

# Converting Wastewater into Energy

Gaye Spencer, GSPR Environmental  
Tel: 01635 569992 • Email: [gaye.spencer@gspr.co.uk](mailto:gaye.spencer@gspr.co.uk) • Twitter: @gayespencer

Innovations in environmental technology are enabling water companies to become more efficient, more cost effective and to reduce their carbon emissions. Mark Neal of Saxlund International, states that by looking at the potential of sludge in a new way, it can be transformed from a costly overhead to a source of revenue.



Mark Neal, water specialist,  
Saxlund International



A Saxlund truck reception in Southern England

New AD facilities can be profitable and efficient, as well as environmentally friendly. Instead of thinking of sludge as a cost centre and something to be disposed of, many water companies are deciding that generating gas from sludge at large water treatment sites (hubs) and transporting sludge from smaller treatment works (satellites) to these hubs will be the model of the future, as they provide greater economy of scale. As part of these sludge treatment improvement facilities, innovative water companies are applying Anaerobic Digestion and Thermal Hydrolysis infrastructures to turn sludge from a previous overhead into a profit - as well as minimising their organisation's impact on the environment.

## 75% Reduction in Cake Transport and Storage Costs

New cake handling systems can reduce costs by 75%. By dewatering sludge, for example through centrifuge or belt press, slurry of circa 6% DS can be dewatered into cake comprising 22% DS, ie representing a 4:1 reduction in volume. This means 1 truck could potentially be used instead of 4 for the equivalent mass (without water). This represents a potential saving in haulage and storage costs of up to 75%. Dewatering is a process efficiency which makes the sludge more friable, stable, safer and easier to transport and store.

## Sludge Drying Processes

Several sludge drying options are available: conical/cylindrical solid bowl centrifuges have large liquid capacities and can deal with more concentrated sludge. Their continuous rotation results in centrifugal force to separate out higher density solids. An alternative option is the belt press filter which compresses sludge cake between two belts and passes it over rollers to exert pressure on the cake, forcing out liquids. Other drying solutions are also available.

## Silo Storage Systems

Once dewatered, the cake can be transported to be stored in silos. The choice of storage systems is important for three main reasons: firstly, security is important to prevent the risk of FOD (foreign object) contamination. Secondly the infeed system (pumped or chain) has an effect on sludge consistency in terms of handling. Thirdly the storage system must be large enough to accommodate up to four days' fill, taking account of reduced manpower over four-day-long bank holiday weekends. It is worth noting that while cheaper systems are available, these may compromise safety: silos have been known to collapse when they cannot properly contain the weight of the sludge.

The more recent silo storage systems that replace hook lift containers are more efficient in construction and operation. They can fill larger rigid trucks or articulated tipper trailers. Larger truck loading silos and truck reception silos enable greater volumes to be handled, reducing the waiting time for a truck delivery and the number of return trips required. A quick turnaround relieves truck operators from unnecessary demurrage (loading charges) and blockage costs. 'Tip and go' trucks have definite benefits against shovel loaders, albeit that consideration needs to be given to the effect of large loads on the discharge method. Inclined receptions need a high torque to move the

equivalent rigid/ articulated load. There is also the reduced cost of container rental and shunting (particularly over public holidays) as a larger standard lorry can service more locations during normal working times. Truck Loading Silos (TLS) offer a quicker turnaround (an estimated 15 minutes loading as opposed to a 30+ minutes shunting time) and reduce physical strain on drivers, who remain in their cabs during loading. They also reduce odour, as silos are odour controlled whereas hook lift containers are only covered. Importantly, they also minimize the risk of contamination from foreign objects which can damage pumps and cause narrow restrictions in downstream plant.

## Discharge and Conveying Solutions

Ideally sludge should be discharged on a 'first in first out' basis - important in handling materials with a shelf-life. A sliding frame mechanism is used to undercut the full section of the contents of the silo to prime a screw trough. Since the whole section is undercut, the pile section discharge is termed "mass-flow" (like laminar flow in a pipe) from the silo. This gives a homogenous discharge to the next process. Such a constant, precisely metered volumetric flow is critical to AD and thermal hydrolysis systems. This requires properly engineered solutions that take account of the materials' non-free flowing properties.

Friable sludge (free from foreign objects), handled without excessive force and with an accurate DS (%) is what the advanced AD operator needs to manage the optimum performance of the digester. The thermal hydrolysis process involves heating sludge to destroy any pathogens and degrading cell structures to create better flowing, good quality sludge which makes it easier for bacteria to digest and to produce methane.

## Cost Savings

In order to maintain economy-of-scale efficiencies in advanced anaerobic digestion at each hub, indigenous waste needs to be topped-up, which means transferring sludge from satellite sites to central hubs. Anglian Water and United Utilities both chose to dewater their sludge to reduce the cost of transporting water so choosing "trailed cake @ 22%" dry solids instead of "tankered wet @ 6% solids." This choice means they use one truck instead of four, so saving transport costs of up to 75%. Although specific figures are not available, we understand the cost saving is largely determined by distance and load volumes from satellite sites. Typically, the saving through sludge cake optimization is around £10,000 to £17,000 per month for a 100m<sup>3</sup> truck loading silo compared with an existing 2-3 RORO container system. And around £27,000 per month for a 240m<sup>3</sup> truck loading silo.

## The Right Technical, environmental and economic solution

It is essential for water companies to select the right technical, environmental and economic solution,



*Truck loading Saxlund system for waste water*



*Saxlund Truck loading silo*



*Saxlund Sludge cake handling system*

not only for their current requirements but for their anticipated future needs. Extensive experience and a full understanding of the processes and risks in this industry - such as the ability to foresee potential issues and to resolve them before they become a real problem - are essential. It's also important for an industry partner to provide a complete, end-to-end quality solution for sludge storage and handling which includes design and construction, commissioning and maintenance.

Anglian Water is one of many organisations to become more efficient and more cost effective, whilst reducing its carbon emissions through its investment in environmental technology:

## Case Study: Anglian Water

Anglian Water supplies water and water recycling services to over 6m domestic and business customers across a 27,500 km<sup>2</sup> area. The organisation provides almost 1.2 billion litres of water per day, making it the largest water and water recycling company in England and Wales by geographical area.

Anglian Water needed to meet Ofwat's obligation for it to provide enhanced digestion for 80% of its raw sludge production and to increase total renewable electricity output from biogas to 86.8GWh/year by 2015.

In considering its choice of technology - and its technology partner - Anglian Water sought tried and tested, robust solutions for storing increasing volumes of sludge at the satellite sites that feed its Colchester, Cliff Quay and Pyewipe hubs.

As part of a multi-million pound anaerobic digestion (AD) scheme, Saxlund completed a series of projects for Anglian Water in 2014. The projects included the construction of raised storage silos, specially designed to allow de-watered sludge to be directly loaded into trucks below for transportation off site. This new technology enables a much faster reception with less odour and less risk of contamination by foreign objects which could cause damage to plant and equipment or blockages downstream.

The flat bottomed silos incorporate Saxlund's industry-leading sliding frame technology to ensure a consistent, precisely metered volumetric discharge of material that is non-free-flowing and difficult to handle. Sludge cake is discharged via integrated sludge pumps into a process feed silo and into a Thermal Hydrolysis process using robust screw conveyors that require minimal maintenance. Integrated control systems enable remote monitoring to ensure the consistent flow which is critical to ensure optimal performance of the AD and thermal hydrolysis systems. Saxlund's systems are specifically designed for storing and discharging sludge and sludge cake and have been tried and tested in hundreds of installations across the UK and Europe.