

Energy From Waste, Yorkshire, UK

Industrial | Case Study (Issue 5/final version/10 April 2017)

The Client

Ferrybridge Multifuel 1 (FM1) is a £300 million power generation plant at Ferrybridge in West Yorkshire. It is owned and operated by Multifuel Energy Ltd, a joint venture between SSE plc and Wheelabrator Technologies Inc. FM1 can produce around 68MW of low carbon electricity using a range of fuels including up to 675,000 tonnes per year of waste-derived fuels from various sources of municipal solid waste, commercial and industrial waste and waste wood.



Main contractor Hitachi Zosen Inova (HZI) began construction in October 2012 and the plant became fully operational in July 2015.

Key Figures

- <math><0.1\mu\text{S}</math> conductivity make-up water
- 12m³/h peak demand

The Client's Needs

Incoming waste is transferred to a bunker from which it is fed to the combustion zone of a 5-pass high pressure boiler to raise steam to power a turbine generator. Make-up water for the boiler has to meet a very high quality specification:

- conductivity <math><0.1\mu\text{S}/\text{cm}</math>
- silica <math><5\mu\text{g}/\text{kg SiO}_2</math>
- dissolved organic carbon <math><0.1\mu\text{g}/\text{kg}</math>



The make-up water treatment plant was specified to produce a normal output of 8m³/h of high purity water with a peak flow of 12m³/h from an on-site borehole source supplemented as necessary by mains water. It was to minimise chemical consumption and the need for effluent neutralisation and to comply with HZI's high standards of engineering. HZI awarded the design and build contract for the water treatment plant to Veolia Water Technologies.

The Solution

Veolia's solution was to custom design a system based on packaged skid mounted equipment to reduce the site installation time on site, whilst complying with the Hitachi Engineering specifications. In order to meet environmental goals the process uses chemical-free membrane technologies – reverse osmosis (RO) followed by Continuous Electro De-Ionisation (CEDI) – and mixed bed polishing cylinders that are regenerated off-site at infrequent intervals.

Process Description

The treatment plant consists of two streams each designed for an output flow of 8m³/h. Under normal operating conditions, one stream is in service with the other in standby but with automatically cycled changeover to ensure that both streams are active throughout the day. Both streams are also able to operate in parallel to provide an output peak make-up flow of 12m³/hr, if required. The two water supplies are mixed in a buffer tank and pumped to duty/standby XL360/1000 softeners each capable of supplying both deionisation streams.

Primary deionisation uses MegaRO reverse osmosis units (one per stream) which remove up to 98% of dissolved inorganics and over 99% of dissolved organics, colloids and particles. They operate at a recovery of 75%, with a permeate flow of 8.6m³/h going forward to a CEDI-VNX 50-2 continuous electro-deionisation (CEDI) unit where it passes through a bank of ion selective membranes and ion exchange resins. At the same time, a small electrical current is passed across the stacks. The resulting high purity water is pumped to two, non-regenerable, exchangeable IHF Mixed Bed Cylinders for final polishing to ensure that the total silica specification is maintained regardless of any variations in the raw water analysis. Conductivity is monitored on the downstream common outlet and once exhausted the IHF are replaced and the exhausted ones would be returned to Veolia's Stoke-on-Trent facility for regeneration.

A central motor control centre with a control section housing a Siemens S7-300 PLC and HMI distributes power and controls the complete system and provides a Profibus DP communication link to interface with the site Building Management and Distributed Control systems.

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