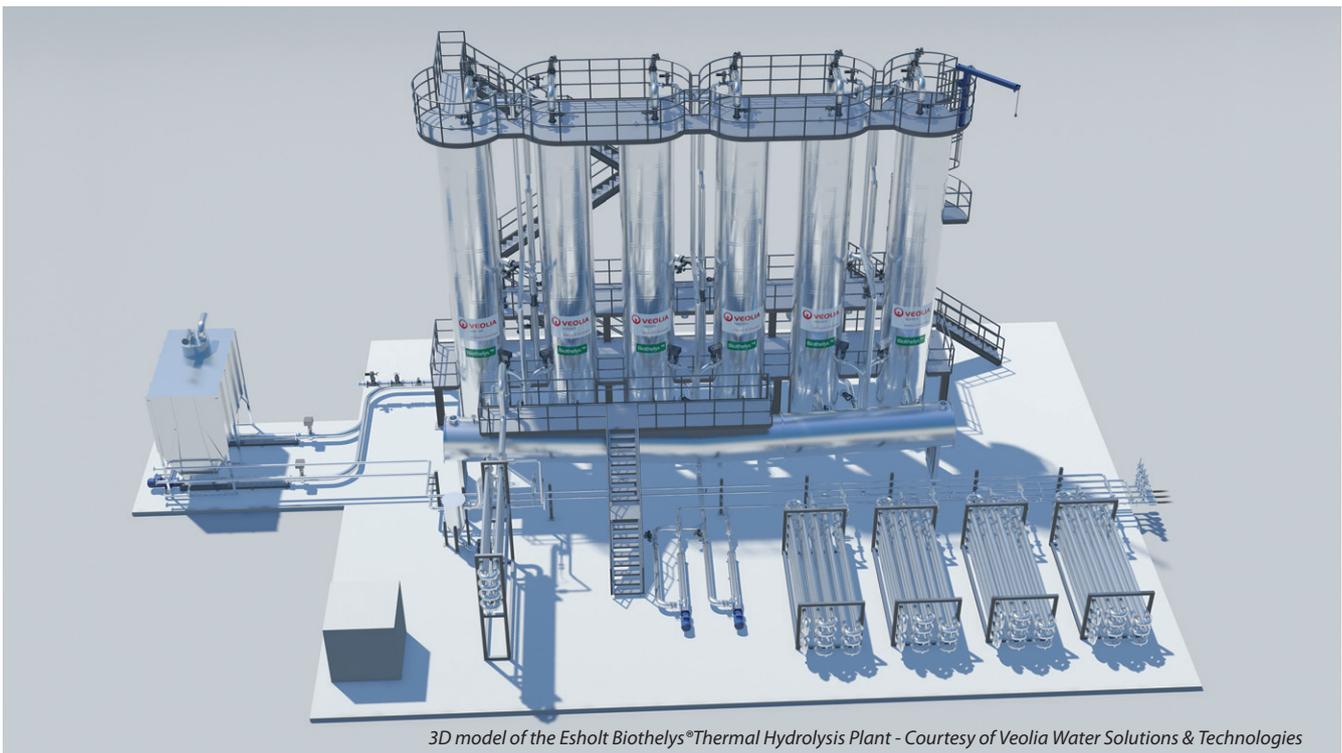


Esholt STW – Thermal Hydrolysis Plant

new process provides 'green' energy from sewage sludge

by Ray Tillier FCIWEM

Esholt STW serves a population equivalent of approximately 760,000 from Bradford and the surrounding area. The works comprises an inlet works, primary settlement, activated sludge, tertiary filtration together with digestion and incineration, which supports operations across the northern region. The plant treats around 28,000 tonnes of dry solids per annum (16,000 by digestion, 12,000 by incineration). Yorkshire Water (YW) is moving away from its reliance on incineration for the disposal of sewage sludge and towards its use for the production of 'green' electrical energy. The first stage of this process is the building of a Veolia Biothelys® thermal hydrolysis plant at Esholt STW.



3D model of the Esholt Biothelys® Thermal Hydrolysis Plant - Courtesy of Veolia Water Solutions & Technologies

What is thermal hydrolysis?

Thermal hydrolysis (TH) is a process which is used to pre-treat sewage sludge by the application of high temperature and pressure (i.e. 165°C and 6 bar) for a period of 30 minutes, prior to feeding to an anaerobic digestion plant.

Its effect is to disintegrate the cellular structure of the sludge into an easily digestible feed for anaerobic digestion. This results in a considerable increase in biogas yield, as well as producing a product which is classed as an 'Enhanced Treated Sludge', is free from Salmonella and where 99.9999% of the pathogens have been destroyed. This biosolids material is approved under the ADAS Safe Sludge Matrix for use as a fertiliser or soil conditioner for all crops including cereals, vegetables and salads as well as for horticultural applications.

The biogas produced by the anaerobic digestion process can be used to fuel a combined heat and power (CHP) plant or cleaned and injected directly into the national gas grid, thus providing a source of 'green energy'.

Thermal hydrolysis in Yorkshire Water

YW currently relies on the use of incineration for the disposal of nearly 40% of its wastewater sludge production. The incineration of

sewage sludge has traditionally been regarded as a reliable method of disposal when compared to restrictions to agricultural recycling.

However, YW has recognised that sludge which is produced by the sewage treatment process is a source of 'green energy' which will contribute to attaining its targets of carbon footprint reduction and sustainability, as well as reducing its overall energy costs. Also, the production of an enhanced treated sludge which results from the use of TH prior to digestion will ensure the security of YW's ultimate disposal route to agricultural land as a fertiliser/soil conditioner.

Esholt STW

Esholt STW was designated as the first of YW's works to use thermal hydrolysis with anaerobic digestion. The TH plant is designed to treat a nominal throughput of 30,000 tonnes dry solids (TDS) per year made up of sludge produced at the Esholt works itself, as well as imports from surrounding works.

Because Esholt is YW's first TH plant, Veolia Water Solutions & Technologies worked in close collaboration with both YW and its external technical advisers to produce Yorkshire Water's Thermal Hydrolysis Asset Standard. This was then used to compare and evaluate the alternative TH technologies at the subsequent tendering stage.

The Power of Sludge

Veolia technologies maximise biogas production and

optimise energy recovery

at wastewater treatment plants of all sizes

www.veoliawaterst.co.uk

Biothelys® thermal hydrolysis pre-treatment of sludge prior to anaerobic digestion, offering a flexible and safe solution for municipal and biological industrial sludge

- Increases biogas yield by more than 50%
- Produces enhanced treated sludge
- Existing digestion plant throughput doubled
- Reduces amount of sludge for final disposal

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Morgan Sindall/Grontmij Joint Venture, (MGJV), one of YW's large scheme delivery partners, was selected to deliver the overall £28 million Esholt scheme, which also includes the building of an additional anaerobic digester and new CHP plant, together with extensive modifications to the existing sludge handling facilities.

The contract for the Esholt TH plant was awarded to Veolia for its Biothelys® TH process following the submission of detailed tender proposals, together with extensive discussions and presentations. In addition to whole life cost, the selection process took into account factors such as the alignment of the cultures of the competing companies with those of YW and MGJV as well as their willingness to offer a plant which totally complied with the constraints of the site, rather than simply providing an 'off-the-shelf' solution.

The Biothelys® Thermal Hydrolysis Process

The Biothelys® TH process was originally developed independently by Veolia in the late 1990s for the treatment of surplus activated sludge, with the objective of producing a zero-sludge sewage treatment works. It subsequently underwent further development for the treatment of both primary and secondary sludges to provide the benefits of increased biogas production and an enhanced biosolids product.

A number of small Biothelys® TH plants with throughputs of between 1,000 and 2,000 TDS per year were built in France from 2004 to 2008, which fully demonstrated the capabilities and reliability of the process. This was followed, in 2009, by the award of the contract for the 10,200 TDS per year plant in Monza, Italy, which became fully operational in March 2011.

Other Veolia TH plants currently under construction are at Lille and Versailles in France, and Oxford in the UK, in addition to Esholt. When complete in 2013, the Esholt Thermal Hydrolysis facility will be the largest TH reference plant within the Veolia Group.

Advantages of the Biothelys® Process

In all TH processes, the actual 'cooking' of the sludge is identical, although the way in which it is achieved is different for each process. The Biothelys® TH system uses only two types of vessel; the reactors and the hydrolysed sludge buffer tank.

In the Biothelys® process, raw sludge is introduced directly into the reactor which eliminates a pumping stage. Biothelys® reactors operate in parallel pairs and the thermal energy from the flash steam is recovered from one reactor to its paired unit. There is no requirement for a separate mixing stage, thus eliminating the need for a recirculation pumping system. Treated sludge is transferred to the hydrolysed sludge buffer tank by the differential driving head and gravity (i.e. does not require a further pumping stage). Hydrolysed sludge is then continuously pumped from the hydrolysed sludge buffer tank to the anaerobic digestion plant.

Some TH processes use a radioactive method of measuring the sludge level in the reactor vessel. This is not necessary in the Biothelys® process, thus eliminating the precautions and procedures required for the use of radioactive isotopes.

The simpler design of the Biothelys® process therefore provides a system with both reduced capital and operating cost by using fewer vessels, pumps, valves and instrumentation.

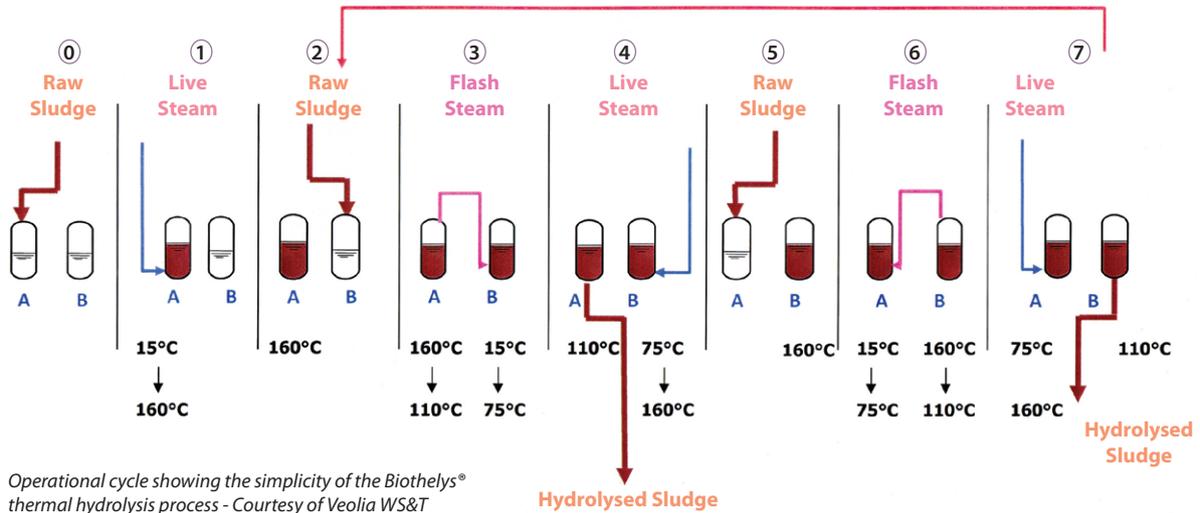
Operational support

In addition to the actual Biothelys® process at Esholt, Veolia will provide a commissioning and support team who will be responsible, in close liaison with Yorkshire Water's operations personnel, for overseeing the initial start-up of the plant to the point where it is consistently achieving its design output.

Since the thermal hydrolysis process is new to Yorkshire Water, Veolia recognise that enhanced levels of operational and process



Tank delivery - Courtesy of Veolia Water Solutions & Technologies



support may be required until their operation and maintenance staff are fully familiar with the new asset.

Veolia will tailor this level of support to suit YW's requirements and could range, for example, from periodic site visits to recommend any minor adjustment which might be required, right up to the provision of full time residential process support staff.

In addition, Veolia will set up a 24/7 hotline to provide a rapid response if required and will also provide remote monitoring of the plant at one of its Operational Control Centres at which authorised personnel will have the facility (password controlled) to monitor the performance of the plant and respond to any problems.

The future of thermal hydrolysis

Yorkshire Water is currently formulating its plan for investment

in the next five year AMP period, to understand the scope of the opportunity for additional investment in thermal hydrolysis.

A number of other UK water utilities have also recognised the benefits of the use of thermal hydrolysis prior to anaerobic digestion, and are in the process of adopting it either as a replacement for other treatment routes such as drying or incineration, or simply to take advantage of the energy benefits and security of sludge disposal which it provides.

Detailed design of the Esholt STWTH Plant commenced in Autumn 2011 and it will be fully operational by mid-2013.

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