Garbage to Gas
Landfills and sewage treatment plants are an overlooked source of clean energy - but a boom in bio-methane might be coming.

By Anne Kim | August 11, 2015

What was once the I-95 landfill near Lorton, Virginia, is now dozens of acres of rolling green fields - dotted by more than 200 metal pipes emerging from the grass.

The pipes are wellheads for natural gas, and they are collecting the methane generated by more than 10 million tons of decomposing garbage dumped by Washington, D.C.-area residents over the course of 30 years.

A vacuum pump draws the gas from underground, through the wellheads, and connects it to roughly 14 miles of pipeline that run throughout the landfill. Under each wellhead, says Mike Malfitano, an environmental technical specialist for Fairfax County, “there’s a three-foot bore hole that goes 110 feet down into the waste mass.”
Although it closed in 1995, county officials expect the landfill to keep emitting gas for at least the next decade. On its best days, says Fairfax County environmental engineer Chris Meoli, the landfill generates 2,000 cubic feet per minute of gas - enough to create 4.9 megawatts of electricity. It’s more than enough to power the Noman M. Cole wastewater treatment plant three miles down the road, saving the county as much as $500,000 a year in power costs, according to a 2015 county report. What’s left over is sold to the grid.

According to the Environmental Protection Agency (EPA), landfills are among the nation’s largest sources of methane, accounting for nearly one-fifth of all methane emissions generated by human activity in 2012. That’s why advocates of landfill gas projects like the one in Fairfax County say these efforts have enormous environmental benefits - first, by capturing harmful methane emissions that would otherwise contribute to climate change and second, by replacing more carbon-heavy fuels for power and transportation.

Moreover, there’s no shortage of garbage. According to the group Energy Vision, Americans dump about 250 million tons of municipal solid waste per year - including 70 million tons of food and yard waste. It’s a clean energy opportunity the nation is literally throwing away.

Advances in waste management, along with recent changes in federal and state policy, are now prompting a potential boom in bio-methane opportunities - not just involving landfills but sewage treatment plants, dairy farms and other sources of organic waste. Companies are also showing greater interest in renewable natural gas as an alternative to gasoline and diesel, further stoking interest and demand.

In May 2015, UPS announced an agreement with natural gas fuels maker Clean Energy Fuels to use renewable natural gas from bio-methane in its delivery fleet. UPS said it expects to use 1.5 million gallon equivalents of renewable natural gas a year, making it the nation’s largest user of renewable natural gas vehicle fuel in the shipping industry.

Mike Whitlatch, Vice President of Global Energy and Procurement at UPS, says the transition to biogas is “an obvious one” because so much of the company’s fleet already uses conventional, fossil-based natural gas.

“We’re trying to reduce our impact on the environment - customers are simply demanding it,” says Whitlatch. “For us to remain competitive, we have to remain sustainable in a future carbon-constrained world.”

But Whitlatch also says it was only recently that renewable natural gas vehicle fuel became available and affordable enough to be economically worth the shift.
Perhaps the biggest boosts have been California’s new “low-carbon fuel standard,” which includes renewable natural gas, as well as recent regulatory changes to the renewable fuels standard under federal law.

First established in 2007, California’s low-carbon fuel standard requires a 10 percent reduction in the carbon intensity of petroleum-based fuels by 2020 and uses a cap-and-trade approach to achieve these reductions. To meet the state’s requirements, gasoline and diesel producers can either develop their own lower carbon fuels or buy “credits” from producers of lower carbon fuels recognized under the standard. In turn, companies that produce lower carbon fuels - such as Clean Energy Fuels - can use the revenues from selling carbon credits to lower the price of their products and make them more competitive.

Similarly, the federal renewable fuels standard, last amended in 2007, requires the nation’s transportation fuel supply to include 36 billion gallons of renewable fuel by 2022. In 2010, federal regulations were expanded to recognize renewable natural gas as a fuel eligible for tradable credits under the program.

According to its publicly filed 2014 annual report, Clean Energy Fuels earned $4.8 million in 2013 and $3.5 million in 2014 from sales of state-level carbon credits generated by its production of renewable natural gas. The company also earned a total of $5.9 million in 2013 and 2014 from credits generated under the federal renewable fuels standard.

These carbon credit revenues are in fact the only reason renewable natural gas is economically viable right now, says Harrison Clay, President of Clean Energy Renewable Fuels, a Clean Energy Fuels subsidiary. Even though renewable natural gas is
already cheaper than gasoline or diesel, its production costs are still at least twice that of fossil natural gas.

“California has the best carbon pricing and carbon regulation in the world, and it’s a great market for a product like ours,” says Clay. “But where there isn’t effective carbon pricing, it’s a more difficult economic proposal with natural gas fuel being so cheap. If there’s no way to monetize the carbon benefit, it’s a challenge.”

Nevertheless, there’s plenty indication that demand for renewable natural gas will continue to grow. Based on a “life-cycle” analysis - that is, taking into account the carbon intensity of production, distribution, etc. - renewable natural gas has a carbon footprint that’s up to 90 percent lower than that of gasoline, according to analyses by the Argonne National Laboratory. By comparison, conventional natural gas vehicle fuel has a carbon footprint that’s only 6 percent to 11 percent lower than gasoline.

In July 2015, the Santa Monica bus system - the Big Blue Bus - announced it was switching to 100 percent renewable natural gas, and the Los Angeles County Metropolitan Transportation Authority is considering a similar switch. Oregon and Washington State have also recently passed “clean fuels” programs, which could also spur future demand and put more carbon credits on the market.

UPS’ Whitlatch says renewable natural gas meets a long-awaited industry need for a less carbon-intensive fuel. “Electricity has many more options, such as wind, solar, geothermal and hydro,” he says. “Heavy duty transportation only has a few viable with lower carbon intensity and the supply at scale.”

Clay says his company has already seen significant growth. According to the company’s annual report, Clean Energy Fuels sold 20.3 million gallons of renewable natural gas in 2014, a 39 percent increase over 2013, when the product first launched. Clay says he expects to get to 40 million gallons in annual sales soon.

To meet demand, the company owns and operates biogas production facilities at landfills in Canton, Michigan and in Millington, Tennessee. It also buys bio-methane through third-party contracts at other landfills and facilities across the country. But Clay also says there’s enormous untapped potential.

“We could do 10 times what we’re doing today without any significant technology breakthrough or change in how we operate our waste management practices,” says Clay. “There’s certainly adequate waste streams out there to get to billions and billions of gallons of bio-methane.”

For one thing, the vast majority of landfills in the United States aren’t currently capturing landfill gas emissions for either power or for fuel. Of the 2,400 or so operating or recently closed landfills in the United States, the Environmental Protection Agency (EPA) estimates that about 645 of them have landfill gas projects.
At least 440 more sites across the country could support a project, says the EPA, but many are instead “flaring” the methane they generate - simply burning it - to comply with federal regulations that now prohibit “fugitive” landfill gas emissions. Capturing the gas from these 440 landfills, the EPA says, could generate 7 million megawatt hours - enough to heat 1.1 million homes - and save emissions from 86 million barrels of oil.

Moreover, it’s not just landfills that are generating potentially useable bio-methane, but sewage treatment plants and even dairy farms. According to Energy Vision, only about 1,300 of the nation’s more than 17,000 wastewater treatment plants have “digesters” that can efficiently turn organic waste into biogas. Some of the newest and biggest digesters, such as one in Sacramento, are being built with fuel production in mind - a trend that will likely continue.

Johannes Escudero, Executive Director of the industry-led Coalition for Renewable Natural Gas, says there’s potential to produce more than 7 billion diesel gallon equivalents of renewable natural gas vehicle fuel per year, if all viable sites could be developed. “That would eliminate the equivalent of more than 10 million cars off the road,” he says.

But for this to happen, policymakers need to stop overlooking bio-methane in favor of what seem to be more glamorous alternatives. “We put a lot of our investment dollars and policy focus on wind and solar,” says Escudero. “But if we were to cap every landfill today, we’re talking about methane emissions for another 30 to 100 years. We need to incentivize development projects that capture those gases and put them to good use, whether it’s electricity, heating, or transportation fuel.”