Town of Hertford

Work Session Meeting (In Person/Facebook)
Monday, October 24, 2022 – 6:00PM
Horace Reid Community Center, 305 W Grubb Street

The Council of the Town of Hertford held a Work Session Meeting at the Horace Reid Community Center (also by Facebook) on Monday, October 24, 2022, at 6:00 PM.

COUNCIL MEMBERS PRESENT

Earnell Brown, Mayor
Jerry Mimlitsch
Connie Brothers
Ashley Hodges, Mayor Pro Tem
Sandra Anderson

STAFF PRESENT

Janice McKenzie Cole, Interim Town Manager
Gina Durante, Town Clerk

A quorum was present.

CALL TO ORDER

Mayor Brown called the meeting to order.

INVOCATION & PLEDGE OF ALLEGIANCE

The invocation was led by Pastor Dario from the Hertford Baptist Church and followed by the Pledge of Allegiance.

APPROVAL OF AGENDA

Mayor Pro Tem Hodges suggested as a friendly amendment to the agenda to add a Closed Session citing §143-318.11a(5), real estate. A motion was made by Councilman Mimlitsch to accept the amendment and approve the agenda. The motion was seconded by Councilwoman Anderson and unanimously approved with the vote as follows:

Councilman Mimlitsch	aye
Councilwoman Anderson	aye
Mayor Pro Tem Hodges	aye
Connie Brothers	aye
Mayor Brown	aye

CONSENT AGENDA

A motion was made by Councilwoman Brothers and seconded by Mayor Pro Tem Hodges to approve the Consent Agenda. The motion was approved, and the vote was as follows:

Councilman Mimlitsch	aye
Councilwoman Anderson	aye
Mayor Pro Tem Hodges	aye
Connie Brothers	aye
Mayor Brown	aye

SCHEDULED APPOINTMENT

Jon Linck, Energy Efficiency Specialist from North Carolina Rural Water Association, presented his findings and report on the efficiency of the town's Wastewater Treatment Facility and recommendations. Presentation attached.

CONTINUED BUSINESS

None

NEW BUSINESS

Withers Ravenel Master Contract and Task Order for Waterlines

Manager Cole addressed the contract and first task order with Withers Ravenel. We are starting with the waterlines, which will be Task Order 1. This is the first Task Order with more to come. Withers Ravenel will be revising the invoicing procedure in the Master Contract to state that payment is due three days after the town receives monies from the state for an invoice. Manager Cole and Larry Sandeen met with Withers Ravenel and discussed the billing as a lump sum and Withers Ravenel conceded to partially break down their billing rates. Manager Cole asked Council for a vote to accept the Master Contract with the changes recommended by herself and Larry Sandeen and move forward with Task Order 1. Mayor Brown asked for a motion to approve, Councilman Mimlitsch made the motion, and Mayor Pro Tem Hodges seconded. The motion passed unanimously (5-0), with the following vote:

Councilman Mimlitsch	aye
Councilwoman Anderson	aye
Mayor Pro Tem Hodges	aye
Councilwoman Brothers	aye
Mayor Brown	aye

Draft of proposed Grant Application for Hertford Riverfront-Downtown Connectivity Plan

Manager Cole discussed the draft of the NC Department of Commerce Rural Transformation grant that Allison Platt has been working on for us for the Hertford Riverfront-Downtown Connectivity Plan. Appendix A & C were recently revised, and

copies of those pages were distributed to Council. The application is due November 1, 2022, so this is the last time Council will meet before the due date. Manager Cole asked Council to approve the draft Ms. Platt has prepared. There was discussion about costs that the town will incur with the project that may include: landscaping, restroom renovations, and signage along Highway 17 and at the docks. Mayor Pro Tem Hodges made a motion to approve the draft and Councilman Mimlitsch seconded. The motion passed (5-0) with the following vote:

Councilman Mimlitsch	aye
Councilwoman Anderson	aye
Mayor Pro Tem Hodges	aye
Councilwoman Brothers	aye
Mayor Brown	aye

MANAGER'S REPORT

Manager Cole announced that the new S-Bridge will be open to traffic by the close of business on Tuesday, October 25, 2022.

Council's Reports/Concerns

Councilwoman Brothers thanked Pastor Dario for today's prayer. She reported that Pastor French received a kidney transplant last week and is doing well. She attended the Hertford Baptist Church Fall Festival on Sunday, October 23, and it was a successful event. She also attended the African American Experience of Northeast North Carolina's unveiling of a marker in Elizabeth City for the sit-in. She announced that so far, we have 270 applications for Toys for Tots in Perquimans and Chowan Counties and will continue to accept applications through the end of October. Volunteers are needed to transport toys from Greenville and deliver to Perquimans and Chowan counties. Donated toys should be unwrapped. More information to come regarding time and date of pick up for Hertford residents at the Perquimans County Recreation Center. Toys for Tots applications are available at the Municipal Building. Lastly, Councilwoman Brothers will be hosting a Christmas Dinner on Sunday, December 4th 3:00PM, at Louise's Event Center for all residents of Hertford. Flyers will be distributed, and invitations sent out for those wanting to attend.

Mayor Pro Tem Hodges has been working on his continued education requirements for duties as Financial Officer. He also commented on the status of the audit and Manager Cole believes it is on track to be completed by October 31.

Councilman Mimlitsch thanked Willis for the mums donated to our town for beautification. He reported that Stacey Layden of TDA is working to have an outdoor springtime event in Hertford. Councilman Mimlitsch complimented Ms. Layden for all her efforts and success in bring activities to Hertford and Perquimans County. Councilman

Mimlitsch did not attend the Ghost Walk last weekend but heard received positive feedback. He thanked the citizens of Hertford for getting out and getting involved. He also thanked the Town Manager and Town Clerk for their work and assisting Council.

Councilwoman Anderson said the over the past few weeks many people, both residents and non-residents of Hertford, have told her how pleased they are with the work of Council and the Town Manager. Hertford is getting a lot of exposure. This past Saturday, October 22nd, the workshop Yes, You Can Own your Own Home was held. Four people attended and childcare was provided. There was a realtor, a mortgage representative and financial manager who shared information, answered questions, and spoke with the attendees.

Mayor Brown thanked Manager Cole, Mayor Pro Tem Hodges, and Sharon Smith for completing the EDA application. She also thanked Manager Cole for the distribution of the mums around town. The planters around town have been replanted after conversations with the owner of Manzer's Nursery in Winfall and the Hertford Beautification Committee. Mayor Brown and the County Chairman of the County Commissioners attended the rededication of the Quaker monument on Sunday, October 23rd. It was well attended and very educational. Mayor Brown received 25 tickets to a screening of The Woman King, a very profound movie with themes of courage, determination, goals, and resilience. Tickets were distributed at the theater on Sunday, October 16th, and then Mayor Brown had a discussion with the attendees on Friday, October 21st. The movie's message had a very positive effect.

Mayor Brown read the announcements.

Mayor Pro Tem Hodges made the motion to go into Closed Session pursuant to §143-318.11a(5), real estate. Councilwoman Brothers seconded the motion. It passed 5-0 with the following vote:

Councilman Mimlitsch	aye
Councilwoman Anderson	aye
Mayor Pro Tem Hodges	aye
Councilwoman Brothers	aye
Mayor Brown	aye

Council went into Closed Session at 7:25PM.

Council came out of Closed Session at 8:13PM.

Councilwoman Brothers made the motion to adjourn the meeting. Mayor Pro Tem Hodges seconded the motion. It passed 5-0 with the following voice vote:

Councilman Mimlitsch	aye
Councilwoman Anderson	aye
Mayor Pro Tem Hodges	aye

Councilwoman Brothers	aye
Mayor Brown	aye

Meeting adjourned at 8:14PM.

Energy Efficiency Assessment

Town of Hertford - Wastewater Treatment Facility

9/16/22

Prepared by: Jon Linck

Energy Efficiency Specialist

North Carolina Rural Water Association

(336)-867-0741

jonlinck@ncrwa.org

NC RWA

TRAINING SUPPORT

North Carolina Rural Water Association, Inc.

Town of Hertford

114 West Grubb St.

Hertford, NC 27944

Phone: 252.426.5311

Fax: 252.426.7060

CONTACTS:

Janice Cole

Town Manager

hertfordmanager@gmail.com

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INTRODUCTION

The North Carolina Rural Water Association (NCRWA) manages an Energy Efficiency program in collaboration with the National Rural Water Association. Funded through a grant from the USDA Rural Utilities Service, the program performs energy assessments, recommends energy efficient practices and technologies, and provides support in achieving recommendations. NCRWA provides no-cost energy assessments that strive to help systems lower their energy consumption and costs. In addition to cost-saving analysis, including capital expenditure payback and return on investment (ROI) calculations, possible funding opportunities are explored. Electric utility rate structures are also analyzed. The eligible systems will serve communities with fewer than 10,000 people, as well as rural areas and similar entities qualified to receive USDA Rural Development water and wastewater loans and grants. Systems that serve low-income areas will receive higher priority for the services of this program.

On 9/16/22, Jon Linck, NCRWA Energy Efficiency Specialist, toured the Town of Hertford Wastewater Treatment plant to explore potential energy efficiency improvements. The audit follows ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Level 1 and Level 2 Energy Audit standards. In some cases, recommendations will extend to Level 3 energy audit; some capital improvements. Below is an overview of ASHRAE Energy Audit Levels:

- Level 1 – Walk-Through Survey
- Level 2 – Energy Survey and Analysis,
- Level 3 – Detailed Analysis of Capital-Intensive Modifications
    - Targeted Audits

Executive Summary

Energy efficiency assessments are designed to identify, explain, and aid in implementation of efficiency recommendations or operational changes that will result in reduced energy consumption and costs. Some energy efficiency improvements require no capital investment (i.e. operational or billing rate changes), some require a small capital investment with a relatively short payback period, while others are more long-term recommendations with longer payback periods and lower returns on investment.

Historical energy usage data was provided by the system, and estimated energy savings are based on this information. Some calculations used for this study include initial estimates, which should be assessed further or collected through bidding and vendor estimates during implementation—the general concept will result in long term savings to operational costs. Share this information among staff and the utility's engineer before implementation. NCRWA can provide additional assistance to help implement any component of this project. Do not hesitate to contact Jon Linck, Energy Efficiency Specialist, or your regional circuit rider for additional assistance.

Site & Equipment Overview

Site Info

Physical Address:

Meads Circle

Hertford, NC 27944

GPS Coordinates:

36.200365, -76.480785

Permit Number: NC0026352

Permitted Capacity: .700 MGD

UNC SCHOOL OF GOVERNMENT Environmental Finance Center

NC Water and Wastewater Rates Dashboard
Rates as of January 1, 2022
Last updated: January 12, 2022

NC Water Infrastructure Environmental Quality

Hertford

Rates Comparison | Financial Benchmarks | Characteristics | Links

Utility Owner			
Ownership type	Municipality		
Primary County	Perquimans		
Primary service area	Hertford town		
Date Rates Effective	07/01/2021		

◉ Water ○ Sewer ○ Water + Sewer

Select comparison group: All Utilities

	Hertford town	Median for all utilities in survey	Statewide Stats
Number of Systems	1	493	567
Est. Number of Connections	989	1,699	
Est. Service Population	2,145	4,199	
Operating Revenue	$1,299,560	$1,672,095	
Operating Expense	$1,567,828	$1,719,244	
Current Assests	$747,350	$1,744,640	
Census Year	2019		2020
Average Household Size	2.16	2.42	
Median Household Income	$39,355	$42,213	
Poverty Rate	25.43%	18.47%	

NCRWA TRAINING SUPPORT

Equipment Summary

On the day of the assessment, an inventory of equipment and their respective power ratings (kW) was taken in order to generate an energy model for the facilities energy usage. This summary of equipment highlights the equipment used in Normal Operating Conditions (NOC). The other equipment on-site is for emergencies or as-needed and are excluded from this assessment. The equipment summary is as follows:

Solids Handling

- 2x - Solids/grit removal motors
- 1x - Conveyor motor
- 1x - Grit pump
- 1x - Paddle drive
- 1x - Conveyor Auger

Aerobic Digester

- 2x - Blower motor

Sludge Ditch

- 2x - Blower motor

Oxidation Ditch

- 4x - Rotor aerators

Clarifiers

- 2x - Blade motors

Buildings & Infrastructure

- 24x - Fluorescent lights

Below is an aerial of the plant with an overview of the facility layout.


Clarifier #1
Office &
Generators
Clarifier #2
Aerobic
Digestor
142
Sludge
Storage
Disc Filters
& Chlorine
Contact
Hertford Wastewater
Treatment Plant
Influent
Solids
Handling
Unit
Oxidation
Ditch
eads Cir

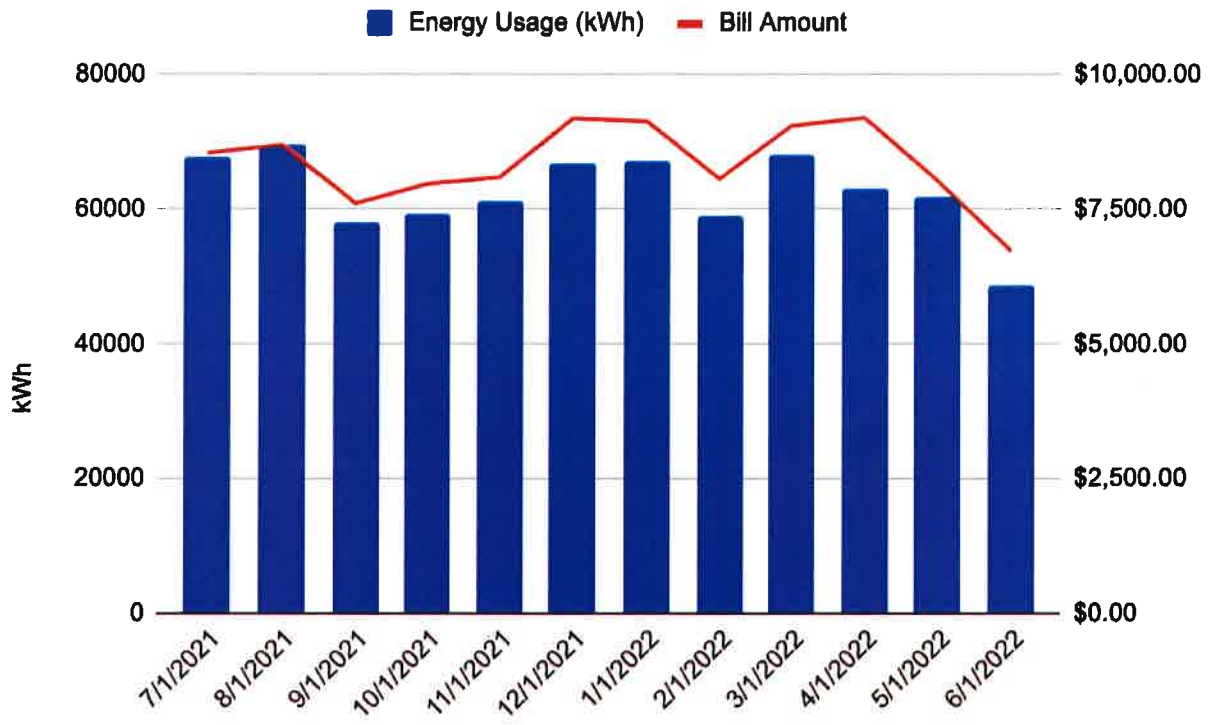
Energy Use & Bill Analysis

Energy Bill Analysis - Town of Hertford

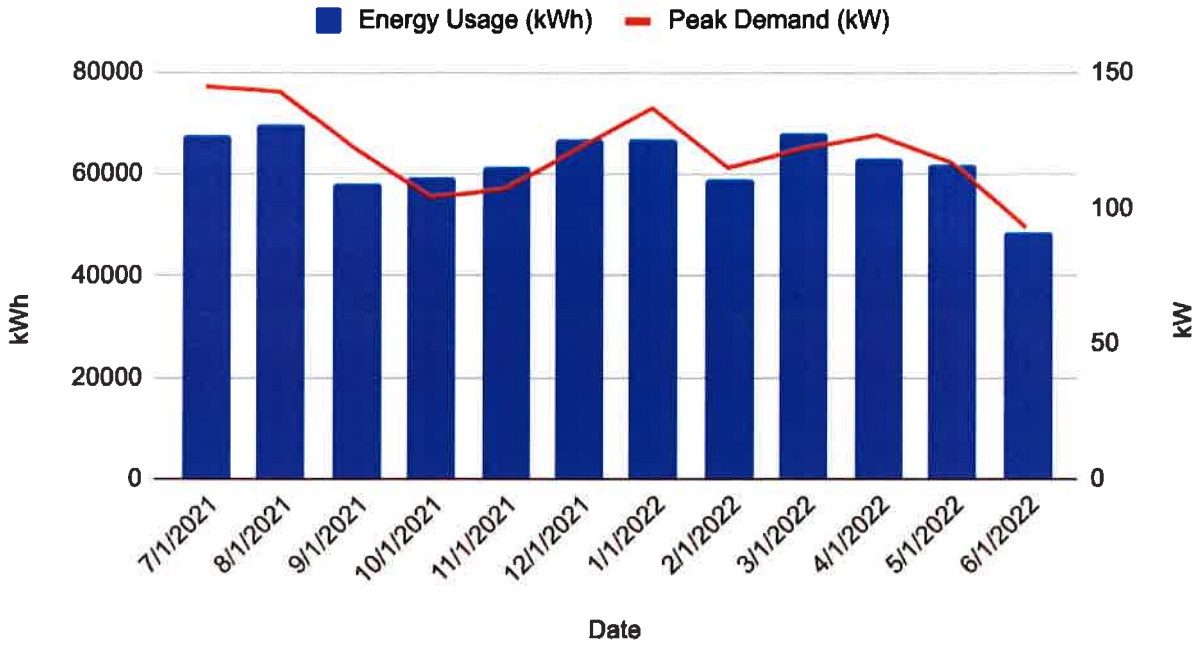
The Town of Hertford has submitted 12 months worth of energy bills starting in September 2021, and ending in August 2022. The graphs below show your monthly costs (red line) against that month's energy usage (blue bars). Ideally, the bill amount should trend evenly with energy usage. Uneven trendlines can signify excess equipment usage, high peak demand charges, power factor fees, and/or changes in operations.

Account Number: 9919000.00 98

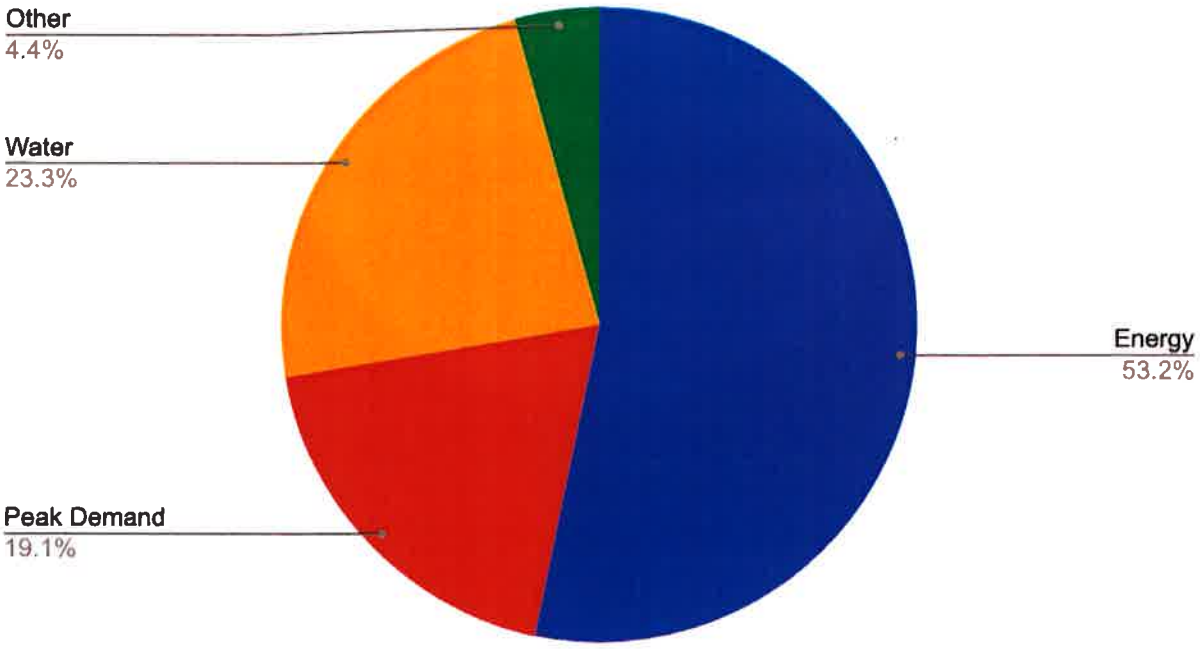
- Demand Rate Code - 363
- Energy Rate 361
- Lighting is flat fee



Energy Usage (kWh) and Peak Demand (kW)



Energy Bill Breakdown



Energy Model

Using information collected during the energy assessment (pump runtimes, pump sizes,etc), a baseline model can be used to approximate how much energy is being used daily, monthly, and yearly. Additionally, we can see how that correlates to various electrical loads (equipment) at the plant. The model's accuracy can be compared to some of the actual bills to determine how accurate the information gathered is and/or if there are some operational shortcomings to assess. Additional steps should be taken to quantify where the inaccuracies of the model exist, and why they're not represented correctly.

Below is an outline of all the equipment used under normal operating procedures and their associated runtimes given by the operator during the assessment:

Item	#	Simultaneous Use	HP	True Power Rating (kW)	Daily Runtime(hours)	Daily Energy(kWh)	Monthly Energy(kWh)	Yearly Energy (kWh)
Solids & Grit Removal Motors	2	2	10	8.27	3.00	24.81	744.35	8932.15
Conveyor Motor	1	1	1	0.80	3.00	2.41	72.19	866.32
Sludge Pump Motor	1	1	1	0.90	3.00	2.71	81.38	976.58
Paddle Drive Motor	1	1	1	0.90	3.00	2.71	81.38	976.58
Conveyor Auger Motor	1	1	1	0.90	3.00	2.71	81.38	976.58
Solids Handling Total	**6**	**6**	**14**	**11.79**	**15.00**	**35.36**	**1060.65**	**12728.22**
Aerators	2	1	35	29.01	20.00	580.22	17406.67	208880.00
Aerobic Digestor Total	**2**	**1**	**35**	**29.01**	**20.00**	**580.22**	**17406.67**	**208880.00**
Aerators	2	1	75	62.17	20.00	1243.33	37300.00	447600.00
Sludge Ditch Total	**2**	**1**	**75**	**62.17**	**20.00**	**1243.33**	**37300.00**	**447600.00**
Rotor Aerators	4	1	20	16.58	20.00	331.56	9946.67	119360.00
Oxidation Ditch Total	**4**	**1**	**20**	**16.58**	**20.00**	**331.56**	**9946.67**	**119360.00**
Blade Motors	2	2	1	0.83	24.00	19.89	596.80	7161.60
Clarifier Total	**2**	**2**	**1**	**0.83**	**24.00**	**19.89**	**596.80**	**7161.60**
Lighting Fixtures	30	16	N/A	0.96	6.00	5.76	172.80	2073.60
Mini Split	1	1	N/A	4.00	6.00	24.00	720.00	8640.00
Buildings Total	**2**	**17**	**0**	**4.96**	**12.00**	**29.76**	**892.80**	**10713.60**
Grand Total	**18**	**28**	**145**	**125.33**	**111.00**	**2240.12**	**67203.62**	**806443.42**

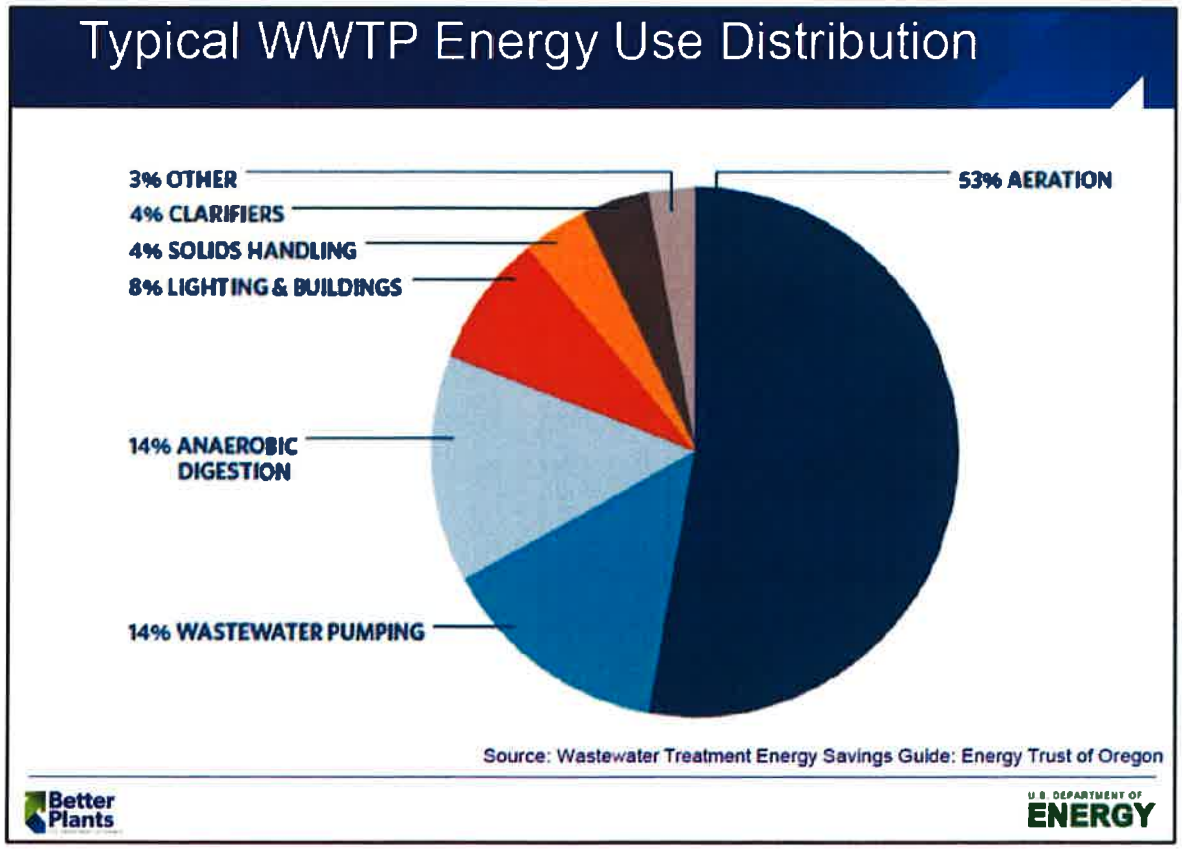
Energy Usage	
Modelled Annual Energy(kWh)	806443.42
Actual Annual (kWh)	750816
Difference(kWh)	-55627.42
Energy Calc. Error	-7.41%
Peak Demand	
Modelled Peak Demand (kW)	125.33
Average Peak Demand (kW)	121.1666667
Difference	4.16
Percentage Error	3.32%

After the energy use model is complete, we can calculate the percentage error and differences between the model and "real-life." The real number compared to the model are simple averages of the energy use and costs over the 12 month billing period. A percentage error of less than five percent is ideal and indicates that

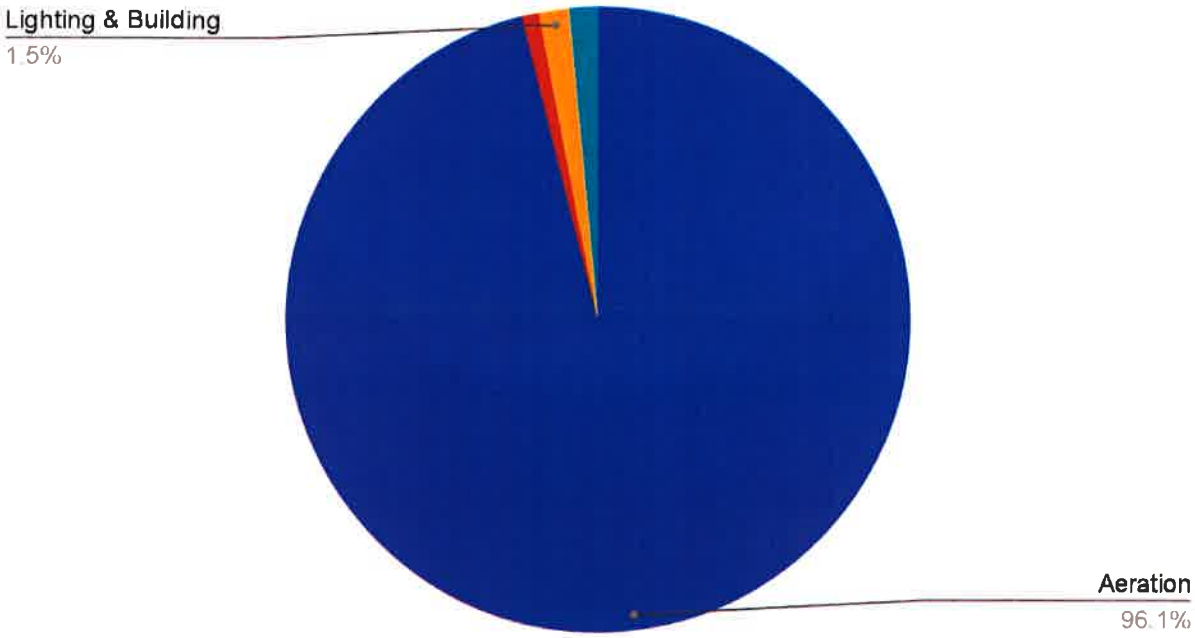
the initial data collected during the energy assessment is representative of the "real-world" energy consumption and plant operations.

Energy Usage

Using the initial data collected on the day of the assessment, we can see which electrical loads (equipment) have the highest demand and energy usage. The critical equipment at these pump stations are obviously the pumps, the lighting, and equipment used to condition the space(heating/cooling). To the left, is a typical energy distribution for a wastewater treatment plant.



Est. Energy Breakdown by Equipment



Energy Use Intensity

Energy Use Intensity (EUI) is a common metric used for measuring energy consumption in the water/wastewater industries. The index is a ratio of the amount of energy consumed per million gallons processed, or kWh/MG. It can be difficult to use a uniform ratio as processes vary significantly in the treatment and level of treatment. However, this index is generally a good indicator and measure of the overall energy efficiency of a system. The following table includes the energy intensity index information for this system. Since the plants have been decommissioned, we will only consider the pumping, lighting, and "other" sections of the chart above and adjust the distribution based on your average daily MGD.

EUI Calculations

Average Daily Discharge (MGD)	0.585
Average Annual Discharge (MGD)	213.525
Annual kWh Usage	750816
EUI	3516.29

The following table shows what would be considered an ideal **Energy Use Intensity** based on average daily flow. A target EUI for a plant this size would be **3,300 kWh/MG or less**—the system currently has an Energy Use Intensity of **3516.29 kWh/MG**. **This system is just outside the ideal target(although is well above average)** for Energy Use Intensity based on systems discharging 2 MGD or less, indicating the a system is mostly energy efficient based on its kWh consumed per MG processed:

Recommended WWTP Energy Intensity Index Table Energ

Average Daily Flow Range (MGD)	Energy Use Intensity (kWh/MG)	Average Effluent BOD (mg/L)	Generating Electricity Onsite (%)	Predominant Treatment Processes		
				Secondary Treatment	% Nitrifying	Biosolids Disposal
< 2	3,300	7.3	10	mechanical aeration	68%	land application
2-4	3,000	6.7	14	fine bubble	66%	land application
4-7	2,400	7.5	7	fine bubble	59%	land application
7-16	2,000	6.5	45	fine bubble	59%	land application

RECOMMENDATIONS

Item One - Simplify Solids Handling System

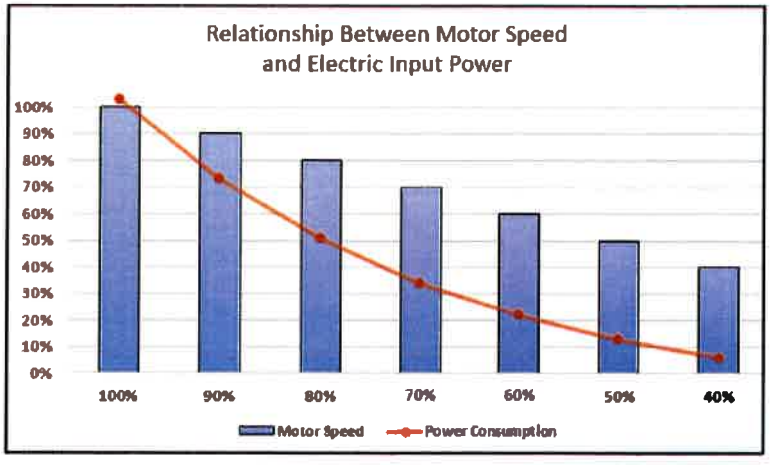
The existing infrastructure to remove solids and grit from influent is far too energy intensive compared to other more streamlined systems. Ideally there should be a maximum of two motors rated no higher than 1hp. The cumulative rating of the system is 4 and a half horsepower versus a maximum of two horsepower but typically around one. The energy savings are not the only aspect being considered in this recommendation. Excess motors and components increase equipment and labor costs associated with maintenance. However, for this assessment, only energy cost will be evaluated.

Item Two - Purchase Variable Frequency Drive for Aerobic Digester & Sludge Storage

ABB Variable Frequency Drive

To optimize your pump efficiency, a variable frequency drive is recommended to meter the pump in a way that reduces your peak demand and energy use. It's important to make sure you match motor hp and VFD ratings before purchase. VFD's have a broad price range and can cost as much as $9500 for a reputable company like ABB. The benefit of some of the more expensive controllers is that they are highly programmable and simple to operate. Additionally, there will be some advanced programmable features baked into the unit to allow for more nuanced operations.

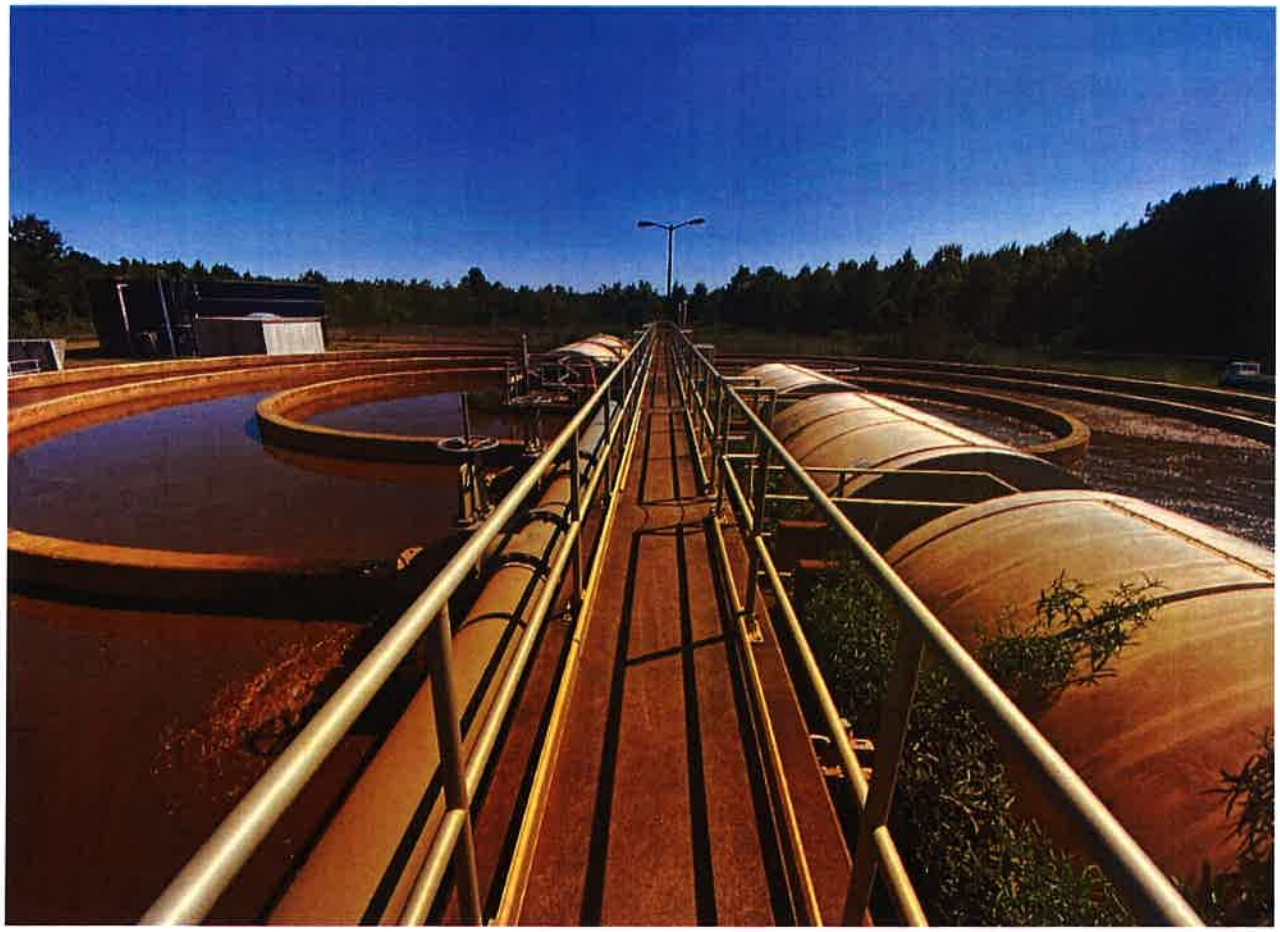
The primary outcome for the Town of Hertford would be to reduce motor speeds to a maximum 75% of their rated load. This is typically the best efficiency point (BEP) for the majority of AC induction motors. Reducing speeds to 55%-60% of rated load is acceptable put and lower and your pump efficiencies drop off substantially. After installation, a good starting point would be 60% with occasional increases to meet demand.



Please consult your local Circuit Rider and electrician before purchasing.

Item Three - Regularly Monitor Dissolved Oxygen Levels in Oxidation Ditch

The Magna Roto Rotor Aerators are precision aeration devices and it is ideal that dissolved oxygen levels are continuously monitored to maintain desired levels. With that being said, it may be the case that the aerators can be run less than current runtimes. Alternatively, adjusting the water level of the oxidation ditch can reduce energy by reducing the load on the motors.



Item Four - Replace T8 Fluorescent Bulbs to LED T8 Equivalents

There are approximately 30 - 45 watt fluorescent bulbs being used throughout the facility. On any given day, its possible that they could be run simultaneously as an operational requirement. Lighting requirements can impact operational cost dramatically if LED's are not installed. Without LED's, energy costs will add up, which is why LED's make a great replacement option; using roughly a third of the energy. It is important to remember to purchase ENERGY STAR certified LED bulbs. As these bulbs will be the most reliable, and will perform as they are expected.

Item Five - Add Insulation & Drywall to Office Ceiling

Offices and auxiliary structures that need to be conditioned will consume an excess amount of energy without a properly sealed building envelope. Thermal bridging is a common occurrence when insulation is not installed where necessary. Lack of insulation will cause problems in all weather conditions so its important that the building has ample protection from the outdoors. Installing insulation with a minimum rating of R-30 on the ceiling will help stop any radiant heat loss/gains from entering the building and will reduce the required heating/cooling load. Rolled BATT fiberglass insulation can be easily found at a local hardware store but spray foam insulation can be easiest to install with the best results.

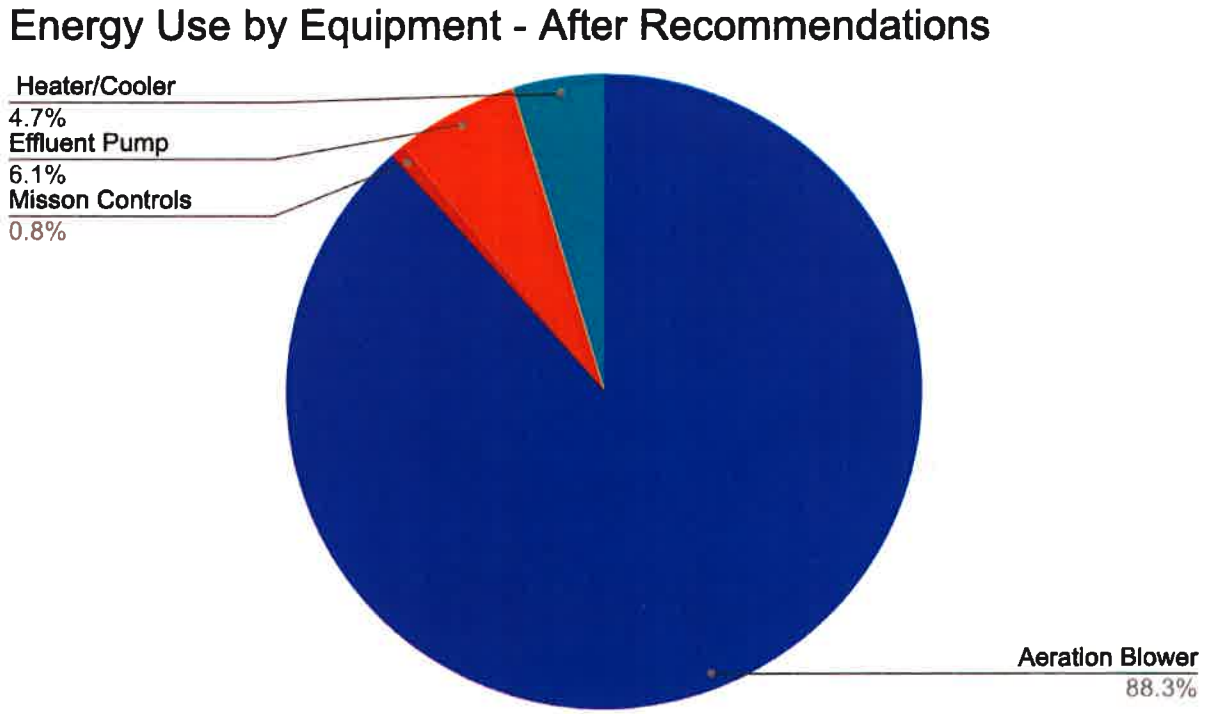
ESTIMATED SAVINGS & ROI

Energy & Cost Savings

The savings outlined in the chart below are estimations given that no real-world data can be obtained on the efficacy of the actionable items. The savings calculated below are based on yearly averages and existing rate schedules. For Time-of-Use (TOU) rates, the "off-peak" rates are used to build a ***conservative*** estimate of your savings. Depending on what actionable items are implemented, maintained, monitored; the savings could be more or less than the chart shown below.

As a whole, the plant is looking at a ***50.1%*** decrease in their annual energy usage but has the potential to save more if benchmarks can be recorded (see Energy Star Portfolio Manager).

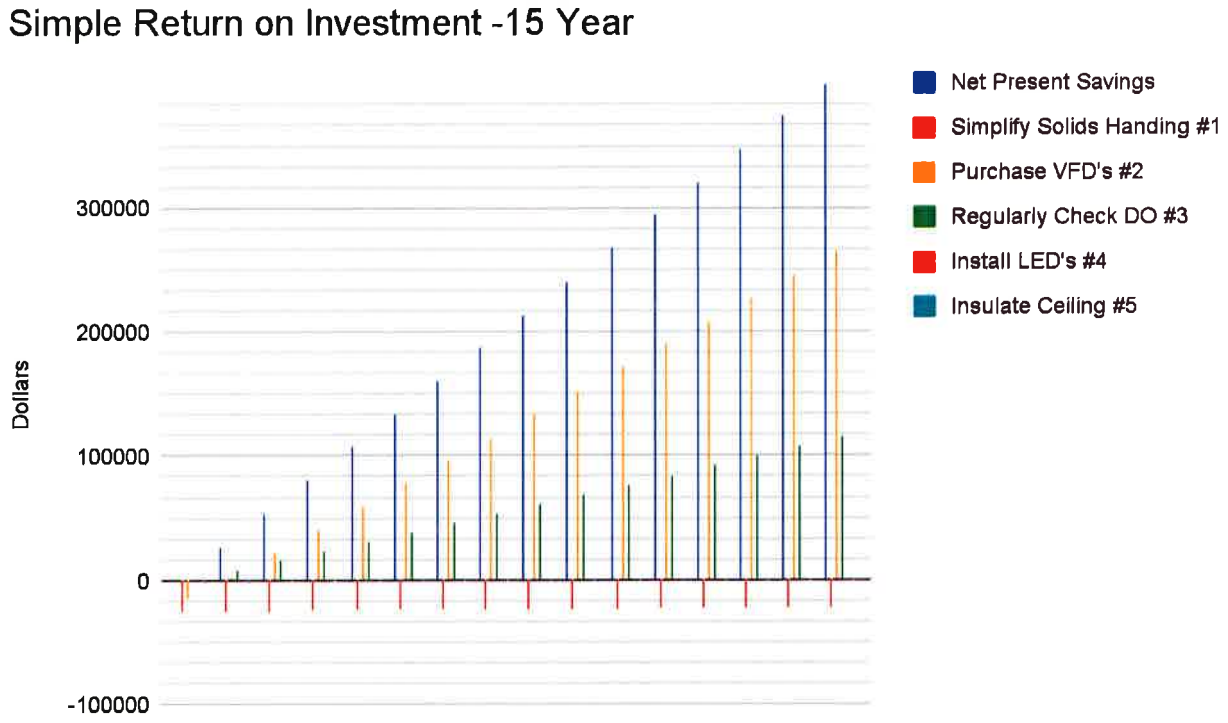
Item	Est. Reduction	Est. Yearly Energy Savings(kWh)	Est. Reduction Peak Demand (kW)	Est. Monthly Savings	Est. Yearly Savings
Simplify Solids Handing #1	78.57%	2727.47	9.09	$16.16	$193.92
Purchase VFD's #2	40.00%	262592	36.47111111	$1,555.86	$18,670.29
Regularly Check DO #3	10.00%	107424	0	$636.49	$7,637.85
Install LED's #4	66.00%	1368.576	0.6336	$0.00	$97.31
Insulate Ceiling #5	15.00%	1296	0	$0.00	$92.15
Total		375408.046	46.19471111	$2,208.51	$26,691.51



Simple Return on Investment

The calculations below show an estimate for equipment and labor cost for each recommendation. Rather than contracting out the work to an engineering firm, it's recommended to use someone from the public works department or a local electrician. All recommendation items can be easily handled by a local electrician. In all actuality, the labor costs are ***liberal*** estimations and the energy savings are ***conservative***.

Item	Est. Equipment Cost	Est. Labor Cost	Est. Total Cost	Simple ROI (years)	Annual Savings	1-Year Forecast	5-Year Forecast
Simplify Solids Handing #1	$25,000.00	$0.00	$25,000.00	128.92	$193.92	(24,806.08)	(24,030.38)
Purchase VFD's #2	$12,000.00	$3,000.00	$15,000.00	0.64	$18,670.29	(14,806.08)	78,351.46
Regularly Check DO #3	$0.00	$0.00	$0.00	0.00	$7,637.85	18,670.29	38,189.23
Install LED's #4	$299.00	$0.00	$299.00	3.07	$97.31	7,338.85	187.53
Insulate Ceiling #5	$1,200.00	$800.00	$2,000.00	13.02	$92.15	(1,902.69)	(1,539.27)
Total	$38,499.00	$3,800.00	$42,299.00	1.58	$26,691.51	(15,505.71)	91,158.56



FURTHER RESOURCES

Motor Management

The U.S. Department of Energy estimates a staggering 50% of the energy used in the United States is consumed by electric motor-driven systems (Dufresne 2016); this number is even higher in water/wastewater treatment plants, nearly 60-70%, due to the heavy reliance on motors to perform the many tasks and processes within these systems. An effective Motor Management Program that maintains high motor efficiency and accounts for the lifetime operating costs of electric motors can lead to significant energy savings and reduced maintenance costs over time.

The US Department of Energy has published a valuable resource for motor management available at the following website: Premium Efficiency Selection and Application Guide: A Handbook for Industry.

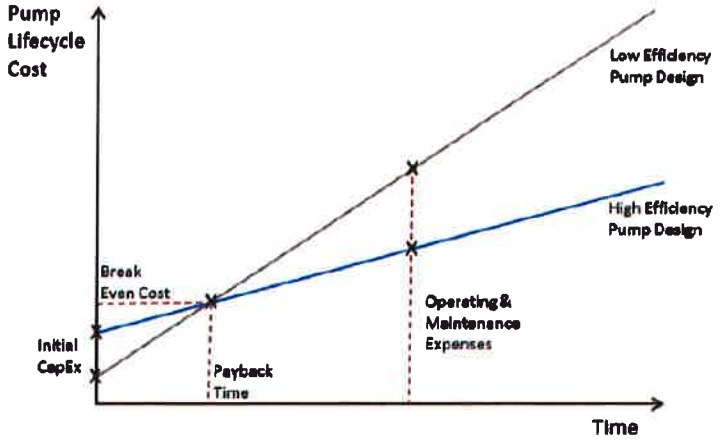
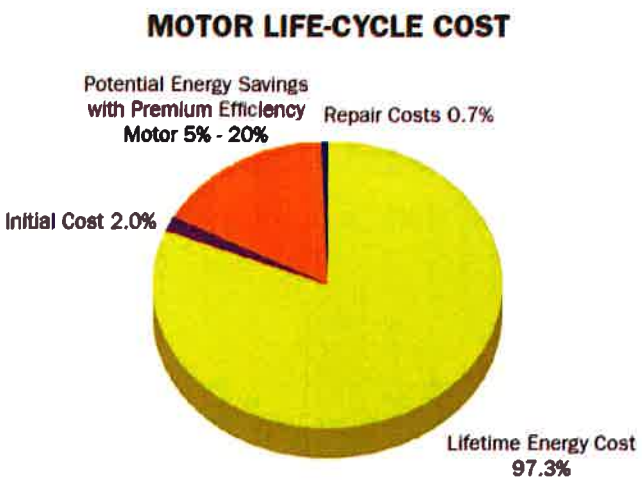


Figure 14: Lifecycle Cost of Pumping Systems using Efficient and Inefficient Design Practice
(Source: Grundfos Pumps)

A sound Motor Management Program consists of three main components:



1. Purchasing
2. Operations
3. Repair

1. **Purchasing** (new and replacement motors)

- Do not purchase based on motor price alone. Try to get a new motor with a higher efficiency rating.
- Purchase based on the motor's efficiency rating, as this will affect the motor's lifetime energy costs. Super Premium Efficiency motors (IE4) are 1-2% more efficient than NEMA Premium Efficiency motors (IE3).
- Always consider life cycle costs in purchasing decisions.

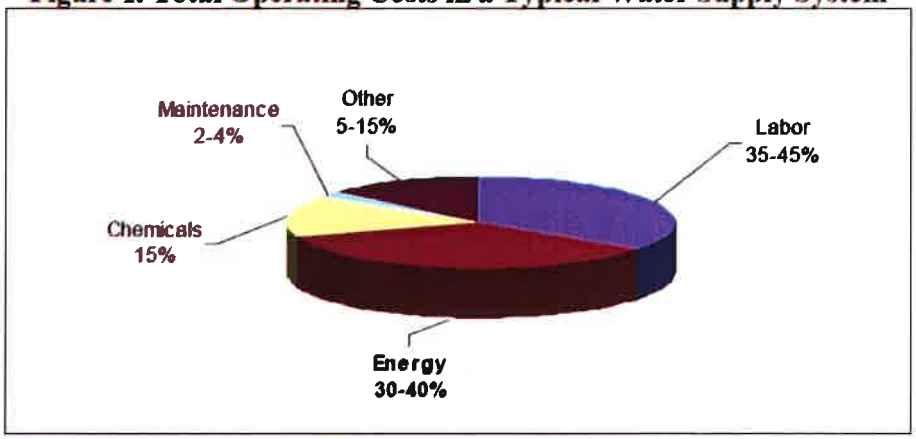
2. **Operations**
   - Make sure the motor is installed properly and maintain proper alignment.
   - Make sure that motors operate in clean air, in the recommended operating temperatures, and that they are cooled properly.
   - Follow all maintenance and greasing schedules.

3. **Repair**
   - Ensure that the repair center or technicians follow industry best practices to maintain motor efficiency and reliability.
   - Consider energy costs to any equipment repair and how that might affect energy consumption.
   - ***It is not recommended to rewind motors less than 50 HP***. For motors that are rewound, make sure the vendors selected are adhering to EASA Standard AR100-2020: Recommended Practice for the Repair of Rotating Electrical Apparatus to maintain the motor's efficiency. Visit Advanced Energy's Guidelines to Good Motor Repair for additional resources and tips.

Proper care and attention to the operation and maintenance of a system's equipment is a great method for improving/extending equipment life, saving energy, and reducing costs. Preventative maintenance can reduce energy consumption and reduce the cost of future repairs, while also catching inefficiencies in equipment that can and does use excess energy and therefore costs more than it should to operate. There are low cost and easy to implement, effective maintenance practices that will help to create a wide variety of potential energy savings. Large equipment typically has high repair costs that may be prevented through regular, consistent maintenance. The maintenance schedule for each piece of equipment or system should be noted and recorded, and should address the following questions:

1. Who is responsible for maintenance? Does the vendor provide maintenance?
2. How often does maintenance need to be performed? What are the actions for maintenance, and who is responsible for keeping and updating a maintenance log?
3. If the facility is performing the maintenance, are all the necessary resources available (e.g., fuel, spare parts, filters, etc.)?
4. Will outside contractors need to be brought in to perform maintenance?
5. Is the equipment's performance evaluated as part of the maintenance check?
6. Where are the records kept for the maintenance and performance evaluations?

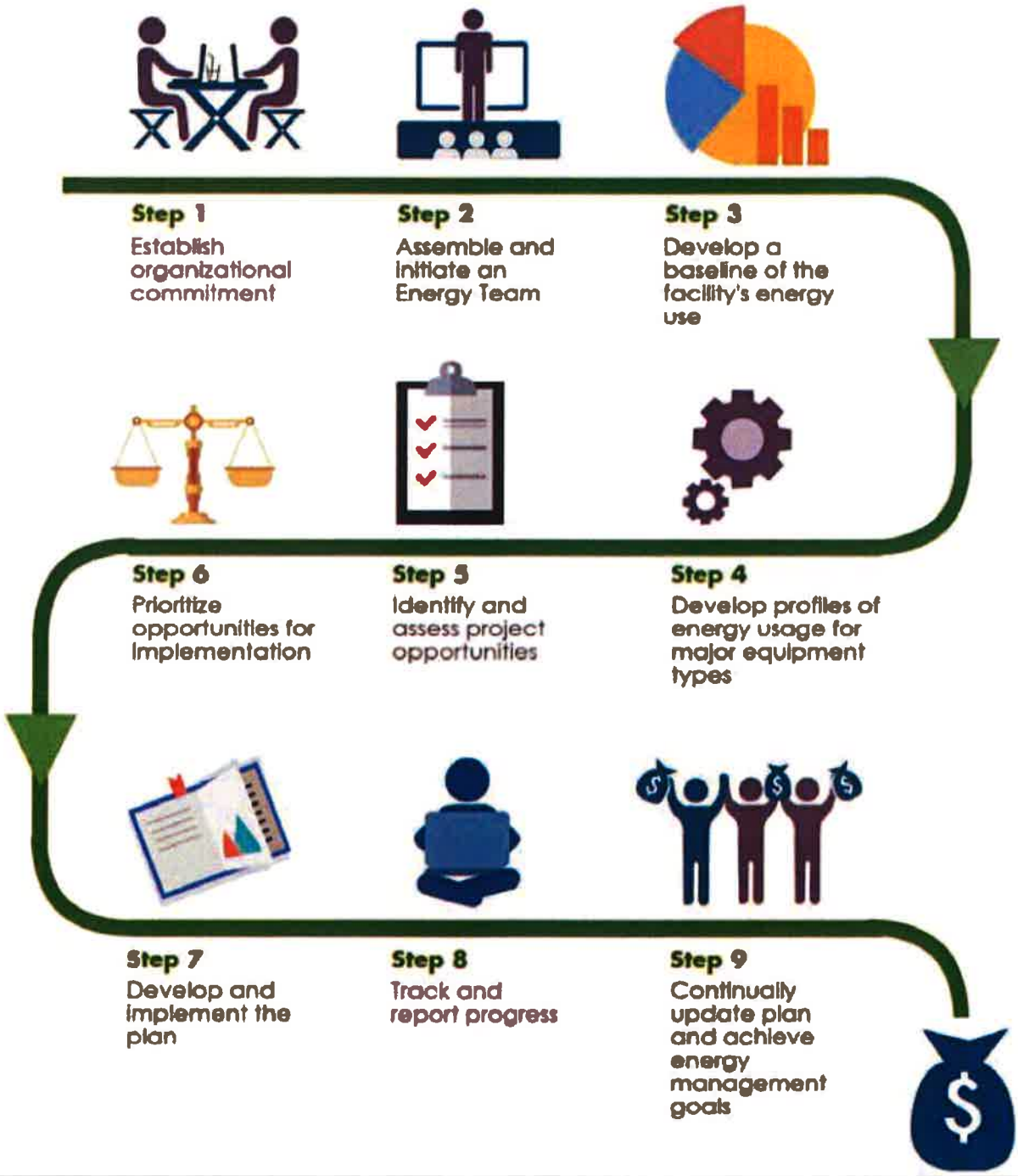
Figure 1. Total Operating Costs in a Typical Water Supply System



Source: Derived from Global 2006

The graphic below provides a valuable step-by-step tool for water/wastewater utilities and their boards/management to begin incorporating and implementing energy efficiency into their business plans, models, and responsibilities. Visit the EPA's publication ***Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities*** for more resources and tips on how to jumpstart an energy management program.

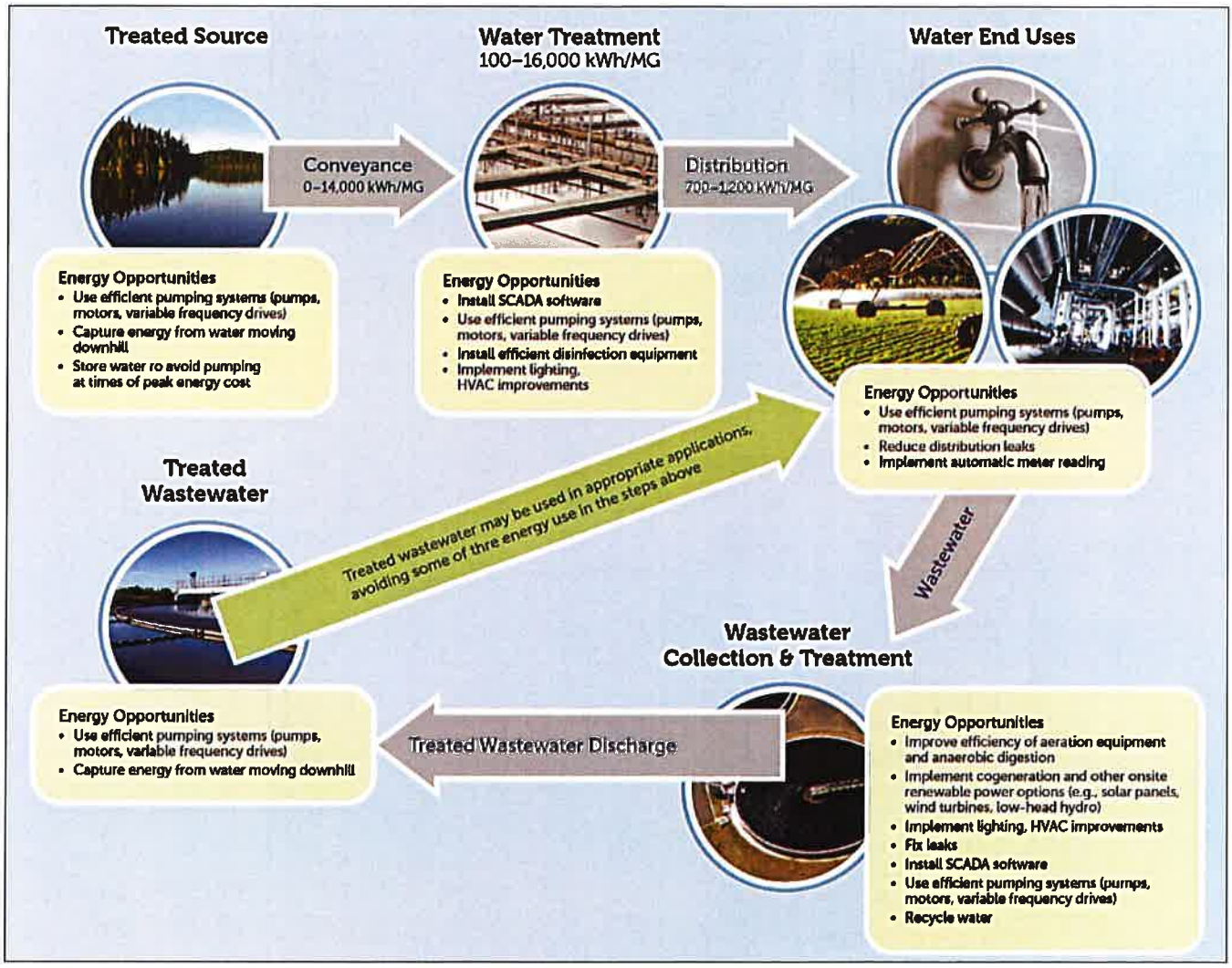
Basic Steps in Building an Energy Management Program



Source: Focus on Energy, Energy Best Practices Guide: Water & Wastewater Industry, pg 17. https://www.focusonenergy.com/sites/default/files/info-center-article/WW-Best-Practices_web.pdf

Water/wastewater facilities account for approximately 4% of all electricity consumed in the United States. Whether implementing a motor management program, upgrading to new/higher-efficiency pumps and/or controls like VFDs, or tweaking processes to occur more during off-peak hours, there are always opportunities for improved efficiencies in any system. Energy efficient equipment typically has a longer service life, and requires less maintenance than older, less efficient technologies. Water/wastewater systems can be responsible for nearly 40-60% of a town's entire energy budget, a clear indication of their immense energy use—this presents a huge opportunity for potential energy savings, and energy efficiency projects should be on the forefront of infrastructure upgrades and long-term planning for water/wastewater facilities.

This graphic provides an overall summary of energy efficiency opportunities in the water/wastewater industry:



ENERGY STAR® PortfolioManager®

DataTrends

Energy Use in Wastewater Treatment Plants

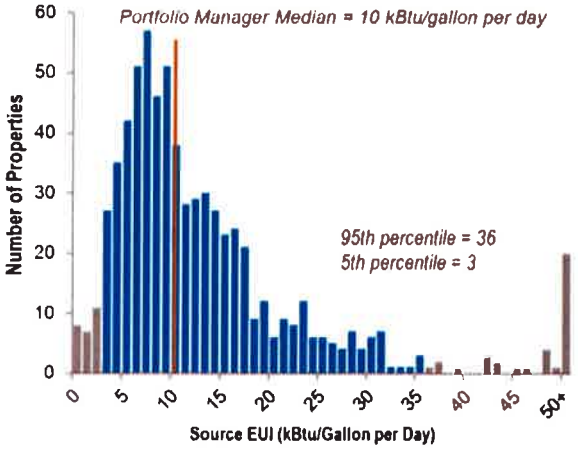
Wastewater Treatment Plants Using Portfolio Manager

- 1,377 Properties
- 16.8 Billion Gallons per Day
- 48 Average ENERGY STAR Score

The U.S. Environmental Protection Agency's (EPA) ENERGY STAR Portfolio Manager is changing the way organizations track and manage energy. Because of this widespread market adoption, EPA has prepared the DataTrends series to examine benchmarking and trends in energy and water consumption in Portfolio Manager. To learn more, visit www.energystar.gov/DataTrends.

What is a typical operating profile?

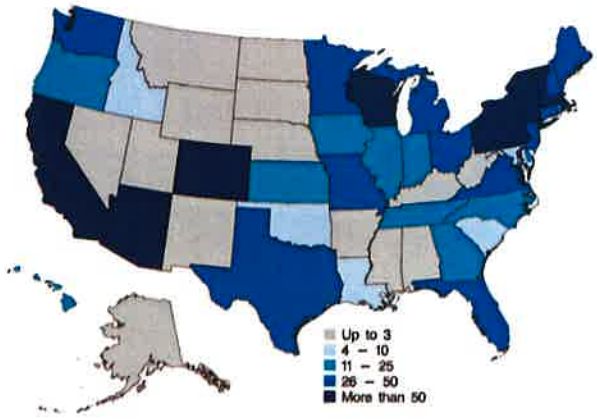
Energy use intensity (EUI) ranges from less than 5 to more than 50 kBtu/gallon per day (kBtu/GPD) across all wastewater treatment plants, with those at the 95th percentile using nine times the energy of those at the 5th percentile. The distribution has a negative skew, which means the most energy intensive plants are further away from the median than the most efficient. Plants may use more or less energy for many reasons, including variable equipment efficiency and energy management practices, as well as variations in climate and business activities.



The size of wastewater treatment plants varies with the population served. The median wastewater treatment plant in Portfolio Manager treats approximately 3 million gallons per day (MGD), but some larger plants may process as much as 50 MGD or more. As you can see, there are plants of all sizes and types benchmarking in Portfolio Manager.

Benchmarking by State

Number of Wastewater Treatment Plants



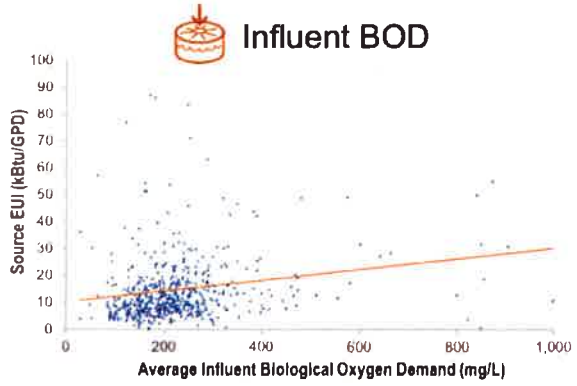
Property Characteristic	Range of Values: 5th percentile	Median	95th percentile
Influent Flow (MGD)	0.2	3	74
Influent Biological Oxygen Demand (mg/L)	102	200	391
Effluent Biological Oxygen Demand (mg/L)	1	5	20
Plant Load Factor (%)	25	60	100
Trickle Filtration?		13% say yes	
Nutrient Removal?		57% say yes	
Heating Degree Days	928	5,343	7,877
Cooling Degree Days	223	910	4,243

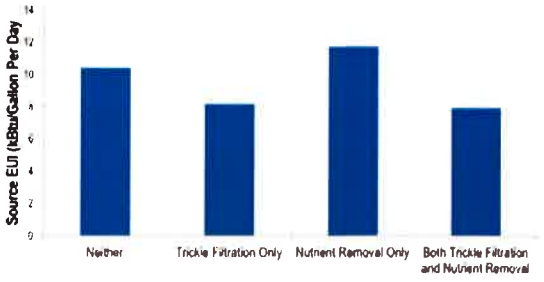
What is Source Energy? Source energy is the amount of raw fuel required to operate your property. In addition to what you use on site, source energy includes losses from generation, transmission, and distribution of energy. Source energy enables the most complete and equitable energy assessment. Learn more at: www.energystar.gov/SourceEnergy.

NC RWA TRAINING SUPPORT

What characteristics affect energy use in wastewater treatment plants?

In wastewater treatment plants, energy consumption is often correlated with the magnitude and type of pollutant load, which can influence the treatment methods and technologies used in a plant. Wastewater treatment plants that have more influent biological oxygen demand (BOD) use more energy, on average, as shown by the slope of the orange trend line in the graph below. The bar graph below shows that plants that utilize trickle filtration have lower energy intensity on average, while plants that utilize nutrient removal in the treatment process have higher energy intensity on average. Nutrient removal is often necessary near sensitive waters.





Wastewater Treatment Terminology

Biological Oxygen Demand (BOD) is the measure of the amount of oxygen required by bacteria for stabilizing material that can be decomposed under aerobic conditions. BOD is a commonly used determinant of the organic strength of waste.

Plant load factor indicates how closely the plant is being operated to design capacity. Most plants are used at between 40% and 100% of design capacity.

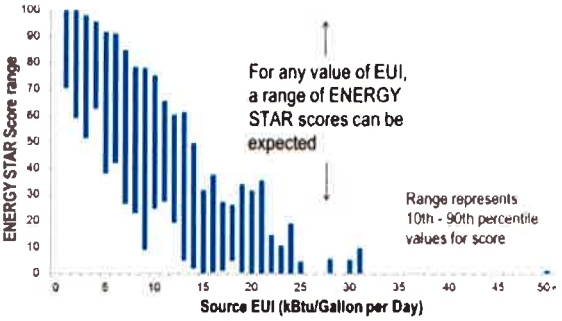
Trickle Filtration is a process used to reduce BOD and ammonia nitrogen levels. Trickling filters are composed of a bed of porous material. Wastewater is distributed over the surface of the media for aerobic treatment.

Nutrient removal is considered to be any process included for the purpose of removing nutrients . This may include biological nitrification, biological denitrification, phosphorus removal, or recirculating sand filters.

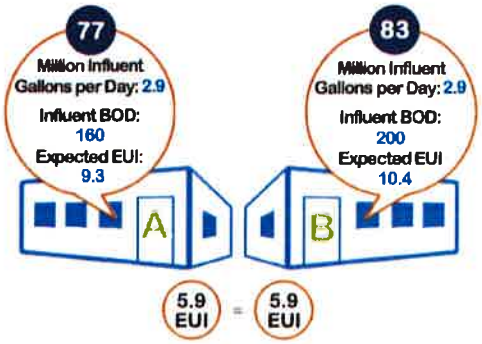
How does EPA's ENERGY STAR score vary with energy use?

EPA's ENERGY STAR score normalizes for the effects of operation. While properties with lower EUI generally earn higher scores on the 1-100 scale, an individual property's result depends on its business activities. For any given EUI, a range of scores is possible.

Score Range for Wastewater Treatment Plants



Let's look at two wastewater treatment plants, Plant A and Plant B. They have the same EUI of 5.9 kBtu per gallon per day, and are identical except that Plant B has more influent biological oxygen demand. Because Plant B has more BOD it is expected to have a higher EUI than Plant A, based on ENERGY STAR scoring models. Since Plant B is *expected* to use more energy, but *actually* uses the same energy, it earns a higher score.



***Note:** Total number of plants benchmarked and total flow rate reflects cumulative data through 2013. Analysis of energy use and property characteristics includes 698 properties benchmarked in the most recent 5 years. The data is self reported and has been filtered to exclude outliers, incomplete records, and test facilities. Portfolio Manager is not a randomly selected sample and is not the basis of the ENERGY STAR score. To learn more, visit: www.energystar.gov/DataTrends.*

EPA United States Environmental Protection Agency

NCRWA TRAINING SUPPORT

Sources of Potential Funding

Any major capital improvement made to a facility presents potential eligibility for grant or loan funding to assist with the implementation of energy efficiency measures. Financing or funding opportunities we suggest you explore are listed below:

1. **DSIRE USA** is a comprehensive source for information on incentives and policies that support renewables and energy efficiency in the United States. DSIRE is operated by the NC Clean Tech Center at NC State, and funded by the U.S. Department of Energy.

2. **U.S. DOE's Better Buildings Financing Navigator.** There are many ways to finance energy efficiency and renewable energy projects in buildings that you own or occupy. The Navigator helps you cut through this complexity to secure financing that works for you.

3. **Energy Savings Performance Contracts** can offer municipalities the flexibility of no up-front investment, with savings guaranteed from energy efficiency improvements. To learn more about performance contracting/energy service companies (ESCOs), visit the U.S. DOE's Better Buildings' Energy Savings Performance Contract website.

4. **USDA** offers a variety of grant and loan opportunities that benefit water and sewer systems. They have a program that offers loan guarantees and grants for renewable energy systems and energy efficiency improvement projects. More information on USDA Rural Development programs in North Carolina can be found here. Your local USDA Rural Development contact is:

   PERQUIMANS COUNTY LOCAL OFFICE
   853 S. Beckford Drive, Suite A
   Henderson, NC 27536
   252-438-3134 EXT. 4

5. The **NC Department of Environmental Quality** (NCDEQ) offers a variety of water quality grants, with some that are associated with energy conservation. Visit https://deq.nc.gov/outreach/grants for more information. The Affordability Calculator is a useful tool to determine a system's eligibility for grants and loans.

6. The **Clean Water State Revolving Fund (SRF)** program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing and grant opportunities for a wide range of water quality infrastructure projects. Visit

https://deq.nc.gov/about/divisions/water-infrastructure/i-need-funding/clean-water-state-revolving-fund for more information. ***Energy efficiency projects are eligible for a 1% interest rate reduction.***

7. The **Rural Water Loan Fund** (RWLF) is a funding program specifically designed to meet the unique needs of small water and wastewater utilities. The RWLF provides low-cost loans for short-term repair costs, small capital projects, or pre-development costs associated with larger projects. Energy Efficiency projects may be eligible for this funding, and more information can be found here: https://nrwa.org/initiatives/revolving-loan-fund/

8. **Environmental Finance Center Network** – offers a summary of any/all available funding sources for water/wastewater improvements for systems in North Carolina. Not all sources of funding are necessarily eligible for energy efficiency-based improvements, however many are and should be explored further. The earlier potential funding sources are contacted/initiated, the better chance the project(s)/improvement(s) will have in receiving any eligible funding opportunities.

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