

City of Pella

COMPANY BACKGROUND



The City of Pella Municipal Power Plant has been owned and operated by the City of Pella since 1911. The power plant has grown to a generating capacity of 38 MW on site and an additional 28 MW at a nearby diesel plant for peak electricity. While the power plant still utilizes coal as its main fuel, it is moving to other energy sources such as co-firing with a coal/ biomass blend.



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PROJECT BACKGROUND

Several areas were examined to improve overall plant performance. The first area of focus was chemical and water conservation in both the cooling tower and the boiler water loop. In addition to conservation, it was necessary to ensure that outfall permit standards were met or surpassed. The second area of focus was on the energy efficiency of the many pumps and fans in the facility.

INCENTIVES TO CHANGE

It has become increasingly apparent over the past few years that the City of Pella needs to find ways to reduce water usage. With about 20 percent of the city's treated water going to the power plant, it was clear that the power plant was one of the first places to investigate. Unprecedented coal prices have made plant efficiency not only a priority, but also a necessity.

RESULTS

Boiler Upgrades: Several options are available to improve the efficiency and reduce the emissions of the coal boilers. These upgrades include new boiler seals for less air infiltration, oxygen controls for minimum excess air and flue gas recirculation to reduce NOx production.

Blowdown and Wastewater Recovery: Approximately 17 percent of the water going to the cooling tower is sent down the drain because of the high concentration of solids. A new chemical treatment system would eliminate about 95 percent of this blowdown as well as allow other sources of wastewater to be used in the cooling tower. These sources would come from the power plant and possibly other area facilities.

Variable Frequency Drives (VFD) for Pumps and Fans: Several large pumps and fans operate on highly variable loads while only slightly changing energy consumption. A VFD will allow a pump or fan to vary its speed to match the load while saving significant amounts of electricity.

Cogeneration: Due to the close proximity of manufacturing plants and other facilities, the power plant has the opportunity to supply steam and chilled water to them. The power plant can utilize heat resources such as extraction steam from the turbines, backpressure steam from a boiler feed pump and excess heat from flue gas to supply the steam. Chilled water can also be supplied by using the produced steam in an absorption chiller. The chilled water system can be optimized by using an ice storage system and an air-side economizer, to help the supplied facilities handle peaking in the summer and low loads in the fall and spring.

Lighting upgrades: Based on recommendations, the facility plans to replace older 400W metal halides with T5 or T8 fluorescent fixtures,

depending on location. The 70W – 300W incandescent bulbs will be replaced by heavy-duty compact fluorescent lamps, and eventually by LED lamps.

Central air for plant use: Several areas of the power plant are air conditioned by separate residential-type units that can be replaced by a centralized unit.

Cooling tower operations: While the power plant generally operates with the water running on all cells before a fan starts, standardizing this procedure will ensure water and electricity conservation in the spring and autumn.

Insulation program: An insulation program is recommended, which would include removable mechanical insulation, building envelope insulation and seals for the building envelope and boilers.

Baghouse ejector recovery: The baghouse utilizes a steam jet ejector to create a vacuum for ash handling. Hot water is created from this process, which can be recovered for plant heating, makeup water heating and cooling tower water.

Vent condenser on deaerator: The deaerators operate at a high pressure and release a considerable amount of steam to get rid of air in the feedwater. Vent condensers can condense the steam for reuse while ejecting the entrapped gases.

Evaporator replacement: An evaporator currently supplies the boilers with distilled feedwater. The best replacement would be a reverse osmosis system in series with a deionizer for a supply of high-quality water without heating losses or the need for a rental system during plant shutdown.

AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO2	28.1
CO	256.8
NOx	160.6
VOC	2.17
PM	0.79

GREEN HOUSE GASES DIVERTED IN TONS (CO2 Equivalent)

Total for all sectors	
CO2	5251
CH4	1481
N2O	54.0
CFC	157

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
BOILER UPGRADES	\$581,400	980,000 THERMS 127 TONS OF NOx	RECOMMENDED
BLOWDOWN AND WASTEWATER RECOVERY	\$81,200	25 MILLION GALLONS	RECOMMENDED
VFD FOR PUMPS AND FANS	\$43,200	405,000 KWH	RECOMMENDED
COGENERATION	\$829,400	1,100,000 THERMS 1,675,000 KWH	RECOMMENDED
LIGHTING UPGRADES	\$15,800	310,000 KWH	IN PROGRESS
CENTRAL AIR FOR PLANT USE	\$6,600	120,000 KWH	RECOMMENDED
COOLING TOWER OPERATIONS	\$4,000	50,000 KWH 250,000 GALLONS	IMPLEMENTED
INSULATION PROGRAM	\$20,000	73,500 THERMS	RECOMMENDED
BAGHOUSE EJECTOR RECOVERY	\$14,500	29,400 THERMS 1,300,000 GALLONS	RECOMMENDED
VENT CONDENSER ON DEAERATOR	\$12,200	41,650 THERMS 250,000 GALLONS	RECOMMENDED
EVAPORATOR REPLACEMENT	\$31,400	53,900 THERMS 2,250,000 GALLONS	RECOMMENDED