

# NICO NANOBUBBLE GENERATOR FOR ANAEROBIC DIGESTION

## BOOSTING BIOGAS PRODUCTION AND STABILIZING DIGESTER PERFORMANCE.

Anaerobic digestion (AD) plays a vital role in modern wastewater treatment plants, converting organic sludge into renewable biogas while reducing solids volume. Yet many digesters operate below their theoretical efficiency due to limitations in hydrolysis, mass transfer, microbial inhibition, and process instability.

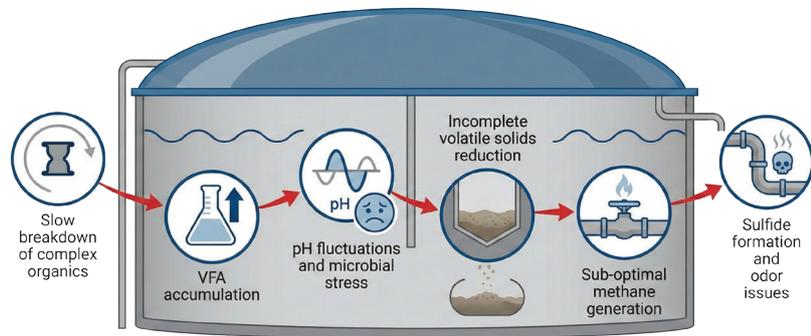
NICO’s nanobubble technology introduces a new level of control and efficiency to anaerobic digestion systems, enhancing biological pathways, improving substrate conversion, and increasing methane yields without major civil modifications.

### THE CHALLENGE IN CONVENTIONAL AD SYSTEMS

Digesters commonly face:

- Slow breakdown of complex organics
- Volatile fatty acid (VFA) accumulation
- pH fluctuations and microbial stress
- Incomplete volatile solids reduction
- Sub-optimal methane generation
- Sulfide formation and odor issues

Traditional mixing and gas injection methods offer limited precision and poor gas utilization efficiency.



## HOW NANOBUBBLES TRANSFORM DIGESTION DYNAMICS

Nanobubbles (<200 nm) exhibit extraordinary stability and remain suspended in liquid for extended periods. Their high internal pressure and large interfacial surface area enable superior gas dissolution and interaction with biological systems.

When applied to anaerobic digestion:

### Enhanced Hydrolysis & Substrate Accessibility

Nanobubbles improve contact between microorganisms and particulate organics, accelerating the rate-limiting hydrolysis step.

### Improved Gas-Liquid Mass Transfer:

Stable nanobubbles dissolve gradually, ensuring efficient gas utilization instead of rapid escape seen with coarse bubbles.

### Microbial Activity Optimization

Controlled nanobubble environments support balanced microbial consortia, particularly methanogens.

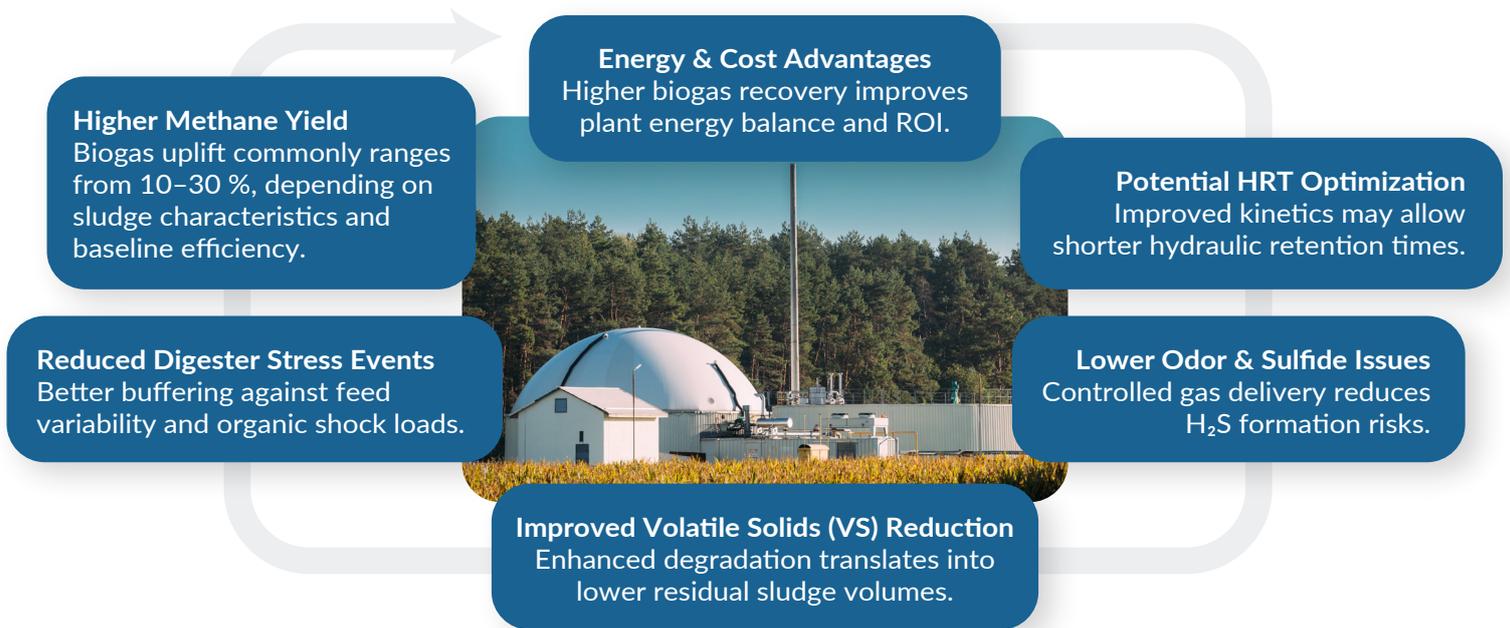
### Process Stability & Shock Resistance

Reduced VFA accumulation and smoother metabolic transitions help stabilize pH and digestion kinetics.

### Selective Micro-Aeration Capability

Precisely dosed oxygen nanobubbles can suppress sulfide formation and promote beneficial facultative pathways without disrupting anaerobic zones.

## MEASURED OPERATIONAL BENEFITS



## WHY NICO NANOBUBBLES?

### Engineered for Biological Performance

- Stable nanobubble generation with precise gas control
- Retrofit-friendly skid integration
- Minimal hydraulic disruption
- Compatible with primary, secondary, and sludge streams
- Scalable across digester capacities
- Sensor & automation ready

### Designed for Real-World Wastewater Conditions

NICO systems are built for demanding sludge environments, ensuring reliable operation under varying solids concentration, viscosity, and loading regimes.

## DRIVING THE FUTURE OF ENERGY-POSITIVE WWTPS

As wastewater treatment plants evolve into resource recovery facilities, maximizing biogas production and stabilizing digestion processes become strategic priorities.

**NICO Nanobubbles enable smarter digestion, higher energy recovery, improved sludge reduction, and enhanced operational resilience.**