Silicon Valley Clean Water Research — Exploring New Technologies for Resource Recovery

Higher-Quality Water • Greater Energy Efficiency & Recovery • Cost Savings • Reduced Biosolids and GHG Emissions

What is SAF-MBR?

SAF-MBR (Staged Anaerobic Fluidized bed-Membrane Bioreactor) uses anaerobic microbes to help purify water instead of their aerobic cousins that currently require a remarkable 1% of the nation's electricity demand to treat water. This process has not changed in over 100 years. Research is showing that anaerobic microbes can purify water with greater benefits, including less energy use.

Other potential benefits of SAF-MBR include flipping the energy balance by producing more energy than is used to treat water, generating significantly less GHG emissions, and reducing the generation of biosolids by up to 30% or more. By converting more biosolids to renewable energy, we also reduce the number of trucks and energy needed to haul them away for landfill disposal. We are also discovering that anaerobic microbes may be capable of consuming stubborn pollutants more efficiently and with less energy. By increasing the efficiency and effectiveness of the wastewater treatment process, we reduce the burden for advanced treatment, and increase the robustness of the water purification barrier prior to potable reuse.

The current energy-intensive aerobic process injects oxygen to sustain microbes as they consume organic material. In contrast, the anaerobic process uses different, slower-growing microbes that don't need oxygen and produce greater amounts of methane (natural gas) as a byproduct, which can be used for energy or new biodegradable materials. By fluidizing activated carbon as a substrate where anaerobic microbes can attach themselves, the efficiency with which they consume organic matter and grow is increased. The water is then filtered using an ultrafiltration Membrane Bioreactor (MBR), creating high-quality water suitable for non-potable reuse. SAF-MBR consolidates current secondary treatment, clarification, and tertiary filtration into a smaller footprint with fewer moving parts, simplifying operation and maintenance of these complicated treatment systems.

Benefits of SAF-MBR

- The energy balance is inverted, producing energy instead of demanding it.
- Biosolids are reduced by 30% or more, thus reducing energy, truck traffic, and GHG emissions.
- A smaller treatment train footprint offers more efficient use of facilities, resulting in operations and maintenance benefits.
- By removing Chemicals of Emerging Concern (CECs) more efficiently, SAF-MBR can improve water quality, reducing the burden on advanced treatment trains for potable reuse.

What is SVCW's role in this project?

In partnership with Stanford University, SVCW applied for a grant from the California Energy Commission (CEC), received the highest ranking of all applicants, and was awarded the $2 million maximum grant amount. In addition to SVCW's cash contribution of up to $500,000, other cash contributions from Stanford as well as in-kind technology/equipment and engineering contributions from SUEZ Water Technologies & Solutions, Trojan Technologies, Santa Clara Valley Water District, and LG NanoH2O were received. Cash and in-kind contributions total about $3.2 million, leveraging SVCW's cash contribution to better than a 6:1 ratio.

This SAF-MBR demonstration project (the largest of its kind in the world) will be built at the SVCW plant as a "closed-cycle," utilizing primary effluent and influent which will then go back into the regular treatment process. Once proven at this scale, operational and maintenance knowledge gained from this demonstration project will be used to understand the feasibility of further process scaling to meet the needs of SVCW and open the door to this new technology for other water treatment facilities throughout the world.

SVCW continues to seek increased efficiencies in resource recovery. Assisting in the development of new innovative approaches like SAF-MBR can provide operational benefits to our facility, and to the water treatment industry as a whole.

STANFORD UNIVERSITY

Collaborating with research partners, like Stanford and the CEC, helps SVCW maintain awareness of pivotal shifts in technologies that reduce costs in our industry. This collaboration also provides mutually-beneficial learning opportunities for the water treatment industry today, and for the operators, engineers, and scientists of tomorrow.

Diagram: SAF-MBR Process