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Company Background

Xcel Energy is an electricity and natural gas provider based in Minneapolis, operating in eight Western and Midwestern states with 3.5 million electricity customers and 2.0 million natural gas customers. The company has two major focuses - enhancing environmental performance and improving operational effectiveness. Xcel enhances environmental performance by reducing emissions through the pursuit of clean energy, energy conservation, and efficiency initiatives. Xcel continues to transition from coal to gas and nuclear, while progressing into renewables like wind, solar, and hydro. Along with cleaner energy, the company is also committed to reducing power usage in the surrounding regions by offering rebates for energy efficiency solutions to households and businesses.



“The MnTAP internship allowed me to gain engineering experience in power generation. From working in a real-world engineering setting I developed communication skills, project management experience, and more self confidence. It is amazing knowing that the recommendations I made resulted in significant water and economic savings.” ~MC

Project Background

The Xcel Riverside generation plant demands high water flow for numerous process and auxiliary systems. Makeup water for most systems is supplied by the onsite well and is first purified by a reverse osmosis system and then a passed through a deionizing system. Process systems targeted for water reduction include reverse osmosis treatment, sampling equipment for deionization, and evaporative cooling. An auxiliary system focus included the condensate recovery from the heating systems. Along with focusing on these main projects, system inspections were also performed to check for any water leaks.



Incentives To Change

Xcel Energy is determined to generate and maintain a clean and sustainable power supply for the surrounding regions. The Xcel Riverside plant strives to reduce water usage to create more environmentally efficient processes. With decreased water usage comes decreased water discharge to the environment, meaning a cleaner operating generation plant. Decreasing water usage also reduces the operational level required by process equipment such as treatment systems and pumps, which means extended life of these units. Reduction in the required operational level also means a decrease in operating costs, which with large water flows results in significant dollar savings.

Solutions

Recover Condensate from Heating Systems

The large generation plant requires significant building heating systems which use steam as the thermal energy source. The steam is condensed and is returned to a single collection tank. Condensate had previously been recycled as makeup water, but is now too low in quality to use for this purpose. It is recommended that this



Recover Water from Sampling System

The deionizing treatment system has a sampling panel which analyzes the conductivity and silica levels to ensure correct operation. The conductivity analyzers do not require any addition of chemicals whereas the silica analyzers do. After sampling, both sets of streams are sent to drain. These sampling systems are constantly analyzing water 8,760 hours a year, so it is recommended that the conductivity analyzer water be recycled back into the reverse osmosis storage tanks. This will result in saving 700,000 gallons of water and \$1,700 annually.

Optimize Air Intake Evaporative Cooling

Water is used to cool the air intake for the combustion turbines. Cooler air increases the density and mass flow rate into the combustion turbine, allowing more efficient combustion. When this water evaporates, the solids in the water are left in the sump of the air intake which requires blowdown to prevent solids accumulation. It is recommended that the blowdown conductivity limit be increased to four times the makeup conductivity to decrease blowdown volume. This will result in saving 650,000 gallons of water and \$1,300 annually.

condensate water be treated with a deionization system so that it can be recycled to the makeup storage tank. The implementation of a treatment system will significantly reduce the water required from the well and discharged to drain. This change will result in saving 3,840,000 gallons of water and \$3,300 annually.

Increase Reverse Osmosis Recovery

Both the first and second pass of the reverse osmosis (RO) system are operating about five percent below their capable recovery limits. For the first RO unit, it is recommended that a control valve be installed on the concentrate stream to drain, allowing control of the system recovery. For the second RO unit, which already has a control valve on the concentrate stream, it is recommended to decrease the set flow rate of the concentrate appropriately to achieve the desired system recovery. Increasing the recovery of the two RO systems will result in saving 1,720,000 gallons of water and \$4,300 annually.



Recommendation	Annual Reduction (gallons)	Annual Savings	Status
Recover Condensate from Heating Systems	3,840,000	\$3,300	In Progress
Increase Recovery of First Reverse Osmosis	920,000	\$2,300	In Progress
Increase Recovery of Second Reverse Osmosis	800,000	\$2,000	Implemented
Recover Water from Sampling System	700,000	\$1,700	In Progress
Optimize Air Intake Evaporative Cooling	650,000	\$1,300	Testing