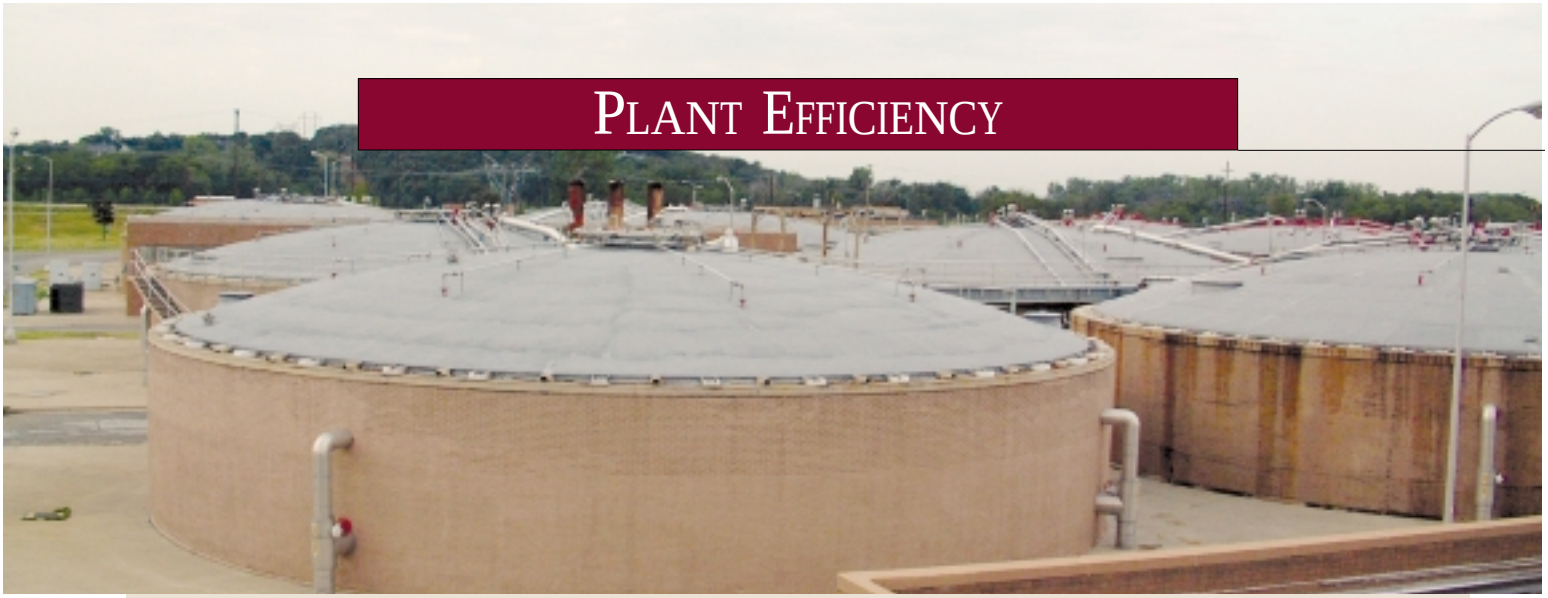

*With its 14 digester tanks, the Village Creek wastewater treatment plant will be able to serve as the region's sole wastewater plant until approximately 2010. The methane gas produced by the anaerobic bacteria in the tanks is burned by two turbines to generate the plant's electricity.*

# Plant Combines Wastewater Treatment and Energy Conservation



*With waste production in the United States at an all time high (more than 13.6 billion tons of organic waste is produced in this country every year) there are not many wastewater treatment plants that can look at naturally occurring organic waste and see a renewable source of energy. However, the Village Creek Wastewater Treatment Plant in Fort Worth, Texas, has done exactly that for the last 40 years. This last year, steps were taken that could make Village Creek a net energy producer instead of an energy consumer.*

The Village Creek plant serves more than 750,000 people and numerous industries in 23 communities in north central Texas. Village Creek is owned and operated by the City of Fort Worth and is the city's only sewage treatment facility. Its permit allows the plant to process up to 166 million gallons of wastewater every day.

Village Creek serves a major portion of the Dallas/Fort Worth Metroplex, one of the fastest growing areas in the country. The plant releases its treated water into the effluent-dominated Trinity River. During the hot summers in North Texas, when the naturally flowing water in the Trinity is at its lowest, 95 percent of the river's flow can be made up of effluent.

## Award Winning

Village Creek has been a showcase since it opened in 1958. The plant serves most of Tarrant County, where Fort Worth is located, as well as a portion of the adjacent Johnson County. All of the products of the wastewater process are reused. The water released from the plant flows down the Trinity River into Lake Livingston, where it is processed as drinking water for the city of Houston.

Village Creek uses a standard activated sludge wastewater treatment process. The plant's large digester tanks use bacteria that convert organic waste into substances that are more environmentally friendly. After the treated water has been released, the organic byproducts are dewatered and the Class A biosolids are applied to allowable agricultural land as fertilizer and soil amendment.

Another byproduct of the organic treatment process is methane gas. Most wastewater treatment plants simply burn off this gas, but not Village Creek. When the plant first opened, it featured reciprocating internal combustion engines rated at 1,620 and 1,760 horsepower. The methane gas produced during the organic treatment process was captured and used to operate the reciprocating engines to generate electricity. Eventually, the point was reached where the plant could generate about 30 percent of its electricity needs.

Over the years, governmental agencies and various industry groups have recognized Village Creek for its efficient operations. In fact, in 1988 and again in 1998 the EPA bestowed Operating and Maintenance Awards of Excellence on the plant. The 1988 recognition named Village Creek the best large advanced wastewater treatment plant in the U.S.

## Beyond Efficiency

The plant has not rested on its laurels. Over the last several years, the internal combustion engines began to show their age. Maintenance on the two units was becoming very expensive and their nitrous oxide ($NO_x$) emissions were above today's achievable limits. Over the more than 40 years of their

service, the engines had been rebuilt several times. It was only a matter of time before the engines would have to be replaced. Therefore, several experts were brought in to help the plant move to the next level of energy and operational efficiency.

Multatech Engineering, Inc., was retained to assist with the engineering and planning process as well as TXU, a Dallas-based global energy company, because of its many years of demonstrated expertise in energy generation and distribution. As the plan for the upgrade of the plant's energy generating capabilities unfolded, aggressive goals were set. The plan was not only to meet all of the plant's own energy needs but, when possible, sell any surplus energy generated on the open market.

Multatech did a feasibility study and determined that the reciprocating internal combustion engines could be replaced with the more energy-efficient gas-fired combustion turbines. Turbines would generate more electricity from the same amount of methane gas. The turbines also would be able to output more electricity relative to their size, and they would have lower operating and maintenance costs, as well as lower nitrous oxide emissions.

Two Solar Taurus Model 60 turbines that are each capable of generating 5.2 megawatts of power were purchased. These models often are used by manufacturing companies and industrial sites to self-generate or co-generate electricity. Research showed that the turbines could generate anywhere from 90 to 95 percent of the electricity used during peak energy consumption periods in the spring and fall of the year. The Village Creek plant consumes more electricity during the rainy seasons in the region because this is when the water pumps are running at peak levels. Fortunately, these also are the seasons when residential consumers are not using a great deal of electricity.

Because of its expertise and significant experience operating combustion turbines to generate electricity, TXU Energy, a subsidiary of TXU, was retained to operate and maintain the turbines, and to act as the energy manager for the facility. In addition to staffing the Village Creek energy equipment with its experts, TXU Energy is able to continually monitor the operations of the turbines from its control center in Dallas. TXU Energy's computer-based systems are connected to the plant's equipment so that anything out of the ordinary operating parameters will immediately alert a technician. Technicians in the Dallas control center will work with operating personnel on the ground at the plant to ensure efficient energy generation. A 20-year contract with TXU Energy was signed and is renewable every year.

Even though it made sense to replace the old internal combustion reciprocating

*Two turbines generate electricity by burning the methane gas produced as a byproduct of the wastewater treatment process. Eventually, the plant may generate excess electricity that may be sold on the open market.*

*On-site technicians monitor the plant's energy-generating operations. Two gas-powered turbines also can be monitored remotely by personnel in a computerized control center in downtown Dallas.*

engines with the more efficient gas-fired turbines, it was realized that the Village Creek plant would not produce enough methane gas to keep both turbines running at peak efficiency and generating 10.4 megawatts of electricity. As a result, authorities are working with TXU Energy to bring a long-term supply of methane gas from a nearby landfill to the Village Creek plant. With these two sources of gas (the Village Creek plant and the landfill) the turbines should be able to meet most, if not all, of its power needs. In addition, during the summer and winter when the area is not experiencing much rainfall and electricity needs are low, it is hoped that the turbines will generate excess power that TXU Energy will be able to sell on the open market.

## Recycling Heat Energy

In addition to capturing and using the methane gas produced during the wastewater treatment process, a closed-loop system for the high-temperature exhaust that is produced by the gas turbines has been established. Rather than allow the heat to dissipate into the atmosphere, the heat recovery system recycles this energy to maintain the required 95-degree temperature in the 14 digester tanks as well as comfort heat for the operational buildings.

The heat-recovery system directs the exhaust from the turbines through a hot-oil circulating system that transfers the heat into an existing hot-water circulation system to maintain temperatures in the digester tanks and the buildings' heating system. The digester tanks must be maintained at 95° to kill any pathogens that may be present and to produce the optimal amount of methane gas from the bacterial decomposition process.

## Getting Credit Where Credit is Due

Efforts to reuse and recycle energy also benefit the Village Creek Wastewater Treatment Plant. The Texas Electric Choice Act requires that all retail electric providers, municipally owned utilities or electric cooperatives participating in the competitive market must either own or purchase capacity to produce energy from renewable sources. If the entity does not own or purchase this capacity, it must purchase renewable energy credits on the open market. Village Creek already is generating renewable energy credits and TXU Energy is managing the sale of these credits.

In addition, the Village Creek plant will generate a significant nitrous oxide reduction credit. Both the gas from the plant's digester tanks as well as that from the nearby landfill are high in carbon dioxide. As a result, the gas burns at a relatively low flame temperature. This lower flame temperature reduces the nitrous oxide emissions from the process. This is particularly important for this area because the EPA has designated the region as a non-attainment area for $NO_x$ emissions.

## What Lies Ahead

With the improvements made to the Village Creek Wastewater Treatment Plant, the facilities will be able to handle the needs of the city and the region currently served through at least 2010. At that time, it is expected that population growth will facilitate either expanding the Village Creek plant or building a second wastewater treatment plant farther upstream on the Trinity River. Until then, Village Creek will continue to be an example of how wastewater management and energy conservation can work hand-in-hand.

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