No- & Low-Cost Efficiency for Existing WWTPs

February 8th, 2024

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Providing effective energy strategies for buildings and communities

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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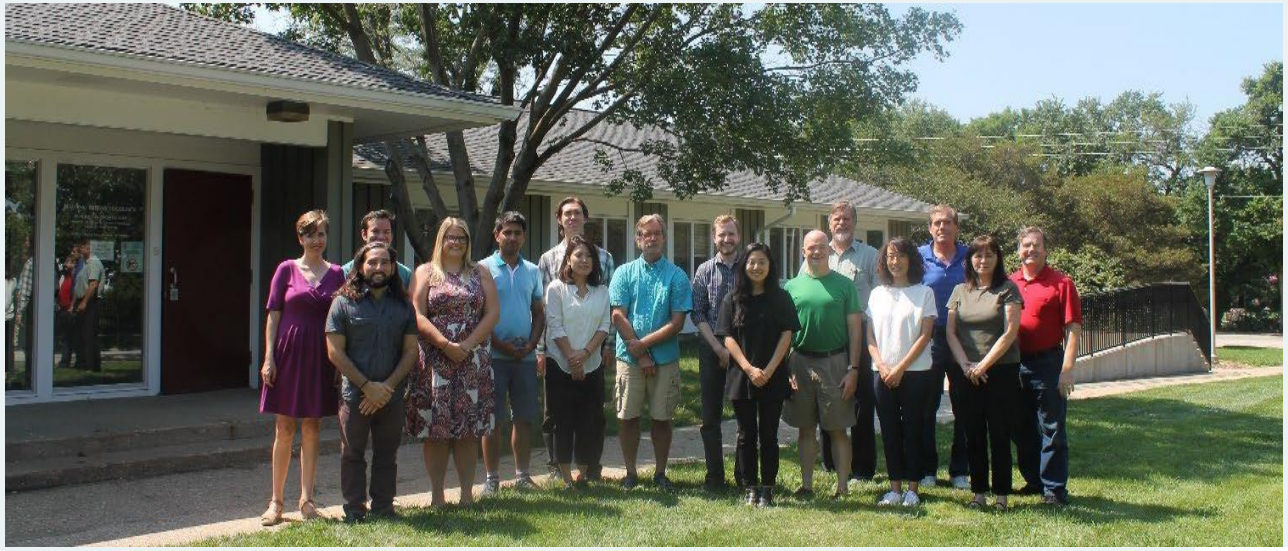
Who We Are

We assist buildings and communities in achieving energy efficiency, saving money, and becoming more sustainable.

We are an applied research program at University of Illinois.

Our goal: Reduce the energy footprint of Illinois and beyond.



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About the IEPA PWI Energy Efficiency Program

The Illinois EPA Public Water Infrastructure Energy Assessment Program helps municipalities reduce the cost of water and wastewater treatment.

- **No-cost** energy assessments and technical assistance
- Comprehensive report listing:
  - Potential savings
  - Estimated economics
  - Funding sources
- Operator continuing education

Apply at:
www.smartenergy.Illinois.edu/water

Funding provided in whole or in part by the Illinois EPA Office of Energy. This program is in partnership with the U.S. Dept. of Energy Sustainable Wastewater Infrastructure of the Future (SWIFT) Accelerator for energy efficiency in wastewater treatment.

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U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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Why Complete an Energy Assessment?

Older Existing System or No Previous Assessments?

Identify missed opportunities

Plan for capital improvements

Uncover what is possible

3rd party support for WWTP personnel's ideas

New or Recently Upgraded?

Always more to improve

Plan for future opportunities outside the scope of recent projects

New technologies and processes always in development

Identify opportunities for repairs or upgrades and associated funding!

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Apply for an Energy Assessment!

Step 1: Initial Application – Pre-Qualification

- Apply at www.sedac.org/water
- Be located in Illinois and be a publicly-owned plant
- Allow SEDAC/ISTC to visit site – Remote visit is an option!
- Be willing to share facility information
- Share final assessment report with Illinois EPA

Step 2: Data Collection

- Facility information –discharge reports, process flow, etc.
- 2 years of utility bills and DMRs
- We're here to assist!

Step 3: Site Visit Scheduled

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Webinar Outline

Part 1 – Shawn Maurer – Overview & Du Quoin Case Study

Part 2 – Scott Raisbeck – Village of Warren

Part 3 – Mark Wolfe – Village of Kincaid

Simple Facility Upgrades

LED Lighting Improvements

- Sooner you upgrade, the less energy is wasted!
- Paybacks are often in the months to couple years timeframe.

Adjust HVAC Setpoints

- Adjust to space needs
- If space not regularly occupied, does it need to be heated to 72°F? Or even 65°F?

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Simple Lighting Change

Turn off outdoor lighting unless staff are present!

- As most plants are fenced-in, lighting is only needed over basins/process equipment when staff present
- Can be added security feature to see lights on – know someone is present
- Can be local switches, motion sensors, or SCADA control point.

Image source: https://www.tetratech.com/solutions/one-water/wastewater/

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Aeration Time Clocks

Time clocks are an affordable and simple way to control aeration energy input where blowers are easily turned on and off.

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Aeration Control With Timers

Aerobic digester frequent example

- Often run 24/7 for mixing
- Common recommendation to reduce to 6-8hrs/day

Lagoon aerators common too.

- Off more during day when algae produce DO and overnight during low loading
- On more in evening and early morning peak loadings

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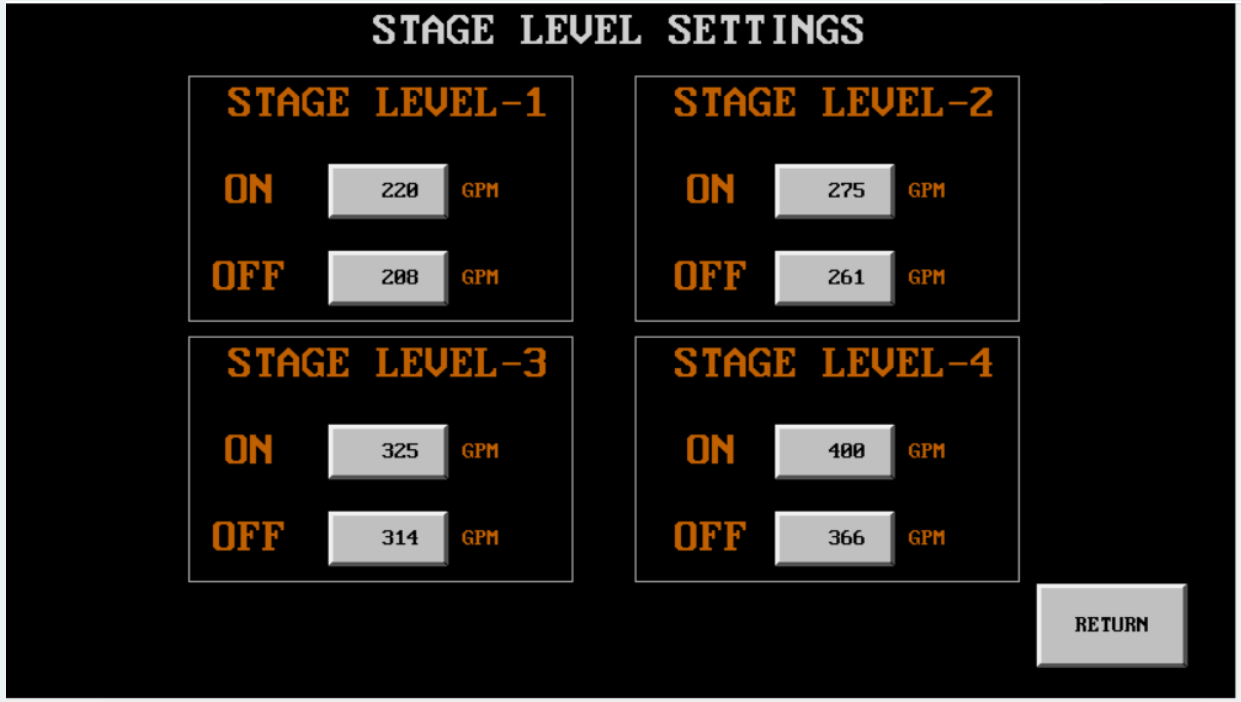
Flow-Paced Aeration Control

Example at Heyworth's Lagoons – Flow Paced Aeration

- As flow increases, number of active mixer/aerators in Cell 1 increases
- Simple SCADA and communications between flow sensor, control panel, and aerators.



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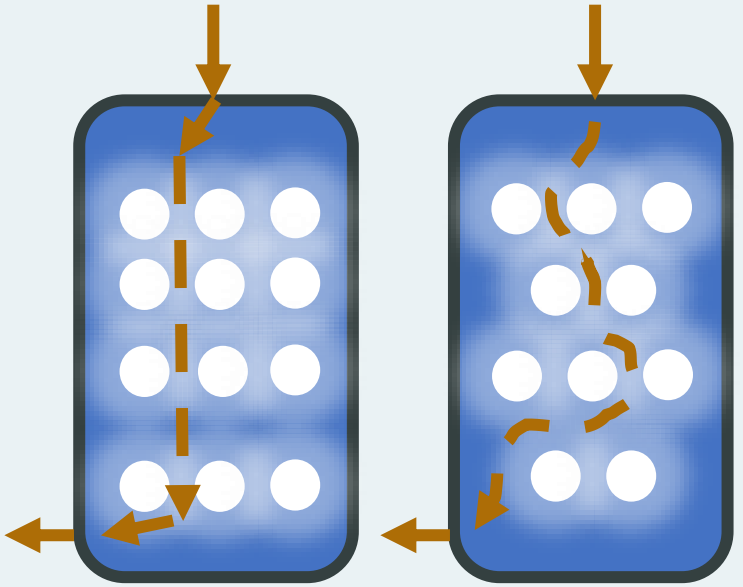
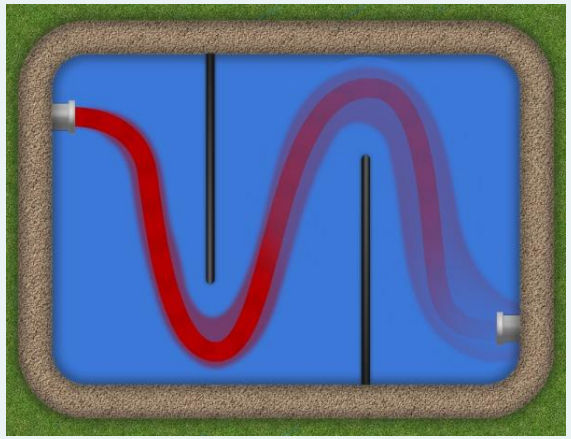
Adjusting Aerator Locations

- Dependent on lagoon influent and effluent pipes, wind direction, sludge accumulation, and aerator locations.
- Short circuits can be disrupted through mixer/aerator relocation
- Can also add baffles to direct flows (bottom image)



Short Circuiting Reduces Treatment Time and Quality



Good Flow Ensures Full Detention Time and Treatment

Image Source: https://lagoons.com/blog/odor/prevent-lagoon-short-circuit/

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Have Variable Frequency Drives (VFDs)?

Have VFDs already?

- Are you using them?
- Check for manual vs automatic operation!
- Check for optimal operation with simple testing.

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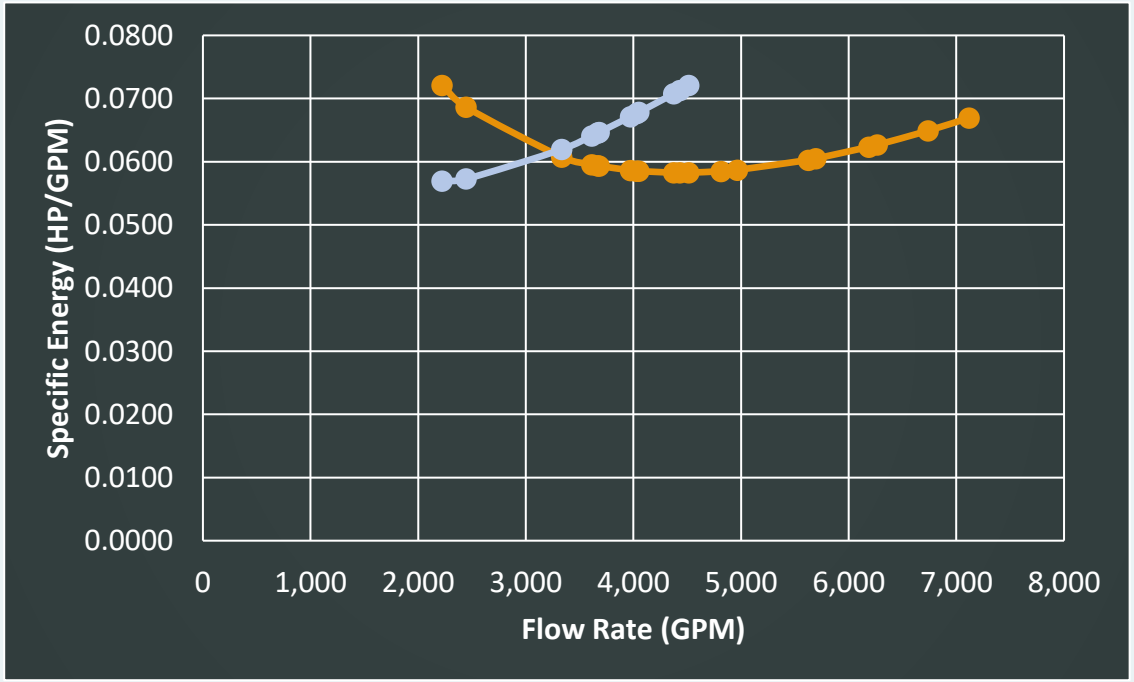
Check VFD Wire-to-Water Efficiency

Sample HP/GPM or kW/GPM at multiple flow rates & VFD speeds

May find optimal control is NOT ramping lead pump to 100% before engaging lag pump.



Note:

1 Pump only more efficient until ~3,300 GPM.

2 Pumps more efficient above ~3,300 GPM.

SCADA can be programed to make this change-over

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Adjust Wet Well Control Levels

Raise wet well “on” level to reduce pumping power and starts/stops.

- Higher water level reduces head requirement for pump
    - Reduced HP per GPM
- Longer run-time reduces wear and tear on pumps

Be aware of head level that might cause surcharging if sudden I&I flow.

Successfully implemented at Kishwaukee WRD – over $5k/yr savings.

Before After

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Summary Message

EXPERIMENT WITH SMALL INCREMENTAL CHANGES

- Changing aeration running 24/7 to 5hr/day all at once likely to cause problems!
- Make small change – check performance – make next small change.

Du Quoin Aerobic Digester Modification

Content provided by Jeff Pruski,

City of Du Quoin WRP Director

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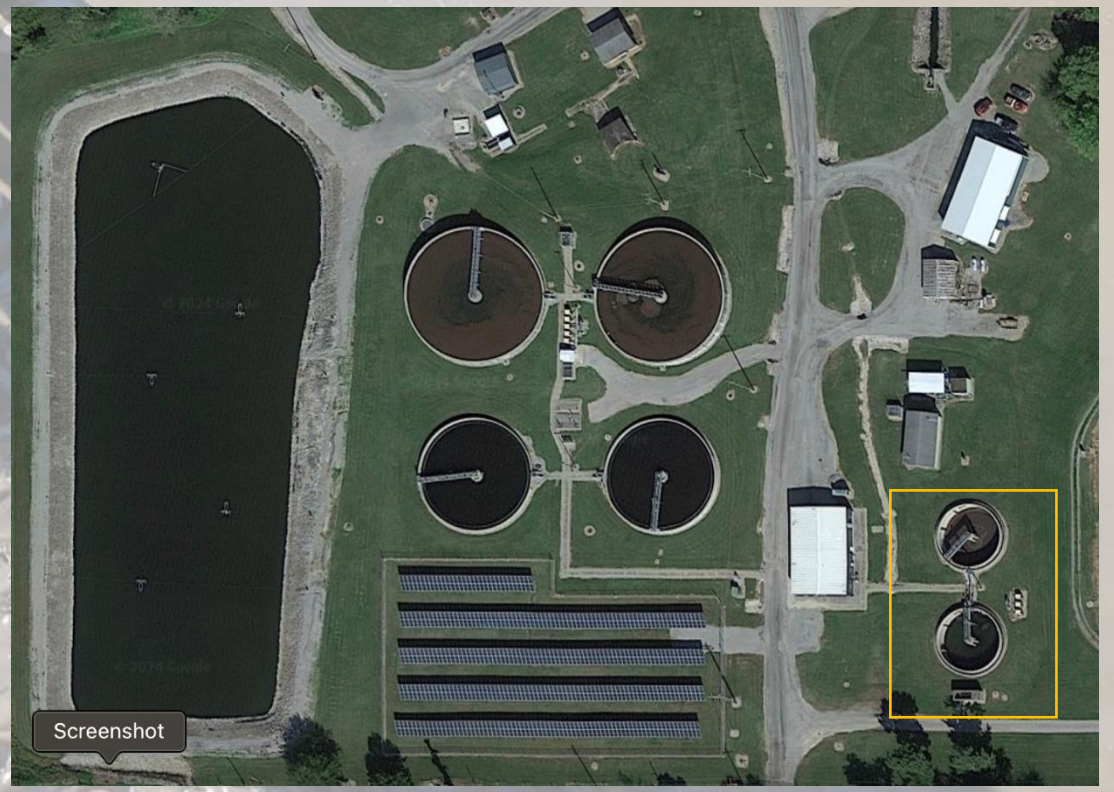
Du Quoin WWTP

- Schreiber Plant
  - DAF-2.4 MGD
  - Max-6.0 MGD
- 2 Rotating bridge aeration basins
  - 5 Blowers
- 2 Rotating bridge clarifiers
- 2 Rotating bridge digesters
  - 3 Blowers
- Sludge thickening and dewatering via belt filter press
  - Landfill disposal



Challenges and Goals

CHALLENGES

- Waste thickening = high solids content
- Poor dewatering due to high solids content
- Odors
- Two blowers for one digester at 1/3 full

GOALS

- Eliminate gravity thickening- Waste directly to the digesters to thin out solids
- Utilize both digesters at full capacity
- Thicken via decanting
- We assumed that thinning out the solids would result in less use of the blowers

Wasting-One Year Ago

- Wasting was done by running the waste activated sludge through the gravity belt thickener.
- Once thickened solids were pumped to the digester.
- At the time only one digester was used and was kept at a level of about 1/3 full.

Digesters-One Year Ago

- As a result of the thickening, digester solids were 6% and higher.
- The lack of fine bubbles caused poor oxygen transfer and some mild to moderate odor issues.

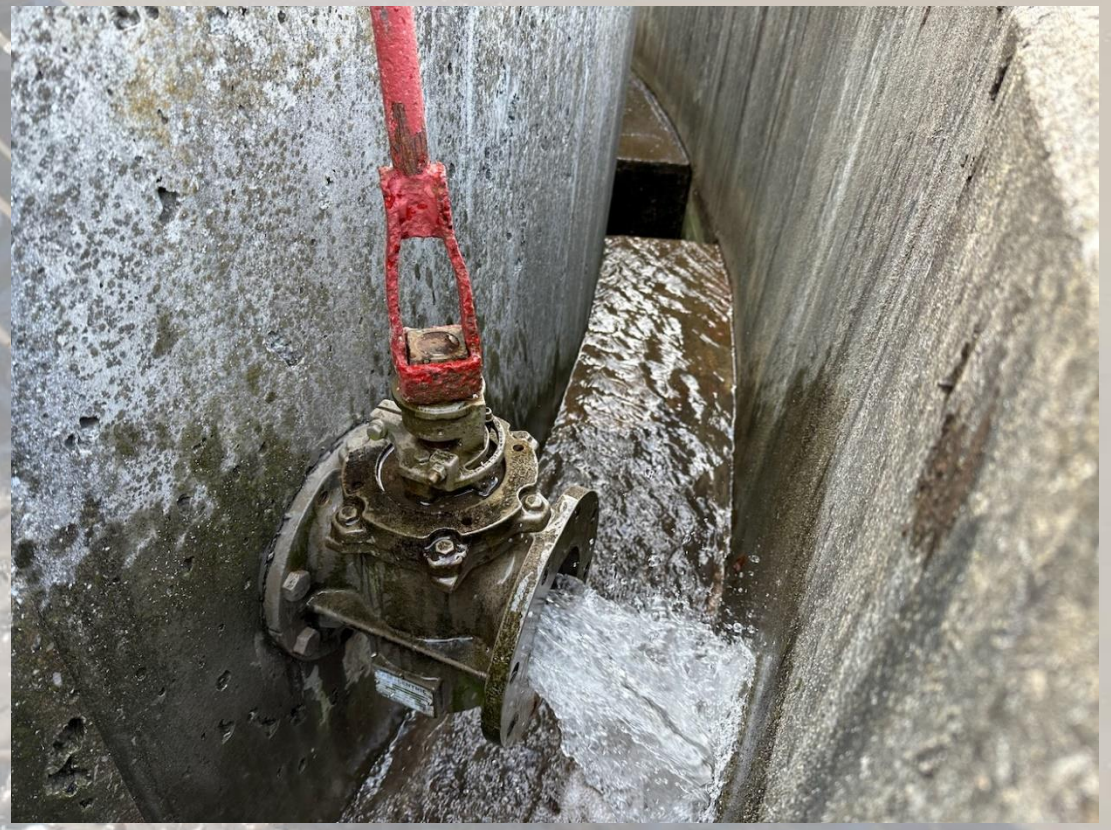
Belt Press Dewatering-One Year Ago

- Belt press feed only 30 GPM
- Poor dewatering and a wet filter cake
  - Ultimately the wetter the cake the higher the disposal cost

Digesters Now

Thickening-Digester Decant

- We wanted to get our solids to about 1% because the belt press seems to run best at around that feed concentration
- To do this we are turning off the air to the digesters and are decanting from them.
- We are using the decant valves on the side of the digester and when we get below those, we use a submersible pump.



Blowers

- Previously 2 blowers for one digester
- When solids were thinned out, only one blower was needed to provide adequate D.O. for both digesters
- If that one blower ran 24/7 there would still be a significant electrical cost savings

Timer/Nitrification

- In the digester there will still be nitrification under aerobic conditions
- Nitrification consumes alkalinity which will lead to a pH drop if not controlled
- Low pH can lead to foaming and biological slimes that are not good when it’s time to dewater

- The blower is set at a one hour on, and one hour off cycle to eliminate pH issues
- This leads to more energy cost savings because the blower is running 12 hours a day.
- On days that we decant, the blower is off even longer, leading to more savings

Other Benefits

- Feeding more GPM to the press
- Getting a dryer filter cake up to 22%-23% at times
- Using roughly half the polymer ($$) compared to what we used to. One drum lasts at least 8 weeks vs. 3-4 weeks
- Dryer cake has meant fewer tons going to the landfill

Village of Warren Aeration Improvements

Scott Raisbeck,

Village of Warren WWTP Operator

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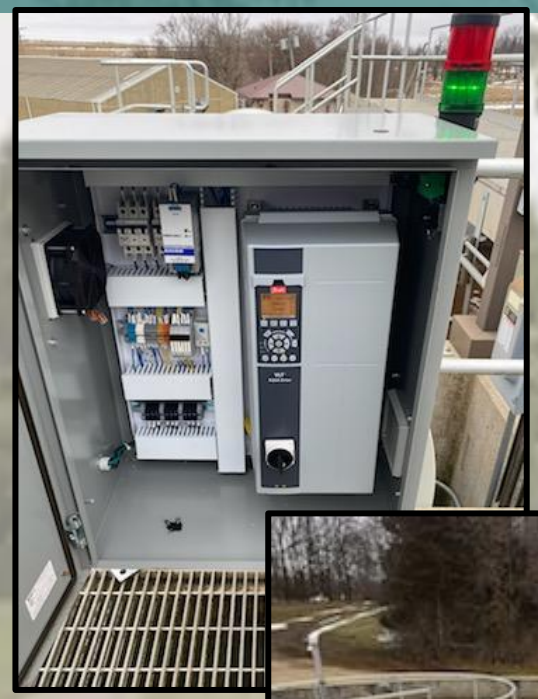
Oxidation Ditch DO Control Added



Oxidation Ditch had VFDs installed as part of previous grant from ComEd

SEDAC Assessment identified additional savings from DO control

Adding Sensors to 2x 20HP motors

Estimated savings: 75,400 kWh & $6,300 per year

Timers Added for Lagoon Aerators

Two lagoons on site - roots blowers for aeration

Smaller lagoon 2x 10HP blowers

Larger lagoon 2x 20HP blowers

Previously ran 24/7

Added control panel with timer controls

Estimated savings based on 6hrs per day runtime: 120,300 kWh & $10,000 per year

DO + VFD Controls for Digesters

- Aerobic digesters with 2x 20HP roots blowers
- Previously ran 24/7, on/off control
- Also operated an air lift for RAS
- Changed to include RAS pump
- Digesters added DO control and VFD
- Estimated Savings: 66,100 kWh and $5,500

Total Project Economics

Worked with SEDAC to complete ComEd Incentive application

Total Project Cost: $80,000

Total ComEd Incentive: $39,000

Total Estimated Utility Cost Savings: $21,800

Simple Payback: 1.9 Years

Currently working with ComEd to verify annual savings.

Questions?

sedac-info@illinois.edu
800-214-7954

www.smartenergy.Illinois.edu/water

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