

Water Reuse Helps White Energy Save Over \$200,000 per Year

Application: Wastewater reuse, cooling tower and boiler chemical treatment

Location: Russell, Kansas, USA

Capacity: 150 gpm (34 m³/hr)

Commissioned: February, 2006

Challenge

Global ethanol production continues to increase, with the United States producing about six billion gallons of this alternative fuel source in 2006. Dozens of new ethanol plants are under construction in the United States and the new facilities will more than double production capacity by 2009.

White Energy's Russell, Kansas plant has been producing about 40 million gallons (151,000 m³) of ethanol per year since 2001. The plant plays an important role in helping the United States achieve its 2007 "Twenty in Ten" goal, which aims to replace 20 percent of the nation's gasoline use with ethanol over the next decade.

White Energy's plant, like most ethanol facilities in the United States, is located in the nation's mid-west where it is in close proximity to the milo, sorghum and corn plants that provide the primary ingredients for ethanol production.

But in addition to the feedstock, a large amount of water is also needed to convert the biomass into ethanol. White Energy's Russell, Kansas plant draws as much as 600,000 gallons (2,271 m³) of water per day from the municipal supply—about a third of the total daily water requirements for this small community of 4,200 people.

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As the city confronted an extended drought during 2006, White Energy, along with the City of Russell, began working together to find ways to reuse water and reduce the plant's use of increasingly limited municipal water supplies.

Solution

White Energy had forged a trusted relationship with GE Water & Process Technologies through a long-standing agreement that outsourced the chemical treatment of its boilers, cooling towers and onsite wastewater systems. GE's broad portfolio offered White Energy the opportunity to create an integrated water reuse and chemical treatment strategy that could not only help the ethanol producer recycle water, but also reduce operating costs and yield environmental benefits.

GE's team proposed a water reuse solution that would recover wastewater from the ethanol production process and recycle the treated effluent as makeup water for the plant's cooling towers.

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CS1287EN.doc Sep-08



Within nine months, the team had completed pilot testing, design, construction and commissioning of the water reuse system, and by August, 2006 the system was fully operational.

The multi-step process incorporates ultrafiltration pretreatment to first remove virtually all suspended solids from the waste stream. Next GE reverse osmosis (RO) membranes filter dissolved contaminants; producing high quality effluent that is reused within the plant's cooling towers.

A second GE RO system was also installed to produce high quality boiler feedwater.

Results

In January, 2008, GE awarded White Energy an ecomagination leadership award in recognition of its industry-leading achievements in water and energy savings.

White Energy's water reuse system recycles an average of 122,000 gallons (462 m³) of per day. This reduces the plant's annual water consumption by about 43 million gallons (163,000 m³)—enough water to meet the annual water needs of 600 US homes. It also reduces the plant's annual water costs by more than \$200,000.

The concentrate from the wastewater RO system is also reused, providing water for the plant's carbon dioxide scrubber system.

Significant savings are produced by the second RO system, which removes dissolved solids from the feedwater and reduces boiler blowdown by more than six times—from 16 gallons (60.5 liters) to just 2.5 gallons (9.5 liters) per minute. Reducing the amount of makeup water that needs to be heated in the boilers enables White Energy to save more than \$60,000 in annual energy costs. The concentrate from the RO system is also recovered, and reused in cooling towers.

The improvement in feedwater quality, combined with increased boiler cycles dramatically reduced the use of anti-scalants in the boilers, lowering costs by almost \$30,000 annually.

GE also worked with White Energy to capture waste steam from the boilers, directing it to a heat exchanger that transferred the heat to the feedwater. This not only saved energy, but also helped to boost water temperature to a level that enabled the boiler to operate at maximum efficiency.