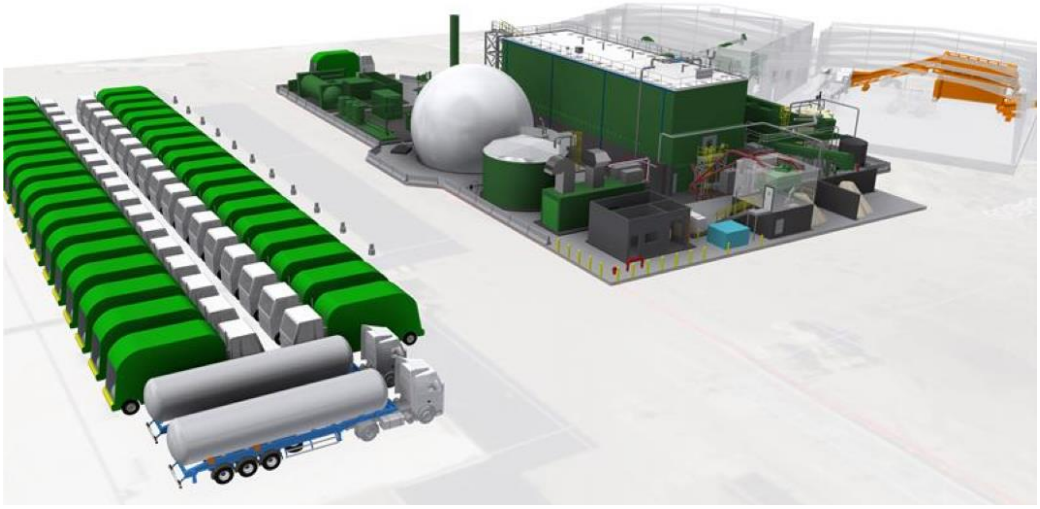
BioCycle

Napa's Next Phase: Anaerobic Digestion Joins a Mature Composting System



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The City of Napa is adding a high-solids anaerobic digester to its existing composting facility, creating one of the more technically integrated organics management systems in the United States. At the center of the project is Zero Waste Energy's SMARTFERM plug flow technology, designed to process high-solids organic waste streams and convert them into renewable natural gas (RNG) for use in Napa's collection fleet. The facility is operated by Napa Recycling, and owned by the City of Napa.

The composting system, commissioned in 2020, is built around an ECS covered aerated static pile design (CASP) that allows the facility to process source-separated organics at scale while meeting California's air quality and emissions requirements. The system uses positive aeration beneath piles covered with a biolayer to maintain optimal oxygen levels and temperatures, accelerating decomposition while capturing and treating process air to control odors and emissions. This configuration enables the facility to handle a mix of residential and commercial organics while maintaining consistent process control and throughput. It also provides the downstream capacity required to cure digestate from the new anaerobic digestion system, ensuring that all residuals are stabilized into a finished compost product.

The SMARTFERM platform operates as a high-solids, plug flow digester, enabling it to process a broader mix of feedstocks typical of municipal organics systems. Material moves through the system in a controlled, staged process, with a biomethane production cycle of approximately 21 days. During that period, the material remains in a

sealed environment under thermophilic conditions, maximizing methane capture before the stabilized digestate is composted.The facility is expected to generate up to 500,000 diesel gallon equivalents of compressed natural gas annually, enough to fuel roughly 50 collection vehicles.

“The high solids approach is really driven by the feedstock,” said Eric Herbert, President of Zero Waste Energy and BHS. “Because we work in the solid waste space, we are always dealing with higher solids content. That’s what makes this type of system the right fit.”

Designing a System Around Feedstocks

A defining feature of Napa’s approach is how it routes different organic materials through the system based on their energy potential. Rather than treating all incoming organics the same, the facility is designed to separate streams and direct them to the most appropriate processing pathway. Residential organics, which are largely composed of yard trimmings and soiled paper, are sent primarily to composting due to their relatively low methane potential. Commercial food waste, by contrast, is prioritized for anaerobic digestion (AD).

“What you’re looking for is the high methane fraction,” said Kevin Miller, Materials Diversion Administrator for the City of Napa. “Commercial routes can be 50% to 70% food waste, sometimes even higher, and that’s where the gas is.”

The AD system is initially designed to process approximately 44,000 tons per year with a mix of one-third food waste and two-thirds green waste. Over time, Napa plans to shift that ratio toward a higher proportion of food waste to increase biogas production and overall system efficiency.

Regional factors also influence feedstock composition. Napa’s location in a major wine-producing region introduces materials such as grape pomace and winery byproducts, which are well suited for AD due to their high energy content. Even destructed bottled wine is expected to be incorporated into the system as a supplemental feedstock.

Integrating Digestion and Composting

The AD system is not designed to replace composting, but to contribute to it. This integration is particularly important in California, where landfill diversion requirements limit disposal options for organic residuals. Digestate must be further processed, and composting provides the pathway to produce a usable end product while maintaining compliance with state regulations.

“In practice, you can have CASP without anaerobic digestion, but you can’t have anaerobic digestion without CASP,” Miller said, referring to the facility’s covered aerated

static pile system. For Napa, that meant building out composting infrastructure first before layering in AD.

A Long Development Arc

While the technology integration is forward-looking, the path to implementation has been long. Napa first evaluated AD as part of a broader infrastructure plan more than 16 years ago.At the time, composting upgrades were considered essential, while AD was viewed as an opportunity that would depend on economics. That distinction shaped the project's timeline.

"We were looking at a whole system," Miller said, including composting, stormwater improvements, digestion, biomass, and solar.

A $3 million grant awarded in 2014 ultimately had to be returned when the City could not meet construction timelines before the funding expired. The composting system was not completed until 2020, delaying the feasibility of digestion.

The project only became viable once multiple financing mechanisms aligned. A $10 million CalRecycle grant, combined with federal investment tax credits secured by the private partners, ultimately closed the economic gap and made the project feasible.

Economics, Operations, and Stability

From the City's perspective, the value of the system spans multiple dimensions, including emissions reduction, cost savings, and energy production. The project is designed not only as a climate solution, but also as an operational and financial asset that supports long-term system stability.

In the near term, one of the most significant benefits comes from reducing the volume of material that must be transported offsite. The digestion process results in approximately 18% mass reduction, effectively increasing onsite capacity and avoiding disposal costs. That translates to roughly 6,000 additional tons of processing capacity per year and an estimated $270,000 in annual savings.

Longer term, the system provides energy price stability by allowing the City to produce its own renewable fuel. That control insulates the City from fluctuations in global fuel markets while aligning with local climate action goals."We're going to own the RNG station," Miller said.

Operationally, the system also improves fleet efficiency. Vehicles can be fueled overnight through a slow-fill system, eliminating the need for mid-route fueling and reducing downtime.

Structuring the Partnership

The project is built on a three-way partnership between the City of Napa, Napa Recycling, and Zero Waste Energy. The City owns the facility, Napa Recycling operates it, and Zero Waste Energy provides the digestion technology as a subcontractor. “The base of everything for Napa is the City’s strong public-private partnership,” Miller said.

According to Herbert, transparency was critical to making the arrangement work. The partners adopted an open-book approach, sharing cost structures, operational assumptions, and performance expectations throughout the development process. “Everybody just put the information on the table,” he said. “That’s how you make a project like this work.” The result is a system in which collection, processing, and energy production are aligned under a single operational framework.

Planning for Future Flexibility

While the system is designed around RNG, Napa is already considering how it may evolve. The facility includes the ability to use biogas for electricity generation if regulatory conditions shift, particularly as California continues to push toward electrification of vehicle fleets. The design reflects a broader strategy of building flexibility into long-lived infrastructure.

At its core, the system captures a simple but powerful idea about resource recovery. “What you’re picking up is literally providing you the fuel to keep picking it up,” Miller said.