Milton Keynes harnesses

Anglian Water's biosolids and energy plant in Milton Keynes has set new standards for anaerobic and delivery of the £16M sludge treatment centre, on behalf of Cambi

Anglian Water (AWS) serves around 5.6M wastewater customers. The region produces around 520,000tonnes of wet sludge per annum and AWS recycles more than 90% of its biosolids (treated sludge) to agriculture.

During 2005, AWS appointed consultant Mott MacDonald and two contractors – GTM (a joint venture between Galliford Try & Imtech Process) and Black & Veatch (B&V) to choose the optimum pre-treatment technology for sludge pasteurisation, and to build or upgrade the chosen treatment sites. The most significant factors in the exercise were capital cost, quantity of biosolids generated and operational costs. It quickly became apparent that utilising and maximising green energy generation would be a major driver in this project.

It was established that advanced digestion technology, as exemplified by the Cotton Valley Sludge Treatment Centre (STC) project in Milton Keynes, could both enhance biogas production and increase digester loading. Based on the original business plan, the decision for Cotton Valley would have had a simple pasteurisation system built processing 13,700tonnes of dry solids (TDS) per year of mainly indigenous sludge with a typical UK digester loading.

But the whole-life cost exercise showed that installing Cambi thermal hydrolysis process (THP) plant at the site, up-front of the existing digesters, gave best value when treating 20,618TDS of sludge as an enlarged STC. Cambi THP can enable digesters to operate at sustained 6kgVS/m³/day organic loading (average UK loading is about 2kgVS/m³/day), and can greatly increase the throughput of existing digesters.

The question changed from, "How cheaply can we make a class A cake?" to, "How much sludge can we digest efficiently in our existing digestion capacity?" In this case, the answer was 50% more than previously thought.

The other advantage of Cambi was that the THP process is proven to produce cake that is typically 8-12% points higher than cakes from other processes. Therefore the quantity of final biosolids would be no more than in the original design. The STC will treat indigenous primary and secondary sludge from Milton Keynes, plus liquid imports and raw cake from the surrounding area.

The new thermal hydrolysis plant at Cotton Valley Sludge Treatment Centre in Milton Keynes is ready for commissioning

The combined sludge then undergoes thermal hydrolysis pre-treatment at high temperature and pressure, prior to conventional mesophilic anaerobic digestion. The digested sludge is dewatered to cake and conveyed via dedicated conveyors to a storage bay.

Reaping the benefits

The Cambi process works by pressure cooking sludge cake in series of tanks to make a sterilised, non-viscous liquid at about 10% dry solids (DS) that can be fed directly to digesters. Steam is recycled within the process to reduce the overall heat requirement.

The system operates completely automatically, and requires daytime attendance for routine and preventative maintenance. Apart from increased digester loading rates, the other major advantage is that the nature of the digester feed sludge is completely changed, so dewatering is greatly improved and biogas production is increased.

The Cambi process is being used in 19 projects so far around the world, treating sludge from 8M people. The latest contracts in the UK are for Northumbrian Water's Bran Sands Regional STC (see *WWT* August 2007) and AWS's Whitlingham STC in Norwich, which will be built in 2008.

The number of contracts is expanding rapidly as existing projects are proving their worth. Operators are realising that the benefits of greatly reduced disposal quantities and more biogas energy more than repay the effort of adopting THP.

Two Cambi sites the project team visited were already operating at the high digester loading than the mark II Cotton Valley project required: Dublin Corporation's Ringsend wastewater treatment works (WwTW) and Thames Water's Chertsey WwTW. AWS, through its international company Celtic Anglian Water, is the operator of the Ringsend plant.

B&V was appointed to develop the STC project at Cotton Valley, having previously built Ringsend WwTW, the world's largest Cambi plant, which serves about 1.5M people. B&V and Cambi had worked together to overcome the challenges of this complex site.

the power of AD

digester (AD) output using thermal hydrolysis pre-treatment. **Keith Panter** reviews the development

The first reactor, which was prefabricated off site, is lifted into place

The sludge hopper is added to the processing facility

Paul Walley from Cambi UK explains: "The Cambi process has been in operation since 1996, but the Dublin project was by far the biggest and most complex undertaking at that time in 2000. As project manager for Ringsend, I was able to work with B&V and make some changes to the way the system operated.

"The biggest changes were in the choice of pump stator material and the way the sludge is cooled and recirculated in the digesters. The changes we made at Dublin are now standard in all new Cambi plants.

"Cambi UK now operates the THP plant at Chertsey as part of an incentivised contract for Thames Water. Sludge is imported from a wide area, mainly in Surrey, and includes a lot of secondary sludge.

"The Cotton Valley project is basically twice as big as Chertsey, but uses the same principles. Chertsey is now our test bed, and we have made further improvements to the system," says Walley.

Work in progress

"The Chertsey plant was designed to treat 8,000TDS per year, but we actually treat 10,000TDS per year and this is fed to two small digesters of 1,600m³ each. We make about 10,000m³ of biogas per day – that's about three times the average biogas production per volume of digestion compared to the rest of the UK," says Walley.

"We have been operating the plant for two years now, and we have only had two hours of unplanned downtime during that period. One other thing I was keen that we build into the Cotton Valley project was improved energy efficiency. We have built in the facility to reduce the quantity of steam used for hydrolysis by increasing the dry solids that can be fed to the system and the amount of pre-heating we can do.

"The other successful innovation from Chertsey we have built into the new plant at Cotton Valley is the ability to quench all process gasses into the digester feed. This means that the system is completely sealed and no odour control is needed," adds Walley.

Construction is now complete and commissioning is under way. The construction process was streamlined by pre-fabricating all major plant items in Cheshire, and bringing them to site as needed (as the photo sequence shows).

AWS programme manager Ian Turner says: "We feel vindicated in the collaborative approach we have taken. By harnessing the knowledge of our own people with consultants, contractors and suppliers, we have achieved a much better outcome for Anglian.

"We were able to successfully challenge our original design to deliver long-term benefits for our customers and the environment, as well as getting the best processes for producing the biosolids product we need. We have incentivised our contractors to give the best operational costs, as well as capital costs, and this has been done through real innovation.

Turner adds, "The solution we now have has given AWS a sustainable biosolids treatment process at lower whole-life cost than we had first predicted."

Cotton Valley Sludge Treatment Centre

- Installation of reception for liquid and cake sludge for 10,000TDS per year
- Addition of pre-digestion centrifuge dewatering, following 6mm screening, for all liquid sludge, including 10,500 dry tonnes of indigenous sludge
- New raw sludge cake silo for sludge blended to 16% DS – pre Cambi Thermal Hydrolysis Plant
- Installation of a 4-reactor Cambi THP and ancillary boiler plant – capacity 20,618TDS per year (with a peak capacity equivalent of 22,240TDS per year)
- Refurbishment of existing digesters and mixing systems (2 x 3750m³) – 11% DS feed at 14 days hydrolic retention time maximum
- Dewatering using existing centrifuges to make a pasteurised cake at greater than 30% DS to new cake pad
- Increase of digestion rate – about 60% organics conversion – new gas holder and gas train
- Upgrade of CHP (about 1MW extra) and addition of steam recovery plant to supply the bulk of the steam required for the THP