



FOIA RESPONSE

April 20, 2020

Dear Ms. Benjamin,

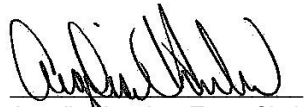
In the following pages you will find the reports and invoices for the information you requested, received as:

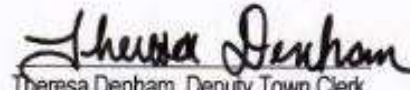
“Copy of the Energy Assessment completed by the University of Illinois for \$7500.”

To further clarify this Full Release, both the Water and Facilities Management departments clarify that these studies were completed with the understanding that the fee will be fully reimbursed by the University of Illinois. Therefore, these studies come at no cost to the Town of Normal, and the refund is expected within 8-10 weeks of the invoice date, 3/24/2020.

Thank you,

By:


Angelia Hynker, Town Clerk


Theresa Denham, Deputy Town Clerk

APPEAL RIGHT

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Public Access Bureau
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Springfield, Illinois 62706
217-558-0486
publicaccess@atg.state.il.us

You also have the right to judicial review. Suit may be filed in the Circuit Court for McLean County:

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Circuit Clerk
104 W. Front St.
Bloomington, IL 61701
309-888-5301
www.co.mclean.il.us/circuitclerk

req # 113679

PO# 107471



INVOICE

INVOICE # 1007
DATE: MARCH 24, 2020

Landscape Architecture - SEDAC
611 East Loredo Taft Drive
101 Temple Buell Hall
Champaign, IL 61820

TO

Town of Normal - Water Plant
11 Uptown Circle
Normal, IL 61761

DESCRIPTION	TOTAL
Final invoice for Energy Assessment Service	\$7,500.00
To be deposited into 1-304244-569000-307900-569152	
TOTAL DUE	\$7,500.00

Please remit payment by check payable to the *University of Illinois* along with a copy of this invoice to:

TBH Business Services
Attention: Jennifer Frank
611 East Loredo Taft Drive
105 Temple Buell Hall
Champaign, IL 61820

INVOICE # 1006
DATE: MARCH 24, 2020Landscape Architecture - SEDAC
611 East Loredo Taft Drive
101 Temple Buell Hall
Champaign, IL 61820

TO

Town of Normal - 11 Uptwon
11 Uptown Circle
Normal, IL 61761

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Champaign, IL 61820

Facility Energy Assessment Report



Smart Energy Design Assistance Center (SEDAC)

Town of Normal – 11 Uptown

Published:	3/24/2020
SEDAC	Donghwa Kim
Building Energy Specialist:	Senior Energy Engineer
Facility Location:	11 Uptown Circle Normal IL, 61761
Site Visit:	01/13/2020

This report was prepared as the result of work by a member of the staff of the Smart Energy Design Assistance Center (SEDAC). It does not necessarily represent the views of the University of Illinois, its employees, or the State of Illinois. SEDAC, the State of Illinois, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. Reference to brand names is for identification purposes only and does not constitute an endorsement. All numerical data are order of magnitude estimates and the number of digits shown is an artifact of the calculation procedure; they are not meant to imply greater accuracy or precision. SEDAC is an applied research program at the University of Illinois at Urbana-Champaign. SEDAC works in collaboration with the 360 Energy Group.

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Acknowledgements

The Smart Energy Design Assistance Center (SEDAC) would like to thank Mr. Mark Clinch, Director of Facilities and Energy Management at Normal City Hall, for participating in the Public Sector Design Assistance Program and for providing access to information necessary to develop this report. Donghwa Kim, of SEDAC, was the engineer responsible for the analysis and is the primary author of this report. Additional assistance in report preparation by Kamau Haymon and Shawn Maurer are greatly appreciated. Other contributors to this report of SEDAC are also gratefully acknowledged.

Executive Summary

11 Uptown is the focal point of Normal, Illinois. The facility serves as a multi-modal transportation hub (level 1) which streamlines travel by air, bus and train. The upper floors (level 2-4) serve as the Town of Normal's City Hall which include the Legal Department, Finance Department, and Council Chambers. It has approximately 68,000 sq. ft. of usable space. The 11 Uptown Building is used by city officials, travelers, and citizens. It is occupied year-round.

This report identified seven potential energy cost reduction measures (ECRMs) for implementation. After a thorough evaluation of each measure, all seven of the ECRMs are recommended based upon their feasibility for implementation and significant return on investment.

Recommended Package (ECRM package 1) of Energy Efficiency Measures			
Simple payback (before incentives)	3.4 years	Incentives Available	\$11,800
Annual Utility Cost Savings	\$12,600	Percent Annual Cost Savings	11%
kWh Reduced/yr	140,000	Percentage kWh Reduction	12%
therms Reduced/yr	2,600	Percentage therms Reduction	9%

The recommendations in this report are designed to allow the facility to create an effective and financially prudent implementation plan to be used to help the building become more energy efficient. The report should be used as a tool to facilitate budgetary planning and obtaining funding/financing. Eligible public-sector incentives are described in this report as well as other opportunities for need-based grants and other funding sources. All information is current at the time of the assessment; for up-to-date information on funding or incentives, contact SEDAC any time at 800.214.7954. Alternatively, you may contact your utility. Implementing the recommendations in this report will reduce energy consumption, help improve occupant comfort and reduce vulnerability to fluctuations in future energy costs. This report can also help towards obtaining LEED® and ENERGY STAR building certification.

Each of the seven ECRMs is discussed in detail in this report. Recommendations on HVAC, Lighting, and Energy Management Control System improvements are included along with suggestions for additional cost reduction measures. Table E1 presents the facility's utility information, as obtained from Ameren Illinois documentation. Table E2 presents the results of the analysis performed on each ECRM.

Table E1: Utility Information for August 2018 through July 2019

Fuel	Utility	Rate Class	Annual Consumption		Annual Cost (\$/yr)	Annual Cost (%)	Unit Cost*	
Electricity	Ameren IL	DS3	1,203,337	kWh	\$96,267	86.4%	\$0.08	\$/kWh
Natural Gas	Nicor IL	-	29,100	therm	\$15,184	13.6%	\$0.52	\$/therm
Floor Area	68,000 sf	Totals	7,015,786	kBtu	\$111,451	100%		
Site Energy Use Intensity			103	kBtu/sf/yr	Energy Cost Intensity		\$1.64	\$/sf/yr
Electricity Use Intensity			18	kWh/sf/yr	Natural Gas Use Intensity		0.43	therms/sf/yr
*Notes: Unit Costs are blended averages which include all taxes and demand charges.								

Table E2: Energy Cost Reduction Measure Analysis

ECRM #	Description	Potential Energy Savings				Estimated Project Cost	Potential Incentive	SPB w/o &w/ Incentive (yrs) ¹	IRR (%) ²	NPV (\$) ³
		kW	kWh	Therm	\$					
1	Upgrade Parking Deck Lighting	7	42,000	-	\$3,400	\$14,000	\$3,700	4.1	23%	\$21,000
								3.0	32%	\$25,000
2	Upgrade MH Lighting	5	17,000	-	\$1,300	\$4,900	\$1,400	3.6	27%	\$9,000
								2.6	38%	\$10,000
3	Replace indoor non-LED lighting with LED	14	44,000	(300)	\$3,300	\$19,000	\$4,300	5.9	11%	\$6,100
								4.6	17%	\$10,400
4	Replace existing belt with notched belt on RTUs	2	5,000	-	\$400	\$500	\$50	1.3	79%	\$3,900
								1.2	87%	\$4,000
5	Find Alternate Filters for Existing Rigid Cell Air Filters	-	8,000	-	\$700	\$1,300	\$1,000	2.0	-50%	\$(700)
								<1	152%	\$400
6	Temperature Setpoint Adjustment on RTU3	-	27,000	2,900	\$3,700	\$2,400	\$1,100	<1	151%	\$13,000
								<1	279%	\$15,000
7	Fix the Air Damper on RTU3	-	1,100	-	\$100	\$600	\$200	6.9	-10%	\$(200)
								4.7	2%	\$(30)
PKG 1	All Measures	28	140,000	2,600	\$12,600	\$43,000	\$11,800	3.4	29%	\$88,000
								2.5	40%	\$100,000

Notes:

- 1) "SPB" Refers to Simple Payback, or the amount of time that the projected energy savings will exceed the first cost of the project.
- 2) IRR (%) refers to Internal Rate of Return. IRR takes incentives into account.
- 3) NPV (\$) refers to Net Present Value. NPV takes incentives into account.
- 4) Total values have been rounded from calculated values to 2 significant digits.

1 Introduction

The Public-Sector Design Assistance Program is an energy efficiency program that provides millions of dollars in rebates to public facilities that make large-scale equipment improvements to their electric and natural gas systems. The [Smart Energy Design Assistance Center](#) (SEDAC) supports the Public-Sector Design Assistance Program in advocating the efficient and effective use of energy by businesses and public buildings throughout Illinois. The objective of SEDAC is to encourage communities, building owners and operators, design professionals, and building contractors to incorporate energy efficiency practices and renewable energy systems. SEDAC is managed by the [University of Illinois at Urbana-Champaign](#), in collaboration with [360 Energy Group](#).

SEDAC has performed an energy savings and cost analysis for various energy cost reduction measures (ECRMs) applied to the 11 Uptown Building, located in Normal, Illinois. The analysis is based on a site inspection conducted on 01/13/2020, engineering calculations, and typical industry assumptions. This report presents the results of the analysis along with the methods and assumptions used.

Engaging in energy-efficiency strategies to control costs is more critical than ever as organizations face the lingering recession and budget challenges. Organizations that take a systematic and strategic approach toward energy management will acquire a broad array of tangible and intangible benefits of interest to themselves and the public at large.

The elevation of energy management to critical importance is a result of many factors, including an increasingly complex and volatile energy marketplace, a growing awareness about the realities of climate change, recognition of the rising importance of intangibles in calculating market value, and an expanding awareness of the importance to restrict the carbon footprint of organizations. According to the U.S Green Building Council, most commercial buildings use 10 to 30 percent more energy than necessary and have ample opportunities to reduce their energy consumption levels. Further, cutting a building's energy use by 30 percent often yields the same bottom-line benefits as a 5 percent increase in net operating income and building asset value.

Public entities known for aggressive and proactive environmental policies stand to reap many intangible benefits including improved community relations, an enhanced reputation as a socially responsible entity, and improved productivity/morale. Energy management practices also help to ensure the reliability of equipment, which reduce the risks and costs associated with equipment failures and downtime.

2 Building Description

2.1 General

The analysis of the building was based on engineering calculations, rule of thumb assumptions, and experience of the engineer. The sections which follow describe details of each building and important input parameters of the calculations.

2.2 Site Conditions and Building Details

The 11 Uptown Building was constructed in 2012 and located in downtown Normal, IL. The facility has two parts – building (city hall/ transportation center) and Uptown Station parking deck. The building has four floors, level 1 is the transportation center and levels 2 through 4 are city hall. The Uptown Station parking deck has four level parking structure with two enclosed stair towers. The building has approximately 68,000 sf and the parking deck has approximately 200,000 sf. The building is occupied year-round 8:30am to 5:00pm Monday through Friday and closed on national holidays. The transportation center on the 1st floor is operated year-round 6:30am to 9:30pm. Typical building occupancy was estimated to be 100 people.

2.3 Building Envelope

This building has a low-slope structural steel roof framing system with insulation and white EPDM located entirely above deck. The exterior walls are primarily brick façade with a steel structure with insulation. There is a large amount of glazing on the building. All windows are double pane insulated glass with thermally broken frames. Windows facing South, North and East have solar shades.

The parking deck is open above the precast concrete spandrels with some selected areas having face brick in-lay.

2.4 HVAC Systems

Heating and cooling is provided by three AAON rooftop units serving a VAV system with hot water reheat. The first floor is served by RTU1, the second and third floor is served by RTU2, and fourth floor is served by RTU3. RTU1 has cooling efficiency of 9.5 EER and heating efficiency of 85%, RTU2 has cooling efficiency of 10.2 EER and heating efficiency of 83%, and RTU3 has cooling efficiency of 9.8 EER and heating efficiency of 85% according to the construction documents. All units are equipped with energy recovery ventilators (ERVs) which transfer heat and moisture between incoming and outgoing air streams. All units also have economizers to bring in outdoor air when conditions are favorable for free cooling. Hot water is provided by three non-condensing Thermal Solutions boilers and heating efficiency of 88% according to the construction documents. We suspect that valve command or wiring could be reversed. All supply and return fans, ERVs, and hot water pumps have VFDs. Temperature set points are controlled via a building automation system (BAS). Individual rooms allow occupants to control the temperature within ± 2 degrees. Daytime temperature setpoint is 70 °F and nighttime temperature setback is ± 5 °F. All RTUs have MERV13 filters after 2" prefilters and these filters need to be changed two times per year.

The parking deck has a supplemental electric resistance heater in each enclosed stair tower. The capacity of the system is 5kW according to the construction documents.

2.5 Lighting and Internal Loads

Due to newer construction of the building, it benefits from mostly energy efficient lighting. The majority of lighting is mixed of 32W T8s, 28W T5s, 54W T5s, 17W T8s, 42W CFLs, and LED screw-in lamps in the building. Additionally, there are some CFLs and MHs which are typically outdoor lighting or service lighting. Occupancy sensors and daylighting controls are in use throughout the building. Lighting is controlled by a lighting control station. During the site visit, we noted that some lights were on in unoccupied areas on the 4th floor of building.

The majority of parking deck lighting is T5 linear fluorescent lighting and there are some metal halides and halogen lamps on top floor parking deck which are typically turned on dusk to dawn. Client is interested in upgrading lighting at parking deck.

The building has typical office plug loads which include several computers, LCD TVs, projectors, printers, etc. Breakrooms have a refrigerator, coffee maker, dishwasher, microwave, etc. The first floor has a Subway and they have a commercial kitchen. We were unable to access the kitchen during the site visit.

2.6 Domestic Hot Water

A 100 gallon electric water heater provides hot water to the breakroom, bathrooms, and shower.

3 Energy Consumption Analysis

3.1 Electric and Natural Gas Utility Data Analysis

The building's energy consumption was obtained from utility bills provided by Mark Clinch. Utility bills were analyzed for a twelve month time-frame from August 2018 to July 2019. Electricity is delivered to the building by Ameren Illinois. Natural gas is delivered by Nicor Gas.

The facility paid a total of \$96,267 for electricity in this time frame and \$15,184 for natural gas. The total utility cost for the facility from August 2018 to July 2019 was \$111,451. The energy consumption of just the parking garage was then calculated. The annual consumption of the parking garage is approximately 116,000 kWh. Table 1 only accounts for building (city hall/ transportation center) energy consumption. Table 2 account for building and parking deck energy consumption.

Table 1: Utility Information for August 2018 through July 2019 (bldg. only)

Fuel	Utility	Rate Class	Annual Consumption		Annual Cost (\$/yr)	Annual Cost (%)	Unit Cost*	
Electricity	Ameren IL	DS3	1,086,924	kWh	\$86,954	85%	\$0.08	\$/kWh
Natural Gas	Nicor IL	-	29,100	therm	\$15,184	15%	\$0.52	\$/therm
Floor Area	68,000 sf	Totals	6,618,583	kBtu	\$102,138	100%		
Site Energy Use Intensity			97	kBtu/sf/yr	Energy Cost Intensity		\$1.50	\$/sf/yr
Electricity Use Intensity			16	kWh/sf/yr	Natural Gas Use Intensity		0.43	therms/sf/yr

*Note: Unit Costs are blended averages which include all taxes and demand charges.

Table 2: Utility Information for August 2018 through July 2019 (bldg. & parking deck)

Fuel	Utility	Rate Class	Annual Consumption		Annual Cost (\$/yr)	Annual Cost (%)	Unit Cost*	
Electricity	Ameren IL	DS3	1,203,337	kWh	\$96,267	86%	\$0.08	\$/kWh
Natural Gas	Nicor IL	-	29,100	therm	\$15,184	14%	\$0.52	\$/therm
		Totals	7,015,786	kBtu	\$111,451	100%		

*Note: Unit Costs are blended averages which include all taxes and demand charges.

Figure 1 represents the comparison of electricity consumption (kWh) and annual cooling degree days (CDD). A degree day compares the outdoor temperature to a standard indoor temperature of 65 degrees Fahrenheit. The more extreme the outdoor temperature, the higher the degree day number. Therefore, degree-day measurements can be related to the amount of energy needed for space heating and cooling as compared to the outdoor temperature. Electricity use in winter months increases due to an increase in usage of lighting, electric heating, boiler pumps, and increased fan energy used by rooftop units.

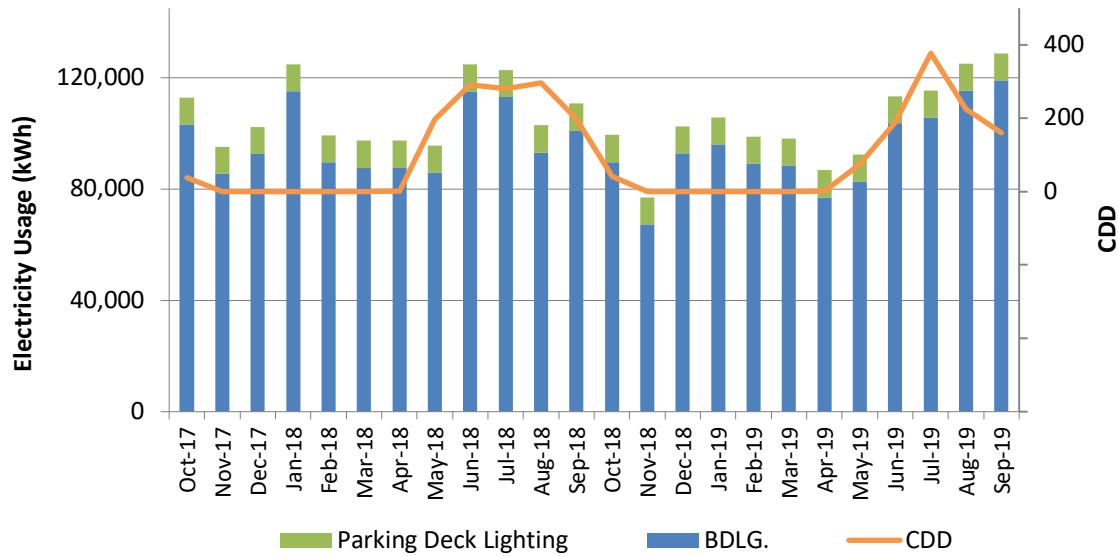


Figure 1: Comparison of Regional Cooling Degree Days versus kWh

Figure 2 represents the comparison of natural gas consumption (Therms) and annual heating degree days (HDD). An HDD compares the outdoor temperature to a standard indoor temperature of 65 degrees Fahrenheit. The colder the outdoor temperature the higher the HDD. As a result HDD measurements can be related to the amount of energy needed for space heating. It should be noted that the natural gas consumption nearly tracks the HDD. This indicates that natural gas consumption is primarily used for space heating needs. The natural gas consumption in the summer is due to some areas calling for reheat.

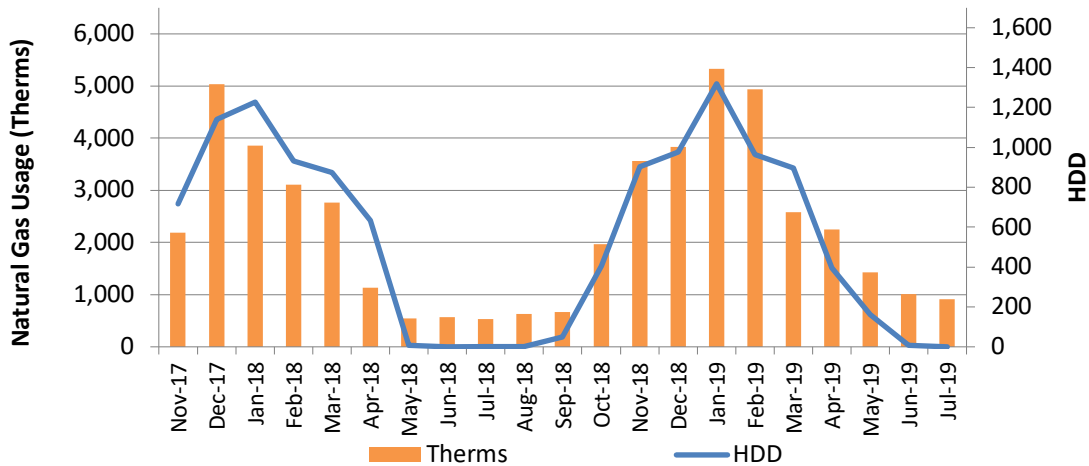


Figure 2: Comparison of Regional Heating Degree Days versus Therms

3.2 Benchmarking

Benchmarking is a valuable tool for gauging energy usage relative to similarly classed facilities. Using the ENERGY STAR Target Finder application, the facility's energy consumption can be compared to other facilities of similar size and use. Table 3 below shows the annual site energy consumption of the 11 Uptown building (except parking deck lighting) compared to the national average of a similar type facility, as well as a facility with an ENERGY STAR score of 75, which is the minimum requirement to apply for certification. An ENERGY STAR score of 75 or higher means that it performs better than at least 75% of similar buildings nationwide and an ENERGY STAR score of below 50 means that it performs worse than 50 percent of similar buildings nationwide.

The results indicate that 11 Uptown has below average performance. With a rating of 43, 11 Uptown is not eligible to apply for the ENERGY STAR. Implementation of the recommended ECRMs will help improve the building's ENERGY STAR score.

Table 3: ENERGY STAR Target Results

ENERGY STAR Portfolio Manager	Site Energy (kBtu/ft²/yr)	Total Annual Energy Costs (\$)	ENERGY STAR Score
11 Uptown	6,618,586	102,086	43
National Average	6,057,116	93,425	50
ENERGY STAR Rated	4,207,317	64,894	75

3.3 Breakdown of Energy Consumption

Determining where and in what quantities energy is used throughout the building helps to prioritize energy improvement efforts to maximum effectiveness. Figure 3 shows a breakdown of the building's energy cost by equipment type as estimated from utility bills. This breakdown gives an indication of possible areas for improvement. As discussed in the previous section, the majority of energy cost in this building is used for lighting (main building lighting, outdoor lighting, parking deck lighting). Heating and Fans/Motors are the next largest uses, which is typical for a building in this area. Focusing energy reduction measures in the largest areas shown here will allow for the greatest energy cost savings. From an energy cost standpoint, lighting should be addressed first, followed by Fans/Motors. Therefore, recommendations provided later in this report will address these areas.

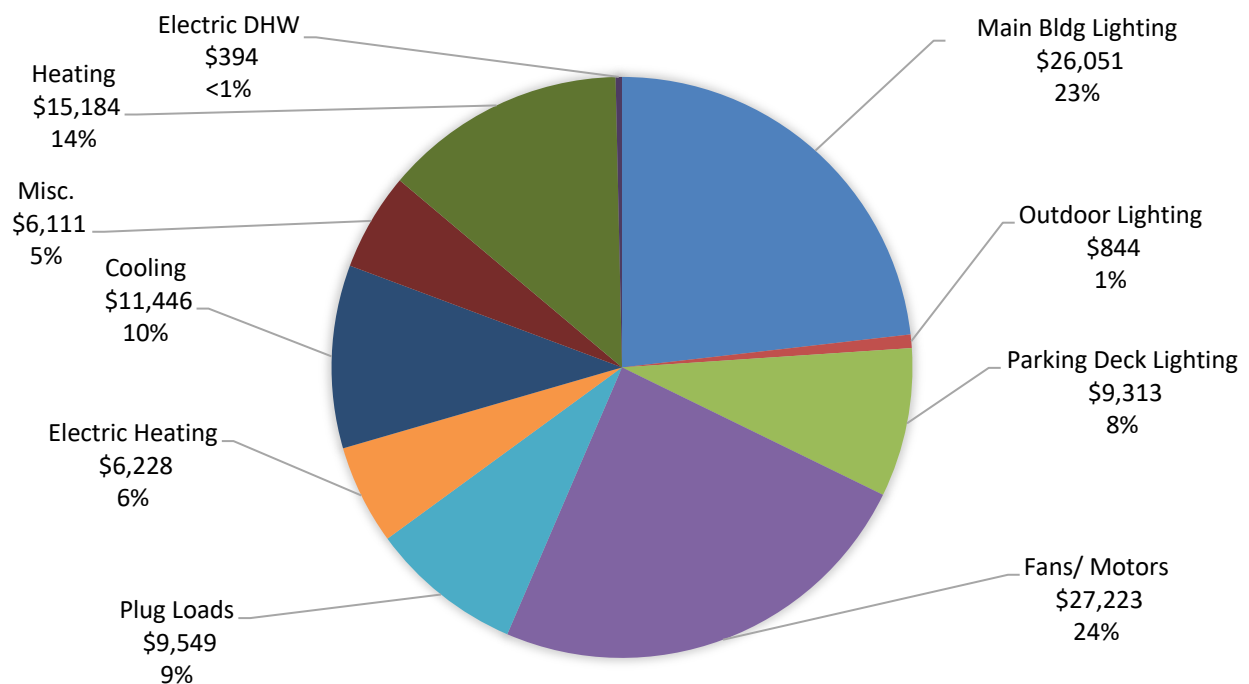


Figure 3: Energy Cost Breakdown

4 Energy Cost Reduction Measures

4.1 ECRM-1 Upgrade parking deck lighting

Issues and Observations:

The current parking deck lighting (28W and 54W T5 fluorescent lamps) is approximately 300 fixtures. Almost 40% of lights operate continuously (24 hours/day) for security lighting and the rest of the lights are controlled by a photosensor and should be off during adequate daylight conditions. The town of Normal is hoping to replace and upgrade this lighting in the near future.

Recommendations:

Upgrading T5 lamps to LEDs will greatly improve the quality of light as well as reduce energy consumption. We recommend replacing the lamps with Type B LEDs. The Type Bs require rewiring of the fixture to bypass the existing ballast and the lamp operates using an internal integrated driver. LEDs typically have a longer lifespan and do not use the ballast. Therefore, they help reduce maintenance costs. If the outdoor lighting is replaced, it is recommended that the photocell sensors are cleaned and checked for functionality to ensure that lights remain off during daytime.

Based on the economics, this measure is recommended.

4.2 ECRM-2 Upgrade exterior lighting to LED

Issues and Observations:

According to construction documents, there are some MHs and non-LED lightings throughout the building. A breakdown of lighting fixture type and locations are shown in the following table.

Table 4: Exterior Lighting List

Location	Lamp Type	# of Lamp
Parking Deck – 4 th FL	250W MH	20
Parking Deck – 4 th FL	150W Halogen	4
Rooftop Service Lighting	100W MH	8
Outdoor Lighting	35W Ceramic MH	7
Outdoor Lighting	26W CFL	26
Outdoor Lighting	32W T8 FL	2
Outdoor Lighting	39W Long Twin Tube	4

Outdoor Lighting	32W Static Grid Troffer	2
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Recommendations:

It is recommended that all existing exterior lighting around the building be upgraded to LEDs. Energy savings would be achieved by upgrading these fixtures to LED fixtures. Additionally, maintenance cost savings can be achieved due to a much longer rated lamp life for LEDs, than for existing lamps.

Based on the economics, this measure is recommended.

Table 5: Existing Lighting and Proposed Lighting List

Existing Lamp	Proposed Lamp
250W MH	60W LED
150W Halogen	40W LED
100W MH	30W LED
35W Ceramic MH	15W LED
26W CFL	10W LED
32W T8 FL	15W LED Linear
39W Long Twin Tube	23W LED Liner
32W Static Grid Troffer	15W LED Liner

4.3 ECRM-3 Replace indoor non-LED lighting with LED

Issues and Observations:

The 11 Uptown building utilizes 32W T8s, 28W T5s, 54W T5s, 17W T8s, and 42W CFLs throughout the building. SEDAC estimates a total of 260 fluorescent-lamp 4' 32W T8 fixtures, 463 fluorescent-lamp 4' 28W T5 fixtures, 157 fluorescent-lamp 4' 54W T5HO fixtures, 11 42W(4-pin base) CFLs, and 48 2'17W T8 fixtures.

Recommendations:

It is recommended that the facility upgrade the existing fluorescent lamps to LEDs. Significant lighting energy savings could be achieved by upgrading these fixtures to LED fixtures. Compared with existing fluorescent lamps, high performance ENERGY STAR rated LEDs have a higher lumen output while consuming approximately 75% less energy.¹ In addition to energy savings, maintenance cost savings can be achieved owing to a much longer rated lamp life for LED lamps, than for existing lamps. We recommend replacing with Type B LEDs. The Type B requires rewiring of the fixture to bypass the existing ballast and the lamp operates using an internal integrated driver. Bypassing ballasts increases upfront costs but saves maintenance and energy costs in the long run as ballasts draw power all the time and are prone to failure.

Based on the economics, this measure is recommended.

4.4 ECRM-4 Replace existing belt with notched belt on RTUs

Issues and Observations:

All RTUs are currently using standard smooth v-belts on the fan motors.

Recommendations:

It is recommended to replace standard smooth v-belts with notched v-belts to increase efficiency for the motor drive system. A notched belt has grooves or notches that run perpendicular to the belt's length, which reduces the bending resistance of the belt. Notched belts can use the same pulleys as they have the same cross-section as standard V-belts. They run cooler, last longer, and are about 2% more efficient than standard v-belts.²

Based on the economics, this measure is recommended.



Figure 4: Notched Belt (left) and Standard Smooth Belt (right)³

¹ <https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/led-lighting>

² <https://www.nrel.gov/docs/fy13osti/56012.pdf>

³ <https://www.altramotion.com/newsroom/2014/08/understanding-trade-offs-when-selecting-belted-drive-systems>

4.5 ECRM-5 Find alternate filters for existing rigid cell air filters

Issues and Observations:

All RTUs have a two-stage approach incorporating a pre-filter of MERV 8 and a final filter of MERV 13 and these filters need to be changed two times per year. This is the best practice to provide the cleanest air possible. However, this also can restrict the airflow so much that it can have an impact on HVAC system fan power and static pressure. Also, replacement filter cost is a significant portion of maintenance expenses. The town of Normal is hoping to find an alternative way to reduce the filter replacement cost.

Recommendations:

It is recommended to have a single stage filter system instead of two stage filter system for commercial office spaces. This can help to reduce not only total static pressure but also filter replacement cost. According to National Air Filtration Association (NAFA), it is recommend using a MERV 13 filter for single stage filter system to maintain optimal system efficiency.⁴

Based on the economics, this measure is recommended.



Figure 5: Pre-filter (MERV8) & final filter (MERV13) vs. Pre-filter (MERV13)

4.6 ECRM-6 Temperature setpoint adjustment on RTUs

Issues and Observations:

The building is using the BAS to program all the thermostats to employ space temperature setbacks at night when spaces are unoccupied. Currently, the building has a temperature setpoint of 70°F with a setback of $\pm 5^{\circ}\text{F}$.

⁴ <https://www.nafahq.org/wp-content/uploads/Commercial-Office-Spaces-Secured.pdf>

Recommendations:

It is recommended that the building adjust their temperature setpoints and setbacks to maximize energy savings. Adjusting the temperature setpoints and setbacks will reduce space conditioning during both occupied and unoccupied hours. We recommend a trial-and-error approach since the setback amount is adjustable and depends on system recovery time. Experimenting with different setbacks can produce the settings appropriate for your building and specific system. SEDAC advocates changing the temperature setbacks of the building from $\pm 5^{\circ}\text{F}$ to $\pm 10^{\circ}\text{F}$.

Based on the economics, this measure is recommended.

4.7 ECRM-7 Fix the air damper on RTU3

Issues and Observations:

After checking the RTU3 airflow system, it was determined that the outside air (OA) damper is not functioning properly. The mixed air fan is trying to pass outside air through the mixed air chamber. However, the outside air damper is closed which is causing a drop in pressure. This reduces the static pressure and causes the Variable Frequency Drive (VFD) to increase its output to meet the set point. This also means that outside air cannot be used to cool the air supplied to the building. As a result, mechanical cooling is being used which results in unnecessary energy consumption.

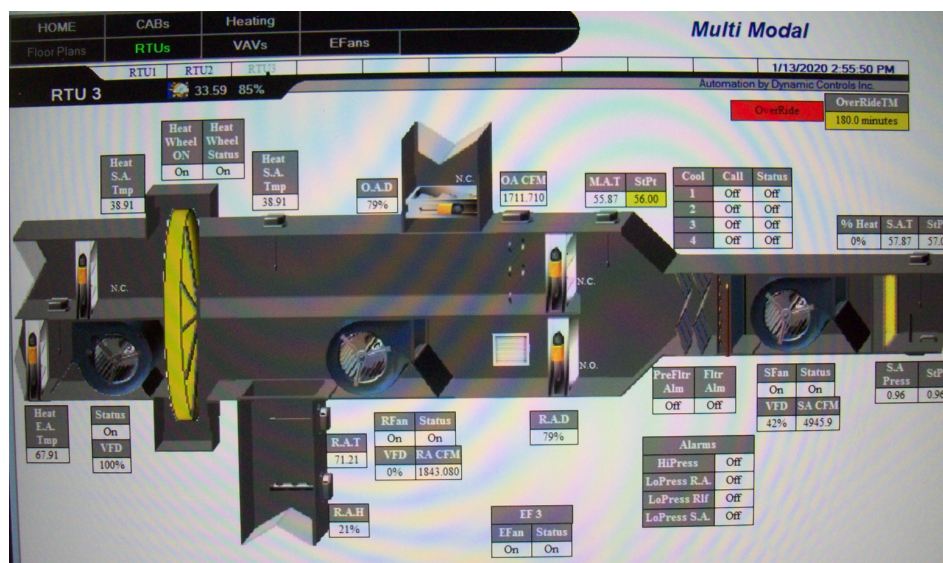


Figure 6: BAS-RTU3 Screenshot

Recommendations:

It is recommended to fix the air damper on RTUs and make sure it works properly. It should be noted that this calculation assumes that all energy saved is due to OA providing cooling instead

of the condenser. This also neglects the enthalpy contributions from humidity. All temperature data points greater than 60°F were not considered in the energy calculation because above this value mechanical cooling is often needed for dehumidification.

Based on the economics, this measure is recommended.

4.8 Potential Measures Not Quantified

Inspect the occupancy sensors on the 4th floor of building

The 4th floor of the building is mostly used for occasional meetings which means there are periods when the floor will have low occupancy or will be unoccupied. During SEDAC's site visit, it was observed that the lights were turned on in many unoccupied areas. Check the occupancy sensors and make sure they work properly.

Inspect the bypass control valve on the boiler loop and boiler sequence

The 3-way bypass valve opens or closes to maintain a return water setpoint; in this case the setpoint is 140°F. The valve was observed to be opening before return water had dropped below setpoint. Also, the fully open bypass valve is heating the building loop more than necessary. Two boilers were firing to maintain the supply temperature above setpoint of 160°F. One boiler would be sufficient given the return in the building loop and also supply water temperature was too high.

According to the BAS, we noticed that the 3-way valve for the building heating loop was at 0% bypass even through the Heating Hot Water (HHW) setpoint was 140°F. We suspect that the valve command logic needs tuning or wiring could be reversed. Inspect the bypass control valve on the boiler loop.

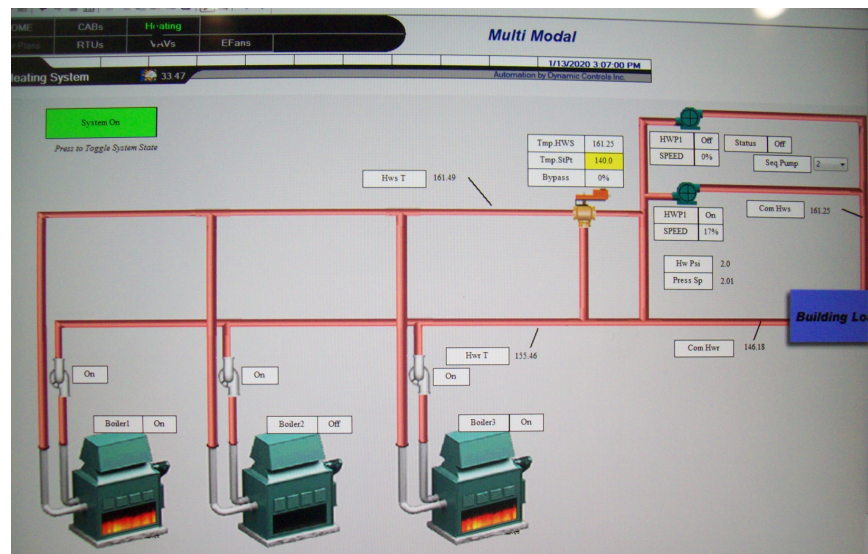


Figure 7: BAS- Boiler Screenshot

5 Incentives

Listed below are various additional opportunities to consider. Please note that the incentive information provided is current at the time the assessment is completed. For up-to-date information on available incentives, contact SEDAC any time at 800.214.7954. Alternatively, you may contact your utility.

5.1.1 Utility Incentive Offerings

Ameren has several Incentives to encourage installation of energy efficient equipment. Incentives change frequently and SEDAC recommends checking with Ameren for the latest incentive offerings. More information may be found at: <https://amerenillinoisavings.com/>

Table 6: 2020 Ameren Incentives

Ameren Offerings	Information	Estimated Incentives
ECRM 1	Ameren Instant Incentives LED Linear T5 HO 4 ft - \$7/ tube	\$3,652
ECRM 2	Ameren Instant Incentives LED Mogul (E39) Medium - \$35/ lamp LED Mogul (E39) Low - \$25/lamp Ameren Standard Lighting Incentives \$0.40 Watt/reduced	\$1,398
ECRM 3	Ameren Instant Incentives LED Linear T5 HO 4ft - \$7/ tube LED Linear T5 4ft - \$4/ tube LED Linear T8 4ft - \$5/ tube LED Linear T8 2ft - \$3/ tube LED Downlight Fixtures - \$5/ tube	\$4,320
ECRM 4	Ameren Instant Incentives BX Section Notched V-belt - \$15/ belt	\$45
ECRM 5	Ameren Public Custom Incentives \$0.18/kWh saved/ year, capped at 80% of project cost	\$1,048
ECRM 6	Ameren Public Custom Incentives \$0.18/kWh saved/ year, capped at 80% of project cost Nicor Custom Incentives \$0.60/therm saved/year, capped at \$350,000 or 35% of the project cost – whatever is less.	\$1,095
ECRM 7	Ameren Public Custom Incentives \$0.18/kWh saved/ year, capped at 80% of project cost	\$195

5.1.2 Contractors and Installers

Visit the Ameren Illinois Energy Efficiency Program Allies website for a list of mechanical and lighting contractors, engineers, architects, energy service companies, wholesalers, distributors, and retailers that can help get your energy efficiency project implemented.

<https://amerenillinoisavings.com/for-my-business/find-a-contractor>

5.1.3 Nicor Gas Rebates for Public Facilities – Natural Gas Saving Program

Nicor Gas provides incentives for commercial and industrial sector facilities located in the Nicor Gas service territory. The utilities offer prescriptive incentives for particular natural gas efficiency projects. Custom incentives are offers for additional natural gas saving measures not specified by the prescriptive program.

Guidelines for the program, including details on eligibility, as well as application examples, can be found at:

<https://www.nicorgas.com/business/ways-to-save/rebates.html>

<https://www.nicorgas.com/business/ways-to-save/custom-incentives.html>

6 Conclusion

This report by the Smart Energy Design Assistance Center evaluated seven Energy Cost Reduction Measures for potential application by 11 Uptown to reduce electrical and natural gas consumption and thereby save on utility costs. After thorough evaluation, seven of the ECRMs are recommended for implementation based on their effective rates of return.

By participating in a Smart Energy Design Assistance Center Program energy audit, the facility is exhibiting a sharpened focus as an organization dedicated to energy management practices. Undergoing an energy audit analysis sends a very strong message to one's community of a solid commitment to energy efficiency and sustainable business practices.

SEDAC recommends that the energy savings initiatives identified in this report be implemented to decrease the building's overall energy consumption. A total reduction of 140,000 kWh and 2,600 therms is possible through the implementation of the suggested ECRMs shown in Table E2. This represents an approximate 11% utility cost savings and 11% energy savings. SEDAC recommends implementing this ECRM package, which includes:

- ECRM-1: Upgrade parking deck lighting
- ECRM-2: Upgrade MH lighting
- ECRM-3: Replace indoor non-LED lighting with LED
- ECRM-4: Replace existing belt with notched belt on RTUs
- ECRM-5: Find alternate filters for existing rigid cell Air filters
- ECRM-6: Temperature setpoint adjustment on RTU3
- ECRM-7: Fix the air damper on RTU3

The suggested ECRMs will greatly reduce the electrical and natural gas consumption of the facility while providing an estimated annual total gas and electric utility savings of \$12,600 (at current costs).

The items included in this report are the primary elements of creating and managing a sustainable building; they are to serve as guides to implementation.

To demonstrate its effectiveness to the State of Illinois, SEDAC is asked to compile quarterly reports that document implementation of energy efficiency measures. We ask that you keep us apprised of all work towards implementation of our recommendations; this information will allow us to accurately reflect subsequent savings. We will also contact you periodically to discuss, answer questions, and review status.

Thank you for the opportunity to be of service. Please do not hesitate to contact us if we may be of further assistance.

7 Customer Interest Form

Below is a selection form that will allow SEDAC to gauge the interest of the client in implementing each individual measure. Please fill this out and return to SEDAC.

ECRM ##	Measure Description	Interest in Implementing?		Estimated Completion Date
		YES	NO	
1	Upgrade parking deck lighting			
2	Upgrade MH lighting			
3	Replace indoor non-LED lighting with LED			
4	Replace existing belt with notched belt on RTUs			
5	Find alternate filters for existing rigid cell Air filters			
6	Temperature setpoint adjustment on RTU3			
7	Fix the air damper on RTU3			

Facility Energy Assessment Report



Smart Energy Design Assistance Center (SEDAC)

Town of Normal Water Plant

Published:	3/24/2020
SEDAC Building Energy Specialist:	Shawn Maurer, CEM, EIT, Senior Energy Engineer
Facility Location:	107 E Mulberry St. Normal, IL 61761
Site Visit:	1/13/2020

This report was prepared as the result of work by a member of the staff of the Smart Energy Design Assistance Center (SEDAC). It does not necessarily represent the views of the University of Illinois, its employees, or the State of Illinois. SEDAC, the State of Illinois, its employees, contractors and subcontractors make no warrant, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. Reference to brand names is for identification purposes only and does not constitute an endorsement. All numerical data are order of magnitude estimates and the number of digits shown is an artifact of the calculation procedure; they are not meant to imply greater accuracy or precision. SEDAC is an applied research program at the University of Illinois at Urbana-Champaign. SEDAC works in collaboration with the 360 Energy Group.

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Executive Summary

The Normal Water Plant is owned by the Town of Normal. The facility is used as a Water Purification and Softening Plant and covers approximately 21,000 sq. ft. of usable space. The Normal Water Plant is occupied 24/7 by operators and lab personnel, and during normal business hours by administrative staff.

This report identified 7 potential measures for implementation. After thorough evaluation of each measure, 4 of the measures are recommended for implementation based on their feasibility for implementation and return on investment.

The Normal Water Plant management and operators should be commended for their ongoing efforts to reduce energy consumption by having already implemented distribution pumping load shedding techniques, upgrading exterior lighting to LEDs, and placing VFDs on process motors. By also participating in a Smart Energy Design Assistance Center Program energy audit, the facility is exhibiting a sharpened focus as an organization dedicated to energy management practices. Undergoing an energy audit analysis sends a very strong message to one's community of a solid commitment to energy efficiency and sustainable business practices.

SEDAC recommends that the energy savings initiatives identified in this report be implemented to decrease the building's overall energy consumption. SEDAC recommends implementing the following package of measures:

- Measure 2: Add VFDs to High Service Pumps
- Measure 3: Upgrade Interior Lighting to LEDs
- Measure 4: Install Interior Lighting Controls
- Measure 6: Upgrade Heating Boiler

Recommended Package of Energy Efficiency Measures			
Simple payback (before incentives)	8.6	Incentives Available	\$66,500
Annual Utility Cost Savings	\$15,800	Percent Annual Cost Savings	12%
kWh Reduced/yr	187,300	Percentage kWh Reduction	12%
therms Reduced/yr	1,400	Percentage therms Reduction	12%

The items included in this report are the primary elements of creating and managing a sustainable facility; they are to serve as guides to implementation. This report can be used as a tool to facilitate budgetary planning and obtaining funding/financing. Eligible public-sector incentives are described in this report as well as other opportunities for need-based grants and other funding sources. All information is current at the time of the assessment; for up-to-date information on funding or incentives, contact SEDAC any time at 800.214.7954. Alternatively, you may contact your utility. Implementing the recommendations in this report will reduce energy consumption, help improve occupant comfort and reduce vulnerability to fluctuations in future energy costs. This report can also be used to plan for LEED® and ENERGY STAR building certification.

Each of the 7 measures are discussed in detail in this report. Recommendations on HVAC, lighting, and treatment process improvements are included along with suggestions for additional cost reduction measures. Table 1 presents a summary of the plant's utility information, as obtained from Ameren Illinois and Nicor Gas documentation. Table 2 presents the results of the analysis performed on each measure.

Table 1: Utility Information for August 2018 through July 2019

Energy Benchmarking For Normal Water Purification Facility						
	Annual Consumption		Annual Costs		Unit Cost³	
Electricity¹	1,541,591	kWh	\$123,327	95%	\$0.08	\$/kWh
Natural Gas²	11,599	Therms	\$6,579	5%	\$0.57	\$/therm
		Total Cost	\$129,907			
		Floor Area	21,000	ft ²		
		Plant Flow	1,393	MG/yr		
Electric Use Intensity	1,107	kWh/MG/yr	Gas Use Intensity	0.55	therms/ft ² /yr	
Energy Use Intensity (EUI)	4,612	kBtu/MG/yr	Energy Cost Intensity (ECI)	\$93.28	/MG/yr	

Notes:

- 1) Electric is supplied and delivered by Ameren IL on a DS-3 rate class
- 2) Natural Gas is supplied by Nicor Gas and delivered by Constellation Energy on a general service rate class.
- 3) Unit costs are blended averages which include all taxes and demand charges.

Table 2: Energy Cost Reduction Measure Analysis

Measure #	Description	Annual Savings				Economic Analysis			
		kWh	kW	Therms	\$	Capital Cost	IRR	NPV	SPB ³
1	Upgrade to IE4 Super Premium Motors	19,800	9	0	\$1,600	\$42,400	-3%	-\$22,600	26.7
	with \$4,200 in Incentives					\$38,200	0%	-\$14,700	20.3
2	Add VFDs to Select Motors ¹	159,300	9	0	\$12,700	\$116,700	7%	\$15,600	9.2
	with \$32,000 in Incentives					\$84,700	12%	\$47,600	6.6
3	Upgrade Interior Lighting to LED	20,200	3	-300	\$1,400	\$3,200	45%	\$11,800	2.2
	with \$600 in Incentives					\$2,600	55%	\$12,400	1.8
4	Install Interior Lighting Controls	7,800	0	-100	\$600	\$2,900	11%	\$700	5.2
	with \$1,000 in Incentives					\$1,900	24%	\$1,700	3.4
5	Add VFD and DO Control to Aeration	15,600	1	0	\$1,200	\$17,100	4%	-\$1,600	13.7
	with \$1,900 in Incentives					\$15,200	5%	\$300	12.2
6	Upgrade Heating Boiler ²	0	0	1,800	\$1,000	\$12,500	5%	\$300	12.2
	with \$2,500 in Incentives					\$10,000	8%	\$2,800	9.8
7	Upgrade Gas Unit Heaters	0	0	400	\$300	\$8,300	-4%	-\$5,200	32.9
	with \$1,400 in Incentives					\$6,900	-3%	-\$3,800	27.4
Pkg	Measures 2-4, 6	187,300	12	1,400	\$15,800	\$135,300	8%	-\$14,200	8.6
	with \$66,500 in Incentives					\$99,200	13%	\$21,900	6.3

Notes:

- 1) Savings from Measure 2 include motor upgrades from measure 1 to ensure VFD compatibility, thus even though Measure 1 is not recommended on its own, it is included as part of Measure 2.
- 2) Measure economics are dependent on incremental cost, not full cost for this measure, since the boiler is already budgeted for replacement.
- 3) "SPB" Refers to Simple Payback, or the amount of time that the projected energy savings will exceed the first cost of the project.

1 Introduction

The Public-Sector Design Assistance Program is an energy efficiency program that provides millions of dollars in rebates to public facilities that make large-scale equipment improvements to their electric and natural gas systems. The Smart Energy Design Assistance Center (SEDAC) supports the Public-Sector Design Assistance Program in advocating the efficient and effective use of energy by businesses and public buildings throughout Illinois. The objective of SEDAC is to encourage communities, building owners and operators, design professionals, and building contractors to incorporate energy efficiency practices and renewable energy systems. SEDAC is managed by the University of Illinois at Urbana-Champaign, in collaboration with 360 Energy Group.

SEDAC has performed an energy savings and cost analysis for various measures applied to the Water Purification Plant, located in the Town of Normal, Illinois. The analysis is based on a site inspection conducted on 1/13/2020, engineering calculations, and typical industry assumptions. This report presents the results of the analysis along with the methods and assumptions used.

Engaging in energy-efficiency strategies to control costs is more critical than ever as organizations face the lingering recession and budget challenges. Organizations that take a systematic and strategic approach toward energy management will acquire a broad array of tangible and intangible benefits of interest to themselves and the public at large.

The elevation of energy management to critical importance is a result of many factors, including an increasingly complex and volatile energy marketplace, a growing awareness about the realities of climate change, recognition of the rising importance of intangibles in calculating market value, and an expanding awareness of the importance to restrict the carbon footprint of organizations. According to the U.S Green Building Council, most commercial buildings use 10 to 30 percent more energy than necessary and have ample opportunities to reduce their energy consumption levels. Further, cutting a building's energy use by 30 percent often yields the same bottom-line benefits as a 5 percent increase in net operating income and building asset value.

Public entities known for aggressive and proactive environmental policies stand to reap many intangible benefits including improved community relations, an enhanced reputation as a socially responsible entity, and improved productivity/morale. Energy management practices also help to ensure the reliability of equipment, which reduce the risks and costs associated with equipment failures and downtime.

2 Building Description

2.1 General

The analysis of the building was based on engineering calculations, rule of thumb assumptions, and experience of the engineer. The sections which follow describe details of each building and important input parameters to the calculations.

2.2 Site Conditions and Building Details

The Normal Water Plant operates as a groundwater purification and distribution plant and has approximately 21,000 sq. ft. of usable space. The facility is occupied by 7 administrative staff members from 8:30am – 5:00pm, housed in the administrative offices on the ground floor; and 4 operators, 5 maintenance personnel, and 2 supervisors whose shifts cover a 24/7 occupancy profile in the lab area of the 2nd floor, and as needed in the process areas of the building. The water plant was originally built in the late 1940's, with additions in the mid-60's and 70's. There are two buildings on site, the main processing plant and the high-service pumping and garage building.

The facility receives groundwater from pump stations in town, treats the water, then pumps to the North and South Distribution systems for the Town of Normal. Below is a process diagram of the plant including details on primary equipment. Table 3 details the primary motors used in the process flow.

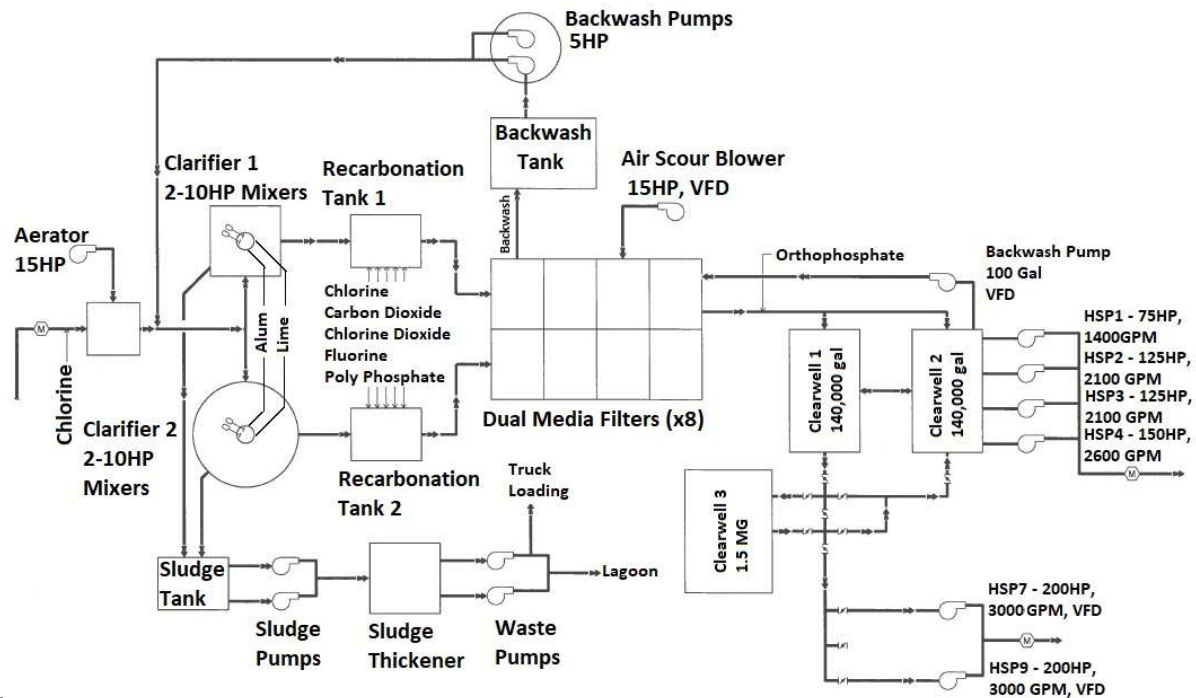


Figure 1: Normal Water Plant Process Flow Diagram.

Table 3: Process Equipment Motor List

Pump Duty	Manuf.	Mnf. Yr	Motor HP	Efficiency
High Service Pump 1	Marathon	1982	75	90.80%
High Service Pump 2	Marathon	1985	125	92.50%
High Service Pump 3	Marathon	1985	125	92.50%
High Service Pump 4	Marathon	2006	150	95.80%
High Service Pump 7	Emerson	2010	200	95.80%
High Service Pump 9	Emerson	2010	200	95.80%
Backwash Pump	Siemens	2009	100	95.40%
Sludge Blow-off Pump 1	Leeson	1994	25	91.50%
Sludge Blow-off Pump 2	Reliance	1987	15	84.00%
Sludge Decant Pump	Reliance	1979	15	84.00%
Sludge Lagoon Pump	Baldor	1997	50	93.00%
Backwash Tank Recirc. Pump	Not Visible	2018	5	88.20%
Backwash Tank Recirc. Pump	Not Visible	2010	5	88.20%
Lime Pump #1	Baldor	2015	3	89.50%
Lime Pump #2	Baldor	2016	3	89.50%
Lime Pump #3	Baldor	2016	3	89.50%
Process Equipment Motors				
Clarifier #1 North Mixer	Baldor	2005	10	87.50%
Clarifier #1 South Mixer	Baldor	2002	10	87.50%
Clarifier #1 Sludge Scraper	Sumitomo	?	0.75	82.00%
Clarifier #2 North Mixer	Baldor	2005	10	87.50%
Clarifier #2 South Mixer	Baldor	2014	10	89.50%
Clarifier #2 Sludge Scraper	Sumitomo	?	0.75	82.00%
Sludge Tank Scraper	Sumitomo	2017	0.75	82.00%
Filter Blower Motor	Aerzen	2010	75	95.00%
Aerator Fan Motor	Not Visible	2015	15	93.00%
Slaker #1 Mixing Pump	Baldor	2000	3	89.50%
Slaker #2 Mixing Pump	Baldor	2000	3	89.50%

The process motor list does not include the large number of small fractional horsepower peristaltic pumps used for chemical dosing throughout the plant.

Water treated at the plant is drawn from 15 wells in and around the Town of Normal and is distributed to 4 water towers and 1 ground storage tank. The plant fills the ground storage tank overnight to reduce peak water demand and smooth plant pumping demand during the day. Operators make efforts to do bulk pumping at night during low-demand periods to keep utility costs to a minimum and run the minimum number of motors during peak utility cost periods.

2.3 Building Envelope

Exterior Walls:

The exterior walls of the main building are constructed of 4" face brick veneer, unknown amount of rigid insulation, and 8" concrete block. The foundation is poured concrete and uninsulated. The high service pump building is also concrete block construction with a slab-on-grade floor.

Roof:

The roof of each section of the building consists of a poured concrete slab with exterior insulation and membrane roof coverings. The roof insulation is assumed to be typical of 1970's construction; about an R-20.

Doors:

Exterior entry doors are aluminum framed with single pane glass panels. The building also has several overhead utility doors around the building that are insulated-core metal, with decent weather seals with no noticeable gaps. All entry doors appeared to be in good condition at the time of the visit.

Windows:

The windows are typically ¼" single-pane units with aluminum framing. There were no noticeable air leaks or damage during the site visit.

2.4 HVAC Systems

The main building has two residential-style air conditioners for the office and lab spaces. The ground floor unit has a single control zone in the administrative offices, while the 2nd floor unit has 3 control zones for the lab, offices, and basement boiler room. Each zone has a hot water heating coil and zone control dampers controlled by non-programmable thermostats. In the basement, shop, storage, and vehicle garage areas of the main building, hydronic unit heaters controlled by simple thermostats provide heating. The 1st floor cooling condenser is a 3.5-ton unit, a couple years old, and the 2nd floor cooling condenser is a 4-ton unit new last year; both are 13 SEER systems.

Hot water is supplied for heating by a Patterson-Kelley Thermific N-700 boiler, with an input rating of 700 kBtu/hr and thermal efficiency of 85%. The boiler is 22 years old and is scheduled to be replaced in April 2022. The boiler room also has a Cargocaire dehumidifier that is 28 years old, with a dehumidification rate of 16lb/hr at 600cfm at standard air conditions (75F and 50% RH).

The high service pump building is heated by two natural gas unit heaters, assumed to both be 175,000 Btu/hr, 80% efficient units. Both are controlled by non-programmable thermostats.

2.5 Lighting and Internal Loads

Most interior lighting for the plant is 2-lamp 4 foot T8 lamps rated at 25W. The main office has about 28-30 PAR-style compact fluorescent lamps, assumed to be 22 watts each. There are an estimated 110 2-lamp and 6 3-lamp T8 fixtures at the plant. Exterior lighting has been upgraded to LED wallpacks and pole lights. Since they have already been upgraded to LEDs, a count of fixtures was not made.

2.6 Domestic Hot Water

The domestic hot water is supplied to the building by a Vanguard model 3WA76 80-gallon electric water heater. The unit is 9 years old.

3 Energy Consumption Analysis

The plant's energy consumption was obtained from utility bills provided by Mark Clinch. Utility bills were analyzed over twelve months from August 2018 to July 2019. The building is supplied with electricity by Ameren Illinois. Natural gas is supplied by Nicor Gas and delivered by Constellation Energy.

The facility paid a total of \$123,327 for electricity in this time frame and \$6,579 for natural gas. The total utility cost for the facility from August 2018 to July 2019 was \$129,907.

Figure 2 represents the comparison of electricity consumption (kWh) and monthly plant flows (million gallons) over time. Such a chart can show if plant operations are tuned to varying flows, or if equipment operates on a continuous basis. Continuous operation indicates a potential for energy savings. Figure 2 shows almost no correlation between plant flow rates and energy consumption, though it does confirm slight increases in overall flows in the summer months versus the winter months due to irrigation and outdoor water consumption. Figure 3 shows the same data in a scatter plot instead of a time-series. This scatter plot confirms that plant energy consumption is only loosely correlated with flow and indicates there is a strong tendency to continuous operation of equipment. Based on knowing that plant pumping and chemical mixing is partially linked to VFDs, and aeration, filtration, and settling are relatively constant processes, and the operators do their best to shed peak electric loads by pumping during off-peak hours, the loose and relatively flat correlation makes sense in this figure.

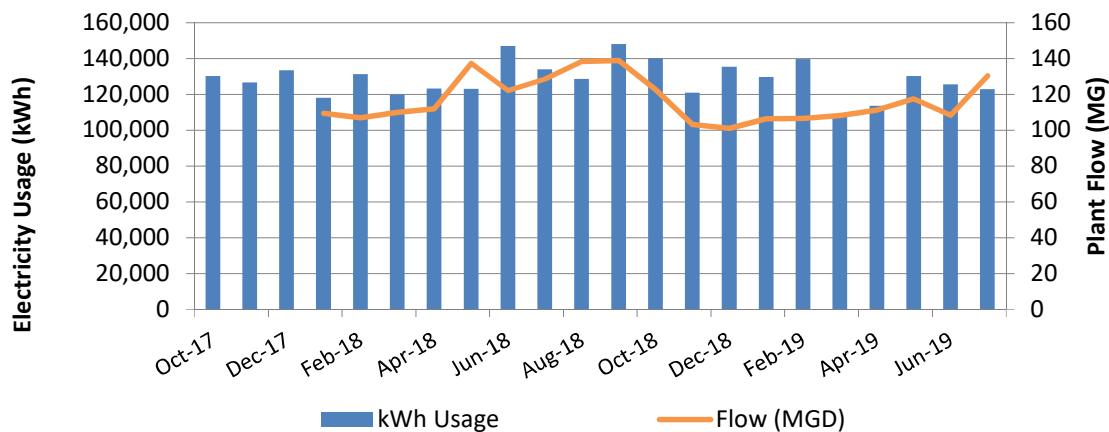


Figure 2: Comparison of Plant Flow with kWh

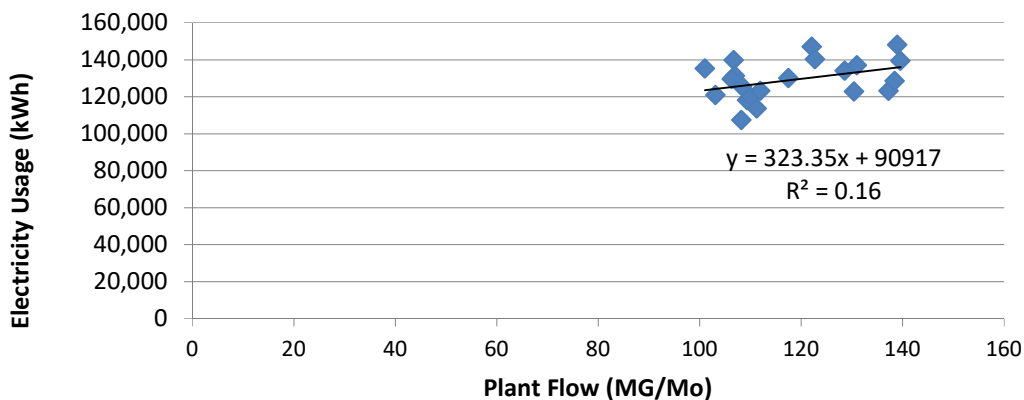


Figure 3: Correlation of kWh Energy Consumption with Plant Flow

Figure 4 represents the comparison of natural gas consumption (Therms) and annual heating degree days (HDD). The chart shows a strong correlation between weather and gas consumption, which makes sense as the only natural gas usage is for space heating.

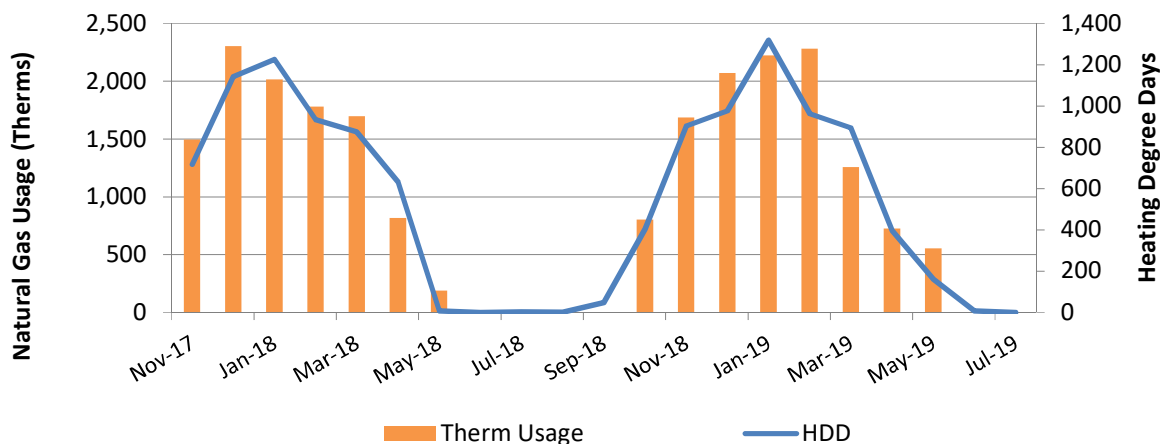


Figure 4: Comparison of Regional Heating Degree Days versus Therms

3.1 Benchmarking

Benchmarking is a valuable tool for gauging energy usage relative to similarly classed facilities. National averages for water purification and distribution for groundwater-sourced plants range widely, 1,014-6,361 kWh/MG in Illinois, according to the IL Section American Water Works Association (ISAWWA). The Normal Plant Data is missing source groundwater pumping energy, which significantly reduces the reported energy intensity value in Table 4. National average groundwater pumping intensity is about 300 kWh/MG from the EPRI report noted in Table 4. Including this estimated pumping energy intensity with the Normal Plant data, the facility is still performing better than the State and National averages at 1,407 kWh/MG/yr.

Table 4: National Energy Use Intensity Comparison for Water Treatment Plants.

Data Source	Electric Use Intensity (kWh/MG/yr)	Energy Use Intensity (kBtu/MG/yr)	Energy Cost Intensity (\$/MG)
Normal Water Plant	1,107	4,611	\$93.28
National Average	1,824 ¹	6,223 ²	N/A
Illinois Average	2,844 ³	9,704 ²	\$284 ³

- 1.) Data from Electric Power Research Institute [Water & Sustainability \(Vol. 4\): US Electricity Consumption for Water Supply & Treatment – The Next Half Century](#). Includes groundwater pumping from source, missing from Normal’s Plant Data.
- 2.) Energy use intensity calculated by converting kWh/MG to kBtu/MG using 3.412kBtu/kWh
- 3.) Data from ISAWWA [Water-Energy Nexus Survey Summary Report](#) March 2012, pp10. Data for groundwater sourced plants.

3.2 Current Best Practices

The Normal Water Plant currently employs load-shifting in their distribution system to reduce electric demand costs as much as possible. Overnight, pumps are run to fill clear wells, water towers, and a ground storage basin so that the system doesn't require as much pumping during peak usage periods in the mornings and evenings. This is an industry best practice and the Town of Normal should be commended for employing this pumping technique.

The plant has begun upgrading motors with variable loading to VFDs. VFDs have the potential to save significant amounts of energy by reducing pump input power to match the load on the system. The backwash system and two new high service pumps have VFDs installed. The plant is already considering VFDs for the other high service pumps in the plant. On top of the energy reduction benefits, VFDs also extend the service life of pumps by dramatically cutting in-rush current and reducing heat and mechanical wear in pump motors.

The plant has also upgraded most of their outdoor wall pack and post-top lighting to LEDs, which will significantly reduce lighting energy consumption for dusk-to-dawn lighting, as well as maintenance cost for replacing bulbs and ballasts.

3.3 Breakdown of Energy Consumption

Determining where and in what quantities energy is used throughout the building helps to prioritize energy improvement efforts to maximum effectiveness. Figure 5 shows a breakdown of the building's energy use by equipment type as estimated from modeling.

This cost breakdown gives an indication of possible areas for improvement. Process pumping is the greatest energy cost at 70%, followed by process motors for aeration and mixing at 10% and space heating and cooling at 8% of total energy cost. The other energy consumers including lighting, miscellaneous equipment and plug loads, and water heating make up the remaining 12% of energy costs. This report focuses on measures to reduce the highest energy costs, pumping and processes equipment energy.

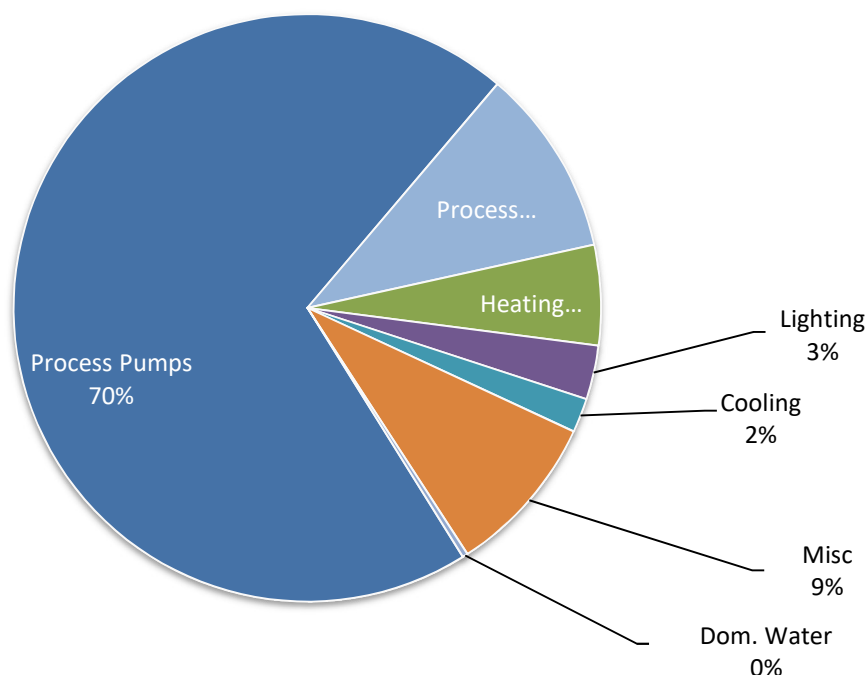


Figure 5: Estimated Energy Breakdown

4 Energy Cost Reduction Measures

Projected savings in this report are based upon estimates of the individual measures. Implementation of measures in various orders can affect the individual and overall energy savings. For example, improving the insulation of a facility while also improving the efficiency of the HVAC system will reduce the projected savings of the individual measures due to diminishing returns.

4.1 Measure 2 Add VFDs on High Service Pumps

Issues and Observations:

Plant operators were interested in the potential savings for adding VFDs to High Service Pumps 1 through 4 and standardizing their horsepower and flow rates. The existing motors and pumping specifications are detailed below.

Table 5: Motors Considered for VFD Upgrades.

Pump Duty	Manuf.	Motor HP	Motor Eff.	Pump Head (ft)	Pump Flow GPM	AOH (Est.)
Hi-Service Pump 1	Marathon	75	90.8%	72	1400	3341
Hi-Service Pump 2	Marathon	125	92.5%	182	2100	1838
Hi-Service Pump 3	Marathon	125	92.5%	182	2100	1838
Hi-Service Pump 4	Marathon	150	95.8%	170	2600	1272



Ideally, the pumps would be staged so that the smallest number of pumps run to handle the given flows. Start/stop sequencing can lead to multiple stops and starts for multiple pumps over the course of the day as demand for water changes, also causing increases in demand electric charges. SEDAC obtained two years of historic plant water flows, and based on the design flow of each pump, used the monthly flows to estimate pump run hours. The flows are assumed to primarily be supplied by one of the two 125HP pumps with hours evenly distributed between them. High flows are assumed to be handled by the 150HP pumps and lower flows by the 75HP pump.

Recommendations:

SEDAC estimated the potential cost savings for adding VFDs to each of the 4 high service pumps to match flow demand. Overall, SEDAC calculations estimated an average 27% reduction in energy consumption for the high service pumps listed in Table 5. The costs for this measure include the cost to upgrade motors 1-3 with Premium efficiency motors, and the cost of all 4 VFDs. The conversion of pumps 1-3 to Premium Efficiency to ensure compatibility with VFDs contributes 3% of the 27% energy savings, the VFDs contribute the remaining 24%.

Ameren offers an incentive of \$125/HP for VFDs installed on pumps that run more than 2,000 hours per year. Based on SEDAC estimates, this only applies to the 75HP high-service pump, possibly one of the 125HP pumps, depending how loading is split between the units. A custom incentive of \$0.18/kWh is applied for the premium efficiency motor upgrades estimated in Measure 1 and VFDs that don't meet the 2,000 hour runtime requirement, and the standard incentive of \$125/HP is applied to the 75HP VFD for our analysis. With incentives, this measure yields positive economics with a simple payback of just under 7 years. The expected life of the VFDs and motors is about 20 years but may be longer depending on maintenance practices and actual process loads. If more of the motors run over 2,000hr per year, the total incentive value will increase and further improve the economics of this measure.

4.2 Measure 3 Upgrade Interior Lighting to LED

Issues and Observations:

Most of the interior lighting at the Normal Water Plant is 2 or 3-lamp fixtures with 25W T8 lamps. The lamps tend to stay on 24/7 throughout the plant. The administrative office area has 22W compact fluorescent PAR-style can lights, which are also typically left on. SEDAC did note a couple rooms on the 2nd floor that had the lights turned off, as well as the shop and garage area lights in the main building and high service pump building.



Recommendations:

SEDAC recommends upgrading the existing interior lighting to new LED fixtures. LED fixtures have a much longer life span than fluorescent and HID lights, produce light immediately, and are not cold sensitive. When switching to LEDs there is an option to use retrofit kits, or new fixtures. Retrofit kits are lower cost and have reduced install labor since they reuse existing fixtures. Additionally, they can be purchased to work with existing ballasts, simplifying installation, or to use line voltage, removing the ballast as a point of inefficiency and potential failure. SEDAC recommends linear fluorescent lights be upgraded with TLEDs that bypass the ballast when feasible.

For enclosed fixtures typical of exterior lighting and can lights, LED retrofits can have shorter life due to heat buildup in the fixture, and lighting efficacy can also be reduced by the existing fixture since the fixture and lamp aren't specifically designed to work together. SEDAC usually recommends a full LED fixture replacement for enclosed fixtures. New fixtures are more expensive, both in material and labor costs, but will last longer and have the best performance in terms of light output and efficacy.¹ However, in the long term, LED fixtures do have the disadvantage that the whole fixture will need to be replaced when the LED fails, which is a departure from typical lighting maintenance where the fixture is semi-permanent and only the bulbs are replaced.

Savings estimates are based on exchanging the existing 22W CFLs in the administrative office with 9W LED bulbs and installing 12W Tubular LEDs in the T8 fixtures. Incentives are available in the form of reduced-price direct purchases from the Ameren online store, or a standard incentive of \$0.20/W reduced. The measure is estimated with incentives to have a payback period of under 2.5 years. LED lighting is expected to have a useful life of 10 years.

¹ <https://thegrid.rexel.com/en-us/knowledge/lighting-design/w/wiki/254/led-lamp-upgrade-vs-fixture-upgrade-which-is-the-best-option>

4.3 Measure 4 Install Interior Lighting Controls

Issues and Observations:

Currently, lighting in the Normal Water Plant is left on 24/7 in most spaces. While the lab and supervisory offices on the 2nd floor are occupied 24/7, the administrative offices follow normal business hours, and most other spaces are occupied on an as-needed basis to check operations and maintain equipment.



Recommendations:

SEDAC recommends installing wall or ceiling mounted sensors set-up as vacancy sensors to control lighting in multiple areas of the facility where automatic shut-off of the lights will not present a safety risk. Vacancy sensors automatically turn off lights if they happen to be left on, but require the lights be manually turned back on. Lighting controls are typically estimated to reduce lighting energy consumption by 20% to 50%, depending on space usage and occupancy patterns².

If this measure is implemented with the LED lighting upgrade, the potential savings will be reduced due to the lower wattage of the LED fixtures, but should remain a cost-effective measure, especially if lights continue to remain on 24/7. The measure costs are based on installing 28 sensors in spaces that lights were noted to be on, but have variable or low occupancy, such as storage rooms, the garages, and chemical rooms. Incentives are available at \$40 per occupancy sensor from Ameren Illinois. The expected payback noted in the summary table is based on control of the existing T8 fixtures at 3.4 years. With LED technology, the payback for the sensors is approximately 2 times longer due to the reduced controlled wattage.

² NEMA LSD 2001 *Demand Reduction and Energy Savings Using Occupancy Sensors*.

4.4 Measure 6 Upgrade Heating Boiler

Issues and Observations:

The Normal Water Plant heating is provided by a hydronic heating system served by a natural gas boiler. The current boiler is a Patterson-Kelley Thermific N-700 boiler with an input capacity of 700 MBH, a thermal efficiency of 85%, is 22 years old, and is budgeted to be replaced in April 2022. The unit is a non-condensing model, meaning there is savings potential when this unit is upgraded.



Recommendations:

The Town of Normal should consider a modular condensing boiler when upgrading their current system. Condensing boilers achieve higher combustion efficiencies, in the 94%-98% range, from using a secondary heat exchange to cool exhaust gases to a point that water vapor condensing out. Modular condensing boilers usually have built-in temperature reset controls based on outside air temperature that keep the boiler operating at maximum efficiency and reduce the potential for heat losses from the reheat system in the summer fighting the cooling system, increasing cooling costs. An example of this type of temperature reset is shown in Figure 6. Implementing a reset schedule such as this will help ensure return water temperature to the boiler stays cool enough to keep the boiler operating in the condensing regime, maximizing the boiler's efficiency.

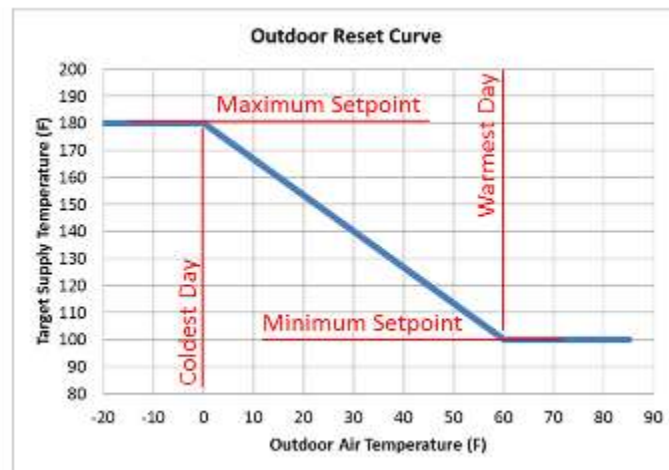


Figure 6: Example boiler reset from mncee.org.

SEDAC estimated that the additional capital cost to install a condensing boiler with outdoor air reset and installation of the outdoor air sensor for the temperature reset control would cost an additional \$12,500 in the material cost versus a 1-for-1 replacement of the existing boiler. Savings are based on an improvement from 85% thermal efficiency to an annual fuel utilization efficiency of 94.5%, which will slightly underestimate savings. Also included are savings for the hot water reset, estimated at 8% of current heating consumption based on the Illinois Technical Reference Manual. Based on the incremental cost of the condensing system with reset over a non-condensing system, the project is expected to pay back within 10 years with a \$2,500/boiler incentive from Nicor Gas.

5 Incentives

Listed below are various additional opportunities to consider. Please note that the incentive information provided is current at the time the assessment is completed. For up-to-date information on available incentives, contact SEDAC any time at 800.214.7954. Alternatively, you may contact your utility.

5.1.1 Utility Incentive Offerings

Ameren has several Incentives to encourage installation of energy efficient equipment. Incentives change frequently and SEDAC recommends checking with Ameren for the latest incentive offerings. More information may be found at: <https://amerenillinoisavings.com/>

Table 6: 2020 Ameren Incentives

Ameren Offerings	Information	Estimated Incentives
Measure 1	\$0.18/kWh Custom – Applies to 3 high-service pump motors	\$4,200
Measure 2	\$125/HP for HSP1 \$0.18/kWh Custom for HSP2-4	\$32,000
Measure 3	\$0.20/Watt reduced	\$600
Measure 4	\$40 per occupancy sensor	\$1,000
Measure 5 ¹	No Ameren Incentives	N/A
Measure 6 ²	No Ameren Incentives	N/A
Measure 7	\$125/HP	\$1,900

Notes:

- 1) Nicor Gas incentives are available at \$2,500 per boiler
- 2) Nicor Gas incentives are available at \$700 per radiant tube heater

5.1.2 Additional Programs and Offerings

Are you looking for more energy efficiency opportunities? Take advantage of any of these programs and offerings to further explore the energy and cost savings opportunities in your public facility. To learn more about eligibility and deadlines, click on each opportunity title to be directed to the specific webpage.

Programs/Offerings	Information	Contact
<u>Boiler System Efficiency Program</u>	Provides technical assistance in reducing natural gas consumption through implementing energy efficient improvements to boiler systems. Managed by the Energy Resources Center.	312.996.4490
<u>Building Operator Certification (BOC) Program</u>	Offers training for maintenance and operations staff on energy saving operational strategies. Managed by the Midwest Energy Efficiency Alliance.	312.587.8390
<u>Energy Assessments</u>	Includes a whole building analysis that provides recommendations for equipment and operational upgrades that reduce energy use and facility costs. Managed by SEDAC.	800.214.7954
<u>Illinois Green Economy Network (IGEN)</u>	Provides funding for interior and exterior lighting and lighting control upgrade incentives for projects completed on Illinois community college campuses. Managed by Illinois Green Economy Network. <i>Please note: Only facilities located in Ameren territory are eligible.</i>	217.785.0164
<u>Public Street Lighting System</u>	Provides technical and application assistance to municipalities in upgrading their street lighting. Managed by Elevate Energy.	773.269.4037
<u>Savings Through Efficient Products</u>	Provides customers with free, easy to install energy efficient products. Managed by the Midwest Energy Efficiency Alliance.	312.587.8390

5.1.3 Smart Energy Design Assistance Center

SEDAC's website contains a wealth of resources on available grants and incentives. For more information, please visit: <http://smartenergy.illinois.edu/energy-incentives.html>

5.1.4 Illinois Clean Energy Community Foundation

The Illinois Clean Energy Community Foundation provides grants for energy efficiency improvements and renewable energy projects: **Please note: Eligibility for ICECF programs vary based on building type.** <http://www.illinoiscleanenergy.org/>

5.1.5 Database of State Incentives for Renewable Energy

For information on state and federal rebates and tax credits, see Database of State Incentives for Renewables and Efficiency (DSIRE): <http://www.dsireusa.org>

5.1.6 Trade Ally – Contractors and Installers

Visit your utilities Trade Ally websites for a list of mechanical and lighting contractors, engineers, architects, energy service companies, wholesalers, distributors, and retailers that can help get your energy efficiency project implemented.

6 Conclusion

This report by the Smart Energy Design Assistance Center evaluated 7 measures for potential application by the Normal Water Plant to reduce electrical and natural gas consumption and thereby save on utility costs. After thorough evaluation, 4 of the measures are recommended for implementation based on their effective rates of return.

The Normal Water Plant management and operators should be commended for their ongoing efforts to reduce energy consumption by having already implemented distribution pumping load shedding techniques, upgrading exterior lighting to LEDs, and placing VFDs on process motors. By also participating in a Smart Energy Design Assistance Center Program energy audit, the facility is exhibiting a sharpened focus as an organization dedicated to energy management practices. Undergoing an energy audit analysis sends a very strong message to one's community of a solid commitment to energy efficiency and sustainable business practices.

SEDAC recommends that the energy savings initiatives identified in this report be implemented to decrease the building's overall energy consumption. A total reduction of 197,600 kWh and 1,500 therms is possible through the implementation of the suggested measures shown in Table 2. SEDAC recommends implementing the following package of measures:

- Measure 2: Add VFDs to High Service Pumps
- Measure 3: Upgrade Interior Lighting to LEDs
- Measure 4: Install Interior Lighting Controls
- Measure 6: Upgrade Heating Boiler

The suggested Measures will reduce the electrical and natural gas consumption of the facility while providing an estimated annual total gas and electric utility savings of \$16,600 (at current costs).

The items included in this report are the primary elements of creating and managing a sustainable facility; they are to serve as guides to implementation.

To demonstrate its effectiveness to the State of Illinois, SEDAC is asked to compile quarterly reports that document implementation of energy efficiency measures. We ask that you keep us apprised of all work towards implementation of our recommendations; this information will allow us to accurately reflect subsequent savings. We will also contact you periodically to discuss, answer questions, and review status.

Thank you for the opportunity to be of service. Please do not hesitate to contact us if we may be of further assistance.

7 Measures Evaluated but Not Recommended

Measures included in this appendix were evaluated by SEDAC for potential energy savings but are not recommended based on poor economics. The measures included in this section may have other benefits outside energy savings alone and are thus included here for consideration by the Normal Water Plant and Town of Normal.

7.1 Measure 1 Upgrade Motors to Premium Efficiency

Issues and Observations:

The Normal Water Plant has many old motors that are not NEMA Premium® models. The following table lists the motors that are currently not premium efficiency and their estimated annual operating hours. Estimated hours are based on reported weekly run-times provided by operators during the site visit.

Table 7: Motors Considered for Premium Efficiency Upgrade.

Pump Duty	Manuf.	Mnf. Yr	Motor HP	Efficiency	AOH
High Service Pump 1	Marathon	1982	75	90.80%	3341 ¹
High Service Pump 2	Marathon	1985	125	92.50%	1838 ¹
High Service Pump 3	Marathon	1985	125	92.50%	1838 ¹
Sludge Blow-off Pump 1	Leeson	1994	25	91.50%	300 ²
Sludge Blow-off Pump 2	Reliance	1987	15	84.00%	300 ²
Sludge Decant Pump	Reliance	1979	15	84.00%	40
Sludge Lagoon Pump	Baldor	1997	50	93.00%	210 ³
Clarifier #1 North Mixer	Baldor	2005	10	87.50%	4383
Clarifier #1 South Mixer	Baldor	2002	10	87.50%	4383
Clarifier #2 North Mixer	Baldor	2005	10	87.50%	4383
Clarifier #2 South Mixer	Baldor	2014	10	89.50%	4383

Notes:

- 1) Hours estimated based on expected load distribution among pumps, historic plant effluent flows, and operator comments that at peak flow, a max of three may run, but 1-2 is typical.
- 2) Based on operator comments that pumps run 8-10minutes, 4-5 times per day.
- 3) Based on operator comments that pumps run 2-3 hours, 1-2 times per week.

Considerations:

SEDAC Investigated the savings potential energy and cost savings from upgrading the above motors to Super Premium models, motors compliant with the International Electrotechnical Commission's IE4 standard. These motors are designed to be more efficient than NEMA Premium® by 1.5-2 percentage points, with higher efficiency gains for smaller motors than larger ones, while being cost-competitive with existing NEMA Premium® models. The benefits of Super Premium motors include: longer life, lower operating costs, less heat production. Based on economic analysis, many of the motors in the water plant considered for upgrades do not have long enough run hours to recommend upgrading to NEMA Premium® or IE4 efficiency, even on an incremental cost basis based on replacement when the motors fail.

The three high-service motors that are not currently premium efficiency models, pumps 1-3 in Table 7, could be replaced with Super Premium models and be cost effective over rewinding, but only as the existing motors fail and need to be replaced. For the other motors in the table,

rewinding is the more cost-effective option until rewinding is either not possible or the cost to rewind the motor exceeds the combined replacement cost and operating cost, typically assumed to be a rewinding cost 60%-75% of the new motor cost.

7.2 Measure 5 Add VFD Control to Aerator Fan

Issues and Observations:

Currently the plant has a 15HP forced draft aerator to add oxygen to the influent water stream. The fan runs at constant speed, 24/7, regardless of changes in flow demand from the system. This can lead to over-oxygenation during low flow periods. Water-to-air interface area is increased in the aerator to remove volatile compounds, oxidize metals for later removal, and, to a limited extent, oxidize organic matter to help in chlorination later in the treatment process. However, over-oxygenating is a possibility with an uncontrolled system wasting energy and leading to process issues. Too much dissolved oxygen in the water can later come out of solution, particularly in filter media, causing air locking and premature/ineffective backwashing. Supersaturated water also increases corrosion, can cause sedimentation issues, and promotes algal growth.



Considerations:

SEDAC investigated the potential energy savings from adding a VFD and DO control to the forced-draft aerator. From details about the impacts of over- or under-aerating potable water in the treatment process, there appears to be some potential for controls to reduce energy impact from aeration, but there is very little industry or academic research into the potential energy savings from aeration control in potable water plants; the main focus being aeration in wastewater plants. However, there are always potential savings when a process can be tuned to match current demands. For the aeration tower, more airflow is needed as water demand, and thus plant flow rate, increases to meet distribution demands or to refill water towers and holding tanks in the distribution system. Also, source water DO content can vary depending on temperature and surface water conditions permeating to the groundwater wells. This variability would indicate there is some potential to vary the airflow rate in the aeration tower at the Normal Water Plant to meet specific DO levels for further treatment.

SEDAC was able to obtain flow data for the plant to try to estimate variability in DO demand for the tower based on flow. Wastewater industry reports indicate a 20-30% aeration energy reduction for wastewater plants can regularly be obtained, but wastewater aeration is a much more energy-intensive process than potable water aeration. Assuming full aeration power is only necessary at full flow, and the relationship between airflow and fluid flow is linear, a 20% reduction in fan energy was calculated. However, fan surge protection, temperature variations, and DO absorption rates will vary as well and prevent a linear aeration energy-to-flow relationship. SEDAC based their savings estimate on a reduction of 10% aeration energy as a conservative estimate. Based on the economics, this measure is not recommended, but is also an area that may require further data and research to better quantify the potential savings.

If the plant is already tracking certain concentrations in the water using sensors already tied to the SCADA system, the capital costs for this measure could be reduced. Chemical concentrations to track would be dissolved oxygen, hydrogen sulfide, ammonia, volatile organic chemicals, methane, or conductivity to identify iron and manganese in draft tower effluent. Any of these, or a combination of them, could be used to control aeration input energy.

7.3 Measure 7 Upgrade Gas Unit Heaters

Issues and Observations:

The Normal Water Plant's high service pump building houses parts storage, high service pumps 7 and 9, and a garage space. The building is heated by two standard natural gas unit heaters, one confirmed to be 172,500 Btu/hr input, the other assumed to be a similar size. In the garage space, it is common for high air changes from doors opening and air gaps around overhead doors and other building joints. High air changes carry heat from the unit heaters out of the building, increasing heating costs for forced-air heating systems.



Considerations:

SEDAC investigated the potential savings and benefits from installing radiant tube heaters in the high service pump building. Radiant heaters heat surfaces rather than the air, so less heat is lost from opening overhead doors and through building air leaks. Note that to install the radiant heaters, gas piping will need to be moved from the middle of the wall over the pumps where one of the current unit heaters is mounted, to a corner so that radiant piping can extend the full length of the west-side wall. Typical savings from radiant heating over forced-air heating is estimated at 15%-20%. The cost for radiant tubes is similar to a standard unit heater replacement, but the installation cost has been increased to account for additional gas piping. Incentives for radiant tube heaters are available at \$700 per unit from Nicor Gas, however, due to the limited natural gas use in this space, savings potential is also limited. The measure is only recommended for investigation once the current unit heaters require replacement.

An alternative option with similar costs and savings potential is to upgrade these units to condensing unit heaters. Increasing the unit efficiency from an AFUE of 80% to 93% can have similar savings to that generated by using infrared heating. This option also avoids the need to change the location of the west side unit heater's gas piping. However, the units will generate condensate fluid that will need to be piped to a floor drain or could potentially be piped into the plant process for treatment along with the groundwater.

7.4 Measures Not Quantified

Change Existing Multi-Size Motor Staging for Same-Size Motor Staging: During the site visit, operators at the water plant noted that they had issues staging the current motors from time to time, and wanted to investigate changing out all the motor for units of the same size during upgrades. To determine if this is possible, SEDAC looked at the daily flow data for the Normal Plant provided by John Burkhart. Below is a plot of that data indicating that overall, daily flows are fairly consistent from day to day. Knowing that the plant operates a load-shedding policy to fill towers and tanks during low demand-periods to offset high-demand period, hourly flow is assumed to be somewhat consistent as well.

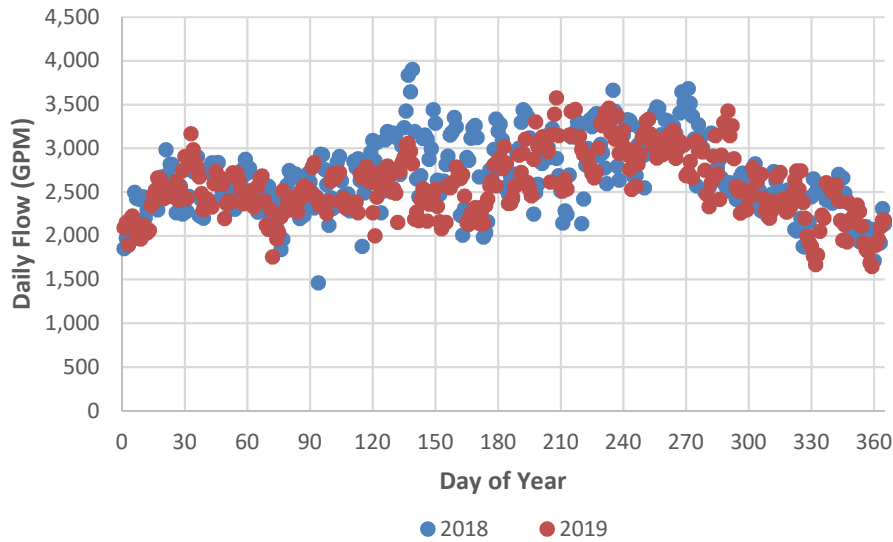


Figure 7: Daily flows in terms of gallon per minute for 2018 and 2019.

From this 2-year data set, the maximum flow was 3,900 GPM, and the minimum was 1,460 GPM. Using the pump curve for the existing 2,100 GPM, 125 HP motors, pumping efficiency is estimated to be about 83%. Using the peak head-pressure rating from those pumps of 182 ft head, an approximate pump HP of 130HP was calculated for all the pumps to have an equivalent size. Based on the current pumps energy, the maximum daily flow data, and 130HP for the replacement pumps, this results in a 10HP reduction in energy to meet the maximum daily average flow using high-service pumps 2, 3, and 4 (125HP, 125HP, and 150 HP). With VFDs on the pumps to meet variable flow demand, these pumps could meet the bulk of flows at around 2,600 GPM, assuming 182 ft of head pressure, with approximately equal power to the existing pumping system of 150 HP. While this means there aren't drastic energy savings available from swapping to same-size pumps, there may be additional benefits in ease of staging, programming of the VFD operations, and maintenance that make this option more beneficial than simply adding VFDs to the existing pumps.

8 Customer Interest Form

Below is a selection form that will allow SEDAC to gauge the interest of the client in implementing each individual measure. Please fill this out and return to SEDAC.

Measure	Measure Description	Interest in Implementing?		Estimated Completion Date
		YES	NO	
1	Upgrade to Premium Efficiency Motors			
2	Add VFDs to High Service Motors			
3	Upgrade Interior Lighting to LEDs			
4	Install Interior Lighting Controls			
5	Add VFD and DO Control to Aerator			
6	Upgrade Heating Boiler			
7	Upgrade Gas Unit Heaters			

Appendix A – Pre and Post Implementation Comparison

Section 3 of this report; Energy Consumption and Analysis, provided the following benchmarking for the Town of Normal Water Plant.

Table 8: Utility and Benchmark from October 2017 through September 2018

Energy Benchmarking For Normal Water Purification Facility						
	Annual Consumption		Annual Costs		Unit Cost ³	
Electricity¹	1,541,591	kWh	\$123,327	95%	\$0.08	\$/kWh
Natural Gas²	11,599	Therms	\$6,579	5%	\$0.57	\$/therm
		Total Cost	\$129,907			
		Floor Area	21,000	ft ²		
		Plant Flow	1,393	MG/yr		
Electric Use Intensity	1,107	kWh/MG/yr	Gas Use Intensity	0.55	therms/ft ² /yr	
Energy Use Intensity (EUI)	4,612	kBtu/MG/yr	Energy Cost Intensity (ECI)	\$93.28	/MG/yr	

Notes:

- 1) Electric is supplied and delivered by Ameren IL on a DS-3 rate class
- 2) Natural Gas is supplied by Nicor Gas and delivered by Constellation Energy on a general service rate class.
- 3) Unit costs are blended averages which include all taxes and demand charges.

If the Town of Normal Water Plant were to implement Package 1 of this report, the benchmarking would look like this:

Table 9: Post Implementation of Recommended Measures - Utility and Benchmark

Energy Benchmarking For Normal Water Purification Facility						
	Annual Consumption		Annual Costs		Unit Cost ³	
Electricity¹	1,354,291	kWh	\$108,343	95%	\$0.08	\$/kWh
Natural Gas²	10,199	Therms	\$5,813	5%	\$0.57	\$/therm
		Total Cost	\$114,156			
		Floor Area	21,000	ft ²		
		Plant Flow	1,393	MG/yr		
Electric Use Intensity	972	kWh/MG/yr	Gas Use Intensity	0.49	therms/ft ² /yr	
Energy Use Intensity (EUI)	4,047	kBtu/MG/yr	Energy Cost Intensity (ECI)	\$81.95	/MG/yr	

Notes:

- 1) Electric is supplied and delivered by Ameren IL on a DS-3 rate class
- 2) Natural Gas is supplied by Nicor Gas and delivered by Constellation Energy on a general service rate class.
- 3) Unit costs are blended averages which include all taxes and demand charges.

The EUI reduces by 135 kBtu/sf/yr to 972 kBtu/sf/yr and the energy cost per square foot reduces by \$11.33/sf/yr to \$81.95/sf/yr for an annual cost savings of just under \$15,800. This represents a 12% reduction in utility expenditures.