Cutting the Electric Bill by $18,600 a Month
Northwest Regional Water Reclamation Facility
Fox Lake, IL

Wisconsin Wastewater Operators Association
Wisconsin Dells, WI
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Village of Fox Lake

Fox Lake

Lake County

Project Location
Village of Fox Lake

Northwest Regional Water Reclamation Facility
Cutting Energy Costs

**Goal:** Focus on the big ticket items!

- **Aeration / Biological Process Changes**
  - Conventional Activated Sludge vs. MLE System
  - High speed turbo blowers w/ D.O. Controls
  - Fine bubble membrane diffusers

- **Biogas Fueled Generator**
  - Offsets power demand at the main feed
Biological Process

What is driving the project?

- **Existing 9 MGD plant expanded to 12 MGD**
  - Replace 20+ year old equipment as part of the facility upgrades

- **Biological Nutrient Removal (BNR) required**
  - Chemical phosphorus removal
  - Modified Ludzack-Ettinger (MLE) for Total Nitrogen reduction
MLE Process

- What is an MLE system?
  - BNR process primarily for Total Nitrogen reduction
  - Designed for TN removal below 10 mg/L
Biological Nutrient Removal

- In addition to the blower change, the plant will begin to operate the MLE process.
- No aeration in the first tank to create an anoxic zone = less oxygen demand.
Reduction in Aeration Demand

- Conventional Activated Sludge: 10,540 scfm
  - Required 2-400 HP blowers

- MLE Design: 6,100 scfm
  - Requires 1-200 HP blower
Existing Blowers / D.O. Control

- **Size:** 4-400 hp centrifugal blowers
- **Flexibility:** Inability to throttle flow, inoperable D.O. Control system
- **Inefficient:** 3-4 times the required D.O. levels in the aeration basins
High Speed Turbo Blowers

- High Speed Turbo Blowers have become an increasingly popular choice.
- Achieving air demands with less horsepower.
- Using D.O. controls and VFD drives to minimize the amount of air used.
Why High Speed Turbo Blowers?

- Lower horsepower on the motor [200hp]
- Ability to meet full range of air flows
- Provide just the air needed, 2 mg/L vs. 5-8 mg/L D.O.
- **Bottom Line: Lower energy bill each month!**
Fine Bubble Diffusers

- It’s not just blowers for aeration savings, new fine bubble membrane diffusers were added.
  - Replace 20-year old ceramic disk diffusers
  - Increase the transfer efficiency from 20-25% SOTE to 35% SOTE
Aeration Savings

- Annual Electric Savings: 2,956,500 kWh
- Estimated Annual Cost Savings: $190,000
  - Nearly $16,000 / month in savings (blowers)
  - About $13,000 / month in actual savings (subtract the mixer / recycle pump HP)

![Annual Energy Use](chart1.png)

![Annual Energy Cost](chart2.png)
Biogas Utilization

- About 40,000 cu. ft. / day in wasted biogas
  - Increased mixing = increased biogas production
  - Will run a 150 kW biogas generator

Goal: Put the wasted gas to use!
Biogas Utilization

- Dual-feed boilers
  - Digester heating
  - Building heat
- Engine generators
Is running a biogas generator worth it?

- 150 kW x 24 hr. = 3,600 kWh / day
  - This equals about $250 / day
  - $7,500 / month in power savings

- Running at 75% of the time, this equals $67,500 per year in savings
Project Costs

- Aeration / Biological System Upgrades (blowers, mixers, diffusers, and D.O. Controls = $1.7 mil.
  - $307,831 DCEO grant for the project
  - Projected payback = 7.5 years

- Biogas Utilization Project (generator, biogas conditioning, piping and electrical = $763,000)
  - $200,000 DCEO grant for the project
  - Projected payback = 10 years
Total Savings

- Average Electric Costs: $50,000/mo.*
  - Blower / Aeration Savings: $13,000/mo.*
  - Biogas Generator Savings: $5,600/mo.**
  - Projected savings: $18,600/mo.*

- 38% electrical savings annually.

* Using an average cost of $0.07 / kWh
** Based on 1,500 hours of operation / year
Questions.....?