hub. Nielsen made a special hub that bolts onto the car rim. Hydraulic hoses run from the motor to the tractor's remote outlets.

"I built it 10 years ago and it hasn't failed

me yet," says Nielsen. "I stick one end of the wire through a hole in the rim and twist it, then activate the tractor hydraulics to rotate the rim. I made 2 identical wheel rims so that when one rim gets full I can unbolt it from the bracket and replace it with another one. The rim will take several hundred feet of electric wire, and it could also be used for barbed wire."

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