

ADAPTABLE PROCESS ENVIRONMENTS · NUTRIENT REMOVAL

BioCycle-ENR Activated Sludge Process



**REAL-TIME OPTIMIZED
TREATMENT ENVIRONMENTS
DELIVER OPERATIONAL SAVINGS**

Contact enviromix.sales@xylem.com to discuss how you can maximize treatment efficiency and minimize energy usage with BioCycle-ENR.



FACING THE LIMITATIONS OF CONVENTIONAL ACTIVATED SLUDGE DESIGN

The design of a wastewater treatment facility typically takes into account influent flow and loading conditions from startup to ultimate build-out, which is often a period of 20 years. Engineers have traditionally designed the activated sludge process based on future-state flow and loading conditions, resulting in decades of operation that is constrained, inefficient, and suboptimal.

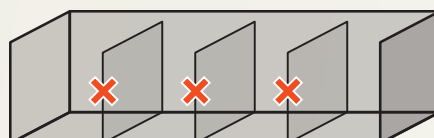


1 RESTRICTIONS OF FIXED PROCESS VOLUMES AND ENVIRONMENTS

Conventional activated sludge treatment processes often have restrictive process environments separated by fixed baffles and discrete equipment, resulting in:

- Inability to turn down aeration without sacrificing mixing.
- Elevated dissolved oxygen (DO) concentration in return streams, diminishing nutrient removal.
- Failure to create adequate anaerobic and/or anoxic volumes during peak flow/load events.
- Increased supplemental carbon/chemical addition due to insufficient anaerobic and/or anoxic conditions.

A more adaptable solution is needed to prevent wasted energy, excess chemical consumption, and process upsets.



2 LIMITATIONS OF SWING ZONES

While swing zones offer a level of versatility for plants during changing conditions, they have two major limitations.

1. Baffled swing zones can only operate in one of two states — aeration or mixing. Conventional equipment limitations don't allow concurrent aeration and mixing, which is often needed during mixing limited conditions.



2. Swing zones are constrained to a fixed volume and physical location within the bioreactor.

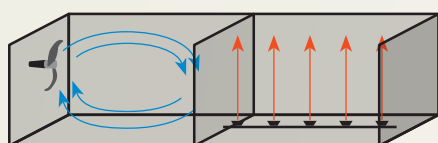
An unbaffled zone that can acclimate to a variety of operating conditions would offer boundless versatility.

3 CHALLENGES WITH POINT SOURCE MIXERS

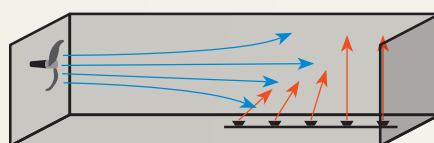
The goal of mixing is typically to maintain the suspension of solids, blend recycle streams, or decouple mixing energy from aeration.

Point source mixers provide fluid flow and mixing of tank contents by imparting thrust and velocity to develop a mixing pattern dependent upon fixed baffle walls. Without a baffle, the mixing pattern cannot develop.

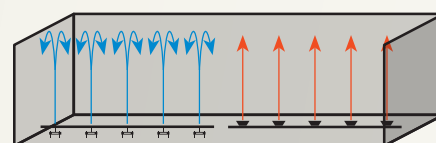
Bottom-up compressed gas mixing negates the need for baffles and maintains the integrity of the process environment.



Propeller mixer + aeration with baffle



Propeller mixer + aeration without baffle

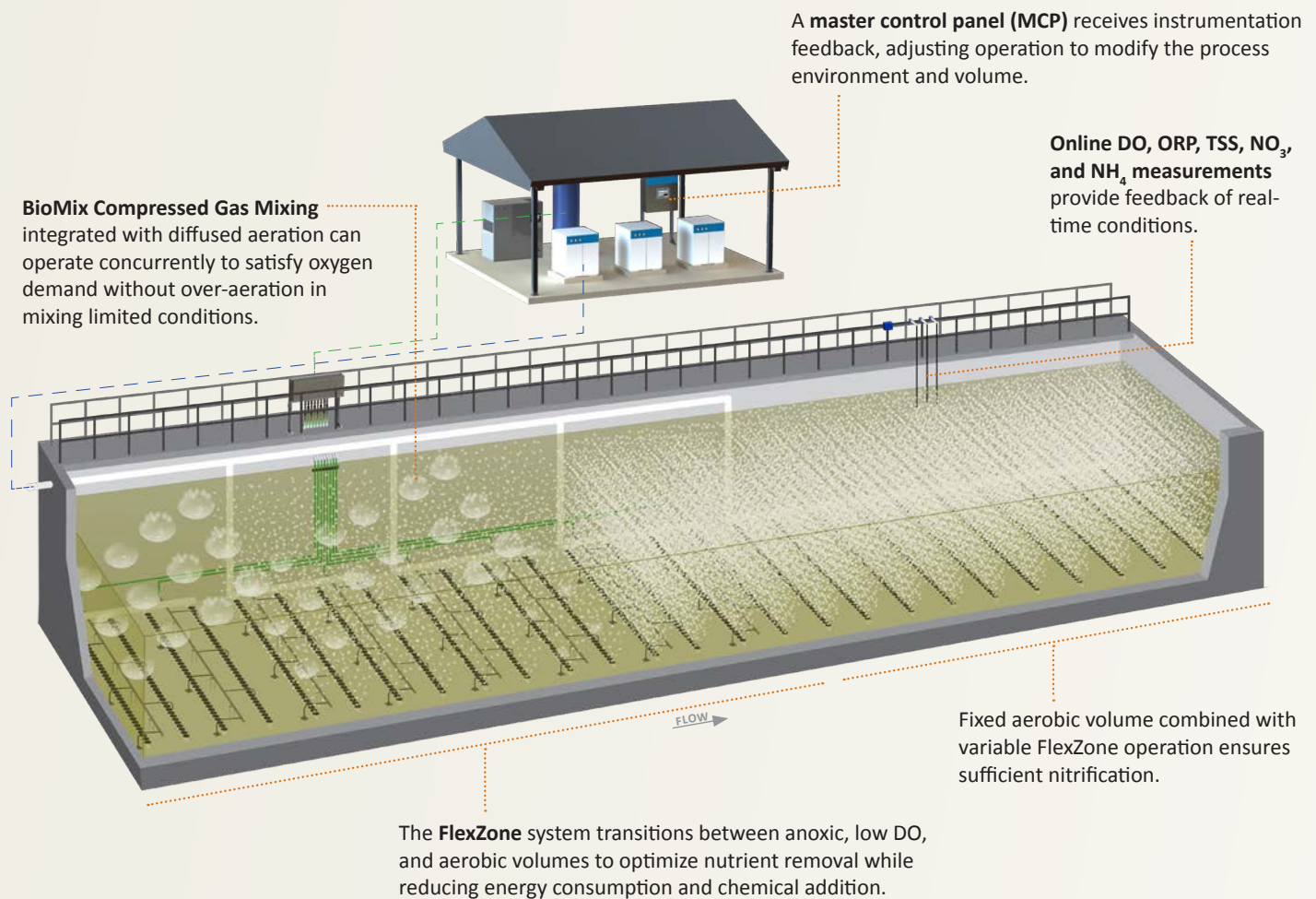


BioMix + aeration without baffle

As permitted effluent nutrient requirements become increasingly more stringent, utility owners are seeking efficient treatment solutions that can meet current and future water quality requirements, overcoming the limitations of conventional activated sludge design.



BIOCYCLE-ENR ACTIVATED SLUDGE PROCESS is an integrated biological treatment solution utilizing activated sludge to meet stringent nitrogen and phosphorus requirements. BioCycle-ENR dynamically adapts to changing conditions by incorporating the patent-pending **FlexZone™ Adaptive Process Volume System** to automatically transition anoxic, low DO, and aerobic environments.



BioCycle-ENR enables facilities to manage reactor volume in real-time to meet nutrient removal demands while improving carbon management, reducing chemical usage, and minimizing energy consumption.



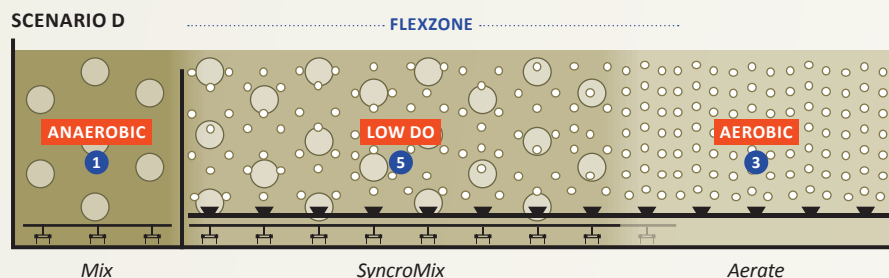
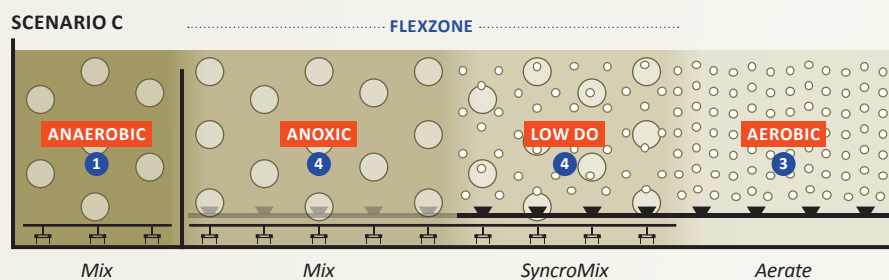
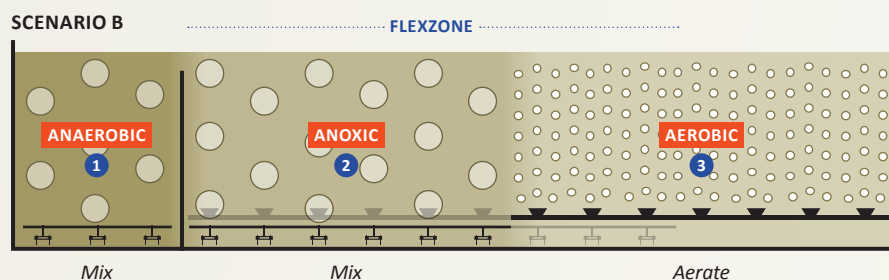
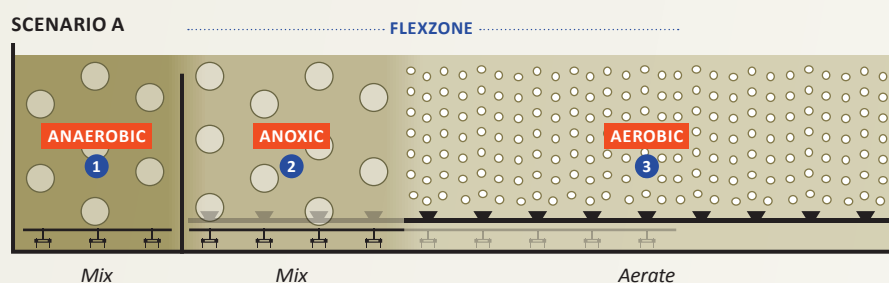
PROCESS OPTIMIZATION

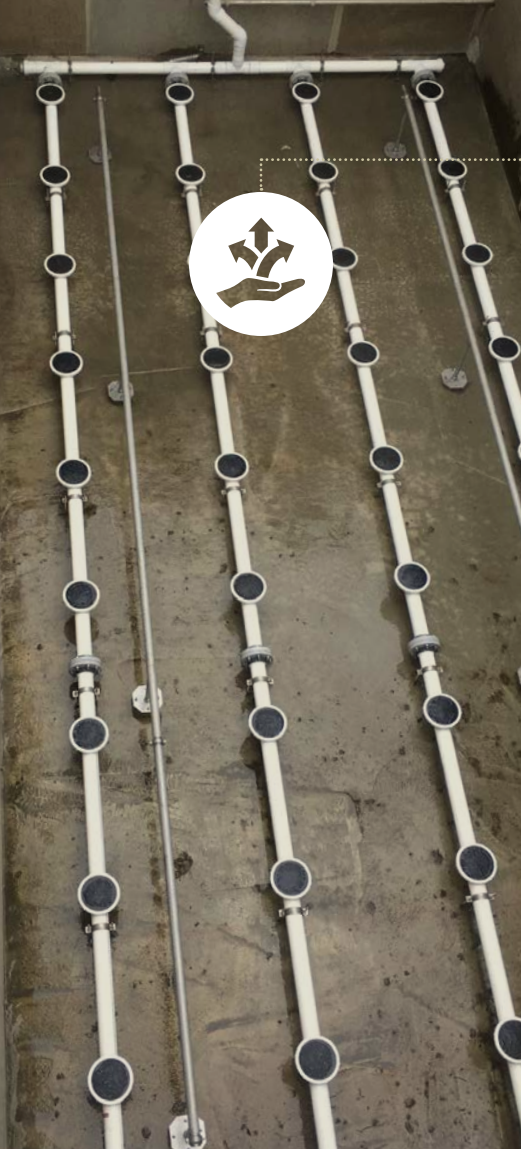
Capitalizing on the FlexZone system, BioCycle-ENR optimizes proven activated sludge processes — such as MLE, A2O, and others — to provide a stable and sustainable treatment system. **The FlexZone system empowers the design engineer and the utility to plan for multiple design conditions by creating flexible process scenarios that manipulate the reactor environment to meet real-time demands.**

BioCycle-ENR enables effective carbon management by preventing over-aeration and thus creating environments that foster denitrification to reduce carbon and enhance fermentation to improve bio-P, resulting in minimized chemical consumption. It also addresses diurnal and seasonal loading conditions while accommodating current and future nutrient removal requirements with an emphasis on optimizing energy efficiency and maintaining process control.

The four FlexZone scenarios to the right demonstrate just a few of the many ways the environments in a single bioreactor can be manipulated to match influent flows and loads throughout the life of the system.

- 1 The anaerobic zone enhances biological phosphorus removal through inline and/or side stream fermentation capability.
- 2 With independent aeration and mixing equipment, the FlexZone can be utilized to expand and contract the anoxic and aerobic environments.
- 3 Versatile aeration design and control respond to a full range of flow, load, and temperature conditions.
- 4 Reducing oxygen demand via enhanced denitrification in anoxic and low DO environments optimizes carbon management.
- 5 SyncroMix — which is concurrent operation of BioMix and diffused aeration to independently meet mixing and oxygen demands — saves substantial energy by providing a low DO environment for simultaneous nitrification and denitrification.





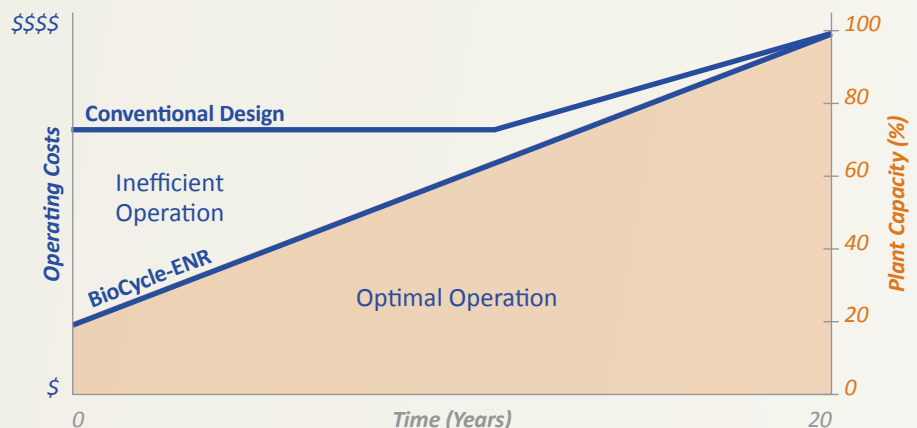
UNPARALLELED FLEXIBILITY

BioCycle-ENR can be designed for greenfield treatment facilities or integrated into facility upgrades utilizing existing equipment, including diffusers, blowers, and instrumentation. **The system can be designed to easily retrofit conventional activated sludge processes, oxidation ditches, sequencing batch reactors, and BNR facilities.**

Independent aeration and mixing operation combined with automated process environment control allow the system to match the required volumetric environments to influent flows and loads throughout various operating conditions over the design life of the facility.

A conventional plant sized for a 20-year life cycle has limited turn down capability, resulting in inefficient operation during most of the facility's life. **BioCycle-ENR offers unmatched turn-down capability to provide optimal operation starting from day one through the design life of the plant.**

Operating Costs*: BioCycle-ENR vs. Conventional Design



*Operating costs include energy, chemical consumption, and labor.



STRAIGHTFORWARD OPERATION

Based on well-proven nutrient removal processes developed over the past 50 years, BioCycle-ENR incorporates the ability to dynamically transition process environments within conventional secondary treatment process configurations.

The system is easy to operate and eliminates:

- The restrictive hydraulic head loss of sequencing batch reactor technology
- Large footprint requirements of oxidation ditch technology
- Limitations of separate fixed process zones associated with conventional activated sludge processes

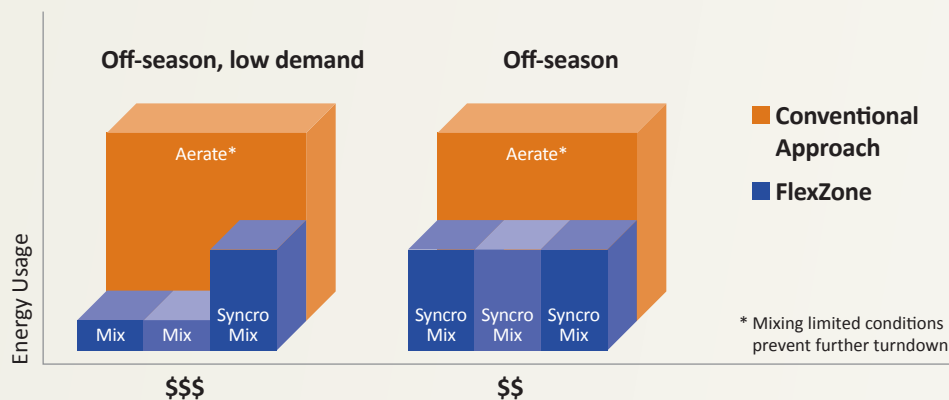
Capitalizing on the FlexZone system's unique controls, BioCycle-ENR automatically adapts operation to ensure treatment objectives are met. Maintenance is minimal with low maintenance in-tank components and easy access to out-of-tank equipment.



ENERGY EFFICIENCY

The BioCycle-ENR process provides **efficient operation through smart process controls and independent mixing and aeration** supplied by the FlexZone system. To eliminate mixing limited conditions, SyncroMix provides simultaneous operation of mixing and aeration, further reducing energy consumption by matching the oxygen supply with demand and using supplemental mixing to keep solids suspended. This **prevents over-aeration and wasted energy**. Unlike conventional activated sludge technology, each BioCycle-ENR design is customized to match the needs of the facility whether it is year one or year twenty.

The example below compares the operation of a treatment plant in a resort town using a fixed conventional aeration approach with limited turndown versus BioCycle-ENR with the FlexZone system. The FlexZone system automatically transitions the aerated volume to mix and/or SyncroMix to meet the oxygen demand, providing unmatched turndown and energy savings.



PROCESS
GUARANTEE



PATENT
PENDING



THIRD-PARTY
VERIFICATION

EnviroMix focuses on delivering solutions that reduce energy costs and enhance process performance in the water and wastewater industry. We design and manufacture performance-proven technologies that improve water quality and reduce energy consumption in critical areas of the treatment process. Utilizing patented and proprietary technology, we provide equipment and process control solutions to enhance plant performance for both the municipal and industrial markets.



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