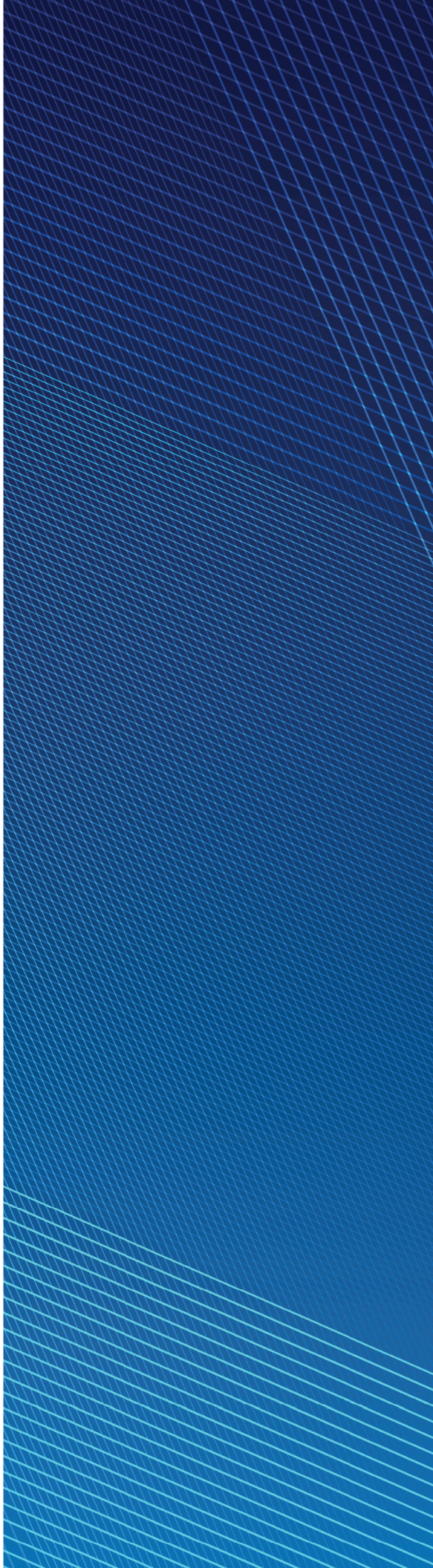
FROST & SULLIVAN

MEMSIFT INNOVATIONS RECEIVES THE 2023 ENTREPRENEURIAL COMPANY OF THE YEAR AWARD

Identified as best in class in the global zero liquid discharge systems industry



Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Memsift Innovations excels in many of the criteria in the zero liquid discharge systems space.

Growing Need for Efficient and Sustainable Solutions Spurs Market Development

Frost & Sullivan's independent research highlights that freshwater scarcity is among the most crucial problems for industries. It poses a critical threat to the environment, water security, and economic development. Industries are progressively employing recovery and wastewater recycling to address the demand for freshwater. Zero liquid discharge (ZLD) is more costly than conventional wastewater treatment methods yet highly effective. It eliminates toxic liquid waste and recovers most water and valuable resources for reuse and re-purposing as green feedstocks with the additional benefit of carbon emission reductions. ZLD also augments water usage efficiency, balancing freshwater use and preventing environmental pollution. Strict regulations and policies regarding wastewater discharge and increasing supply chain constraints on critical minerals and resources drive demand for ZLD systems. Incentives and non-compliance penalties further motivate organizations to adopt ZLD technologies. Moreover, enhanced research and development in water treatment technologies magnifies the demand for affordable ZLD systems. Improvements in thermal systems, membrane desalination systems, and forward osmosis technology condense operational costs considerably. Organizations with complex wastewater streams, high water utilization, and sizable wastewater output face increasing pressure to employ sustainable water recovery approaches.[1]

[1] *Growth Opportunities in the Global Zero Liquid Discharge (ZLD) Systems Market, Forecast to 2024* (Frost & Sullivan, 2018)

Amplifying awareness and concerns about wastewater pollution fuel ZLD's application globally. For example, public protests in China led to the cancellation of several projects (e.g., chemicals and wastewater discharge pipelines). The public's mounting concerns push industries worldwide to implement ZLD systems as a best practice solution for decentralized wastewater treatment, contribute to environmental wellness, and generate additional revenue streams from the sale of recovered resources. Regions with high water stress and countries with escalating growth and industrialization face the risk of highly compromised water quality. Therefore, industries that use large volumes of process water and generate highly contaminated waste streams must seriously focus on minimizing water consumption. China, India, and the United States (US) are introducing stricter environmental regulations that require the adoption of ZLD.

Despite solid growth drivers, the market faces some challenges. Conventional ZLD systems have high energy consumption, mainly based on evaporation, making the process extremely energy intensive and expensive. Cutting-edge technologies help lower costs and make ZLD and minimum liquid discharge more accessible for industrial applications. Frost & Sullivan's research analysts forecast the global ZLD market to grow from $482.2 million in 2017 to $944.5 million in 2024 at a compound annual growth rate of 10.1%. The foremost factors propelling the global market are industrialization, economic growth, and the challenges of supplying safe water. ZLD systems integrating membrane-based technology magnify energy efficiency and costs. Frost & Sullivan estimates the membrane segment to generate the greater part of the revenue in the ZLD market, anticipated to grow from $225.1 million in 2017 to $494.7 million in 2024.[2]

Memsift Innovations: Blazing the Trail with Cutting-edge Products

Founded by Dr. J Antony Prince in 2018 and headquartered in Singapore, Memsift Innovations (Memsift) specializes in brine treatment and ZLD, facilitating trailblazing, sustainability-focused products. The company aims to help society and industries create economical, energy-efficient, and environmental wellness-centered solutions using its state-of-the-art membrane technologies. Memsift envisions being a "global leader in providing membrane-based solutions for water, energy, and environmental challenges."[3]

By leveraging client feedback and monitoring industry trends, the company gauges market needs, guides its product roadmap, and continuously evolves its capabilities to maintain its innovative edge. Memsift understands that the recycling rate for industries that generate high-saline wastewater is less than 20%. Standard treatment processes do not eliminate salinity, and reverse osmosis (RO) is a prominent technology for saline wastewater treatment. Still, it has a limited application because of the salt concentration in the feed water. Furthermore, treating and disposing of the RO rejection, brine, and high-strength wastewater is always grueling, and indiscriminate disposal of reject back into the sea or sewer is an unaddressed environmental problem. Traditional distillation and evaporation techniques are expensive; therefore, there is a growing need for affordable, sustainable technologies that catalyze enhanced brine treatment and ZLD.[4]

[2] Ibid.
[3] https://www.memsift.com/about-us/
[4] https://www.memsift.com/

After meticulously considering and understanding the market challenges, Memsift offers its leading-edge thermal membrane process-based ZLD system that treats industrial wastewater using almost five times less energy than the current incineration procedure. The company's advanced ZLD system integrates a distinctive, highly hydrophobic hollow fiber membrane, augmenting the system's efficacy.

STOMATE® and TS-30™

For a successful thermal membrane separation process and membrane distillation, the membrane should preferably have the best features in terms of thickness, porosity, pore size, chemical and thermal stability, surface chemistry (hydrophobicity), and high liquid entry pressure. Memsift's hydrophobic hollow fiber membrane, STOMATE®, has a unique surface chemistry for vapor and steam transportation. It also has ultra-hydrophobicity (contact angle >150°), at least two times higher vapor permeability, high chemical and thermal stability and liquid pressure, and no wetting issue. STOMATE® enormously adds to Memsift's competitive edge with multiple applications: ZLD, brine treatment, product concentration, resource recovery, landfill leachate treatment, mining wastewater treatment, pervaporation, and acid-recover.[5]

> *"These patents fortify the company's competitive advantage and ability to commercialize, making its innovative technology surpass the traditional membrane distillation methods. Their acquisition highlights Memsift's dedication to creating better products, high customer satisfaction, and forward-thinking initiatives. Frost & Sullivan opines that purpose-built strategies and best practices set Memsift apart from its competitors, with superior design, reliability, and quality as its central pillars."*
>
> ***- Iqra Azam,***
> ***Best Practices Research Analyst***

Together with STOMATE®, the company's excellent ZLD thermal membrane system, TS-30™ recovers up to 100% chemicals and more than 95% water at a much lower operating cost than conventional evaporators. Memsift's groundbreaking technology also substantially minimizes the overall carbon footprint by up to 80%.[6] STOMATE® and TS-30™ remarkably decrease the industrial effluent treatment cost and simultaneously enable the treatment of some very aggressive and risky chemicals.

Memsift's pioneering ZLD system robustly solidifies the company's market position with several benefits: valuable resources (acids, products, salts, and precious metals) recovery, up to 100% water recovery, up to 50% energy savings, up to 50% capital cost and space savings, low operating temperature (60°C to 80°C), and high thermal efficiency, meaning it can operate at higher output ratio because of optimized heat recovery. TS-30™ is independent of salt concentration and requires less or no pre-treatment. Its modular system prompts easy scalability.

Moreover, its technology has proven applications for brine treatment. The primary data shows that the membrane-based ZLD system consumes less energy than conventional thermal techniques. Memsift's advanced product supports pervaporation to separate organic solvents and bio-fuels. Since TS-30™ thrives

[5] https://www.memsift.com/products/
[6] https://www.filtsep.com/content/news/memsift-innovations-technology-awarded-us-patent/

on vapor pressure difference, it can split a liquid mixture with two different boiling points (e.g., water-ethanol, water-isopropyl alcohol, water-acetone, and ethylene glycol-water).[7]

Owing to the singularity, high performance, and successful implementations of Memsift's technologies, in February 2022, the US Patent Office (USPTO) granted a patent for its improved membrane distillation process, TS-30™. In January 2023, USPTO also granted a patent for STOMATE®, testifying to the product's exceptionality and value. These patents fortify the company's competitive advantage and ability to commercialize, making its innovative technology surpass the traditional membrane distillation methods. Their acquisition highlights Memsift's dedication to creating better products, high customer satisfaction, and forward-thinking initiatives. Frost & Sullivan opines that purpose-built strategies and best practices set Memsift apart from its competitors, with superior design, reliability, and quality as its central pillars.

A Foot in the Present and an Eye on the Future

With its product-led customer-focused strategy, Memsift consistently brings to market best-in-class products. In early 2023, it launched GOSEP™, a next-generation high-temperature chemical-resistant ultra-nanofiltration membrane that averts fouling through the water layer formed by the intermolecular hydrogen bond (between the water molecules) and the functional groups on the membrane's surface.[8]

> *"Frost & Sullivan recognizes that Memsift is a disruptive leader in the ZLD systems market, constantly capitalizing on development prospects and prompting stiff barriers for existing competitors and new market entrants. The company sustains an impressive speed to market with its capacity to launch technology-integrated products that meet and exceed customers' needs."*
>
> ***- Iqra Azam,***
> ***Best Practices Research Analyst***

The ability to quickly manufacture and commercialize new, efficient products substantiates the company's high-growth potential. Memsift is well-positioned with industry-leading products that provide tremendous value in high-demand sectors.

Since its inception, Memsift's sterling reputation and customer-centric framework have led to its coveted preferred partner status. Over the years, it has added new customers and partners to its established base, swiftly expanding business opportunities. For example, in May 2021, Memsift and South Korea-based Angstroms Co Ltd (Angstroms) initiated a cooperation agreement to analyze market opportunities for Memsift's capabilities in Korea through pilot trials. As part of this collaboration, Angstroms introduced Memsift products to its customers in South Korea, helping the company expand its reach and operational footprint. Memsift is also seeking similar opportunities for other regions.[9]

In October 2022, the company procured a new contract to build a 3.5 million liters per year chemical recovery plant in Singapore by implementing its exclusive TS-30™ advanced membrane distillation technology. The project will be commissioned in the second quarter of 2023 and can potentially scale up to 14 million liters annually in two phases.[10]

[7] https://www.memsift.com/zeroliquidrecharge-membrane-distillation/
[8] https://www.linkedin.com/feed/hashtag/?keywords=gosep
[9] https://www.filtsep.com/content/news/memsift-enters-south-korean-market-through-partnership
[10] https://www.filtsep.com/content/news/memsift-to-recover-chemicals-from-microelectronics-industrial-effluent-in-singapore

"This is a key milestone in Memsift's journey helping the high-value manufacturing industries to close their toxic liquid-waste loop that allows our clients to eliminate the disposal cost and recover resources while reducing the overall carbon footprint to meet their internal ESG targets."

- Dr. J Antony Prince, Founder and Chief Executive Officer, Memsift Innovations

Staying persistent with steadfast business expansion, in December 2022, Memsift secured a 37.2 million Indian rupee contract to build a first-of-its-kind resource recovery plant in India for the manmade fibers industry through its trailblazing TS-30™. This accomplishment significantly contributes to the wide-ranging commercialization of membrane distillation technology for real-world applications. Memsift plans to strengthen its technology's applications in multiple industrial verticals (e.g., pharmaceutical, chemical, pulp and paper, mining, and metal finishing). This strategy will enable the company to attain resource circularity and decarbonize industries by closing the liquid-waste loop.[11]

In April 2023, Memsift acquired a new contract from a global microelectronics corporation to develop Singapore's first nickel recovery plant via its TS-30™ improved membrane distillation technology, followed by pilot trials. The project focuses on reducing the microelectronics manufacturing process' environmental impact. Memsift's "membrane distillation system recovers up to 100% nickel from the microelectronics industrial effluents, as estimated nickel recovery is about 10.2 tonnes/year with 11.5 kilograms of nickel's carbon footprint."[12]

Frost & Sullivan recognizes that Memsift is a disruptive leader in the ZLD systems market, constantly capitalizing on development prospects and prompting stiff barriers for existing competitors and new market entrants. The company sustains an impressive speed to market with its capacity to launch technology-integrated products that meet and exceed customers' needs.

[11] https://www.filtsep.com/content/news/memsift-secures-372mn-contract-to-build-resource-recovery-plant-in-india
[12] https://waterwastewaterasia.com/memsift-to-recover-nickel-from-microelectronic-industrial-effluent-in-singapore/?utm_source=rss&utm_medium=rss&utm_campaign=memsift-to-recover-nickel-from-microelectronic-industrial-effluent-in-singapore

Conclusion

Emphasizing the lack of cost-efficient, successful, and sustainable zero liquid discharge (ZLD) systems, Singapore-based Memsift Innovations (Memsift) facilitates pioneering products intending to become a global leader in membrane-based solutions. The company harnesses client feedback and monitors industry trends to stay aligned with market needs, ameliorate its product roadmap, and constantly develop its technology to fortify its competitive advantage. Memsift's game-changing TS-30™ (ZLD system) and STOMATE® (hydrophobic hollow fiber membrane) strengthen the company's differentiated value proposition to the ZLD and minimal liquid discharge markets. TS-30™ efficiently recovers valuable, up to 100% water recovery, up to 50% energy savings, up to 50% capital cost and space savings, low operating temperature (60°C to 80°C), and high thermal efficiency. Memsift's cutting-edge and sustainable ZLD system recovers up to 100% chemicals and more than 95% water at over 80% lower operating cost than conventional evaporators. Accentuating continuous business expansion, higher reach, and commercialization, the company actively participates in collaborations and new projects. Staying aligned with market trends and shifting customer needs, Memsift creates new products, demonstrating its robust leadership qualities.

With its strong overall performance, Memsift Innovations earns Frost & Sullivan's 2023 Global Entrepreneurial Company of the Year Award in the zero liquid discharge systems industry.

What You Need to Know about the Entrepreneurial Company of the Year Recognition

Frost & Sullivan's Entrepreneurial Company of the Year Award recognizes the best up-and-coming, potentially disruptive market participant.

Best Practices Award Analysis

For the Entrepreneurial Company of the Year Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Entrepreneurial Innovation

Market Disruption: Innovative new solutions have a genuine potential to disrupt the market, render current solutions obsolete, and shake up competition

Competitive Differentiation: Strong competitive market differentiators created through a deep understanding of current and emerging competition

Market Gaps: Solution satisfies the needs and opportunities that exist between customers' desired outcomes and their current market solutions

Leadership Focus: Company focuses on building a leadership position in core markets and on creating stiff barriers to entry for new competitors

Passionate Persistence: Tenacity enables the pursuit and achievement of seemingly insurmountable industry obstacles

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

About Frost & Sullivan

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The Growth Pipeline Engine™

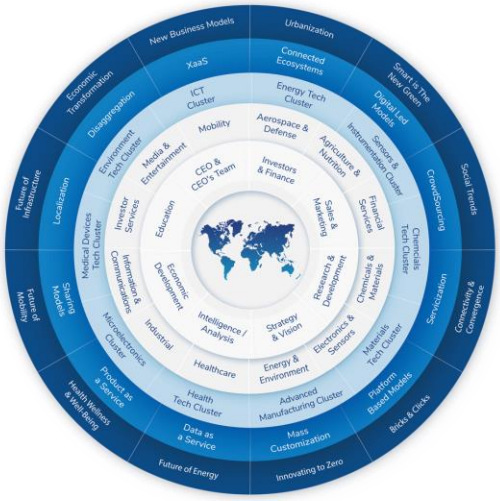
Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.
Learn more.

Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.



Analytical Perspectives:

- Mega Trend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)