

A conceptual illustration of a floating island of earth. On the island, there are two industrial storage tanks. The larger tank in the foreground has the 'Waste 4 Generation' logo and tagline printed on it. To the left of the tanks, a glowing lightbulb is shown with a thin, white, smoke-like trail leading from it to the tanks, suggesting an idea or innovation. The background is a light grey gradient with a vertical green bar on the right side.

CASE STUDY 2

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A 5MW anaerobic digestion site based in the North of England, which due to a number of reasons was effectively ‘moth-balled’, operating on only a couple of tankers per week, with an electrical output average of less than 10% of targeted production.

The digesters were found to be highly contaminated with debris, rocks, and indigestible feedstock. We were brought in to try and get the process and biology back up and running on a minimal budget, where one of the other potential options was site closure.

Initial Investigation

- We started our initial investigation on behalf of our client in February 2019, the plant had been moth-balled for a number of months previously, and was left to slowly decline. The digesters were found to be completely stagnant and highly inhibited. There was significant contamination of the digesters, which meant the plant struggled with both feeding and with transfer between digesters as well as the pasteurisation system. The plant barely produced sufficient heat to both warm the digesters as well as pasteurise digestate, and so was running out of digester storage (pre-PAS), as pasteurising had been kept to an absolute minimum. The re-commissioning of this plant was conducted in two stages, between which the plant operator was managing the plant.

Phase 1

- Before we could consider ramping up production, we had to de-grit, screen and de-contaminate the digesters as this was preventing feeding and digester operation. This primarily involved a large scale screening unit to separate any unwanted material from these digesters from each of the inlets/outlets. The digesters were highly contaminated, and this screening programme removed considerable amounts of mango stones, rocks, bricks, other debris as well as tools.
- A methodical programme was put in place to keep the plant in operation whilst undertaking this screening programme.

Phase 2

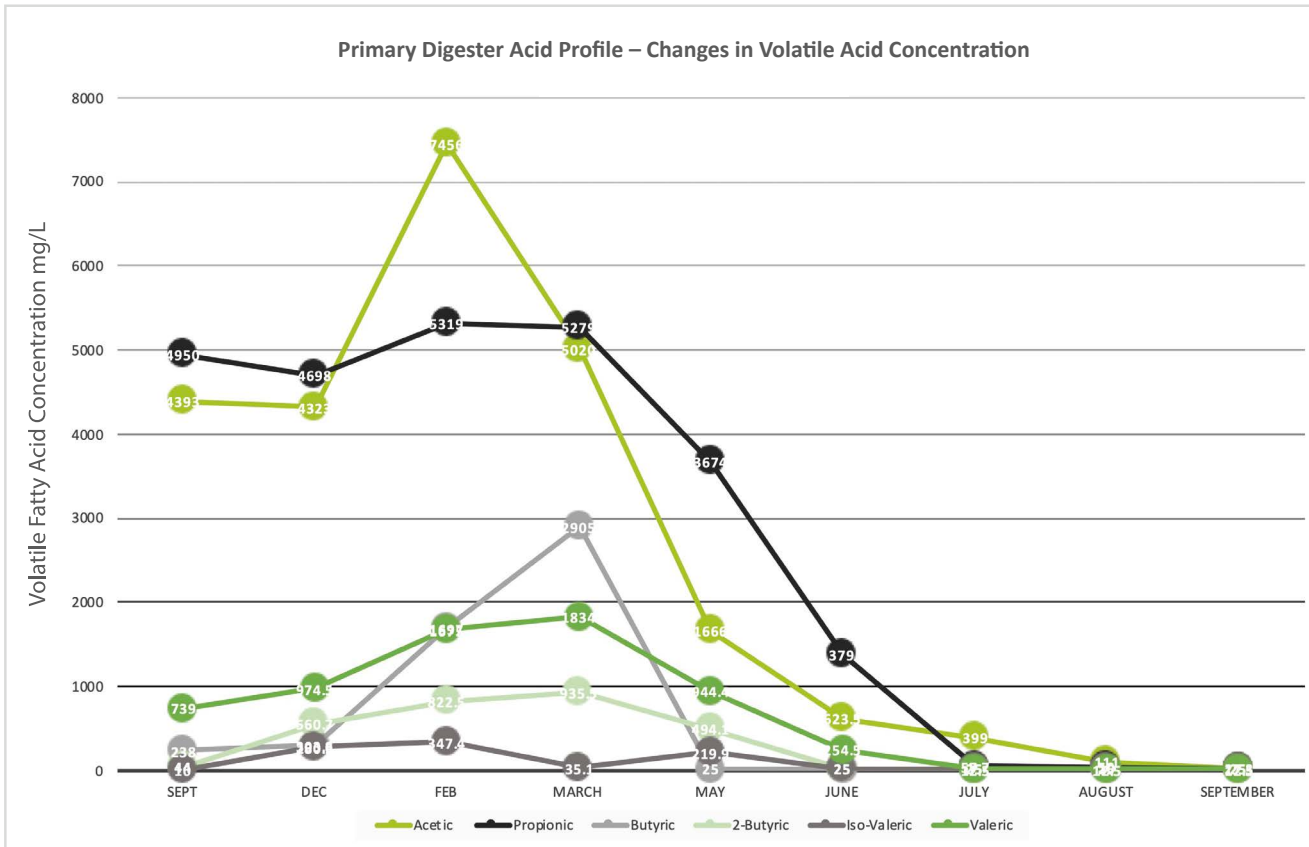
- After the digesters were de-contaminated, a few months later we were given the green light to begin a full re-seeding and re-commissioning programme. Unfortunately the progress gained in this initial re-seed struggled to be utilised by operators in addition to mechanical issues, and therefore a new re-seeding programme was scheduled for the following year, Feb-March 2020.
- Fresh digestate was brought in to supplement the digesters with healthy bugs, which could also assist with the breakdown of the long-chained fatty acids present, as well as helping to flush through the highly inhibited digestate from the primaries, to the secondary digester and out through the PAS. As we were extremely limited on operating capacity (both in storage space as well as available capacity for feeding), we decided to both feed and seed in parallel. Whilst this would take longer to bring both digesters back online, until we could produce sufficient gas production from the digesters (at the limited throughput), we were unable to pasteurise more which put a limit on re-seeding speed. However, as soon as gas production began to increase (due to the reduction in inhibitors as well as the new seeded digestate), we were able to then feed and seed in parallel, and quickly accelerate the process, ramping up gas production and electrical output.

Ramp-Up

- Following re-seeding we increased output towards 3.5MW, at which point we were restricted by engine availability (due to scheduled maintenance & repair works) as well as feedstock availability (COVID).

- De-contamination & screening program began June/- July 2019 in order to remove debris and contamination within the digesters, from historically poor quality feedstock and contaminants.
- The screening program was critical for the re-starting of the plant as contamination continued to block pumping, feeding & recirculation required for plant operation.
- Following the screening program, an initial re-seed of the digesters began in September/October 2019, where seed material was brought in from a sister plant.
- Progress gained by the re-seed was not utilised efficiently due to operator/mechanical issues.
- Feb - March 2020 began a new re-seeding program which proved highly successful.





The profile on this digester shows extremely inhibited digesters, with high levels of acetic and propionic acids being unable to be converted across.

Propionic acid itself is inhibitory to the digesters.

From the graph, you can see how the other long chained acids began to peak throughout the de-contamination program, as the digesters began to mix again and the settled digester contents began to mix through the whole of the digester operational capacity.

Concentrations of all the volatile acids were brought down, as the digester began to become healthier, and the bugs began to work efficiently, converting acids to biogas as quickly as the acids are being produced.

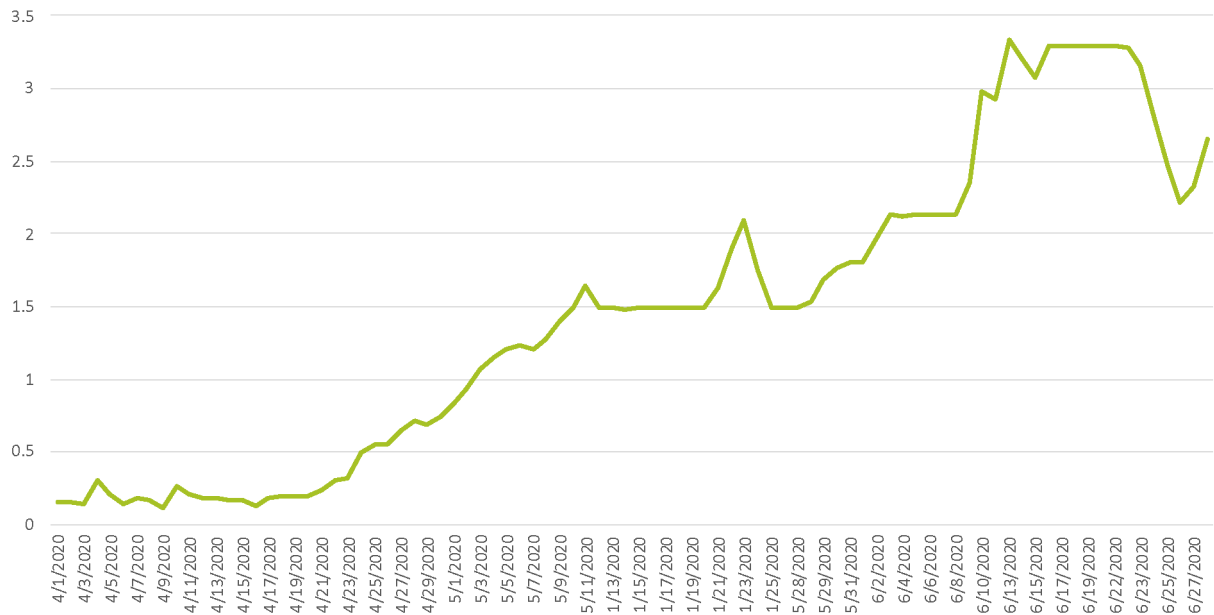
The retention time, feeding & loading rates, inhibition, nutrient deficiencies, mixing and feed composition were all reviewed and amended to provide ideal condition to achieve digesters in optimum condition

Plant Limitations

As well as the issues with contamination within the digesters, W4G have worked hard to overcome the following:

- Difficult & undesirable feedstocks
- Feedstock shortages & adjustments (Covid Related)
- Reduced de-sulphurisation capabilities
- Problems with solids feeding
- CHP maintenance & repairs.
- Other problems associated with ramping up plant & equipment which has been dormant for a considerable amount of time.





Steady & Continued Increases in Production

The increases in electrical production steadily increased following the de-gritting and re-seeding program, and we were able to effectively ramp up production in both a stable (and healthy manner).

There were dips in production associated with downtime and repair and plant and equipment, as shortage of feedstock during the start of the pandemic.