Another Biofuel Scam?

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Scam *- A fraudulent business scheme; esp. for making a quick profit; swindle. To scam means to victimize; deprive of by deceit.*

I am generally very cautious about calling any business proposition a scam, but when I read a recent article on the E-Fuel MicroFueler, described as *"Earth's First Home Ethanol System"* - that term immediately popped into my head.

The invention came to my attention about a year ago when a reader referred me to it and asked for my opinion. At that time the invention had been covered by the New York Times:

Home Brew for the Car, Not the Beer Cup

> The MicroFueler will use sugar as its main fuel source, or feedstock, along with a specially packaged time-release yeast the company has developed. Depending on the cost of sugar, plus water and electricity, the company says it could cost as little as a dollar a gallon to make ethanol.

There were some pretty far-fetched claims made in the article, such as *"burning a gallon of ethanol made by his system will produce one-eighth the carbon of the same amount of gasoline"* and the inevitable *"it could cost as little as a dollar a gallon to make ethanol."* But in general it was based on the principles of a home-brewing system. The economics weren't good, though, so they were basing their hopes on the idea that they could *"buy inedible sugar from Mexico for as little as 2.5 cents a pound."*

So while the assumptions around their business model weren't grounded in reality, that doesn't constitute a scam. But when the performance of an invention is vastly overstated, the promoters are entering that sort of territory. Apparently, even the cheap Mexican sugar wasn't enough to propel the business model, so they came up with the idea of feeding the machine alcohol so it can produce alcohol:

Strauss to convert beer waste into fuel

> GreenHouse Energy (GHE), a three-year-old San Diego company, wants to make the ability to convert the byproduct of brewing beer into a clean- burning fuel as commonplace as brewing a strong pot of coffee.

> GHE has created E-fuel MicroFuelers, which convert spent beer yeast and sugar waste into clean-burning ethanol through the processes of fermentation and distillation. To make their business model run, GHE requires large amounts of organic waste. Breweries and wineries alike were logical providers, and GHE President Russ Earnshaw knew early on he wanted to work with one brewery in particular.
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> "Karl Strauss is a great local brewery," Earnshaw said. "They have a well-known name and want to be on the cutting-edge of green energy solutions, so we thought it would be great to step in and open up a relationship with them."

This would qualify it as more of a gimmick in my opinion, but still not yet to the level that I would label it a scam. After all, how much economic sense can it make for a brewery to send their waste to local homes for processing? It is already at the brewery, so if this makes sense for consumers it would make even more sense (on many levels) for the brewery to simply process all of their own waste and sell the ethanol. So the business model is now that a brewery will send you beer or wine waste, and the person who failed Economics 101 and bought one of these can then use electricity to extract the alcohol.

The unit lists for 10 grand, but they claim the government will gladly pitch in half the cost. I can't tell you how pleased I am at the thought that the government is making such good use of my tax dollars. If this is true, then I would expect the government would pay for half of my hypothetical moonshine still - as long as I am pouring the product in my car.

I will mention also that they are setting themselves up for a lawsuit when someone puts too much ethanol in their vehicle and incurs damage. Their website highlights a study suggesting that the optimal blend for an auto may be E20 or E30 - a strong "Go" signal for customers wondering if that is a good idea.

But the real slide toward scam comes as a result of a story in which a journalist wrote a very misleading story on the unit. And the reason the story is so misleading is that the journalist was completely out of her element and didn't ask the right questions (or spot the "wrong" answers). Yet the story ended up in the Business Section of the L.A. Times:

Making fuel at home: Waste wine primes the pump

The subtitle reads: *"The MicroFueler makes ethanol out of organic waste in minutes. It can be installed at individual homes, and companies are eager to supply owners with garbage."*

There is so much wrong in this story, but I am going to focus on some choice excerpts:

> It sounds too good to be true:

She could have stopped right there and applied the first rule of Due Diligence 101. It is easy to fool people when they are outside of their area of expertise. If she is not qualified to ask the right questions, then if it sounds too good to be true she probably should have dropped the story or pulled in an expert for an opinion. But alas, she continued:

> The problem with ethanol, [inventor and CEO Tom] Quinn said, was energy inefficiency -- not only in the carbon cost of growing, harvesting and transporting the corn that was used to make it, but also in the distillation process that turned it into usable fuel.

Yet ironically this system works best with waste ethanol that was produced using corn (in a brewery), and will be cleaned up with a distillation process that will be less energy efficient than the much larger systems ones in full-scale ethanol plants. (The percentage of heat lost will be far lower in the large facility).

> "In the U.S. alone, more than 100 billion gallons of organic fuel is thrown out," said Quinn, who reached out to ethanol scientist Floyd Butterfield to see if they could collaborate on a system that could make ethanol in a manner that was cost effective and better for the environment.

I would like to see a source for that. I do not believe it. Our gasoline demand is around 140 billion gallons per year right now, and I am to believe that we throw away an amount equivalent to over 70% of what we actually use? And I guess that would be this Floyd Butterfield? At the link Floyd tells the tale of having converted a truck to run off of pure ethanol. Once when he was running out of ethanol and wasn't going to be able to make it home, he stopped and put 3 gallons of water in and drove the rest of the way home. This is great news, because the MicroFueler can only produce ethanol at 95% purity, with 5% water remaining.

As they say on their technology page, *"E-Fuel scientists have experimented with multiple blends of ethanol and water and have determined, contrary to conventional wisdom, small amounts of water improve the efficiency of burning ethanol."* It occurs to me that they should sell this research to the government and the ethanol industry, which is currently spending lots of money to get that last 5% of water out.

Here is where the ignorance of the journalist starts to show badly:

> The idea was to use organic waste rather than corn to make a product known as cellulosic ethanol. Although Quinn's MicroFueler is most effective with wastes that are high in alcohol, ethanol "can be made out of any waste -- lawn clippings, dairy products, old chemicals, cardboard, paper, bruised and discarded apples from the grocery store. It can be fermented and turned into fuel in minutes," Quinn said.

First of all, this unit does not make cellulosic ethanol. To suggest or imply that it does is simply false. Here is what the company claims on their website:

> To further simplify the E-Fuel100 ethanol production for consumers, the MicroFueler supports a variety of organic waste as fuel (among them are discarded liquids rich in sugar, waste sugar, liquids with residual alcohol, cellulosic materials** and even algae**).

At the bottom of the page, we see this: ***Additional processing outside of the MicroFueler may be required*. May be? So you are telling me that I might be able to throw cellulosic materials or algae into this thing and get ethanol from those feedstocks? Well, all I can say is prepare to be sued for fraud, because in my opinion this implication crosses the line into Scam City (which was already being flirted with as far as I am concerned).

> So far, only one MicroFueler is up and running. It was installed in late June at the Pacific Palisades home of Chris Ursitti, CEO of GreenHouse International Inc., the San Diego firm that is distributing the units and supplying feedstock to those who install MicroFuelers at their homes.

Once you get a few more units out there, you better line up some good lawyers. You are certainly going to be sued for false advertising.

> GreenHouse has contracts with Karl Strauss Brewing Co., Gordon Biersch Brewing Co. and Sunny Delight Beverages Co. to convert 29,000 tons of their liquid waste using MicroFuelers.
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> Though Ursitti is the only one now using the system, the plan is for a tanker truck to pick up the companies' waste and deliver it to home-based MicroFuelers, which convert it to ethanol on site. MicroFueler owners are charged $2 a gallon once they pump out the fuel.

So, let's think about this again. A brewing company has a bunch of liquid waste that contains alcohol. Even though it presently costs them money to dispose of, instead of cleaning up this waste themselves to recover the ethanol, they are going to put it in a tanker truck and haul that waste (and all that water!) to people's houses and dump it in their MicroFuelers. The owner of the MicroFueler, having paid $10K to buy one of these things, is now going to pay for electricity, water, and sewage and then pay another $2 a gallon for the finished product. They are then going to put it into their vehicle, hopefully in proportions that don't ruin their cars. Wow.

Again, the journalist makes a patently false statement:

> Converting expired beer and other liquid wastes into cellulosic ethanol takes minutes and uses three kilowatt-hours of electricity to produce one gallon of fuel.

How about some voodoo economics? The following, combined with the cellulosic misdirection, are enough to convince me that consumers are being seriously misled:

> Factoring in the $5,000 federal tax credit, an annual household fuel consumption of 2,080 gallons and a $2 charge a gallon, GreenHouse estimates the average consumer payback time is about two years.

Some of the assumptions in their business plan are simply amazing. First, their estimate of 2,080 gallons is almost double the real annual household fuel consumption. There are an estimated 112 million households in the U.S., and our total gasoline consumption is about 140 billion gallons. That is 1,250 gallons of gasoline per household. But because of the lower energy density, one would have to replace that gasoline with around 1,800 gallons of ethanol (actually about 1,900 since this ethanol contains 5% water). Further, they apparently also made the assumption that people are going to run E100 in their cars to justify that two-year payback claim. But their two key assumptions are both wrong.

They admit that you are going to spend $10,000 on the unit, yet they assure that you will get a $5,000 tax credit (hey, they haven't steered us wrong yet, have they?) and then you are going to pay $2 per gallon plus electricity to produce each gallon. So over the course of 2 years the average household would pay $5,000 (plus another $5,000 from the taxpayer) plus $3,800 (1,900 gallons at $2/gal) plus another $1710 of electricity (again, taking their word that it is only 3 kWh of electricity per gallon, and using $0.15/kWh) for 3,800 gallons of ethanol to replace 2,500 gallons of gasoline.

Today's average retail price of gasoline is $2.64. So in two years an average household would pay $6,600 for gasoline. The total price over two years via this ethanol route (and I am assuming free feedstock and value for your labor) is $15,510. But if they are correct and we taxpayers get to kick in $5,000, then the cost is only $10,510. So much for a two-year payback. Again, this appears to be for those who failed Economics 101, and is being helped by a journalist who failed Due Diligence 101.

I must say that things have certainly changed a lot since Quinn and Butterfield were featured in the New York Times a year ago. At that time the unit was going to be fed sugar and was going to produce ethanol at a cost of only $1/gal. Quinn claimed at that time *"It's going to cause havoc in the market and cause great financial stress in the oil industry."* Now a year later the unit prefers to be fed alcohol so it can produce alcohol, will cost $2/gal, and will produce almost as much carbon as one would produce from burning gasoline.

An E-Fuel MicroFueler Dealer Responds

After I wrote this essay, I went back and searched through my Gmail to see when I had first heard about the E-Fuel MicroFueler. It turns out that about a year ago a regular reader of my blog - and someone I had exchanged a number of e-mails with - sent me the first bit of information and asked for my opinion. He told me at that time that he had become a dealer of these systems.

At the time, the idea was to use sugar as the feedstock. I made a number of comments to him, including my concern that the capital costs alone were too high to make the unit economical. I said that I felt like they would need to get capital costs down by 2/3rds, and I questioned several assumptions in the economics. Further, I flagged up a concern that people who couldn't program their VCRs would be expected to produce ethanol in their garage. On the other hand, I did favor the idea of localized production of fuel (and still do).

Following the essay on my blog - Another Journalist Fails Due Diligence 101 - in which I pulled no punches, we exchanged several e-mails. I told him that I felt like what was being presented about

the MicroFueler's capabilities bordered on fraud. In response, he said he wanted to clarify a number of points raised in the L.A. Times article that I addressed. Since he is not authorized to speak on behalf of E-Fuel, he will not be identified and this will be his opinion - and not the official company position. One of my core principles is to allow people to respond to my criticisms, so in the interest of fairness, I present excerpts of his response to me.

On the topic of the government picking up half the cost, he wrote:

> Section 30C of the US Internal Revenue Code (as amended by the Stimulus Act) provides an income tax credit of 50% (up to $50,000) for a taxpayer to install "Alternative Fuel Vehicle Refueling Equipment" as long as the fuel is used in a "trade or business". Individuals can qualify for a credit of up to $2,000. This credit applies to commercial E-85 pumps, natural gas refueling equipment, hydrogen, biodiesel, and yes, even MicroFuelers. The credit also applies to other "turn-key" ethanol fuel production/dispensing solutions. The same government that provides these incentives is the same one that gives incentives to the petroleum industry for exploration, infrastructure, research & development, etc. Fair is fair.

If individuals qualify for $2,000, then that puts the out of pocket cost at $8,000 - and not the $5,000 that I have seen mentioned again and again.

Regarding my comment about people being trusted to put the correct amounts of ethanol in their vehicles, he wrote:

> There was a study by the University of North Dakota that looked at the ability of unmodified non-flex fuel vehicles to run on ethanol/gasoline blends. The study showed that these vehicles could run quite well on high-level blends such as E-50, E-60, etc. The study also looked at fuel economy when using these various blends and concluded that blends of E-20 or E-30 might well be the "optimal" blend in terms of overall fuel economy for non-flex fuel vehicles, but the results tended to be different for each make/model/year vehicle tested.
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> "Optimal" in the real world translates (and this is very important) into two things:
> 1. Lowest net cost per mile (including vehicle manufacture & upkeep)
> 2. Lowest net "well to wheel" emissions per mile (including vehicle manufacture & upkeep)
>
> Optimal Ethanol Blend-Level Investigation
>
> Unfortunately, it didn't address the question of vehicle longevity, but we have many real-world data points that support our position that ethanol is unlikely to cause any problems.
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> We know that most vehicles built after 1989 have parts that are ethanol compatible (fuel pumps, fuel injectors, fuel lines, etc). In fact, if you compare part numbers between today's "flex fuel" and "non-flex fuel" vehicles, you'll find the exact same part number used in both applications. There is a lot of fear, uncertainty, and doubt about whether ethanol can be used in non-flex fuel vehicles – but the fact is that we've been using high-

> level ethanol blends (up to E100) in a number of unconverted non-flex fuel vehicles with no problems except the occasional "Check Engine" light... and the only reason the Check Engine light comes on is because the on-board ECU thinks that the fuel system is putting too much fuel into the engine so it assumes there is a problem when, in fact, there really isn't. It's just that the ECU was never programmed to take the possibility of using ethanol (lower energy density) into account. In these cases, the "Check Engine" light is a false indication of a non-existent problem.

I am familiar with the University of North Dakota study. It was paid for by the American Coalition for Ethanol. I think we would agree that if an anti-ethanol result was found as a result of research funded by the American Petroleum Institute, ethanol proponents wouldn't accept that at face value.

The study has been widely spun as showing that an optimal ethanol blend was E20 or E30. But I looked at the report, and previously commented on it at TOD. Here were some of my comments on this paper:

> I took some time to review this paper again. This is what I see from the ethanol tests. Look at Figures 10-13. Here is the reality of the tests:
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> Figure 10. 2007 Toyota Camry, 2.4-L engine - 6 of 7 tests show worse fuel efficiency on an ethanol blend. There is one apparent outlier, which was the basis for the claims. (And it looks like a classic outlier, with almost all of the other points falling as predicted).
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> Figure 11. 2007 Chevrolet Impala (non-flex fuel), 3.5-L engine - 5 of 5 tests show worse fuel efficiency on an ethanol blend.
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> Figure 12. 2007 Chevrolet Impala (flex fuel), 3.5-L engine - 8 tests, 2 show better fuel efficiency, 2 show the same, and 3 show worse fuel efficiency on an ethanol blend.
>
> Figure 13. 2007 Ford Fusion, 2.3-L engine - 4 of 5 tests show worse fuel efficiency on an ethanol blend. There is one apparent outlier.
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> So, what can we conclude? Of 25 data points, 18 confirm that the fuel economy is worse on an ethanol blend. That is 72% of the tests, and these tests were paid for by the ethanol lobby (which is why I suspect the results were spun as they were). The outliers are interesting enough for further investigation, but you have vastly overstated the test results. In reality, if you pulled the results out of a bag, you have only a 28% chance of improving your fuel efficiency on the basis of any particular test. Further, the outlier didn't always occur at the same percentage, which would be quite problematic even if the result is confirmed.

Note: A reader just pointed me to an NREL study that attempted to replicate the results of the North Dakota study and refuted it (vindicating my skepticism of the results):

Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines

The key findings:

> • All 16 vehicles exhibited a loss in fuel economy commensurate with the energy density of the fuel.*
> • Limited evaluations of fuel with as much as 30% ethanol were conducted, and the reduction in miles per gallon continued as a linear trend with increasing ethanol content.
> *This result was expected because ethanol has about 67% of the energy density of gasoline on a volumetric basis.

Given the number of times ethanol proponents have touted this test, this will be the subject of an upcoming post.

On the L.A. Times article itself, and my claim that the author had been duped:

> "Duped" might be a bit strong, but there were certainly a few problems with the article. I'm not sure if Tom/Chris misspoke or if they were misquoted (I wasn't there), but the inaccuracies should have been identified and cleared-up before the article went to press. Incorrect? Perhaps in some ways. Misleading? Maybe. Intentionally misleading (fraud)? No... I'm confident that there was no intent by E-Fuel or GreenHouse to be misleading. I think it's unfair to expect any journalist to have the same level of technical knowledge and industry experience that we have, so I'm prepared to live and let live when an article doesn't get everything exactly right. The fact is that nobody "lied" here, and there's really no way to control what gets printed. No journalist in the world would allow us to review the article before it goes to print.
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> I agree that someone with more experience could have handled the interviews or at least reviewed the article before it went to press. And perhaps an "interview" isn't the best way to present the concepts that were discussed. Maybe a "press sheet" or "whitepaper" would be more appropriate. We (the biofuels industry in general) need to be careful to properly manage customer expectations because, ultimately, failure to do so could seriously undermine our credibility.

Regarding my comment that a big ethanol refinery would be more efficient:

> Energy efficiency of huge biorefineries isn't going to be much different than in the MicroFueler. It takes a certain amount of energy to distill no matter what quantities we're talking about. Take a look at Floyd's 1982 design and then look at the MicroFueler design and you'll see it's pretty well thought out. Where "the big boys" have a definite advantage is there economies of scale with respect to capital costs. Where we have a huge advantage is the cost of feedstock, carbon balance, and the (near) elimination of the whole petroleum distribution system.

I disagree with that. A smaller purification system is going to suffer heat losses to a much greater degree. It is inevitable. You see it all the time when trying to run a laboratory column to simulate a production column. Efficiencies aren't nearly as good because of the higher relative heat losses.

Regarding the comment that 100 billion gallons of fuel are thrown away:

> Misquoted or misspoken. He probably meant to say that the US is sitting on about 100 billion gallons worth of cellulosic biomass on a sustainable, annual basis. That's the USDA/DOE "Billion Ton" study. There's a fine line between "thrown out" and "not utilized". Then there's all the stuff that we're paying to haul away to landfills (another 6-10 billion gallons worth). Tom knows the difference, but somehow the two thoughts got combined into a single statement.

We exchanged a number of e-mails regarding the claims around adding water to ethanol to improve the engine efficiency. I have seen some references to that, but I haven't been able to find actual results. (See this article, for instance). My comment was that the results may have been spun like the University of North Dakota study cited above. But one thing that I told him I don't believe is credible is that a person was running out of fuel and added 3 gallons of water to their tank to get home (see the previous story for that example). It is possible that a vehicle running on ethanol - and with a pretty full tank - could "tolerate" that much water.

But this much is true. It takes a lot of energy and capital to get that last 5% of water out of ethanol that is produced. Cars can run on ethanol that contains water (hydrous ethanol), albeit at a lower efficiency (which is why the water is removed). Brazil runs some of their cars on hydrous ethanol. But the claim that this improves the efficiency is pretty far-fetched, in my opinion. One of the articles I recently read stated that the water lowered the combustion temperature, thus increasing the efficiency. But if you look at the equation for efficiency of an engine, a lower combustion temperature will normally result in a lower efficiency. Regardless, I don't put much faith in highly counter-intuitive results until they have been well-replicated (see 'cold fusion'). And if they are - it would be a potentially revolutionary finding.

On the cellulosic issue, he wrote:

> The MicroFueler is an automated fermentation, distillation, and dispensing platform. Our fermentation process regulates agitation, temperature, and other parameters to optimize output, but fermentation is fermentation. Distillation isn't rocket science. If you can boil water then you can distill ethanol. We happen to be able to do this very efficiently and we produce a very high quality fuel. So the question is, can we really hydrolyze cellulosic materials to liberate the sugars and then convert them into ethanol? The answer is yes. The better question is "can we do this efficiently in order to get close to the maximum theoretical yields?"
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> You can't just put grass clippings in a MicroFueler and walk away from it and expect ethanol fuel. There's more to it than that. But, it's not a big deal to put a grinder, pump, and a 300 gallon tank next to a MicroFueler or to add a bottle of enzymes now and again. It's like having a pool, and then having the pumps, filters, to make it work, and the chlorine to keep it all clean. Or like a washing machine for that matter. Laundry detergent is mostly enzymes, and the clothes don't wash themselves.
>
> There's another issue here which is that people toss around the term "cellulosic" far too often without really knowing what it means. Food waste (starch/carbohydrates) is very easy to work with, but it's not cellulosic. People think that anything other than corn is

> cellulosic. Blame that on the media.

Around the economics, he essentially said that not everyone will save money, but some will save a lot of money. I haven't seen the assumptions that went into those financial calculations, but I am highly skeptical that the average person would save any money.

In his conclusion, he again hit upon the local production aspect, which was the one part I did find appealing:

> And here's the $64,000 controversy... Say for example I feed my MicroFueler a steady diet of corn (grain) and amylase enzymes. I grow the corn on my farm, make the fuel on my farm, and feed my chickens the WDGS that are left-over from making ethanol. No transportation. Then I collect the chicken manure and spread it back in my corn field (which I also irrigate with the wastewater). By the way I'm also paying a premium for wind power to run my MicroFueler in this scenario. Is this sustainable? Does this defeat the argument that all corn ethanol is patently unsustainable (by definition)? I guess it all depends on the price delta between a bushel of corn and a gallon of gasoline. High gas prices and low corn prices you better believe I'm making fuel.

I don't think anyone would argue that corn ethanol is unsustainable by definition. If a farmer is growing his own corn and taking care of the soil, and using that to produce his own ethanol, then he has a shot at sustainability. We lose the plot when we try to ramp that up to be a large scale solution.

To conclude, I recognize that my original article was pretty harsh. But that is because in my opinion there has been a distinct pattern of embellishment with this device, and if there is one thing I loathe it is people making far-fetched promises around renewable energy. I found the L.A. Times article to be irresponsible, either because the journalist did a poor job or the developers were overselling their device.

The end result of articles like this is that it creates the potential for money - private equity and taxpayer funds - to flow to an undeserving source. Ultimately this will have the effect that the funds will dry up, and promising technologies won't be funded as a result. Imagine funds for cancer research being diverted to some of the fraudulent cancer cures, and you have the sort of example that gets me worked up. That is the reason I am quick to pounce on embellishment in this sector.