



Energy Audits

City of Fairfield Facilities

May 2009

Prepared By:



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Executive Summary

The City of Fairfield has established a goal to reduce their energy costs by 30% through the implementation of energy efficiency projects. The purpose of this report is to identify opportunities in the city's main energy using facilities.

It was determined that a significant energy savings can be achieved at the water treatment facilities and at the City Recreational Center. Installing a pool cover in the aquatic center and heating controls in the community center will produce substantial savings and are highly recommended. A variety of opportunities are available at the waterworks facility and should all be considered due to their large impact on the overall energy usage of the city. The wastewater treatment facility also has opportunities which will have a large impact on energy usage but the measures currently available may require system-wide improvements to the facility before savings can be realized.

Additional opportunities are available at all of the City of Fairfield's other buildings. These opportunities consistently include lighting and HVAC improvements.

Project Summary Table

Facility	Electrical Savings				Natural Gas Savings			Total Cost Savings	% Total Cost Savings	Project Costs	Payback Period
	kWh	% Savings	kW - months	Energy Cost	Therms	% Savings	Fuel Cost				
Fire Department	3,630	9%	-	\$ 367	1,229	23%	\$ 1,326	\$ 1,693	17%	\$ 14,000	8.3
City Hall	6,446	14%	-	\$ 651	550	29%	\$ 634	\$ 1,285	19%	\$ 21,000	16.3
Public Works	15,500	79%	-	\$ 1,535	164	5%	\$ 181	\$ 1,716	31%	\$ 21,000	12.2
Library	49,785	22%	-	\$ 4,530	751	10%	\$ 798	\$ 5,328	19%	\$ 32,000	6.0
Law Center	51,305	11%	-	\$ 3,456	3,424	24%	\$ 3,576	\$ 7,032	15%	\$ 50,000	7.1
Rec Center	33,780	18%	-	\$ 3,399	23,565	54%	\$ 24,562	\$ 27,961	43%	\$ 191,000	6.8
Waterworks	279,019	11%	500	\$ 19,639	7,248	45%	\$ 7,755	\$ 27,395	15%	\$ 132,000	4.8
Wastewater	317,775	20%	145	\$ 19,922	-	-	\$ -	\$ 19,922	22%	\$ 55,000	2.8
TOTAL	757,239	16%	645	\$ 53,500	36,930	40%	\$ 38,832	\$ 92,332	21%	\$ 516,000	7.1

1. Introduction

The City of Fairfield has retained Michaels Engineering to complete energy audits for its city facilities. The goal of the audits is to determine the potential amount of energy that can be saved through energy management improvement projects. The City of Fairfield has established a goal to reduce their energy costs by 30%.

This report contains a description of the City's major energy using facilities and rough savings estimates for the identified measures. These estimates were generated using rules of thumb, experience with similar projects in other facilities and engineering judgment. The analysis and cost estimates are not investment grade.

The intent of these estimates is to provide a magnitude of savings potential and approximate costs to achieve the savings. The estimates will help the City of Fairfield to decide whether to pursue certain projects and to plan for future facility upgrades. Select projects can be analyzed in detail as part of a separate effort if further project development or investment-grade financial information is needed to support the decision making process.

2. City of Fairfield's Overall Energy Consumption

Table 1 Energy Use and Cost of the City of Fairfield Facilities

Billing Month & Year	Electricity (Code el)		Demand Summer (Code dms)		Demand Winter (Code dmw)		Natural Gas (Firm) (Code gf)			
	Cost	kWh	Cost	kW-Month	Cost	kW-Month	Cost	Therm		
Jan 08	\$ 15,011	460,961			\$ 9,573	870	\$ 17,468	17,186		
Feb 08	\$ 15,310	485,977			\$ 9,575	870	\$ 17,386	16,059		
Mar 08	\$ 14,925	437,925			\$ 9,367	852	\$ 14,510	12,947		
Apr 08	\$ 14,763	416,526			\$ 10,655	969	\$ 8,744	7,514		
May 08	\$ 16,354	390,846			\$ 8,998	818	\$ 5,248	4,027		
Jun 08	\$ 22,529	478,707			\$ 8,761	796	\$ 3,759	2,669		
Jul 08	\$ 21,100	450,109	\$ 15,308	900			\$ 2,046	1,380		
Aug 08	\$ 22,452	455,149	\$ 15,074	887			\$ 1,905	1,579		
Sep 08	\$ 17,652	464,735	\$ 16,464	968			\$ 2,790	2,613		
Oct 08	\$ 10,279	332,368			\$ 9,339	849	\$ 1,997	2,130		
Nov 08	\$ 10,099	358,330			\$ 9,862	897	\$ 11,099	12,896		
Dec 08	\$ 12,466	394,472			\$ 9,144	831	\$ 16,912	17,224		
Totals:	\$ 192,941	5,126,105	\$ 46,846	2,756	\$ 85,275	7,752	\$ 103,865	98,224	\$ -	-
Avg. Rate:	\$ 0.0376 / kWh		\$ 17.000 / kW-Month		\$ 11.000 / kW-Month		\$ 1.057 / Therm			

Building Square Feet:	Total Electricity		Total Other Fuels		City Total	
	MMBtu/yr.	Btu/sq.ft.-yr.	MMBtu/yr.	Btu/sq.ft.-yr.	MMBtu/yr.	Btu/sq.ft.-yr.
Yearly Energy Consumption	17,495	N/A	9,823	N/A	27,318	N/A

Yearly Energy Cost	Total Electricity		Total Other Fuels		City Total	
	\$/yr.	\$/sq.ft.-yr.	\$/yr.	\$/sq.ft.-yr.	\$/yr.	\$/sq.ft.-yr.
	\$ 325,061	N/A	\$ 103,865	N/A	\$ 428,926	N/A

3. Energy Comparison of City Facilities

Table 2 Current Energy Usage and Costs for Each Facility

Facility	Electrical					Natural Gas				Total Energy Cost
	kWh	% of Total	kW - Months	kWh per Sq-ft	Energy Cost	Therms	% of Total	Therm per Sq-ft	Fuel Cost	
Fire Department	39,990	1%	-	9.3	\$ 4,047	5,386	6%	1.25	\$ 5,809	\$ 9,856
City Hall	45,651	1%	-	7.9	\$ 4,610	1,921	2%	0.33	\$ 2,215	\$ 6,824
Public Works	19,500	0%	-	1.2	\$ 1,931	3,239	4%	0.21	\$ 3,582	\$ 5,513
Library	228,360	5%	-	11.0	\$ 20,778	7,509	8%	0.36	\$ 7,978	\$ 28,756
Law Center	470,320	9%	1,059	19.1	\$ 31,683	14,118	15%	0.57	\$ 14,746	\$ 46,430
Rec Center	186,830	4%		7.0	\$ 18,692	43,741	48%	1.65	\$ 45,596	\$ 64,288
Waterworks	2,511,424	50%	6,009	N/A	\$ 162,550	16,004	17%	N/A	\$ 17,073	\$ 179,623
Wastewater	1,559,040	31%	2,894	N/A	\$ 92,625	-	0%	N/A	0	\$ 92,625
Total	5,061,114	100%	8,903	-	\$ 336,916	91,916	100%	-	\$ 96,999	\$ 433,915

4. Fire Department

4.1. General Building Description

The fire department is a 4,300 square foot building constructed in 1972. The building consists of a garage area where the fire trucks are stored and an office area which also contains the Jefferson County Public Health Offices. The fire department area is occupied by at least one person 24 hours per day. The public health offices are occupied from 6:30 AM to 4:30 PM from Monday-Friday.

Five forced air natural gas fired furnaces are used for heating in the office area. All five of the furnaces appear to be of the condensing type and have an efficiency of 90% or greater. Two ceiling mounted natural gas fired unit heaters (80% efficiency) are in place in the garage area. None of the thermostats in the building are programmable and are manually set to one temperature for adjustment. Rooftop mounted air-cooled condensing units are used for cooling in the office area, the garage is not cooled. The bathroom exhaust fans are on at all times, regardless of occupancy.

The lighting in the garage consists of 4-lamp, 4-foot T8 fluorescent fixtures. The office area is lighted entirely with magnetic ballast 4-foot T12 fluorescent fixtures. There are no occupancy sensors in the building.

4.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation:

- Retrofit existing T12 fixtures with high efficiency T8 lamps and ballasts.
- Install wall-switch occupancy sensors in offices and meeting rooms.
- Install programmable thermostats and adjust setpoints to include setback control when the building is unoccupied (55F-60F during heating season and 80F during cooling).
- Install infrared heaters in the garage area and control with programmable thermostats.
- Install ventilation occupancy controls or timers on building exhaust systems to operate as needed or appropriate.

4.3. Savings Summary

Table 3 Savings Impact on Existing Usage for the Fire Department

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	39,990	-	\$ 4,047	5,386	\$ 5,809	\$ 9,856
Savings	3,630	-	\$ 367	1,229	\$ 1,326	\$ 1,693
% Savings	9%	-		23%		17%

The amount of heating energy used in this facility is rather high for its size. The greatest opportunity for savings appears to be from the heating system in the garage area and the office. Improvements in controlling the office areas with programmable thermostats and installing a more efficient and properly controlled system in the garage may produce greater savings than estimated. Implementing the listed measures will cost roughly \$14,000 and produce a simple payback period of 8.3 years. The majority of the savings and costs will be for installing an infrared heating system in the garage area.

5. City Hall

5.1. General Building Description

Fairfield City Hall is a 5,800 square foot building constructed in 1930. The building is home to the offices of various city departments and staff. The building is occupied from 8 AM to 5 PM, Monday-Friday.

Four, forced air natural gas fired furnaces are used for heating. All four of the furnaces have an 80% efficiency rating. None of the thermostats in the building are programmable and are manually set to one temperature for adjustment. Rooftop mounted air-cooled condensing units are used for cooling.

The lighting in the garage consists of 4-lamp, 4-foot T8 fluorescent fixtures. The office area is lighted entirely with magnetic ballast 4-foot T12 fluorescent fixtures. There are no occupancy sensors in the building.

Attic insulation in the building consists of 2 inches of rigid insulation and has an R-value of 10.

5.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation:

- Retrofit existing T12 fixtures with high efficiency T8 lamps and ballasts. Also replace all incandescent lamps with compact fluorescent lamps.
- Install wall-mounted occupancy sensors in offices and meeting rooms.
- Install programmable thermostats and adjust setpoints to include setback control when the building is unoccupied (55F-60F during heating season and 80F during cooling).
- Install high efficiency condensing furnaces with a 94% or greater efficiency rating.
- Install LED exit signs.
- Additional attic insulation (blown cellulose or fiberglass batt insulation) should be installed in the attic being careful not to interfere with HVAC equipment or storage areas in the attic.

5.3. Savings Summary

Table 4 Savings Impact on existing Usage for City Hall

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	45,651	-	\$ 4,610	1,921	\$ 2,215	\$ 6,824
Savings	6,446	-	\$ 651	550	\$ 634	\$ 1,285
% Savings	14%	-		29%		19%

Based on current energy usage, the City Hall building is currently operating fairly efficiently. Improvements to this building will have a longer payback period but should still be considered to bring it up to date with energy efficiency standards. Improvements to the lighting and heating systems will provide the majority of the savings and costs. Implementing the listed measures is estimated to cost \$21,000 and have a payback of 16.3 years.

6. Public Works

6.1. General Building Description

The public works building is a 15,680 square foot facility built in 1982. The building is used for storage of the department's equipment and vehicles and also serves as a maintenance shop for the vehicles. The public works building is occupied from 7 AM-4 PM Monday-Friday and at unscheduled times when necessary.

The garage portion of the building is heated with gas-fired unit heaters controlled by manual thermostats. The office, break room, and restroom areas are heated with baseboard electric resistance heaters. Small, wall mounted air conditioning units are used sparingly in the office areas. The garage area is not cooled.

The building is lighted entirely with T12 fluorescent fixtures with magnetic ballasts. All of the light fixtures are manually controlled and do not have occupancy sensor controls.

6.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation:

- Replace existing T12 fixtures with high efficiency T8 lamps and ballasts.
- Remove existing electrical heating equipment currently present in offices, break rooms, and restrooms. Replace with a high efficiency forced air natural gas heating system or several small gas fired unit heater to reduce fuel costs. This equipment should also include programmable thermostats.
- Program thermostats to include setback control when the building is unoccupied.
- Install infrared heaters in the garage area and control with programmable thermostats.

6.3. Savings Summary

Table 5 Savings Impact on existing Usage for the Public Works Building

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	19,500	-	\$ 1,931	3,239	\$ 3,582	\$ 5,513
Savings	15,500	-	\$ 1,535	164	\$ 181	\$ 1,716
% Savings	79%	-		5%		31%

The majority of the building's energy use is from lighting and heating. Replacing the electric heat will provide the greatest impact and return. Installing infrared heat in the garage area will provide significant savings but with a longer return. Implementing all of the measures is estimated to cost \$21,000 and produce a payback period of 12.2 years.

7. Library

7.1. General Building Description

The Library is a 20,800 square foot building constructed in 1996. The Library is occupied from 9:30 AM to 8:00 PM on Monday-Wednesday, from 8:30 AM to 6:00 PM on Thursday-Friday, and from 1:00 PM to 5:00 PM on the weekends.

The library utilizes a central heating and cooling system. A gas-fired condensing hot water boiler with a minimum efficiency of 86% is used for heating. A 70-ton chiller supplies chilled water. The Variable Air Volume (VAV) air handling system has variable speed supply and return air fans. A Johnson Controls Energy Management System (EMS) is used to control all of the HVAC equipment.

The library is lighted entirely with 4-foot T8 fluorescent fixtures. Some areas of the library have already been de-lamped to reduce energy consumption. Library staff reduces lighting in the main library area by not turning on all of the lights.

7.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation:

- De-Lamp the existing 3-lamp T8 fluorescent fixtures to a 2-lamp fixture.
- Install high efficiency, 28-Watt T8 lamps to replace the existing 32-Watt standard T8 lamps.
- Install wall-switch occupancy sensors in offices and other similar rooms.
- Install an ultrasonic humidifier to replace the electric, steam humidifier.
- Perform Retrocommissioning for the HVAC system.

7.3. Savings Summary

Table 6 Savings Impact on existing Usage for the Library

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	228,360	-	\$ 20,778	7,509	\$ 7,978	\$ 28,756
Savings	49,785	-	\$ 4,530	751	\$ 798	\$ 5,328
% Savings	22%	-		10%		19%

Based on energy records, the library is operating fairly efficiently, and the electrical and heating energy used at the facility compares well to similar facilities of its size and type. The lighting system will need to be looked at in further detail to determine the best approach to improving the lighting system. The lighting is already controlled conservatively by staff and savings may not be fully realized due to its current operation. An in depth retrocommissioning of the HVAC system would produce considerable savings. Implementing the lighting and HVAC measures will cost roughly \$32,000 and have a payback of 6.0 years.

8. Law Center

8.1. General Building Description

The Fairfield Law Center is home to the Fairfield Police Department and Jefferson County Law Enforcement Center. The 24,680 square foot building was completed in 2000 and also houses the county jail. A majority of the building is occupied at all times.

The facility's HVAC system consists of 13 packaged rooftop units, which have an air side economizer capability. The rooftop units are controlled with programmable thermostats in the office areas. Due to the hours of use of the facility the thermostats do not operate on the same schedule. Due to lack of accessibility the controls and other details regarding the jail portion of the facility are unknown. Although from inspection on the roof it was apparent that there is a significant amount of exhaust air.

The office areas and prison portion of the building is lighted with T8 fluorescent fixtures. 400-Watt metal halide fixtures are used in the garage area and appear to be on for a significant amount of time while unoccupied. Metal halide fixtures take 10-15 minutes to warm up and turn on and therefore are usually left on to eliminate waiting. Occupancy sensors which operate during low occupancy hours are in use in the hallways of the office area.

8.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation:

- De-lamp the 3-lamp fixtures to 2-lamps throughout the building or install high efficiency low wattage 25-Watt T8 lamps to replace the existing standard 32-watt lamps. Further analysis of lighting levels will be needed to determine the best alternative.
- Install wall-switch occupancy sensors in offices and meeting rooms.
- Program thermostats to include setback control when areas served are unoccupied. All of the thermostats should have similar heating and cooling set-points to avoid simultaneous heating and cooling. A review of the operating hours of certain areas will need to be conducted to determine the best settings and control scheme
- Replace the existing 400 Watt metal halide fixtures in the garage area with 8-Lamp T8 fixtures, which can then be controlled with an occupancy sensor.
- Install heat recovery units on the building's main exhaust systems and use to pre-heat outdoor air.
- Install LED exit signs.
- Review current HVAC operations and implement controls adjustments where appropriate. Verify that the economizer mode is functional on the rooftop units, review the outside air

levels and requirements, and possibly install CO2 controls to modulate outside air in the prison area.

8.3. Savings Summary

Table 7 Savings Impact on existing Usage for the Law Center

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	470,320	1,059	\$ 31,683	14,118	\$ 14,746	\$ 46,430
Savings	51,305	-	\$ 3,456	3,424	\$ 3,576	\$ 7,032
% Savings	11%	-		24%		15%

Due to the type and usage of the Law Center building it uses a large amount of energy on a square foot basis. The addition of a heat recovery system and adjustments to the HVAC controls will provide the greatest payback and savings. Improvements to the lighting system will not provide as great of a payback but should be considered. Implementing all of the measures is estimated to cost \$50,000 and have a payback period of 7.1 years.

9. Recreational Center

9.1. General Building Description

The Recreational Center consists of two separate buildings, the Roosevelt Community Center and the Aquatic Center. The Roosevelt Community Center is a 12,000 square foot former school constructed in 1920. The Aquatic Center was completed in 1992 and has 14,800 square feet with a 104' x 50' indoor pool. The community center is open from 6 AM to 9 PM Monday-Friday, 8 AM to 4 PM on Saturday and from 1 PM to 5 PM on Sunday. The Aquatic Center is open from 6 AM to 8 PM Monday-Friday, 8 AM to 4 PM on Saturday and from 1 PM to 5 PM on Sunday. During the summer the aquatic center is closed on Sundays.

The community center building is heated with a gas fired steam boiler that supplies steam to cast iron radiant heaters in each room. It was noted by staff that a number of the steam traps are likely in need of replacement. The community center building is cooled with window mounted air conditioning units.

The aquatic center's HVAC system consists of one large and two small air handling units. One small air handler serves the entrance area of the facility while the other is used to remove condensation from the exterior windows. The large unit serves the pool area. The pool air handler has a coil to coil heat recovery loop in the intake and exhaust ducts of the system. A gas fired hot water boiler is used for both pool water heating and space heating. The aquatic center pool does not have a pool cover.

The lighting in the community center consists of T12 fluorescent fixtures with magnetic ballasts. None of the rooms have occupancy sensors. The aquatic center pool area is lighted with 400-Watt metal halide fixtures. The locker room, shower, and entrance area of the building uses T12 fluorescent fixtures with magnetic ballasts for lighting. The aquatic center also does not have occupancy sensor lighting controls.

9.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation in the Roosevelt Community Center:

- Install programmable controls and automatic control valves to replace the manual control valves on the cast iron radiant heaters in each room of the Roosevelt Community Center.
- Retrofit existing T12 fixtures with high efficiency T8 lamps and ballasts.
- Install occupancy sensors in all rooms.
- Program thermostats to include setback control when the building is unoccupied.

The following measures were identified as opportunities that should be considered for implementation in the Aquatic Center:

- Install an automatic pool cover.
- Reduce pool temperature to 80F.
- Install a solar water heater for heating the pool water.
- Replace the metal halide light fixtures with 6-lamp T8 fluorescent lighting.
- Install ceiling mounted occupancy sensors in the locker rooms.
- Retrofit existing T12 fixtures with high efficiency T8 lamps and ballasts.

9.3. Savings Summary

Table 8 Savings Impact on existing Usage for the Recreational Center

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	186,830	-	\$ 18,692	43,741	\$ 45,596	\$ 64,288
Savings	33,780	-	\$ 3,399	23,565	\$ 24,562	\$ 27,961
% Savings	18%	-		54%		43%

Based on the Recreational Center building types and sizes, the amount of energy used is relatively high when compared to similar buildings. The projects that will have the greatest impact on energy usage are the installation of automatic control valves on the steam heating system in the community center and the addition of a pool cover in the aquatic center. Other items that will have a significant impact are a solar pool water heater, the reduction of pool water temperature, and lighting retrofits. Zone controls in the community center will cost roughly \$18,000 and have a payback of less than 3 years. The pool cover, while costing an estimated \$40,000 will have a payback period of 4 years. Installing a solar pool water heater would save around \$5,000 but may prove to be too costly to install at an estimated \$80,000, renewable energy incentives or grants may help to bring this cost down. Implementation of all of the projects would produce a 6.8 year payback at a total estimated cost of \$191,000.

10. Waterworks

10.1. General Building Description

The Waterworks facility supplies an average of 1.29 million gallons of water to the City of Fairfield each day. The Waterworks facility utilizes two types of filtration. In addition to the standard filtration process used at the facility, there is also an electro dialysis reversal (EDR) separation process used to filter the water. The energy used at the waterworks facility includes city well pumps, water tower high service pumps, and filtration processes.

The main building at the waterworks facility uses electric coil unit heaters for heating, which are not controlled with programmable thermostats. The EDR building is heated with a 100% make up air unit to satisfy ventilation requirements.

The lighting in the main building consists mainly of T12 fluorescent fixtures with magnetic ballasts. Other areas of the building use a variety of lighting types. The EDR building is lighted with T8 fluorescent fixtures.

10.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation:

- Retrofit existing T12 fixtures with high efficiency T8 lamps and ballasts.
- Install wall-switch occupancy sensors in offices.
- Install natural gas heating systems in the building to replace all electric heaters. Infrared heaters and forced air furnaces should be used as appropriate.
- Install variable frequency drives on the high service pumps.
- Sequence the service pumps and well pumps to reduce demand during on-peak hours.
- Install a heat recovery make up air unit on the EDR building.

10.3. Savings Summary

Table 9 Savings Impact on existing Usage for the Waterworks Facility

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	2,511,424	6,009	\$ 162,550	16,004	\$ 17,073	\$ 179,623
Savings	279,019	500	\$ 19,639	7,248	\$ 7,755	\$ 27,395
% Savings	11%	8%		45%		15%

The Waterworks facility is the City of Fairfield’s largest consumer of energy; this is mainly due to the large pumps required for pumping from the wells and to the water towers. The 400 HP Jordan well pump and the 125 HP high service pump (two other high service pumps were not operating) were analyzed to determine their efficiencies. Both pumps proved to be operating at an acceptable pumping efficiency for their size, approximately 70% for the high service pump and 65% for the well pump. The amount of electrical energy used by the facility is consistent with other facilities of comparable size but there is room for improvement. The projects with the greatest impact and return on investment are installing a heat recovery make up air unit on the EDR building and installing a variable frequency drive on the high service pumps. A number of options can be pursued to eliminate the electric heating of the building and are strongly recommended. Sequencing of the pumps should be analyzed in greater detail to determine its feasibility. Implementing all of the measures is estimated to cost \$132,000 and have a 4.8 year payback.

11. Wastewater Treatment

11.1. General Building Description

The Wastewater Treatment Plant treats an average of 1.69 million gallons of wastewater daily. The treatment process is an activated sludge type system with oxidation ditches. During discussions with facility personnel it was noted that a majority of the challenges at the facility stem from maintenance issues and have a direct impact on energy consumption. During periods of rain the facility has troubles handling the excessive amounts of flow that are beyond the limits of the system. Another concern is the leaking blower supply line in the underground portion of the air piping.

Liquid propane and Fuel Oil are used at times for supplemental fuel to methane fired boiler and for the digester burn-off flare.

11.2. Energy Saving Opportunities

The following measures were identified as opportunities that should be considered for implementation:

- Install oxidation reduction potential controls on the blower system to properly control the blowers to modulate oxygen levels based on BOD demand which will reduce blower energy.
- Install automatic controls on the mixing drives and influent pumps to control the VFDs according to BOD demand.
- Install variable frequency drives with automatic controls on the return activated sludge pumps.
- Fix the leaking blower supply line to reduce load on the blowers.
- Consider ways to redirect runoff water away from sanitary sewer.

The savings for this facility depend on resolving the current maintenance issues that affect the stable and efficient operation of the wastewater treatment plant.

Additional savings can be achieved with the installation of a methane capture system to use the excess methane for the generation of electricity. The payback for a project of this type is likely to be long but should be evaluated further for feasibility.

11.3. Savings Summary

Table 10 Savings Impact on existing Usage for the Wastewater Facility

	Electrical			Natural Gas		Total Energy Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Base Usage	1,559,040	2,894	\$ 92,625	-	\$ -	\$ 92,625
Savings	317,775	145	\$ 19,922	-	-	\$ 19,922
% Savings	20%	5%		-		22%

Most of the facility’s main energy using equipment is equipped with variable speed drives, but lacks proper control to optimize the operating efficiency of the equipment. The facility currently has a number of maintenance and operation issues which affect the performance and control of the equipment and requires that system wide improvements be made for the facility to gain energy efficiency. A majority of the maintenance and operation issues stem from overflows seen during moderate to heavy rainfalls.

If the costs of installing controls and variable frequency drives on existing equipment are analyzed without the additional maintenance and operating cost improvements, the improvements would cost roughly \$55,000 and produce a simple payback period of 2.8 years. The scope and costs of the facility improvements have not been made at this time, a more detailed analysis is required.

12. Savings Impact Summary

Table 11: Existing Energy Usage and Cost

Facility	Electrical			Natural Gas		Total Cost
	kWh	kW - months	Energy Cost	Therms	Fuel Cost	
Fire Department	39,990	-	\$ 4,047	5,386	\$ 5,809	\$ 9,856
City Hall	45,651	-	\$ 4,610	1,921	\$ 2,215	\$ 6,824
Public Works	19,500	-	\$ 1,931	3,239	\$ 3,582	\$ 5,513
Library	228,360	-	\$ 20,778	7,509	\$ 7,978	\$ 28,756
Law Center	470,320	1,059	\$ 31,683	14,118	\$ 14,746	\$ 46,430
Rec Center	186,830	-	\$ 18,692	43,741	\$ 45,596	\$ 64,288
Waterworks	2,511,424	6,009	\$ 162,550	16,004	\$ 17,073	\$ 179,623
Wastewater	1,559,040	2,894	\$ 92,625	-	\$ -	\$ 92,625
TOTAL	5,061,114	9,962	\$ 336,916	91,916	\$ 96,999	\$ 433,915

Table 12: Energy Intensity Comparison after Implementation

Facility	Before		After	
	kWh per Sq-ft	Therm per Sq-ft	kWh per Sq-ft	Therm per Sq-ft
Fire Department	9.3	1.25	8.5	0.97
City Hall	7.9	0.33	6.8	0.24
Public Works	1.2	0.21	0.3	0.20
Library	11.0	0.36	8.6	0.32
Law Center	19.1	0.57	17.0	0.43
Rec Center	7.0	1.65	5.8	0.76
Waterworks	N/A	N/A	N/A	N/A
Wastewater	N/A	N/A	N/A	N/A

Table 13: Potential Savings Estimates

Facility	Electrical Savings				Natural Gas Savings			Total Cost Savings	% Total Cost Savings	Project Costs	Payback Period
	kWh	% Savings	kW - months	Energy Cost	Therms	% Savings	Fuel Cost				
Fire Department	3,630	9%	-	\$ 367	1,229	23%	\$ 1,326	\$ 1,693	17%	\$ 14,000	8.3
City Hall	6,446	14%	-	\$ 651	550	29%	\$ 634	\$ 1,285	19%	\$ 21,000	16.3
Public Works	15,500	79%	-	\$ 1,535	164	5%	\$ 181	\$ 1,716	31%	\$ 21,000	12.2
Library	49,785	22%	-	\$ 4,530	751	10%	\$ 798	\$ 5,328	19%	\$ 32,000	6.0
Law Center	51,305	11%	-	\$ 3,456	3,424	24%	\$ 3,576	\$ 7,032	15%	\$ 50,000	7.1
Rec Center	33,780	18%	-	\$ 3,399	23,565	54%	\$ 24,562	\$ 27,961	43%	\$ 191,000	6.8
Waterworks	279,019	11%	500	\$ 19,639	7,248	45%	\$ 7,755	\$ 27,395	15%	\$ 132,000	4.8
Wastewater	317,775	20%	145	\$ 19,922	-	-	\$ -	\$ 19,922	22%	\$ 55,000	2.8
TOTAL	757,239	16%	645	\$ 53,500	36,930	40%	\$ 38,832	\$ 92,332	21%	\$ 516,000	7.1

13. Conclusion

The measures that have been identified as a result of the audits combine for a 21% reduction in energy costs. A majority of the energy is used at the waterworks and wastewater facilities. It was initially thought that these facilities would produce the greatest amount of savings, but since many of the large pieces of equipment are already utilizing variable frequency drives, and the large pumps are quite efficient, the savings for these facilities is moderate. The largest savings comes from the Recreational Center, which will benefit greatly from improvements to the aquatic center pool and also with improvements to the heating system in the community center.

The next steps will involve discussion of these results with you, to determine the specific opportunities that you would like to further explore. These opportunities will be further explored in Feasibility Studies to determine investment grade energy savings and cost estimates. Reimbursement for the costs of performing the Feasibility Studies may be available in part or in whole from Alliant Energy.