



**Managing sludge
with Advanced
Energy Recovery.**

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Sewage sludge is the essential solid by-product of the wastewater treatment process, but it's a valuable resource too. We treat sludge safely, and recycle it to land sustainably as biosolids. We also use sludge as a fuel to produce biogas to generate renewable electricity and reduce our reliance on energy imported from the grid. We're continuing to look for ways to increase our renewable energy generation, and for more sustainable and resilient ways to dispose of sludge.



Background.

A primary component of our activities around wastewater involves disposing of sludge in effective and sustainable ways.

Historically we've treated sludge to high standards using anaerobic digestion (AD). This produces biogas which can be used as a fuel in our combined heat and power (CHP) engines to generate renewable energy. This renewable energy is then used to run our largest sites, offsetting the need to import electricity and natural gas from the grid, and reducing carbon emissions.

- **Generated a record 289GWh of renewable electricity from sludge.**
- **Full scale pilot Advanced Energy Recovery plant to treat sewage from around 250,000 people.**
- **Predicted to extract over 80 per cent of available energy in sewage.**
- **Residual product is 84 per cent less than the volume of sludge entering the process.**

Increased generation from sludge.

A key change in the way we manage our sludge during the current AMP has been to move towards advanced digestion using the Thermal Hydrolysis Process (THP). Using THP before anaerobic digestion helps break down the organic matter in the sludge into more accessible (digestible) compounds for the microbes in the anaerobic digesters to utilise. The microbes use these compounds more efficiently, which results in more biogas production.

This has allowed us to make more efficient use of sludge by increasing the amount of biogas produced, and therefore increasing the amount of renewable electricity and heat generated. In addition to the renewable energy benefits of pre-treating sewage sludge with THP, it also reduces the amount of treated sludge which needs to be recycled to land.

Last year we renewably generated over 20 per cent of our overall electricity from sludge and biogas, but there's more we can do. As well as expanding our use of advanced digestion and THP, we're also piloting a full scale advanced energy recovery (AER) plant to treat sludge by means of pyrolysis. In addition to fuel gas, this produces a carbon-based and mineral-rich material as its final product.

Advanced Energy Recovery.

Located at our Crossness sewage treatment works, the full scale pilot AER plant will treat sewage from around 250,000 people. The AER plant uses pyrolysis and involves processing sludge at temperatures of up to around 800 degrees Celsius in close to atmospheric pressure, without any oxygen, to produce fuel gas that can be used in engines to produce electricity.

While pyrolysis isn't a new idea, the amount of energy needed to dry sewage sludge to prepare for the process used to be prohibitive. Now, as a result of innovative thinking, we've adapted Bucher press technology from the cider industry, to squeeze more water out of sewage sludge.

By combining pyrolysis with drying the sludge at low temperatures, the Bucher press and existing processes – anaerobic digestion, combined heat and power engines and thermal hydrolysis – it's likely that we can cut carbon emissions even further by using more heat from the CHP engines to dry sludge at the start of the process.

AER is still in its infancy, but we predict that when it's maximised to its full potential, we'll be able to extract around 80 per cent of the available energy that's left in sewage after conventional processes. We can then use this to power our operations.



Circular economy benefits.

By using this technology effectively, the volume of residue (called char) is also 84 per cent less than the volume of sludge entering the process.

Char is a carbon-based and mineral-rich material, and we hope we'll be able to recover even more nutrients, precious metals and carbon to contribute further to the circular economy.

Our ambition is to make AER technically and economically viable, and unlock many potential benefits for customers, the environment and the wastewater industry.

