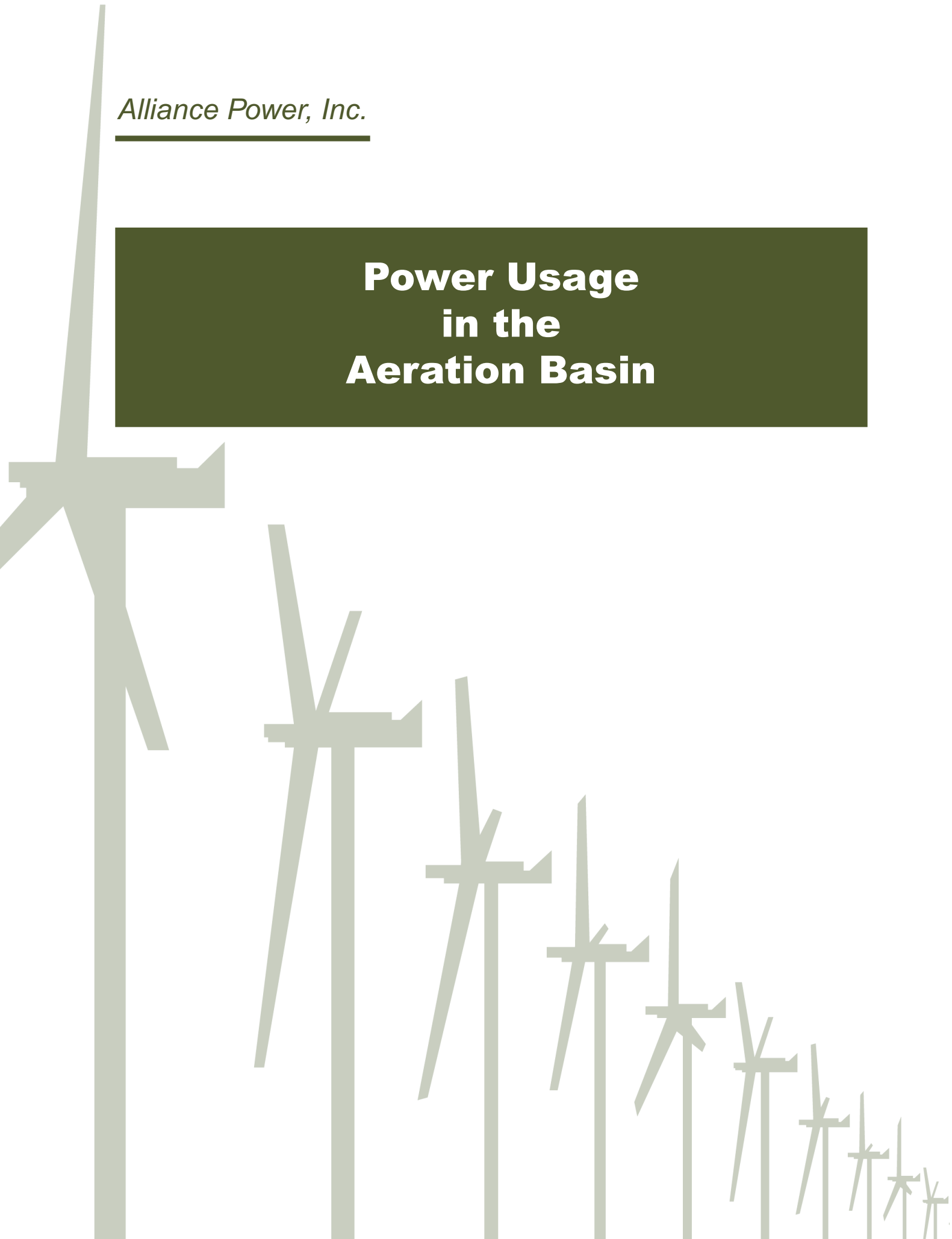
Alliance Power, Inc.

Power Usage in the Aeration Basin



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Summary

Alliance Power has implemented numerous innovative energy savings programs using emerging technologies. The company has developed, installed, and operated distributed gas combustion power generation systems, large scale fuel cells, photovoltaic solar power plants, wind farms, and other innovative technologies that have produced reliable cost savings. This article showcases Alliance Power's prowess in providing multiple energy saving strategies to a single municipal partner.

The Dublin San Ramon Services District (DSRSD) wastewater treatment facility (located in Northern CA) is continually evaluating green strategies and seeking methods to reduce operating expenses. Methods used by the DSRSD facility to accomplish these goals include generating its own power using digester gas, saving energy with cogeneration, and investigating energy programs using emerging technologies.

For example, the DSRSD facility hired Alliance Power to help move forward with its green initiative that includes a pair of 300 kW fuel cells that Alliance helped acquire with a $2.7 million grant. The fuel cells take digester gas and convert it into ultra-clean electricity. The fuel cell program has reliably provided DSRSD with several million dollars in cost savings at a minimal cost to DSRSD.

In its latest project and the subject of this paper, Alliance Power was able to provide new energy savings using Kurz 454FTB single-point insertion thermal mass flow meters on the aeration basin and save DSRSD's wastewater treatment facility an additional 17.2% of their energy costs.

Power Usage

DSRSD's wastewater water treatment facility is designed efficiently so that gravity moves effluent from one treatment process to the next. The site has three single-stage centrifugal blowers that are used to add dissolved oxygen (DO) to the aeration basin. Operating these blowers accounts for up to 60 percent of all power consumed at the site. One blower is used a majority of the time for adding the required DO to maintain the aerobic bacteria in the aeration basin. Additional blowers come online as needed when there is greater demand placed on the system due to an increase in the outside air temperature or when there is stronger sewage that requires a higher biological oxygen demand (BOD).

In an earlier project, the Operations Supervisor of the DSRSD facility had replaced existing FCI, Sierra, and Sage thermal mass flow meters with Kurz 454FTB meters on the digester gas lines to improve operational monitoring and EPA reporting data. The meters responded so well with fast response time and highly accurate readings in the digester gas environment that the Operations Supervisor wanted to test the meter's functionality in the aeration basin environment. Suspecting the potential for energy savings, DSRSD hired Alliance Power to look for ways to externally fund the project. Alliance Power's extensive engineering experience allowed the company to work with DSRSD on documenting energy usage through the existing aeration control system, blower usage, and electrical meters. Detailed data compared the oxygen concentrations, electrical usage, and other data from before and after installing the Kurz meters.

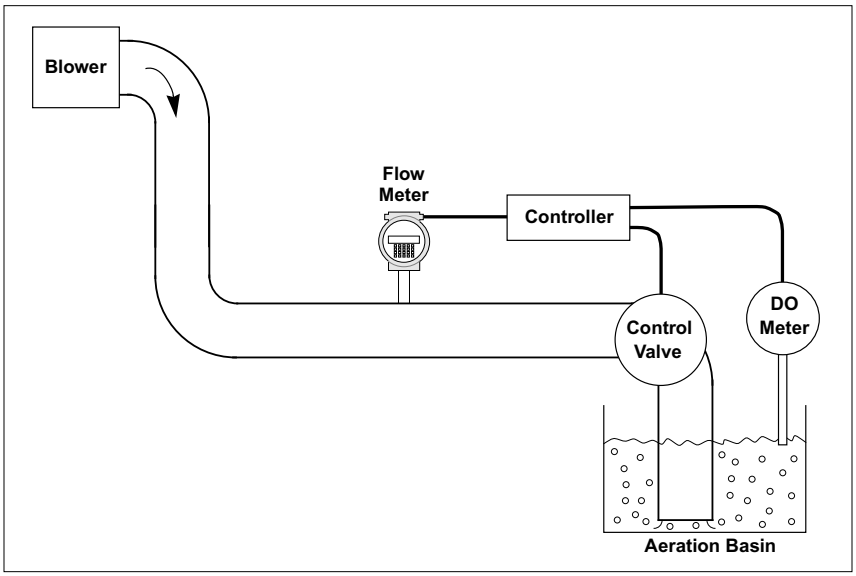
Test Configuration

Flow meters monitor the rate of air flow entering the aeration system in ten zones and provide feedback to the controllers for setting the control valve for each zone. The oxygen levels change based on several factors including temperature, effluent levels, and bacteria type.

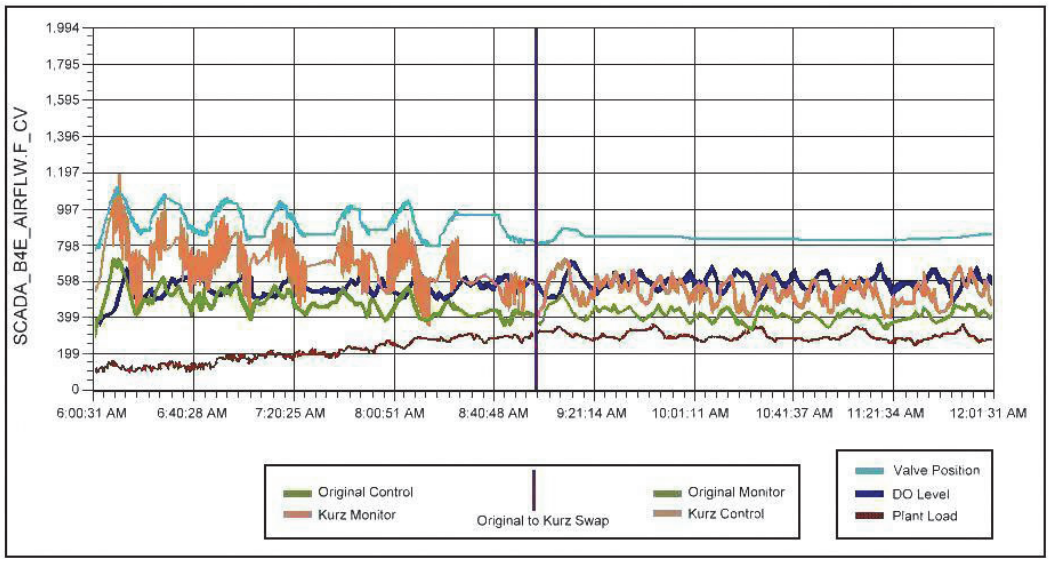
For the test, two meters were installed on one of the air lines that feed one of the control valves. The configuration was set-up to allow the control of the process to be switched from one meter to the other. By switching, the meters would alternate control, with one meter controlling and reading flow and the other meter only reading and recording flow. By doing this switching, comparisons could be performed on the same basin. The meters used in the test, the Kurz 454FTB and the FCI ST98, were left in the existing cascading control loop configuration.

The DSRSD facility has five tanks (30 ft X 208 ft x 15 ft) in its aeration basin flowing in a serpentine configuration. Three 400hp blowers each with a capacity of 8,400 CFM at 9 PSIG are available to maintain the DO targets. Approximately 17 million gallons of effluent can be treated per day.

Historically, the slow response time (several minutes) of the originally installed FCI ST98 meters caused the control valve for that zone to overshoot and undershoot airflow while hunting for the correct DO target. As shown in the following SCADA output graph, using the original meter as the control caused the valve to constantly fluctuate. Making the valve continually hunt and adjust is inefficient and costly. When the Kurz 454FTB meter replaced the original meter, the response time between flow rate and the control valve was less than 1 second, keeping the control valve position steady. With the Kurz meter controlling the flow rate, the control valve did not hunt. Improving the response time and accuracy of the flow meter to changing conditions within the aeration basin allows the blower operation to match to the current demand, increasing the energy efficiency of the blowers.

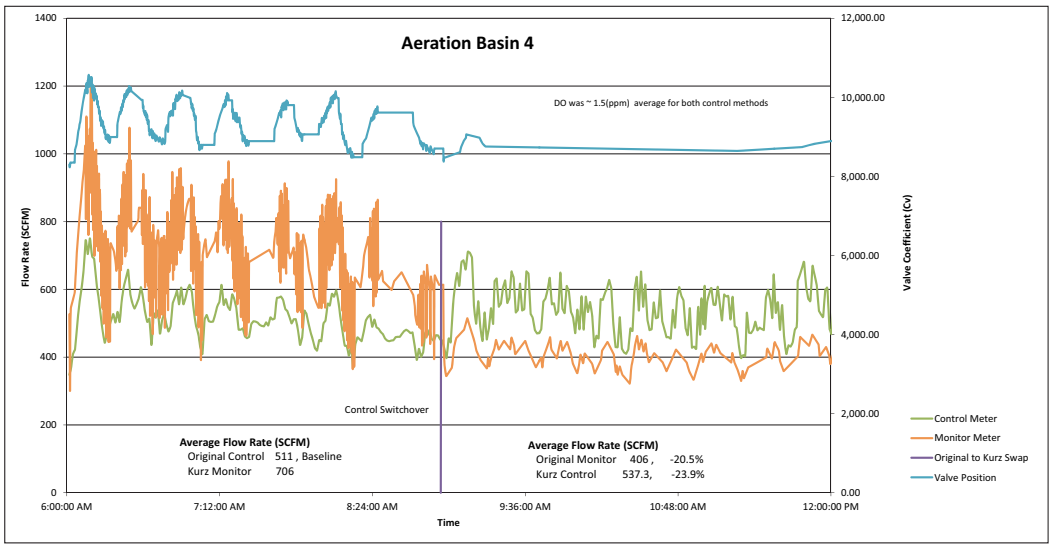


SCADA Output



Computational Analysis

As shown in the following graph, the FCI ST98 meter in the control position caused the valve to fluctuate from ~8,000 Cv to over 10,000 Cv (valve coefficient), and the flow rate ranged from ~400 SCFM to ~900 SCFM. With the Kurz 454FTB meter in the control position, the fast response time (less than 1 second) between flow rate and the control valve kept the control valve position steady, which resulted in a 23.9% air savings.



Conclusion

The Kurz meters offered substantially better response time and accuracy than the original meters in regulating the automated DO and control valves. The Kurz meters delivered accurately responsive metering, making the process more efficient by removing response delays and reducing the overall power consumption of the aeration process.

Energy savings over the entire test period were recorded up to 20%. For the acceptance verification test, power usage was measured for 10 consecutive days for each set of meters, with loads and temperatures being similar. During the test period, the FCI meters used 91,473 kWh and the Kurz meters used 75,745 kWh, resulting in a 17.2% savings on energy use. DSRSD was able to show the energy savings from using Kurz meters to PG&E and qualify DSRSD for rebates.

The findings from the DSRSD facility are not unique. Last year a wastewater treatment facility replaced 16 of its original meters in its four aeration basins with 16 Kurz 454FTB meters. Total oxygen production and energy consumption was measured for three months and compared with data during the same period of the previous year. While oxygen production increased 4.95% during the test period because of higher load, 15.44% less energy was used to generate the oxygen and resulted in 16.2% total energy efficiency over the original meters. The energy savings translates to an estimated annual dollar savings from $224K to $336K per year.

About Alliance Power

Since 1999, Alliance Power Inc. (based in Centennial, CO) has performed the mission of developing innovative energy and electrical generation projects and energy saving programs using emerging technology, cost-effective program management, and accelerated development expertise. Alliance partners with industrial, municipal, institutional, and utility clients to determine opportunities for energy savings through the implementation of a wide variety of ultra-clean renewable technologies, innovative energy saving equipment, emerging power generation equipment, or energy saving programs.

Alliance's engineering and technical staff has more than 100 years of combined expertise within the utility, energy generation, and energy efficiency market. Alliance is able to quickly and cost-effectively identify any significant energy cost saving strategies that can be implemented to reduce a client's energy costs and improve energy efficiency. Working with Alliance Power, a typical energy savings program can save a client from $500,000 to over $1,000,000 per year in reduced energy costs.

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