



## ***Kent County's Heat-Recovery Energy System Puts Wastewater Facility on Path to Energy Independence***

### **Project Statistics**

County: Kent County, Delaware

Project Scope: Heat Recovery Water Heating System to be installed at Wastewater Facility

Project Cost: \$699,000 (\$381,000 from EECBG allocation; \$287,400 additional funds leveraged)

Completion Time: To be completed Summer 2011; Plans currently being finalized; 4 months of construction

Contractor: Most work performed internally

### **Overview**

Kent County's Department of Public Works plans to replace the existing HVAC System in the two administration buildings located at the Kent County Regional Wastewater Treatment Facility with a more efficient wastewater energy exchange process.

### **Challenge**

Kent County is seeking to establish the county wastewater facility as energy independent. In 2006, the county worked with Constellation Energy to obtain a state grant to study the feasibility of the wastewater facility functioning as a "renewable energy park." County staff decided that the facility would become energy independent and began researching wind, solar, biomass, and hydropower options.

### **Solution**

Instead of using more conventional ground-source geothermal heating, Kent chose to use the plant's wastewater effluent as the heat-sink, or geofluid, for the water source heat pumps. The temperature of the effluent, which varies between 55 and 75° F (over the course of the year), makes it a good heat sink for the pump system. On average, the heat pumps will process approximately 11 million gallons of water per day, or 7,600 gallons per minute. Two 10 million gallon vats will be set up near a heat exchanger, which will take heat or cool the wastewater.

1. Heat is exchanged to (cooling) or from (heating) the Condensing Loop by the heat pump.
2. The heat pump transfers heat to or from the air in the building through the evaporator.
3. Heat transfer is performed by an air-to-refrigerator coil or heat exchanger (Evaporator). Depending on whether the unit is heating or cooling, the coil will either extract energy from or inject energy into the condenser loop.
4. The condenser, a refrigerant-to-water coil (Heat Exchanger), then transfers heat from the refrigerant to the water distribution loop.

## Heat-Recovery Water Heating

The U.S. Department of Energy (DOE) estimates that the equivalent of 235 billion kWh worth of hot water is discarded annually through drains, and a large portion of this energy is in fact recoverable. This normally wasted energy source can be a viable renewable energy source for county facilities. Counties can consider heat-recovery water heating when adding or replacing large heating or air-conditioning equipment.

Heat recovery is the capture of energy contained in fluids or gases that would otherwise be lost from a facility. Heat sources can include heat pumps, chillers, steam pipes, and wastewater drain lines. There are two basic requirements for heat-recovery water heating (HRWH): (1) hot water demand must be great enough to justify equipment and maintenance costs, and (2) the waste heat temperature must be high enough to serve as a useful heat source. Large facilities, like hospitals and military bases, are good candidates for HRWH due to their available waste heat and demand for hot water.

Designs are presently being finalized. The County will go to bid between November and December of 2010 and begin construction April of 2011.

## Other Activities at Wastewater Facility

In addition to the EECBG supported project, there are several other energy efficiency projects in process at Kent County's Wastewater Facility.

The facility already features photovoltaic solar panels. The heat exchangers for the chlorine gas system will be converted to ultra-violet.

Passive solar hot water heaters are being used to heat greenhouses where bio-solids are dried. Currently, 1/3 of bio-solids are being dried using this process, and eventually, the county will shift toward treating all bio-solids in that way. Delaware placed their EECBG allocation into the state's revolving loan fund, and Kent obtained funding for the bio-solid project from that fund.

Kent County continues to research other opportunities for renewable energy generation, including solar, wind, and biomass. The county has been monitoring wind since 2004, but is waiting for wind energy technologies to progress before tapping into that resource. Due to elevation, hydropower may not generate enough power to justify investment. Likewise, biomass would require a \$10M investment in an anaerobic digester and operational resources, an investment that the county isn't equipped to make currently.

### County Benefits

This project resulted in:

- 700,000 kilowatt hours energy saved
- 503 CO<sub>2</sub>e GHG reduction
- Reduced reliance on traditional energy sources
- Creation of 10 jobs

## Public Outreach

Public forums about the wastewater treatment projects were organized by the County's Levy Court. Press releases and public service announcements provided additional information to the community about the projects. The Public Works staff will host an Open House as projects near completion.

## On-going Measurement & Verification

Since retrofits at the wastewater facility involve both active and passive solar projects, measuring energy savings from particular upgrades will not be a straight-forward process. The county will use a building-wide meter and engineering estimates to document reductions.

"This project is designed to reduce our GHG footprint and our reliance on traditional energy sources to heat and cool the building."

*- Jim Newton, Environmental Program Manager, Kent County, Delaware*

## Lessons Learned

Kent County staff note that counties should make liberal time estimations when developing their work plans. Kent County found that, at times, projects were significantly held up in the engineering phase.

## Links

<http://www.co.kent.de.us/Departments/PublicWorks/WWTPConstructionPrgress.htm>