

Rainwater harvesting solution helps E.ON Castleford recover and recycle water, UK

Power | Case Study

The Client

E.ON is one of the UK's leading power and gas companies, generating about 10% of the UK's electricity needs. Typical of their generating plants is Castleford which produces 56MWe.

The plant was originally built as a Combined Heat and Power plant but was reconfigured by E.ON to operate as a stand-alone Combined Cycle Gas Turbine (CCGT) power station.

In May 2011, E.ON completed an innovative project at Castleford to reduce water consumption and produce greener energy.

Key Figures

- 45 bar boiler
- 100m³ /day of make-up water
- Opportunity to reuse water and minimize discharge
- £153K investment
- ROI within 3 years

The Client's Needs

Castleford has a single General Electric LM6000PD 43MWe gas turbine exhausting via a bypass stack into a waste heat recovery boiler. The boiler produces steam to drive a 13MWe condensing steam turbine with steam extraction to provide additional operational flexibility by meeting variations in steam loads and the capacity for additional electricity generation.

The plant is designed to be both highly fuel efficient and environmentally friendly. The boiler operates at 45bar and needs up to 100m³/day of very high purity make-up water. That make-up water used to be produced from mains water by an on-site ion exchange demineralisation plant.

Originally all the surface water drainage and rainwater was combined with the boiler blowdown and ion exchange waste water and neutralised prior to discharge as effluent. Mains water is expensive and, increasingly, in short supply, so E.ON's engineers were keen to recover this water and recycle it as make-up to the boiler system. They asked Veolia Water Technologies for help.

The Solution

Veolia Water Technologies's solution was a two-stage membrane water purification system with a capacity to produce up to 5m³/h of high purity water. The treatment process consists of reverse osmosis followed by continuous electro-deionisation (CEDI). In reverse osmosis, water is passed through a semi-permeable membrane which removes around 97% of the dissolved salts.



Process Description

CEDI is a polishing process that combines ion-selective membranes and ion exchange resins to further purify the water, removing the remaining dissolved salts, including silica, to trace levels. CEDI achieves “mixed bed” water quality (better than 0.2µS/cm conductivity with less than 10µg/l of silica) without the use of regeneration chemicals, and the Castleford plant is the first of its kind in the UK power generation industry to use this technology.

In order to minimise site construction time and avoid a prolonged shutdown as the existing ion exchange plant was decommissioned and the new plant commissioned, Veolia Water Technologies built the MegaRO™ reverse osmosis and Ionpro CEDI units in a container.

The plant was pre-commissioned at works then delivered to site and simply connected up to the recovered water tank and the boiler feed tank. The recovered water tank collects the harvested rainwater and process wastewaters, but there is also an emergency mains water back-up. The MegaRO™ uses the latest generation of energy efficient low pressure reverse osmosis membranes and a variable speed drive motor for the MegaRO™ feed pump, ensuring that power consumption is minimised whatever the required flow.



The Benefit

Surface run-off and process wastewater which previously had to be treated and discharged to sewer is now recycled to produce demineralised boiler make-up water. This means that Castleford is largely self sufficient for process water.

It also improves the plant's environmental footprint, minimising the consumption of mains water, eliminating the old ion exchange demineralisation plant with its regeneration chemicals and reducing effluent discharge. It also makes economic sense. The savings accrued by these reductions means that E.ON anticipates a payback within three years.

AQUAservice

- **3 year service agreement**
- **Ensures plant operates at peak efficiency**
- **Includes maintenance & 24 hour emergency response, from ELGA Process Water's service team**