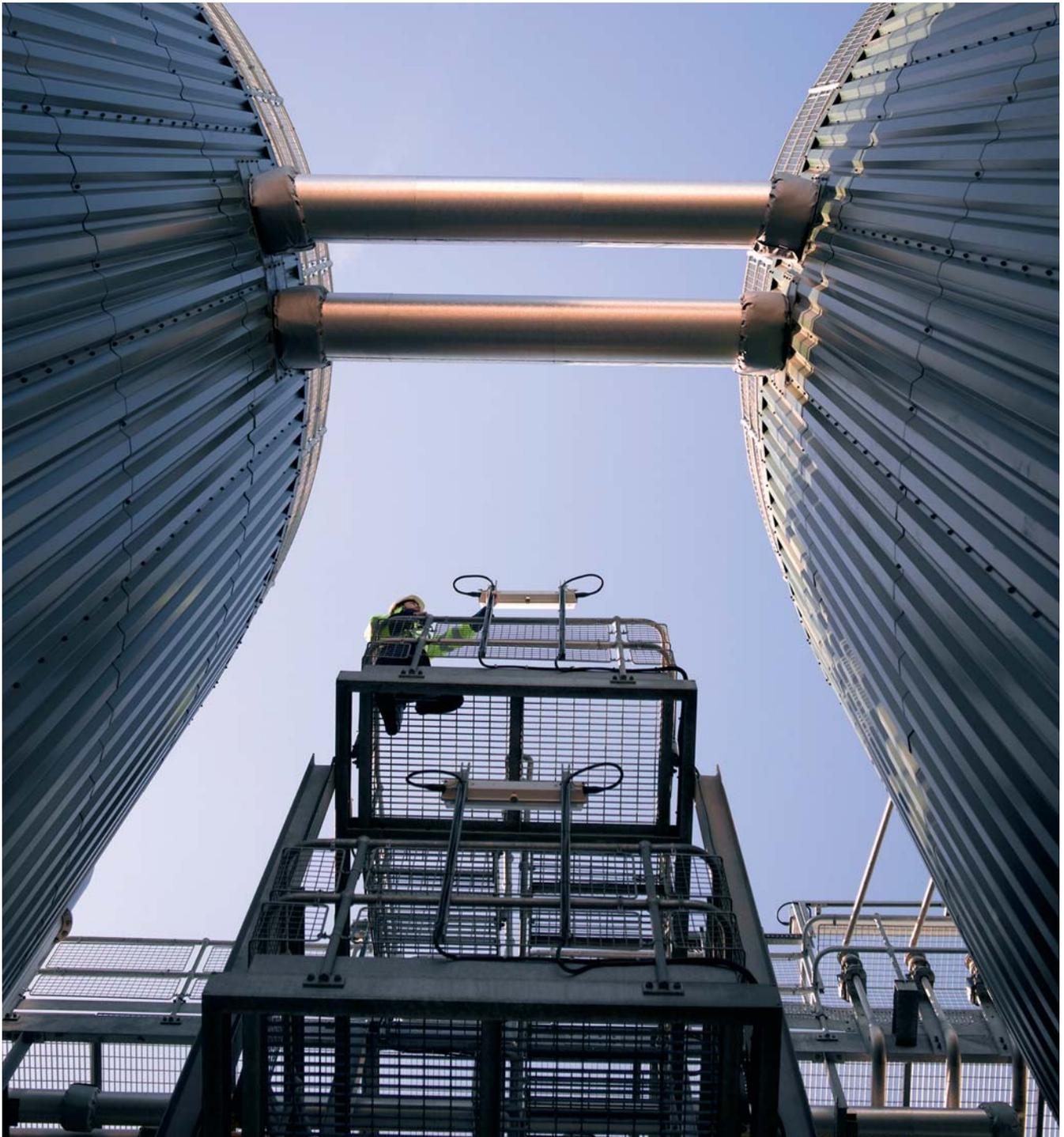


Bristol (Avonmouth) STW

£35m scheme increases electrical self generation at sludge centre

by David Jones

The implementation of the EU Nitrates Directive will reduce land application rates of compliant treated sewage sludge. Together with competitive pressures from other utilities, it will become more difficult to dispose of sludge to land within an economic and sustainable transportation radius of Wessex Water's Bristol STW. Work by ADAS has confirmed that the future position is not tenable and a sustainable alternative to agricultural outlets is required for a significant proportion of the sludge produced in the Bristol area. In December 2004, OFWAT approved funding for a solution to this need under the Nitrates Directive quality driver, with a target completion date of 31 December 2009.



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Wessex Water has adopted a strategy to increase electrical self-generation capacity through sustainable routes, recognising the impact on its business of the dramatic increase in energy costs. To deliver the objectives at the Bristol STW, the Board of Directors approved a £35 million scheme, with the aim to generate in excess of 3.9MW at the Avonmouth site.

Bristol STW at Avonmouth is Wessex Water's largest sludge treatment centre, managing approximately 50% of the company's total sludge make to a compliant standard through lime treatment and digestion. It serves around one million people in the Bristol area.

Wessex Engineering Construction Services (WECS) was asked to deliver the Scheme under a series of phases.

Phase 1 - Enhanced Digestion

Phase 1 consisted of the delivery of an Acid Phase Digestion (APD) process installed upstream of the existing 6 No. Mesophilic Digesters. The biogas output from the combined processes was to deliver 2.9MW through the existing CHP engines.

The APD process was to produce an increase in biogas volume from 22,000m³/day to 33,000m³/day when processing 84tDS/day of sludge. Sludge temperatures were to be raised to and maintained at 42°C. The acid phase takes place in 6 No. reactor Vessels.

The design of the APD process was carried out by a specialist process consultant. The system at Avonmouth represents a two fold increase in size to that previously provided by the consultant at the time of design. Design of civils, supporting sludge thickening equipment, pumping systems and M & E works were completed by Wessex Water's design consultant.

The construction works consisted of a new across site twin main to feed raw sludge to a buffer tank set on a piled reinforced concrete base. Three Gravity Belt Thickeners and associated sludge feed and thickened sludge delivery pumps were installed on a large reinforced concrete base to deliver sludge from the buffer tank to the Reactor Vessels. The Gravity Belt Thickeners were to thicken the sludge to 6.5%.

The six reactor vessels were nominally 8.5m dia x 13m high constructed of glass coated steel panels. The vessels were erected on piled reinforced concrete bases.



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New feed pumps and a new overhead pipeline were installed to feed the sludge from the vessels to the six Mesophilic digesters. The biogas from the digesters was fed to the existing CHP's via a new overhead gas supplied under the project. A dedicated MCC and PLC were provided to control the whole installation.

Phase 2 - Secondary Digester Upgrade

Phase 2 is to consist of the conversion of four concrete holding tanks to mesophilic digesters. Each tank is of nominal 20m in diameter. On completion the commissioned installation an additional 1 MW of electricity will be generated through the biogas generated from the digestion process.

The design for this phase of work was completed by Wessex Water's nominated design consultants. The construction works are now underway with a scheduled completion for December 2008 and the digesters to be commissioned by June 2009.

The scope of the scheme will include the draining down of four secondary holding tanks and two forwarding tanks. These tanks will be inspected and remedial works completed as necessary.

A new common sludge tank is to be constructed of glass coated steel panels erected on a piled reinforced concrete base. Sludge will be fed to the tank via an across site pipeline. Sludge will be fed from the tank to the four secondary tanks via new pump sets and new overhead pipelines.

The secondary tanks will each have a new glass coated steel roof erected on them to retain the biogas produced from the digestion process. New heat exchangers to heat the incoming sludge will be provided. New mixing system will be installed.

Forwarding tanks will be upgraded with new mixing systems and new sludge forwarding pumps.

PHASE 3

Phase 3 will consist of the installation of a new belt drier to dry sludge to 92% dry. The dried sludge will be disposed of as a fuel to a third party. This will reduce the volume of land being disposed to land. A standby drum drier will be provided and located in an existing building.

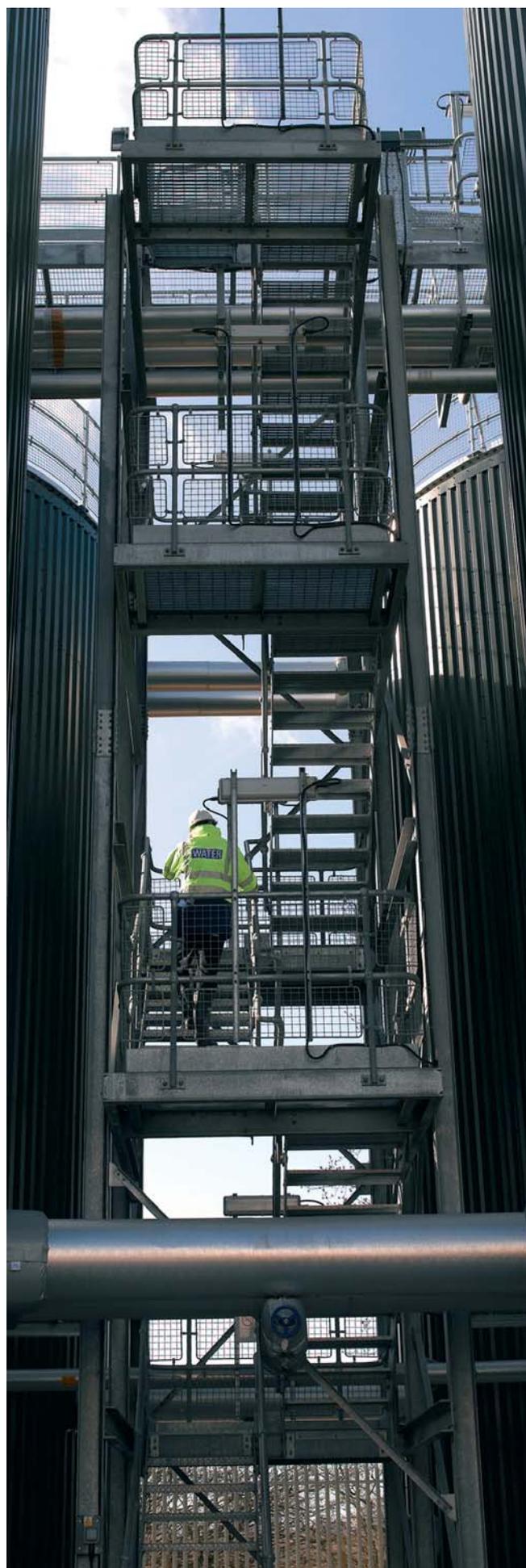
The belt drier will be run using mostly waste heat from the five CHP engines making it an efficient way of drying sludge. Waste heat from the exhausts of the engines at temperatures in excess of 500°C will be passed through waste heat boilers. The boilers will produce steam to supply the belt drier at six bar and 158°C. The belt drier will be installed in a new building and will share a pair of final product silos with the standby drum drier. Dried sludge will be supplied to the silo's using pneumatic conveying systems. The product from the silos will be loaded in to lorries for transportation to the third party.

The low grade heat from the CHP engines is used to provide hot water to heat the APD plant and the digesters. The standby drum drier is already in construction and the major components already installed.

Progress to date

Phase 1 was delivered to budget and the construction works completed on programme. The commissioning of the complex scheme provided the project and commissioning teams with many challenges, but it has now successfully delivered the 2.9MW electrical energy required of the phase.

Note; The Editor & Publishers wish to thank David Jones, Contracts Manager with Wessex Engineering & Construction Services for preparing the above article for publication. ■



Bristol (Avonmouth) courtesy Wessex Engineering & Construction Services