3 September 2015

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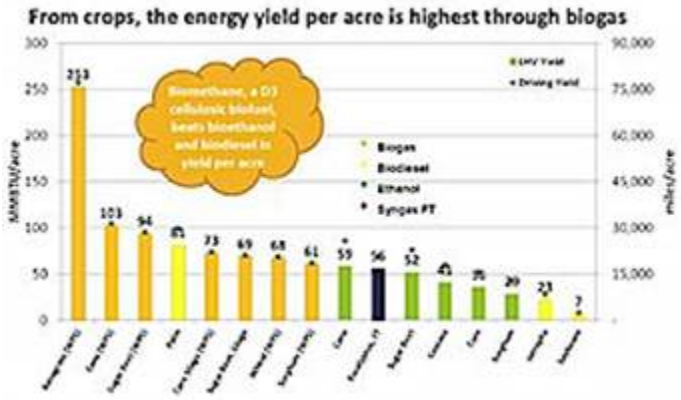
The Gas Rush: Could the US switch fuels over to 51% renewable natural gas?

September 2, 2015 | Jim Lane



51 percent? Could renewable natural gas get that big?

The rationale behind the Eureka!, and some Caveats for all you Emptors.

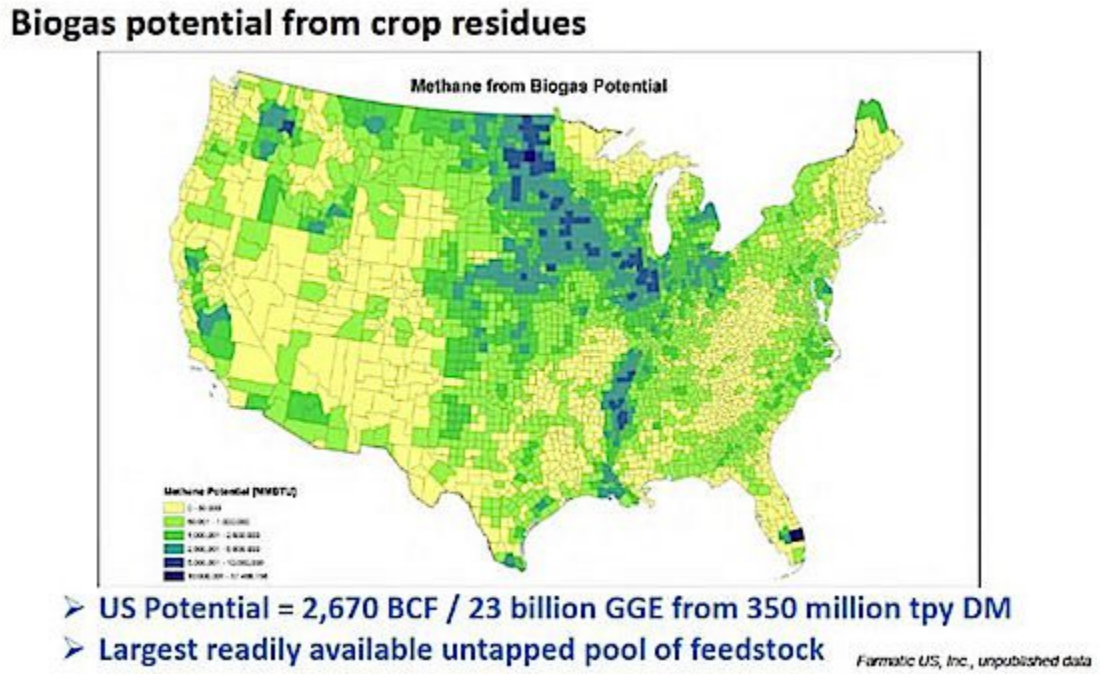
A few years back we lived in the era of the *National Energy Solution Summed Up in One Word*: it was *gasoline*, then *diesel*, then *ethanol*, or *biodiesel*. Then there was the Two-Word Era: in p[art because of an *Inconvenient Truth*, the craze was on for *cellulosic ethanol*, *algae biofuels*, *aviation biofuels,* and there was the *Hydrogen Economy* or the *Glucose Economy,* depending on who you were talking to.

We seem to have reached the Three-Word Era.

Seems like every day we hear the drums beating for *Renewable natural gas* and *low cost methane*. And there's been a steady news flow in new natural gas project and technology announcements, posted cellulosic RINs, a surge in investor enthusiasm, and increasing stakeholder acceptance.

In a remarkable presentation at the Infocast Methane Bioengineering Summit in San Diego this week (and earlier at the Advanced Bioeconomy Feedstocks Conference in New Orleans, in June), Farmatic CEO Michael Schuppenhauer said that the US could replace up to 51% of its fossil transportation fuel through biogas, and that from crop residues and waste streams alone, 33 states could generate more than 10 percent of their transportation fuel.

You can see an **8-Slide Guide** digest of that presentation, right here.



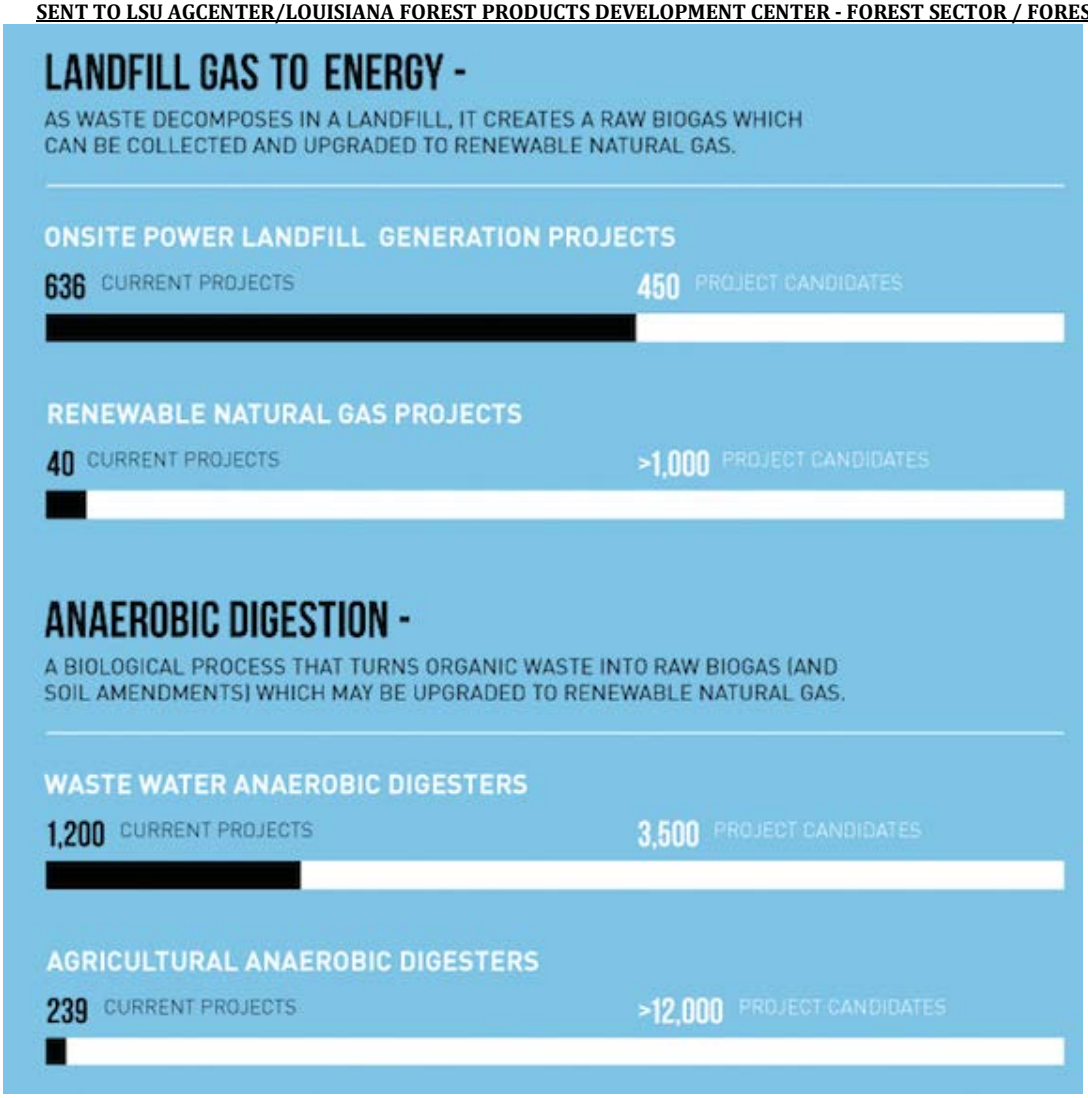
Building that low carbon fuel economy, Schuppenhauer said, would create 2.5 million jobs and create $240 billion in investment in the communities that adopted this pathway.

Heady stuff, the kind of wild west, gold rush enthusiasm not seen in this sector since the ethanol heyday of the mid 2000s.

Real reasons for enthusiasm

Part of the enthusiasm stems from low-carbon enthusiasts, who see reductions in carbon intensity of up to 85% for "Landfill gas cleaned up to pipeline quality NG; compressed in CA," according to California's Air Resources Board.

But the prices look good too, with Farmatics's projected fuel costs ranging from $2.39 (per gasoline equivalent gallon) to negative $1.00 per GGE. Yes, negative cost fuel — that's CNG made from food waste. From energy crops and residues, the costs come in around $1.52-$1.71 per GGE, Schuppenhauer said.



Now, even in these days of unbelievably low oil prices — hanging around in the mid $40s for West Texas Intermediate — those are incredibly attractive opportunities for investors, regardless of how they feel about the environment. Not to mention, the potential to register cellulosic fuel RINs under the Renewable Fuel Standard.

For all those reasons, we've reported on the substantial increase in cellulosic renewable fuels via the EPA's registration service, almost all of it coming from renewable natural gas. In all, 61 million of the 62 million RINs issued for cellulosic fuels have come from renewable compressed or liquified natural gas — 98% in all.

Here are the Caveats for all you Emptors

1. Vehicle and pump infrastructure.

OK, there are roughly 150,000 natgas powered vehicles in the United States, according to the DOE's Alternative Fuels Data Center. GE and the CNG Now group disagree, putting the number at 250,000, incouding conversions.

No matter, either way, it's a major limiting factor. With low gas prices, that's bound to change — but the availability of vehicles and refueling infrastructure is a major dampening factor, until more vehicles hit the road. For now, think city bus fleets, where refueling can be done in the fuel yard. Also, Utah. where there is a $3,000 state tax incentive credit for CNG vehicles.

2. Residue supply chain.

According to Farmatic, the availability of waste is a limiting factor. The Coalition for Renewable Natural Gas puts the upper limit of waste availability at around 7 billion gallons of gasoline equivalence. That's about 3 percent of US fuel usage.

The solution, according to Farmatic, is crop waste, and they point out that the energy derived — in miles per acre — is here for CNG than ethanol. But, we run into the problem that those residue supply chains haven't been built yet — for any type of cellulosic fuels.

Also, Birgitte Ahring, a professor at Washington State University, warns that anaerobic digester organisms need to be improved before gas conversion is made as efficient as it needs to be — they face the same barriers of recalcitrance that we see on the cellulosic ethanol side. Not insurmountable, but a barrier, nonetheless.

We also note that converting 350 million tons of crop residue biomass into CNG will leave us with 120 million tons of lignin, leftover. And that will need a market.

3. Energy crop development.

The biggest source that Farmatic sees is in energy crops — and the Billion Ton Study and Son of Billion Tons give considerable encouragement here — 385 million ton potential, 60% Miscanthus and 40% Sorghum.

The problems here? It's a collection of Not Quite Yets. First, we don't have that much seed, we don't have the growers contracted, we don't have the supply sheds set up including transport to the miniplants for conversion. We probably don't even have enough baling equipment in the midwestern United States — or anywhere that energy crops would grow.

It's something that the country will grow into. The good news here — you don't need to wait for a cellulosic liquid biofuels plant to grow biomass sorghum. CNG will do just fine.

4. Beware those tipping fees.

In the Farmatic models, we see $30 tipping fees per ton of organic waste. Those are definitely available now in selected locales. However, we've seen tipping fees turn into feedstock fees quite rapidly in other fuel markets. rem,ember the days when you could get waste fryer oils for nothing, and pick up a $25 per week collection fee from a restaurant? Now, you pay up to 25 cents per pound for fryer oil.

5. Energy crop costs have doubled.

In the Farmatic model, we see the Billion Ton Study numbers, accurately reported, for feedstock costs. The problem is, they've evolved. Right now, the DOE is guiding project developers to think in terms of around $115 per ton today for biomass. Longer-term, $80 per ton. So, those models that use the old Billion Ton figures of around $50 per ton — they all have to be updated.

6. The real costs of infrastructure.

A CNG vehicle cost? You can buy a DIY converter kit for between $1000 and $1800 — but professional truck conversion will run around $9000, according to this report. Another way to go to market is to simply wait for the fleet to turn over and sell CNG one vehicle at a time — that takes decades. There are 300 million registered vehicles in the US. Converting half to CNG would probably drive the conversion cost down dramatically, but it would be something like $750 billion to convert half the fleet at $5000 a pop.

Dispensers? To get around 50 percent fuel usage, you need to add on large-station, fast-fill capacity at roughly 129,000 or more outlets in the US.

Consider that it takes around 150,000 outlets to distribute gasoline, and that has around 60 percent market share. But, do the math, based on 1750 GGE/day at a large station.

Those conversions run $1.2M- $1.8M per outlet, according to the ADFC. Let's assume that the conversion cost could come down by half if there was a massive deployment that afforded economies of scale. Still, we're looking at something like $97 billion.

These locations can do onsite compression — but they will need a natural gas feed. Hopefully, not with expensive pipelines. We've left out that delivery cost, entirely, on the assumption that it costs no more to deploy gas than any other novel fuel.

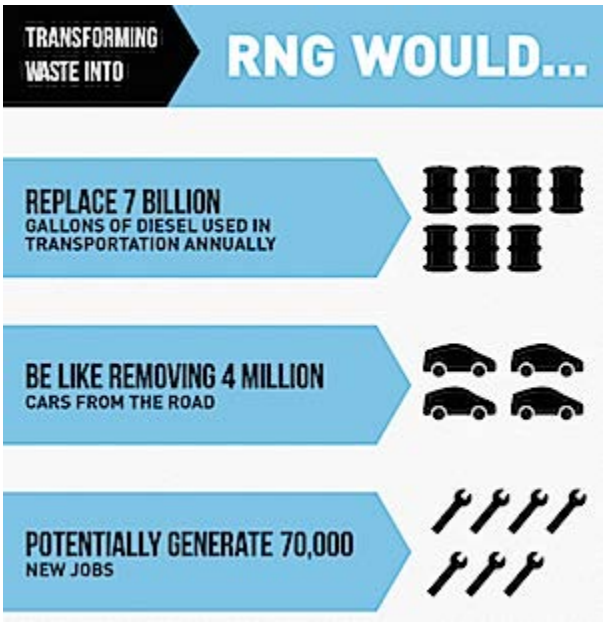
The Bottom Line on cost

There's a short-term, high-impact conversion path — and there's a dramatically less costly growth path for renewable natural gas, based on hoping to change over the fleet as it retires.

Short-term cost? There's the $240 billion aforementioned to deploy the technology. There's some $750 billion in vehicle conversion costs, the $96 billion in fueling infrastructure. And, there's a $30 per acre capital "establishment cost" per acre for energy crops, according to this report. Needing something like 50-100 million acres: that's another $1.5-$3 billion in prep cost.

All in? Think $**1.089 trillion** to convert over half of US fuel usage to CNG in a reasonable time frame, excluding any costs associated with exploration or production, or the effect on the cost of natgas itself in the face of such a demand shock, which could be modeled and could be considerable.

So, it's a $1 trillion solution. Compare that to around $50 billion for the build-out (to date) of the current liquid renewable fuels infrastructure — and you see the problem. It's expensive.



At incremental deployment levels, such as the Coalition for Renewable Natural Gas looks at, where the focus is on waste, and tipping fees, and a much smaller number of (mostly fleet) vehicles, purchased on a "as we replace them anyway" basis by fleet owners, running many more gallons than the average passenger car, and fueled with overnight time-fill systems: that is a **much less impactful scenario**, in terms of the dollars.

So, for now, consider that renewable CNG will be focused on organic waste streams, including food waste, manure and landfill gas — and "as you replace them" fleet conversions that might take 20 years, but will not have that much bottom line impact.

50% conversion of the US anytime soon? Not a chance in the world, despite some very attractive energy densities and yields for CNG compared to other renewable fuels — and highly attractive carbon numbers (though these change with the introduction of energy crops into the mix because of land use change factors).

In the end, it comes down to infrastructure and the costs of infrastructure change.

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