Wastewater Treatment - Energy Saving Opportunity

Medora Corporation GridBee SolarBee
Facultative Pond - Limitations / Challenges

- No aeration equipment
- Rely on wind for mixing
- Rely on algae for DO
- Short circuiting issues
- Sludge buildup
- Odors
- Lowest operating cost
- Loading typically 30-50 lbs/acre
- If can't meet limits, need to have system evaluated / re-engineered
Partial Mix Pond - Limitations / Challenges

- Uses high HP aeration for DO
- Uses high HP for mixing
- Typically short on mixing
- Short-circuiting is still an issue
- Sludge buildup around aerators
- High energy / maintenance costs
Effluent Storage Pond - Limitations / Challenges

- Blue-green algae blooms
- Irrigation nozzle plugging
- Odor issues when irrigating
- Need mixing energy to try and control, typically high HP
- May need to comply with pH and DO limits
Odors

Typically use high HP brush aerators to try and provide an odor cap

Brush aerators are high maintenance / have struvite issues

Need to allow sludge to settle to reduce water content

Would like to decant continuously

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Complete Mix Ponds / Activated Sludge Systems

- **Main reactor basin**
  - Use high HP aeration for DO
  - Use high HP aeration for mixing

- **Complete Mix Ponds**
  - Use high HP aeration for DO
  - Use high HP aeration for mixing

- **Anoxic basin**
  - Need to mix without adding air
Aeration / Mixing Equipment Technology

Splasher Type Aerators

Aspirator Type Aerators

Diffused Air Aeration – fine bubble / coarse bubble)

Medora Corporation GridBee SolarBee
Typical example of Aeration / Mixing Overhead

- Aeration energy use accounts for 45% of facility energy use:
  - Rest of Facility: 55%
  - Aeration: 45%
Layered Water allows for Selected Mixing Depth And Long Distance Circulation

SolarBee SB Series
Solar Powered Mixers

GridBee GF Series
Electric Powered Mixers

GridBee AP Series
Air-Powered Mixers
Long-Distance Circulation / Mixing
Generates both horizontal and vertical flow

- Dish promotes near-laminar flow
- Different from wind mixing
- Moves 10,000 gpm
  - near zero lift = near zero HP
  - minimal friction loss
  - minimal HP requirement allows for solar or 100 watt electric power

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Largest - Energy Saving Opportunity

Partial Mix Ponds

- Need DO and mixing to get the DO mixed into the pond
- Use high HP aeration to both mix & oxygenate
- Typically requires more HP for mixing than oxygenation

- This imbalance creates an operational inefficiency
- Excessive grid-power consumption
- Increased greenhouse gas emissions

- SB and GF mixers can provide mixing while reducing energy
- Each SB / GF mixer can displace ~ 40hp of in-efficient mixing
- Payback is typically 0.5 years to 3 years, less with incentives
- Bonus, reduces organic sludge buildup in the pond
Additional - Energy Saving Opportunities

- Facultative Ponds
  - SB and GF mixers can help avoid the need to add high HP aeration equipment when the BOD loading increases over time
  - Bonus, reduces organic sludge buildup in the pond

- Complete Mix / Activated Sludge Basins
  - Use high HP aeration to both mix & oxygenate
  - Anoxic basins need mixing without adding DO

- AP air powered mixers provide mixing while reducing energy
- AP mixers add little air, helps to maintain an anoxic zone
- Supplemental mixing can enhance the process
LDC Energy Saving Mixer approach in Wastewater

• LDC technology is a circulator / mixer, not an aerator.
• Very efficient long-distance mixing device.
• Aerated basins and partial-mix wastewater ponds typically need much more aeration HP for mixing than for DO production. With the SB and GF series wastewater mixers doing the mixing, the aeration / mixing system can be dialed back to provide just the needed DO. The typical payback is 1-3 years, with $$$ millions of dollars of energy savings over the 25 year machine life.
• Each LDC has proven to displace 30-50 hp of mixing energy.
• Leave the aerators in place, run them less hours, often just at night.
• Each Energy Savings Mixer can typically displace 30-50 hp of aeration mixing hp. At $0.10 per kwh, savings per energy saving mixer is approx. $750,000 over 25 years!
• With (6) mixers installed, save approx. $4,500,000 over 25 years . . .
LDC Technology working with Existing Aerators

LDC positioned between aerators, pulling water from under and around the aerators.

DO produced by aerators is distributed throughout the pond over entire surface area.
Wastewater – Adjustable intake design

During the day, supersaturated oxygen in the top two feet are captured and mixed deeper into the pond. At night, when the surface is below saturation oxygen, surface re-aeration occurs and atmospheric oxygen is mixed into the pond.

Horizontal and vertical circulation patterns are created for improved distribution of oxygen, algae, bacteria, and nutrients. The intake hose is adjustable in length, so that only the desired water column depth is circulated.
Odor Capping Intake Design

Laminar flow spreads radially from the machine and covers the entire pond. No aerosols or bacteria are released into the air.

No odorous sulfide leaves the pond.

Sulfides are converted to sulfate (\(\text{SO}_4\)) as they pass through the oxygenated layer and no odors escape the pond.

Constant removal of surface film allows methane to escape the pond easier, leading to increased anaerobic digestion, reduction in sludge volume, and sludge densification.

Odorless methane leaves the pond.
LDC Circulation / Mixing in Wastewater Ponds / Basins
Study Site - Rochester, NH

Pre-SPC
Lagoons with 116 kW fine bubble blower system

Activated sludge, advanced tertiary-treatment plant

During-SPC
Converted to equalization basins receiving sludge, raw septage, backwash & raw sewage
Rochester - kWh Usage & Cost

Energy Reductions

kWh = 74,150/mth
= 889,803/yr
= 88.5%

Cost = $8,722/mth
= $104,658/yr
= 86%

Pay back period
= 1.9 yrs

Carbon Footprint Reduction =
1,180,336.0 lbs CO$_2$/yr
St Helens and Boise Paper WWTP – St. Helens, OR

- Seven (7) circulators in WWTP secondary - 33% municipal / 67% industrial
- Partial grant from Bonneville Power Energy Smart Industrial Program
- 1st year, aeration usage decreased approx. 52% from 568 hp/day to 266 hp/day
- 3rd year, aeration usage decreased approx. 68% from 568 hp/day to 182 hp/day
- DO in the pond is monitored and the units are monitored via SCADA
- 68% reduction in energy - DO is averaging 3-4 ppm - seeing sludge reduction
AP500 version is designed for wet wells, lift stations and industrial tanks / basins.

AP2000, AP4000 and AP7000 versions are designed for use in lakes, stormwater ponds, wastewater ponds, activated sludge basins, industrial tanks / basins.

AP8000 version is designed for use in activated sludge aeration basins and anoxic basins.

Customer can use their own air source or an optional air unit.
GridBee® AP Series - Air-Powered Mixers

Floating Version

Pedestal Version

AP7000F

AP8000

Same patented intake design as floating SolarBee and Gridbee machine, but air-lift not impeller driven. Clog free design for better solids handling, and no moving parts in the water,
GridBee® AP Series - Pedestal Mixer Flow Pattern
GridBee® AP Series - Floating Mixer Flow Pattern

- Surface Flow
- Low Pressure Zone
- Direct Uplift Flow
- Induced Flow Pattern
- Water Pulled Horizontal Toward Intake
- Uncirculated Water Below Horizontal Intake

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Diffuser System Before
EQ Basins - AP Mixers
Customer Installation Photos

AP2000 Units After

Medora Corporation GridBee® SolarBee®
EQ Basins - AP Mixers
Customer Installation Photos

AP2000 Units After

Medora Corporation GridBee® SolarBee®
EQ Basins - AP Mixers
Customer Installation Photos

Air Units After – Replaced 125hp units with 25hp units
GridBee® Air-Powered Mixers and Circulators

Customer Installation Photos

AP7000F Floating Style Mixer in basin, recently started
**GridBee®** Air-Powered Mixers and Circulators

**Customer Installation Photos**

*AP7000F Floating Style Mixer in basin, after 2 days*

Medora Corporation GridBee® SolarBee®
Customer has installed AP8000P mixers in the back end of four parallel aeration basins and they turned off approx. 50% of the bottom diffusers (90 diffusers per basin) to start the de-nitrification process sooner. The AP8000P mixers are using approx. 3hp of air per basin versus the 50hp of air per basin to maintain mixing in the back half of the basin. They were able to reduce their Nitrates from around 10 to 6 mg/l.
GridBee AP Series Air Powered Mixers - Activated Sludge Project
GridBee AP500 Air-Powered Mixer System
(includes mixer, air unit, and accessories)

The AP500 air-powered mixer, the smallest mixer in the AP Series features a non-clog design with no moving parts and no electricity in the water, it is portable, compact, and lightweight, and easy to install.
GridBee® AP500 Air-Powered Mixer System

Applications:
• Wet wells / lift stations - reduce grease buildup, H2S odor /corrosion and, prevent wipe clogging
• Tanks – municipal and industrial tanks; mix most types of liquids
• Standby mixer - can be used as backup wherever you need it

Features:
• Can be suspended from a chain or set on the bottom of a tank
• Constructed of 316SS and polymer materials
“This is our first AP500 installation. In 6 hours it has almost completely removed a foot thick scum layer. When we attempted to lower the unit through the scum, it wouldn't go through. It rested on top. The only way to get it down was to turn it on and let it work itself down. We are impressed.”
GridBee® AP500 Air-Powered Mixer System
Installation Before / After Photos

Before Startup of AP500 Mixer

24Hrs after Startup of AP500 Mixer

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LDC Application Benefits

**Lagoon Systems**
- Provide energy savings with a 1 to 5 year payback
- Reduce short circuiting
- Maintain or improve wastewater treatment
- Provide odor control
- Reduce algae BOD / TSS issues in the back end

**Waste sludge storage ponds**
- Energy savings vs brush aerator
- Less struvite problems
- Less sludge mounding

**EQ Basins - Anoxic Basins**
- Energy Savings / improve mixing

**Main Reactor Basins**
- Energy savings, allows less intense aeration while keeping solids suspended
Incentives and Purchase Options

Long-Distance Circulation technology qualifies for possible incentives in three categories:
- energy efficiency
- energy conservation
- renewable energy

Ask about the following programs:
- ARRA – Green, American Made
- Energy rebates, PG&E, SCE, Xcel, TVA, Bonneville Power
- Federal tax incentives
- Rent-to-own
- Lease-purchase
- Grant opportunities
- Sole Source Justification / Sole Source Letter
GridBee® Air-Powered Mixers

Full Specifications, Videos, Case Studies, White Papers, Questionnaires, etc. available at: https://www.medoraco.com/resources