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COLOCATING ANAEROBIC DIGESTION WITH COMPOSTING

By Resource I 15 February 2023 I

Italian waste management company Entsorga demonstrates how colocating anaerobic digestion with composting maximises value from food waste reprocessing.

Since 2020, an established composting facility in Santhià, a municipality in Northern Italy, has also been home to a biomethane plant. The setup shines a light on the environmental and economic benefits of connecting aerobic and anaerobic systems.

Entsorga colocates anaerobic digestion with composting

The biomethane plant, built by the facility owner Entsorga, uses semi-dry anaerobic digestion and aerobic composting processes, which eliminate liquid output: “Over the years, we have understood that the anaerobic digestion process continued to produce too much liquid waste, which was expensive to treat,” explained Group President, Pier Paolo Cella Mazzariol.

“In 2019, we exclusively secured the semi-dry anaerobic digestion process from Zenviro Tech, further developing it based on our experience. The technology uses a small amount of water, which then completely evaporates during the composting phase. The implementation of this upgrade, combined with our composting and refining technologies, has eliminated liquid waste and made the recovery of organic waste even more efficient.”

Founded in 1997 and headquartered in Tortona, Italy, Entsorga is active across Europe, the Americas and Africa. To date, the company has built more than 100 plants globally, including projects for small communities and large, fully-automated industrial systems.

An experiment

Entsorga’s Santhià plant began as an experiment in a mini-laboratory, created by the company’s Research and Development team. In the midst of the pandemic, the entire process was monitored remotely by a team of dedicated processors using a cloud-based system.

“We built a digester on a scale of 1:12 to reproduce the real conditions of the process, to study the stability and consequently correct the mixture that was to be sent to the principal digester,” says CEO Gian Francesco Galanzino.

“The results of the tests permitted us to define the organisational choices on a larger scale, optimising the recovery, time and cost of the production of biogas”.

The process explained

The connected facilities treat source-segregated food waste, with contamination levels of between 7-11 per cent, using anaerobic digestion and composting in sequence. In the first phase, the organic waste undergoes mechanical pre-treatment – using a food waste bag splitter, a magnet, and squeezers to remove contaminants such as plastic and ferrous metals. Such equipment, Entsorga says, “doesn’t shred plastic into small particles, making it easier for us to produce a high-quality Solid Refuse Fuel (SRF).”

While it is mandatory in Italy to use compostable bags for food waste collection, there is still some contamination of input material by normal plastic bags. According to Entsorga, the plant’s digestate solid residues typically contain around 50 per cent non-compostable plastic bags. If small particles of compostable

plastic remain in the digestate, they will decompose during the composting phase. These particles, Entsorga says, often aid the resulting SRF, contributing to higher levels of biogenic content and therefore boosting the eligibility of the SRF as a renewable fuel.

The organic waste is made into a pulp suitable for faster anaerobic fermentation and a higher biogas yield. The digester can take 30 per cent solids, allowing bigger bits of wood to be processed if needed. It is then agitated through a horizontal shaft, with the digestate in the digester remaining in suspension, avoiding the precipitation of solids.

Biogas is produced alongside the solid digestate, ready to be further purified and transformed, through an upgrade system, into biomethane inserted directly into the grid, which runs near the plant.

The second phase sees the digestate firstly mixed with a bulking material of vegetable origin, which contains garden and other plant wastes. According to Entsorga, “such operation is required to prepare a mixture porous enough to be successfully composted.” This mixture is then collected using an automated bridge-crane and then subjected to a biological composting treatment. The process takes place in a closed environment and is accelerated by an automatic mechanism of forced aeration, as the air, temperature, and humidity are monitored. After about 40 days, the treated mixture is refined to eliminate non-compostable elements such as aggregates, plastic and glass (and refined samples tested), after which it is sent to the plant’s bio cells for slow maturation, and then for storage.

After a minimum period of three months from the arrival of the waste in the plant, the post-AD compost is ready to be used. 90 days is the legal minimum required for biowaste composting in Italy and ensures the compost’s stability, allowing for the elimination of ammonia and nitrate issues.

The end result

The plant’s integrated treatment lines allow for increased performance levels. Water accounts for around 45 per cent of the weight of waste entering, which evaporates during the aerobic process. 20 per cent of the total waste is transformed into biomethane, with another 20 per cent transformed into quality compost. The remaining 15 per cent is mostly made up of plastics and other residues that contaminated the differentiated organic fractions. Entsorga uses a refinement system to convert this material into Secondary Solid Fuels (SSF or RDF), which can be used in cement factories instead of traditional fossil fuels. This saves the costs associated with landfilling and incinerating the contaminants that enter with the food waste.

The connected facilities currently process 40,000 tonnes of organic waste every year, a quantity which is set to increase to 80,000 tonnes with a second digester. Construction is already underway. At full operation, Entsorga says that the plant will transform the organic waste of around one million inhabitants into five million cubic metres of biomethane, 20,000 tonnes of high-quality compost, and 16,000 tonnes of SSF annually. This, the company states, will save the environment emissions equivalent to 50,000 tonnes of CO2.

The future for Entsorga

Gian Francesco Galanzino adds: “The construction of a second digester began in January and is nearly complete. Start-up is set for the end of September, with the new digester expected to achieve design capacity (80,000 tpa of food waste) in early 2023.”

“Performance measurements for the first digester show a biogas production rate of 190 Sm3/h per tonne of input – significantly higher than the number reported in the scientific literature (145 Sm3/h), with 58 per cent methane. For investors and decision-makers, this is excellent news, meaning a speedier payoff on their investments and policies.”

“Looking to the future, we already have an impressive pipeline of projects in Italy, Europe, and the US. After COVID-19, we have seen a substantial increase in commitments and interest in sustainable waste management processes by companies, investors, and even in public opinion.

“Russia’s invasion of Ukraine has also inflated energy prices, focusing attention on the geopolitical issues associated with fuel imports,” adds Galanzino.

“The EU’s REPowerEU scheme sets out intentions to increase renewable natural gas production to 35 billion m3 by 2030, replacing up to 20 per cent of gas imports from Russia. Although this project is incredibly ambitious, we are up for the challenge – we have been preparing for it for the last 25 years.”

This feature was originally written by Resource Media for the Association for the REA's Organics Recycling and Biogas magazine. The Association for Renewable Energy and Clean Technology (REA) is the UK's largest renewable energy and clean technology body, representing around 550 member companies.