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Municipal Wastewater Utility Improvements Reduce Annual Energy Expense by 65%

Case Study: City of Riverbank, CA

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Municipal Wastewater Treatment Plant Achieves 75% Energy Savings using Innovative Engineering and Financing Plan

Abstract

This is a case study for an Energy Savings Performance Contract (ESPC) at the wastewater treatment plant for the City of Riverbank in California. The existing plant has an average of 1.67 MGD flow and consists of the headworks, four treatment ponds, and seven percolation ponds. Prior to the project, the treatment ponds used surface aerators to provide oxygen for the biologic process. The plant was primarily operated manually with limited dissolved oxygen control. The utility bills showed excessive energy use – annual usage was 5,673 kWh/MG/yr. Schneider Electric and the City of Riverbank entered into a construction contract to retrofit the treatment ponds with blowers and fine-bubble diffusers for more efficient oxygen transfer. Additionally, a control system was installed to maintain a dissolved oxygen set point. This scope of work is estimated to save 75% of the electricity consumption at the wastewater treatment plant and will save the City 65% of their electric bill, or $240,129 per year. The energy and utility analysis was done by following a five-step process:

1. Benchmark baseline energy data
2. Analyze baseline utility data and model utility rates
3. Model baseline energy consumption
4. Model estimated energy consumption after the scope of work is installed
5. Determine estimated dollar savings associated with the scope of work

This case study outlines these processes and discusses the customized energy model that was developed for this analysis. Financial parameters of the project are discussed, including the city's payback criteria, final project costs, and utility incentives. Finally, a discussion is presented on the benefits of using an ESPC for this type of project and why the city chose to use this contracting method to accomplish their goals.

Project at a Glance

Customer Benefits:

- Guaranteed savings with fixed project costs
- Reduced energy consumption and costs
- Project risk transfer
- Single contact for service and support
- Equipment upgrades and improved operational control and visibility at wastewater treatment plant

Project Type:
Performance contract

Location:
Riverbank, CA, U.S.

Properties:
Wastewater treatment plant - Avg flow of 1.67 million gallons per day (MGD)

Funding:
Utility savings

Wastewater Plant Renovations:

- New submersible fine bubble diffusion system
- Variable flow blowers for optimized control
- New SCADA control system for better visibility

Total Savings:
$4,802,580

Introduction

Wastewater treatment plants are a relatively untapped market in the world of energy efficiency. With proper design and analysis, progress can be made to improve plant efficiencies and reduce site utility bills, while also providing much needed upgrades to aging equipment. Wastewater treatment plants and drinking water plants account for 3-4% of energy use in the US. For municipal governments, these plants use approximately 30-40% of their total energy consumption[1]. And in California alone, water and wastewater agencies spend more than $500M/yr on energy[2]. These energy costs represent the largest controllable expense for municipalities who provide water or wastewater services. However, energy efficiency in wastewater plants has not been adopted as quickly as it has been in other industries, so there exists a large opportunity to reduce energy usage in these types of facilities. At the same time, there is much need for updated infrastructure at these plants as well. As of 2008, there was an estimated $105 billion worth of needs at wastewater treatment plants in the US[3]. Many plants are over 20 years old and are using technology that is out of date and inefficient. This paper presents a case study of a California municipality that wanted to address both the rising costs of energy and the outdated equipment at their wastewater treatment plant while developing a plan to mitigate potentially increased treatment level requirements by the state. The paper focuses on the energy savings results from an in-depth energy analysis.

The City of Riverbank hired Schneider Electric to evaluate their wastewater treatment plant for energy savings opportunities. The process began with a preliminary benchmarking analysis to determine savings potential. Initial estimates appeared promising, so an Investment Grade Audit agreement was entered into to develop a scope of work and quantify financial parameters of upgrading the plant. A project was developed to replace surface aerators on the treatment ponds with blowers and fine-bubble diffusers for more efficient oxygen transfer. Additionally, a control system was installed to maintain a dissolved oxygen set point. This scope of work is estimated to save 75% of the electricity consumption at the wastewater treatment plant and will save the city 65% of their electric bill, or $240,129 per year. The procurement methodology that the city used was an energy savings performance contract (ESPC). Through using this arrangement, the city would be able to implement a project with a fixed price and guaranteed savings.

Wastewater treatment plants are ripe for energy efficiency improvement. These facilities represent:

- Up to 40% of total energy consumption for municipal governments
- The largest controllable expense for municipalities
- Total of $105 billion in needed infrastructure improvements at plants across the US

Figure 1: Wastewater Treatment Plan Aerial View

Background on City of Riverbank Wastewater Treatment Plant

The City of Riverbank in California is a small city with just over 23,000 residents. It operates its own wastewater treatment plant, which has an average flow of 1.67 million gallons per day (MGD). The wastewater treatment plant has primary treatment only through aerated lagoons and uses percolation ponds rather than discharging the effluent. The plant operates under the State Waste Discharge Requirements which do not specify any limits for effluent BOD, TSS, and Nitrogen. An aerial image of the plant is shown in Figure 1.

Project Results

75%

Reduction of electricity consumption at wastewater treatment plant

65%

Reduction in electric bill, amounting to a savings of $240,129 per year

Footnotes: 1. "Energy Efficiency for Water and Wastewater Utilities," Retrieved from http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm
2. "Process Energy – Water/Wastewater Efficiency," Retrieved from http://www.energy.ca.gov/process/water/index.html 3. MU.S. EPA, 2008, "Clean Watersheds Needs Survey", EPA-832-R-10-002, pg 2-1

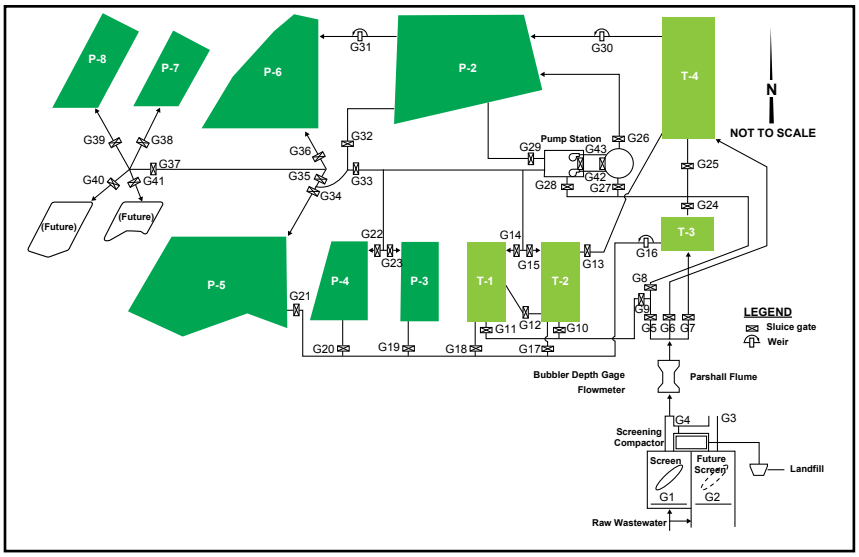


Figure 2: Wastewater Treatment Plant Flow Diagram

There is one electric meter at the plant that serves all loads, including:

- (23) 75 HP surface aerators
- (2) 25 HP transfer pumps
- (1) 2 HP compactor at headworks
- Exterior area lighting

The primary treatment is accomplished in four treatment ponds through the use of surface aerators to provide oxygen for the biologic process. Once the sewage is adequately treated, it is transferred to the percolation ponds through the opening of sluice gates or weir gates. A flow diagram of the plant is shown in Figure 2. The four treatment ponds are shown in light green and the seven percolation ponds are shown in dark green. Treatment ponds T-1 and T-2 have liners installed while ponds T-3 and T-4 are unlined but have a sealed bottom to ensure no percolation into the ground.

The plant was primarily operated manually with limited dissolved oxygen control in the treatment ponds and intermittent use of the transfer pumps. Lights were controlled through photocells and only ran at night.

Electricity is the only utility on site and data was collected from Modesto Irrigation District for the plant electric meter. The offices and maintenance facility were metered separately from the plant usage. The annual utility spend for the wastewater treatment plant meter was $367,137. The annual electricity usage was 3,458,190 kWh. Given the average flow of 1.67 MGD, this equated to a benchmark value of 5,673 kWh/MG/yr.

Scope of Work

A project was developed to target reducing energy use at the wastewater treatment plant. This project consisted of replacing the surface aerators with submersible fine bubble diffusers and blowers with VFDs. It also included the installation of a SCADA control system to provide better control and visibility into the plant processes, particularly controlling the dissolved oxygen level in the treatment ponds.

The existing treatment ponds used constant speed surface aerators to provide oxygen for the biologic process, as seen in Figure 3 and Figure 4. Typically, only two of the four treatment ponds were used at a time and not all of the surface aerators would be in operation at any given time. These aerators had low oxygen transfer efficiency, and thus required excessive horsepower to deliver the appropriate amount of oxygen to the biologic process.

Figure 3: Surface Aerator (idle)

Figure 4: Surface Aerator (in operation)

The solution that maximized energy savings replaces the twelve surface aerators in treatment ponds T-1 and T-2 with Parkson's Biolac Treatment System, which uses moving aeration chains with suspended fine bubble diffusers, motorized and controlled air valves, blowers, and an automated control system. The moving aeration chain and fine bubble diffuser system is shown in Figure 5 and Figure 6. Four 60 HP blowers with VFDs were installed to provide air to this system. The VFDs are controlled to maintain a dissolved oxygen set point in the treatment ponds. Ponds T-3 and T-4 were left as-is and will continue to be used as polishing ponds and for maintenance purposes.

While this solution was chosen to maximize energy savings, there are also several maintenance benefits from changing system types. For example, subsurface aeration reduces the build-up of sludge in the treatment ponds. Currently, when the sludge build-up reaches a certain depth, the treatment ponds need to be taken out of service, dredged, and then have the sludge hauled away to a dump site. This happens every 12 to 15 years, but is very costly for the city. Additionally, the system chosen is modular and upgradeable, so if plant flows increase, the system can be added on to. Or, if new permit requirements are enforced, a tertiary treatment system can be added to the existing system to increase the levels of treatment.

Energy Analysis

In order to determine the energy and utility savings that would be seen from this project, a five-step process was used.

These 5 steps are:

1. Benchmarking
2. Baseline Utility Analysis
3. Baseline Energy Analysis
4. Post-Retrofit Energy Analysis
5. Post-Retrofit Utility Analysis

A summary of each of these steps is described as follows.

Benchmarking

The first step in the analysis was to benchmark the wastewater treatment plant's energy use to identify the magnitude of energy savings available. Monthly bills from August 2010 through September 2012 were collected from the electric utility company to determine the annual energy consumption of the plant. Monthly operating reports were also collected, which showed the plant's daily flows and loadings. A summary of the annual usage is presented in Table 1.

Table 1: Benchmarking Data

Date Range	kWh	MG/yr	kWh/MG/yr
9/2011-8/2012	3,458,190	609.6	5,673

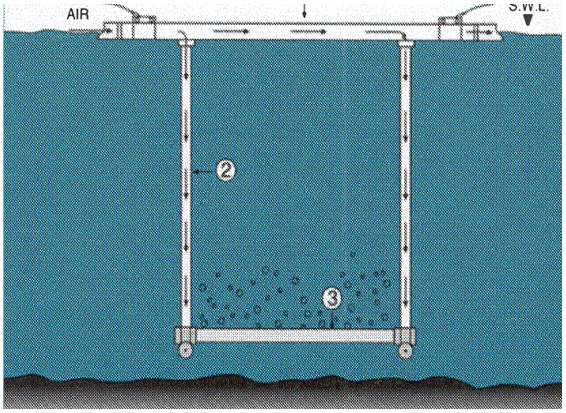


Figure 5: Aeration Chain Schematic

Figure 6: Aeration Chain + Diffuser

Benefits of fine bubble diffusion system:

- Energy savings achieved through reduced oxygen requirements
- Reduced sludge build-up results in less downtime and cost for dredging and maintenance
- Modular and upgradeable system allows for plant flow increases and easier system additions

This data was then compared with industry benchmarks to identify potential savings opportunity. One source that was evaluated was data provided by EPRI as shown in Table 2. This data is only provided for the four most common types of wastewater plants in the US[4]. The wastewater plant at the City of Riverbank was an aerated lagoon plant, and thus did not fit into any of these categories. However, aerated lagoons are less energy intensive than any of these four process types, so the data does provide some context of expected energy consumption.

The baseline data was also entered into Energy Star's Portfolio Manager to determine a score relative to other wastewater treatment plants. The score that this plant received was 4 out of 100, as seen in Figure 7. This means that 96% of plants operate more efficiently than this one.

Based on the comparisons from both EPRI and Energy Star, it was apparent that the wastewater treatment plant at the City of Riverbank was using more energy than needed. In fact, the opportunity to save 50% or more in energy was anticipated based on this analysis.

Figure 7: Energy Star Benchmark Score

The project significantly increased the city's ENERGY STAR rating from 4 up to 94 out of 100, making it one of the most energy efficient plants among peers with similar systems.

Table 2: Unit Electricity Consumption from EPRI (kWh/MG/yr)

Treatment Plant Size	Trickling Filter	Activated Sludge	Advanced Wastewater Treatment	Advanced Wastewater Treatment Nitrification
1 MM gal/day	1,811	2,236	2,596	2,951

Footnote: 4. Goldstein, R. and Smith, W., 2002, "Water & Sustainability (Volume 4): U.S. Electricity Consumption for Water Supply & Treatment - The Next Half Century", EPRI, pp. 3-5

Baseline Utility Analysis

The next step in the analysis was to create a utility baseline. The two years of energy and demand usage from the monthly billing data were compared, year to year, to identify any anomalies or changes in operation. A summary of the two years of data for monthly electricity usage and demand for the wastewater treatment plant are shown in Figure 8 and Figure 9.

In addition to the monthly billing data that was received, 15-minute interval data was collected for the electric meter for the most recent 12 months. This data was analyzed and found to be very consistent between the days in a given week or month, with the exception of when maintenance activities occurred. A typical daily 24-hour profile from the interval data is seen in Figure 10.

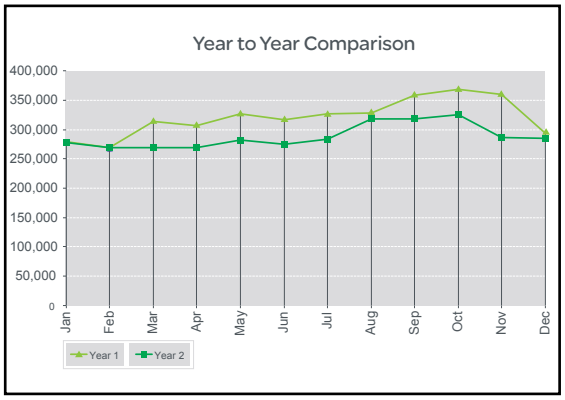


Figure 8: Electricity Usage (kWh)

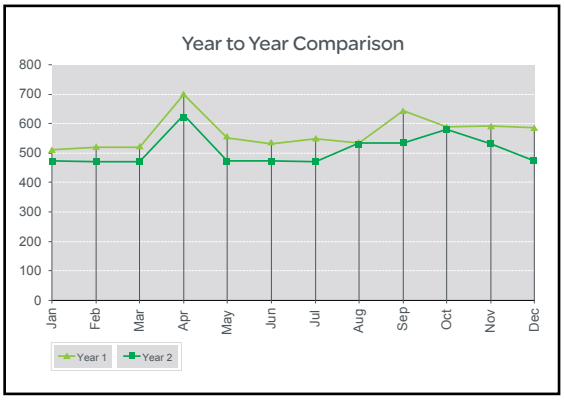


Figure 9: Electricity Demand (kW)

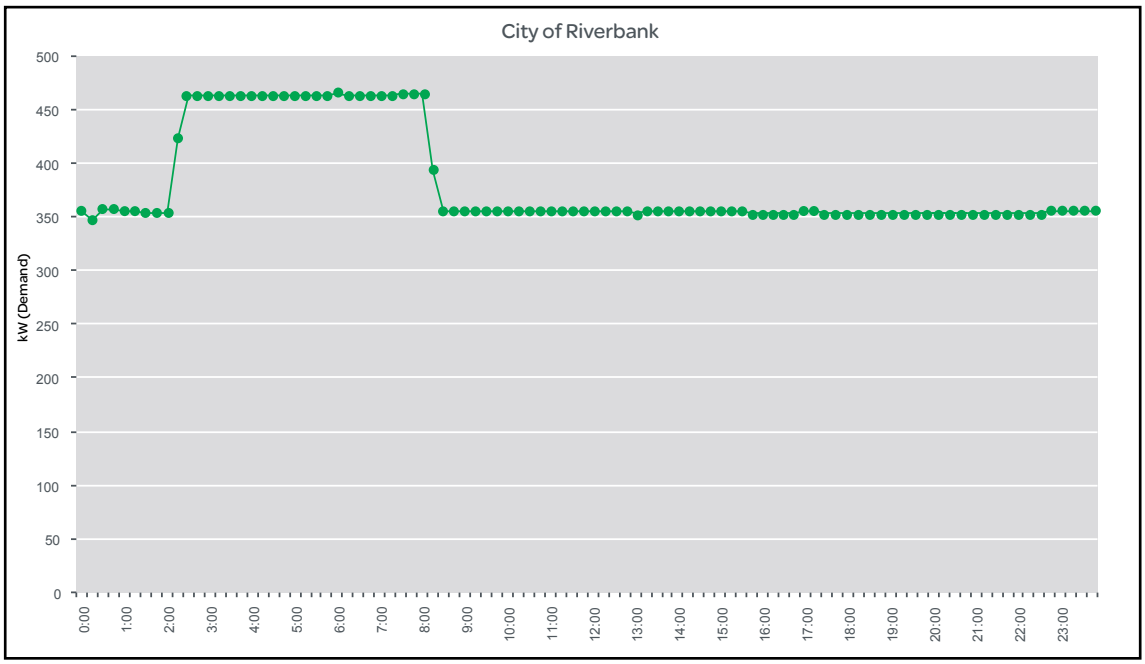


Figure 10: 24-hour Electricity Demand Profile (kW)

In addition to evaluating the electric usage and demand of the plant, the utility rate needed to be evaluated. The wastewater treatment plant is charged under the GS-TOU rate through Modesto Irrigation District. In order to accurately estimate savings on a project, the rate plays a critical role in monetizing the energy savings. A tariff simulation was created to verify that the rate structure was understood. Each component of the rate was calculated based on the monthly billing data, summed together, and then compared with the actual bill to determine the error, as shown in Table 3. The error dropped below 1% starting in January of the analysis year, which corresponded to when the utility company updated the rate values. The accuracy of this analysis ensured the rates were understood.

Table 3. Simulation of Utility Tariff to Verify Rate Structure

Bill Read Date	Total Cost from Bills	Customer Charge	Energy Charge	Demand Charge	Power Factor	Capital Inf Adj	GHG Adj	Total Calc Cost	Error (%)
9/30/11	$33,786	$142	$25,036	$8,724	$171	$889	$127	$35,089	-3.9%
10/31/11	$31,956	$142	$22,273	$9,523	$186	$913	$130	$33,168	-3.8%
11/30/11	$28,387	$142	$19,511	$8,711	$170	$802	$115	$29,450	-3.7%
12/31/11	$27,405	$142	$19,521	$7,730	$151	$798	$114	$28,455	-3.8%
1/31/12	$27,804	$142	$19,031	$7,738	$151	$776	$111	$27,948	-0.5%
2/28/12	$26,526	$142	$17,830	$7,706	$151	$729	$104	$26,661	-0.5%
3/31/12	$28,127	$142	$19,102	$7,713	$151	$778	$111	$27,997	0.5%
4/30/12	$30,048	$142	$18,449	$10,321	$202	$753	$108	$29,974	0.2%
5/31/12	$31,212	$142	$22,255	$7,736	$151	$790	$113	$31,187	0.1%
6/30/12	$30,653	$142	$21,685	$7,775	$152	$771	$110	$30,636	0.1%
7/31/12	$31,074	$142	$22,113	$7,728	$151	$792	$113	$31,039	0.1%
8/31/12	$35,526	$142	$25,433	$8,767	$172	$892	$127	$35,532	0.0%

Baseline Energy Analysis

The next step in the analysis was to create an energy baseline of the plant to ensure operations were understood. Operational information was collected through interviews with plant operators as well as analysis of utility data. As shown in Figure 8 and Figure 9 on page 8, it was observed that plant energy usage decreased from the first year to the second year. It was also observed that there was a spike in electric demand in April in both years, which corresponded to when the operators did annual maintenance on the plant. This maintenance required the contents of two of the treatment ponds to be transferred to the larger pond. During this time, additional surface aerators were used to maintain the biologic process, thus causing a spike in electric demand.

The interval data was very helpful as it also provided insight into the operation of the plant and how the loads were being controlled. Figure 10 shows that the plant operated at a near constant load throughout the day with an approximate 110 kW increase in load between 2 a.m. and 8 a.m. Upon further analysis, the base load corresponded to seven of the surface aerators operating at a time, while the increased load corresponded to nine of the surface aerators operating. It was also noticed in the interval data, that only eight of the surface aerators were typically running between 2 a.m. and 8 a.m. on Sundays. Additional deviations from the base load were noted in other days, which corresponded to when transfer pumps were being used to transfer the effluent from the treatment ponds to the percolation ponds or when maintenance activities took place.

Once the operation of the plant was understood, a baseline energy model was created. A simple model was created that estimated a 24-hour profile of electric demand of the surface aerators, transfer pumps, headwork motors, and miscellaneous loads such as lighting. This was compiled for both a Monday through Saturday schedule and a Sunday schedule, based on the different operation. The resultant loads were summed up and compared with the utility baseline. Figure 11 shows how the electricity usage compared between the utility billing data and the model. Annually, there was less than 1% error between the two. Figure 12 shows how the electricity demand compared between the utility data and the model. The main discrepancy was in April, when site maintenance took place. The spike was not modeled, and thus no savings were taken during this month. With this data point excluded, the annual error on electric demand was less than 5%.

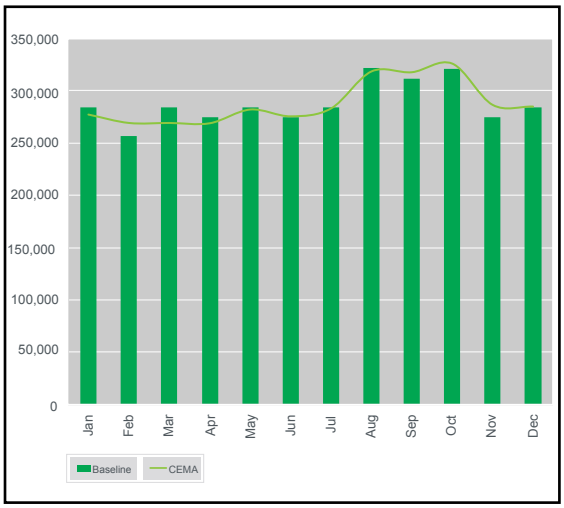


Figure 11: Comparison of Baseline Energy (kWh)

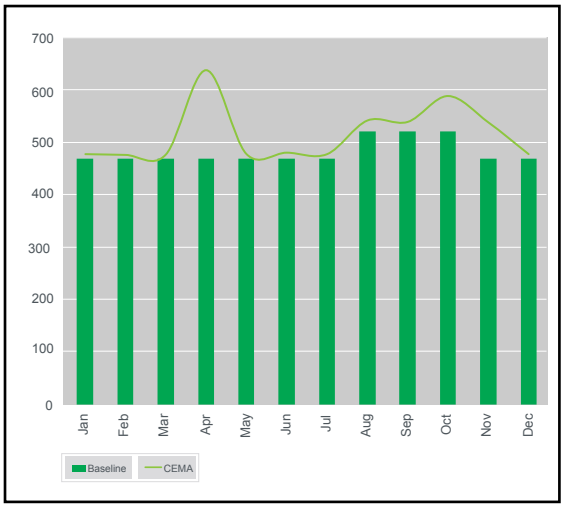


Figure 12: Comparison of Baseline Demand (kW)

Table 4: Constant Inputs to Model

Input	Value	Unit	Source
Effluent BOD limits	40	mg/L	Design Limits
Effluent NH_4 limits	11.25	mg/L	Design Limits
lb O_2 / lb volatile sludge mass	1.42	unitless	Modeling Paper[5]
lb O_2 / lb NH_3-N	4.57	unitless	Modeling Paper[5]
C_{20}[5]	10.144	mg/L	DNR[6], Site Data
Dissolved Oxygen set point	2	mg/L	Operating Parameter
Θ[3]	1.024	unitless	EPA Manual[7]
Ω-value[4]	0.99619	unitless	EPA Manual[7]
β-value[2]	0.95	unitless	EPA Manual[7]
α-value[1]	0.7	unitless	EPA Manual[7]
Diffuser Transfer Efficiency	12.5	%	Equipment Data
Air fraction[6]	23	%	Constant
Air density	0.0752	lb/ft[3]	Constant
Pond depth	8	ft	Site Data
Pressure losses in the aeration system	1.6	psig	Modeling Paper[5]
Atmospheric Pressure at the plant location	14.64	psia	Site Data
Blower Efficiency	65	%	Equipment Data

Table Notes: [1] α-value is the relative rate of oxygen transfer in wastewater compared to clean water [2] β-value is the value comparing oxygen saturation in wastewater to clean water [3] Θ is the Arrhenius constant used to correct for the effects of temperatures [4] Ω-value is the pressure correction factor for the plant location [5] C_{20} is the steady-state oxygen saturation concentration for tap water at 20°C and 1atm [6] Air fraction is the % of air that is oxygen

Table 5. Variable Inputs to Model

Input	Range of Values	Unit	Data Variability	Data Availability
Wastewater Flow	1.43-2.64	MGD	Continuous	Daily
Influent BOD	186-361	mg/L	Continuous	Daily
Influent NH_4	30	mg/L	Continuous	n/a[1]
Air temperature	28.4-104	°F	Continuous	Hourly
Water Temperature in ponds	15-27	°C	Seasonal[2]	n/a
C_{ST}[3]	7.95-10.07	mg/L	Seasonal[3]	n/a

Table Notes: [1] Influent NH_4 was not measured, so a constant value of 30 mg/L was assumed for this analysis [2] Water temperature in the ponds was assumed to vary seasonally and was evaluated for the summer season and winter season. Summer was considered to be May through September. Winter was October through April. [3] C_{ST} is the steady-state oxygen saturation concentration for tap water at a given temperature and 1atm. This value is based off of the water temperature in the ponds and is also assumed to vary seasonally.

Post-Retrofit Energy Analysis

The next step in the process was to estimate the energy usage of the wastewater plant once the proposed retrofit took place. Savings came from two primary sources. First, since the fine bubble diffusers had much higher oxygen transfer efficiency than the surface aerators, the horsepower requirements for the blower motors were greatly reduced from those of the surface aerators. In treatment ponds T-1 and T-2, the twelve 75 HP surface aerators were replaced with four 60 HP blower motors, with one being redundant. Second, since the VFD speed on the blower motors would be controlled to a dissolved oxygen set point in the treatment ponds, the power draw on the motors could be even further reduced from the peak for which they were designed.

In order to properly model the energy usage of the proposed system, the load on the blower motors needed to be understood. This load was calculated by doing an aeration calculation. This calculation is typical for a design engineer to put together in order to size the blowers. In the case of a design calculation, the peak conditions are evaluated to determine the largest the blower would need to be. However, to determine the energy use, the range of operating conditions needs to be evaluated, not just the peak conditions. Furthermore, since the utility rates are charged based on time-of-use periods, understanding when the savings occur is equally important to understanding how much savings to expect. With these constraints in place, it was determined that doing an hourly analysis of the plant was the best option.

In order to understand how to go about modeling the wastewater treatment plant, it is helpful to understand what the inputs are to the model. Tables 4 and 5 contain a list of inputs that were utilized in the energy model of the wastewater plant, categorized into those that are constant and those that vary. The values used for the constants, the units for each input, and the source of the values are shown in Table 4. The inputs that vary as well as the frequency of data available are shown in Table 5.

Primary sources of savings:

- Fine bubble diffusers significantly reduce the horsepower requirements for blower motors
- Automatic control of VFD speed on blower motors reduce power draw from peak

Footnote: 5. Bolles, S., "Modeling Wastewater Aeration Systems to Discover Energy Savings Opportunities," Retrieved from http://www.processenergy.com/Aeration%20Paper.pdf 6. "Maximum Dissolved Oxygen Concentration Saturation Table," Retrieved from http://dnr.mo.gov/env/esp/wqm/DOSaturationTable.htm 7. U.S. EPA, 1989, "Design Manual: Fine Pore Aeration Systems," EPA/625/1-89/023, pg 38

Once the inputs to the model were known, the calculation could then be set up. There was, however, one primary difficulty with building an hourly model that needed to be addressed. Hourly input data was not available for flows and loadings on the plant. This was addressed by converting the daily data into hourly data by using a diurnal curve. A diurnal curve shows the hourly variation in flow and strength of wastewater over a typical 24-hour period. The curve shown in Figure 13 was used for this analysis[8]. The data from this curve was normalized so that the average daily flow and loadings was set equal to 1. The normalized value for each hour was then multiplied by the daily data to get an 8,760-hour profile for flows and loadings for the year.

The results of the analysis showed wide fluctuations in the power requirements of the blower motors, even to the point of exceeding available capacity, as determined by the design calculations. Upon further review of the analysis, it was determined to not use this diurnal curve for the wastewater flow value.

Due to the large volume of the treatment ponds, the actual change in volume each hour is a relatively small percentage, and would not require the excessive aeration values to maintain a dissolved oxygen level that were calculated in the model. The flows were then set to a constant value each day based on the average daily readings while the hourly BOD and NH_4 values did vary in accordance with the diurnal curve. Once these calculations were set, an 8760-hour profile of blower motor kW was calculated for the year. Other loads such as transfer pumps, headwork motors, and miscellaneous loads were not impacted by the ECMs, so the values calculated in the baseline analysis were used and added to the blower motor profile to determine an overall hourly electric profile for the entire wastewater treatment plant.

Savings were determined using two approaches. The first approach was to calculate the energy (kWh) savings. The hourly profile for the wastewater treatment plant from the model was binned into the three time-of-use periods for each month, as defined by the utility company's rate schedule. The difference between the baseline energy use and the post-retrofit model use was then calculated. The minimum method was used to determine the energy savings. The minimum method looks at the value calculated in the baseline model and the value from the utility baseline and then sets the smaller value as the baseline value from which to calculate savings. This is done for each time-of-use period in each month. This ensures savings will not be overestimated for any of the data points. The energy savings for this project were estimated to be 2,593,087 kWh per year, or 74.98% of the baseline.

The second approach was to calculate the demand (kW) savings. Because demand is easily impacted by small variations in flow rates, it is difficult to accurately project the savings that will actually be seen on utility bills from the demand component. For this reason, a conservative approach was used to determine the expected demand savings. The post-retrofit model was re-run setting the hourly flow for every hour of the year as the maximum daily flow. This resulted in much higher blower power requirements, but ensured that if the peak flow occurred at any time of day, the demand savings would not be overstated. The rest of the process was the same as described previously. The demand savings for this project were estimated to range between 268 kW and 326 kW, depending on the month. This is equivalent to 41.75% of the baseline demand values.

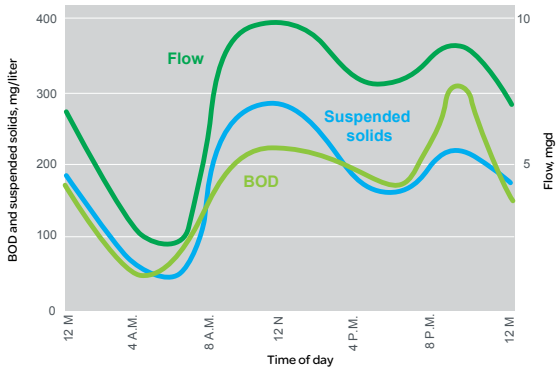


Figure 13: Diurnal Curve of Typical 24-hour Period

Savings were determined by calculating both energy (kWh) and demand (kW) savings

Footnote: 8. Smith, D., 2013, "Water and Wastewater Basic Training 101," Schneider Electric

Post-Retrofit Utility Analysis

The final step in the analysis was to determine the financial value of the energy and demand savings from this retrofit. The savings values calculated previously were run through the tariff simulation that was created in the baseline utility analysis step to determine the expected utility bill after the retrofit takes place. The difference between the baseline cost and this calculated cost are the anticipated savings. The dollar savings for this project were estimated to be $240,129 per year, or 65.4% of the baseline costs.

Financial Analysis

A financial analysis for this project was done to show how quickly this retrofit would pay for itself in utility bill savings. The city wanted to have a project that would pay for itself within the life of the equipment being installed. On average, that would be 15-20 years. The final project cost for this retrofit was $3.9M, which gave a simple payback of 16.5 years. A loan was taken out by the city to fund the project up-front, and then it will be repaid over time with the savings from the utility bill.

In addition to the utility bill savings, utility incentives were also evaluated. Based on the customized program from the utility company, a rebate of approximately $180,000 could have been available for this project. However, due to the fact that the city didn't technically "own" the project because a loan was used to fund the project, it became ineligible for rebates, so none were pursued.

Use of Energy Savings Performance Contract

The procurement method that was used by the city to get this work done was through an Energy Savings Performance Contract (ESPC) with Schneider Electric. In an ESPC, the customer will typically take out a loan to pay for the project. They will contract with an Energy Services Company (ESCO), who will be paid for the implementation of the work, and in turn will guarantee the customer that they will see the savings that were estimated on their utility bills. The ESCO will be liable to write the customer a check for the savings that were not achieved, if there are any. The city chose this procurement methodology because they did not have the up-front funds to pay for the plant upgrade. Additionally, they wanted the fixed price contract that comes with an ESPC and the guarantee of utility savings so they could be sure to have the funds available to pay off the loan.

In this project, Schneider Electric was the general contractor and oversaw the construction of this retrofit. They managed sub-consultants to finalize engineering on the project and sub-contractors who provided the civil, electrical, mechanical, and automation engineering work.

Post-project installation, Schneider Electric also provided support and training for the plant operators on the new systems that were installed to ensure they are knowledgeable on how to operate the new equipment. Additionally, verification of energy savings is being completed by using a short-term Option C strategy, as defined in the International Performance Measurement & Verification Protocol (IPMVP).

Benefits of an Energy Savings Performance Contract

- Delivers guaranteed savings
- Enables cities to fund upgrades without expending upfront funds
- Provides one point of contact for service and support
- Mitigates risk

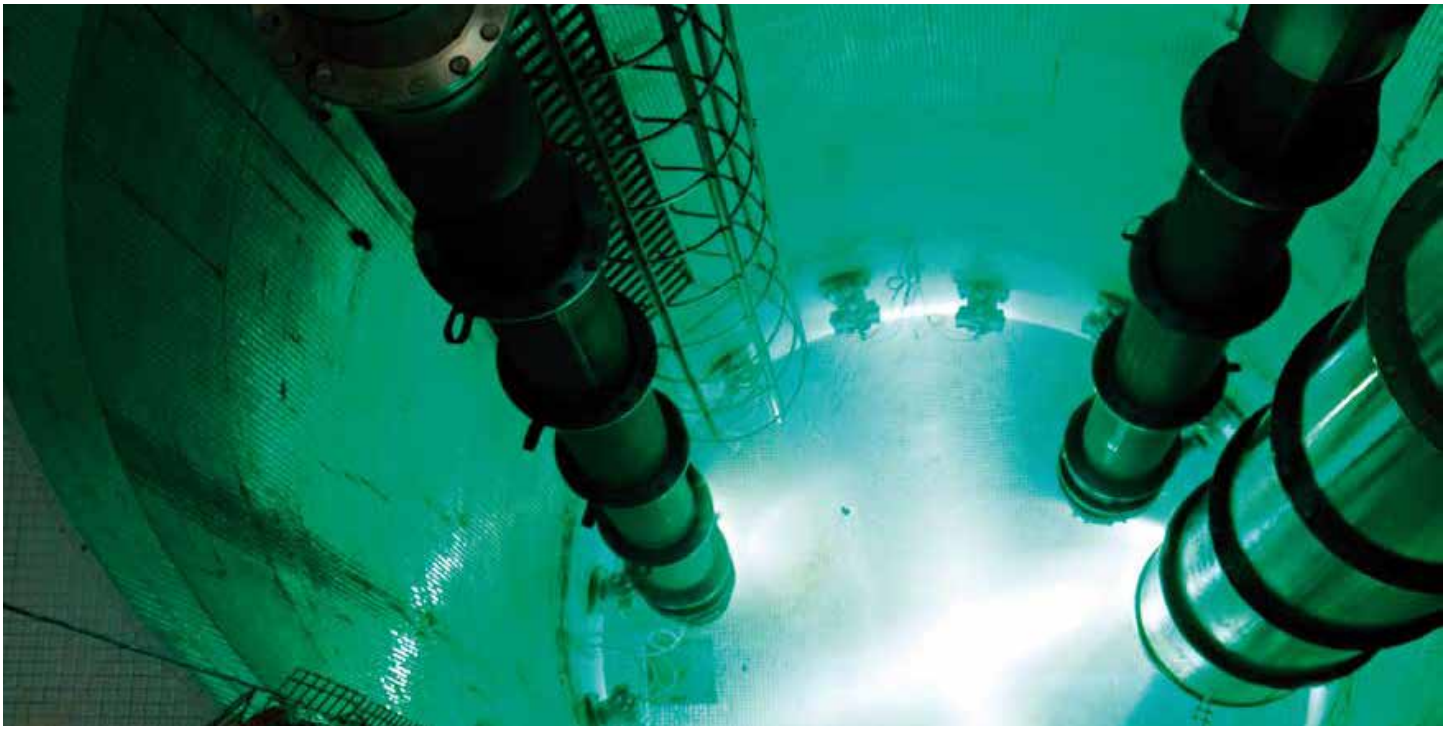
Financials

$240,129

amount of estimated annual dollar savings, equal to 65.4% of baseline costs

$4.8 million

total amount the utility will save in avoided energy costs over 20 years



Conclusion

The project with the City of Riverbank and Schneider Electric has proved to be a successful partnership in which the city received an upgraded wastewater treatment plant which resulted in a significantly reduced electric utility bill and provided a path forward in the event their permit requirements become stricter. In order to support the financial analysis and guarantee associated with this project, a detailed and innovative approach to estimating energy savings was developed. While not every wastewater plant will have the same magnitude of opportunity as this one, it is a great example of how a city can mitigate risk, upgrade their plant, become more efficient, and utilize the utility savings to pay for it. It also shows how energy efficiency can be considered in this relatively untapped market without reducing the quality of operations.

About the Author

Ben Johnson is an Energy Engineering Manager for Schneider Electric's Energy and Sustainability Services group. He's been with the company for 10 years and has worked as an energy analyst, project development manager, and energy team lead. He is a Professional Engineer, Certified Energy Manager, Project Management Professional, and LEED AP. He received his Bachelor's of Science degree in Mechanical Engineering from Arizona State University and is currently working on his Master's of Science degree in Engineering Management at California State University – Long Beach.

To discuss your project with Ben, **complete this short form**.

To learn more about Schneider Electric's water/wastewater solutions, visit **www.enable.schneider-electric.com**.

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