

F R O S T & S U L L I V A N

FROST & SULLIVAN BEST PRACTICES AWARD

MEMBRANE BIOREACTOR - NORTH AMERICA

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New Product Innovation 2019



FROST & SULLIVAN

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2019

BEST  
PRACTICES  
AWARD

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## Background and Company Performance

### *Industry Challenges*

Municipalities treat the wastewater generated by water used in homes and produced by storm runoff to provide clean water for reuse by people, businesses, fisheries, and natural habitats. Membrane bioreactors are a widely used wastewater treatment technology that combines biological treatment, such as activated sludge, with membrane filtration. The advantages of membrane bioreactors are that they decouple the solids retention time from the hydraulic retention time, have a smaller footprint to ease installation, and provide superior biotreatment that generates high-quality effluent.

However, Frost & Sullivan points out that membrane bioreactors have distinct limitations, including debris accumulation, sludge formation, and high chemical cleaning and aeration costs that increase overall operating expenses.

Frost & Sullivan recognizes how Canada-based Fibracast has developed its FibrePlate™ membrane bioreactor to properly address these limitations in using membrane bioreactors to treat wastewater. This solution has already won the company contracts throughout North America.

### *New Product Attributes and Customer Impact*

#### **Quality**

A successful strategy for technology developers to achieve best-in-class quality is to design products with a full complement of features and functionalities. Fibracast nicely follows this strategy through FibrePlate, which is a horizontal, hybrid 0.04 micrometer (um) ultrafiltration polyvinylidene difluoride (PVDF) membrane. Fibracast's engineers designed FibrePlate to combine the benefits of hollow-fiber and flat-sheet membrane technologies into a hybrid membrane solution that provides robust and efficient ultrafiltration at lower capital and operating costs than other competing solutions.

Each FibrePlate module contains sixteen triple-reinforced sheets that are potted in a permeate header, and a single module provides 500 square feet of filtration surface. Fibracast's engineers mount each membrane panel horizontally to create an open flow configuration that prevents the accumulation of debris. In addition, FibrePlate has a novel header design that maintains an open flow throughout the membrane that eliminates hydraulic restrictions as well as debris collection, thereby ensuring that the module's surface life will be 100% active and to keep flux rates low over the life of the membranes.

#### **Design**

In addition to offering FibrePlate to provide innovative water treatment, Fibracast has designed its hybrid ultrafiltration membranes to be quite simple to use by housing them in stainless steel cassettes that contain single, double, or triple module stacks. Each cassette can serve as a single, self-supporting unit or as part of an assembly, depending on the flow it treats.

FibrePlate cassettes can be installed in plug-and-play fashion within assemblies to meet the flow needs of the commercial, industrial, and municipal water treatment plants that they serve. Frost & Sullivan considers this as a clear advantage compared to many membrane bioreactors that require considerable redesigning to be integrated into legacy wastewater treatment systems. Fibracast builds the required air and permeate connections into the cassette frame to minimize the connection points, which can potentially leak (as is sometimes the case with other competing systems). Operators manually insert and remove a cassette from a treatment train as needed.

### **Positioning**

To address customers' unmet needs, Fibracast provides its FibrePlate technology with a smaller footprint than other membrane bioreactors, which competitors cannot easily replicate due to Fibracast's patented formed sheet membrane element and filtration system (US Patents 10,105,651 and 9,492,792). For example, FibrePlate takes up one-half the space of the widely used Zeeweed membrane bioreactors made by another manufacturer and is one-fifth the footprint of the sheet membrane bioreactors made by other manufacturers.

This smaller footprint enables Fibracast to address the need of replacing aging membrane bioreactors nearing the end of their service life. Fibracast can install FibrePlate in these plants and double the flow, which is quite valuable in retrofitting water treatment plants that do not meet their flow rate because of design errors.

### **Customer Service Experience**

Frost & Sullivan notes that any solution is only as valuable as the service that backs it up. Fibracast provides accessible, fast, stress-free, and high-quality customer service long before installing its FibrePlate solution. First, Fibracast closely collaborates with the owner, staff, and engineering consultant of a proposed water treatment project to learn the project objectives and preferences. Fibracast is then armed with the data to optimize the design and operation of the ultrafiltration system and to ensure the seamless startup and commissioning of the project.

Fibracast begins training operators during the design stage and continues this training throughout the commissioning of the project. Fibracast does not leave its customers after commissioning; the company sends representatives for a first annual visit and then for any subsequent visits as desired by the customer. In addition, Fibracast provides a recommended list of critical spare parts for each project and maintains a comprehensive list of spare parts in a web portal defined by its clients. Fibracast provides clients with an inventory list of parts, drawings, and piping and instrumentation diagrams (PI&Ds) - no matter when the project was commissioned.

### **Customer Purchase Experience**

Because each customer has unique needs and constraints, providing an optimal solution to address both can be challenging. Fibracast successfully meets this challenge, evident by

its wastewater customers' testimonials. For example, ESG Operations Inc. in Macon, Georgia, manufactures wastewater treatment systems for municipalities throughout the US South, including Vicksburg, Mississippi, and Albany, Georgia. The manager at ESG Operations congratulated Fibracast for providing membranes that processed three times the flow while using half the footprint of competing systems when integrated in ESG's treatment installations.

After the Sterling Natural Resource Center (SNRC) in Highland, California, is completed in 2021, it will convert up to 8 million gallons of wastewater daily and up to 130,000 gallons of imported organic waste streams daily into three megawatts of renewable power, clean water to replenish the Bunker Hill Basin groundwater aquifer, and fertilizer for soil enrichment. SNRC will help the region store hundreds of millions of gallons of water for the droughts common to southern California. In addition, SNRC will be a showcase for advanced technologies, including FibrePlate membranes.

The CEO of the East Valley Water District described his team's work with Fibracast as making a commitment to next-generation membrane technology. The district's director of engineering and operations added that in order to support the construction of a state-of-the-art wastewater facility, it was essential to use what he described as the membranes of the future.

### **Brand Equity**

A key metric in solution success is the degree of loyalty to the brand. Customer testimonials are the best indicator that Fibracast continues to foster strong brand loyalty. Cloacina LLC in Arroyo Grande, California, provides wastewater systems and originally integrated Fibracast's membranes because they represent a disruptive advance in what their CEO called an otherwise complacent segment of wastewater treatment. The CEO continues to use Fibracast's products, as they still deliver what the company initially promised.

Energy savings, reduced footprint, and operational robustness led the city of Delphos, Ohio, to use Fibracast's membranes in its wastewater plant. The plant superintendent declared that nearly two years of successful performance convinced Delphos to undertake a second project with Fibracast.

The city of Selkirk in Manitoba, Canada, tasked two engineering firms, a government agency, and its own experts with assessing five separate membrane suppliers' products for capital and operating expense and operating benefits. The Selkirk manager of water and wastewater utilities reports that everyone unanimously agreed that Fibracast's membranes were the best and states that his city believes in the company and its novel technology.

## *Conclusion*

Frost & Sullivan research shows that growing populations and the industrialization of agriculture are driving the expansion of the global water and wastewater market, which has led utilities in many countries to invest in water reclamation and reuse. Wastewater treatment technologies that can minimize the cost while optimizing the efficiency of treatment will win opportunities in this robust market.

Frost & Sullivan applauds the way that Fibracast addresses these needs through its FibrePlate membrane bioreactor. To accomplish this, the Canadian company combined the advantages of hollow fiber and flat plate membranes. The resulting FibrePlate system improves treatment efficiency, eliminates membrane cleaning costs, and has a smaller footprint than other competing membrane bioreactors.

With its strong overall performance, Fibracast has earned the 2019 Frost & Sullivan New Product Innovation Award.

## Significance of New Product Innovation

Ultimately, growth in any organization depends on continually introducing new products to the market and successfully commercializing those products. For these dual goals to occur, a company must be best in class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.



## Understanding New Product Innovation

Innovation is about finding a productive outlet for creativity—for consistently translating ideas into high-quality products that have a profound impact on the customer.

## Key Benchmarking Criteria

For the New Product Innovation Award, Frost & Sullivan analysts independently evaluated 2 key factors—New Product Attributes and Customer Impact—according to the criteria identified below.

### New Product Attributes

- Criterion 1: Match to Needs
- Criterion 2: Reliability
- Criterion 3: Quality
- Criterion 4: Positioning
- Criterion 5: Design

### Customer Impact

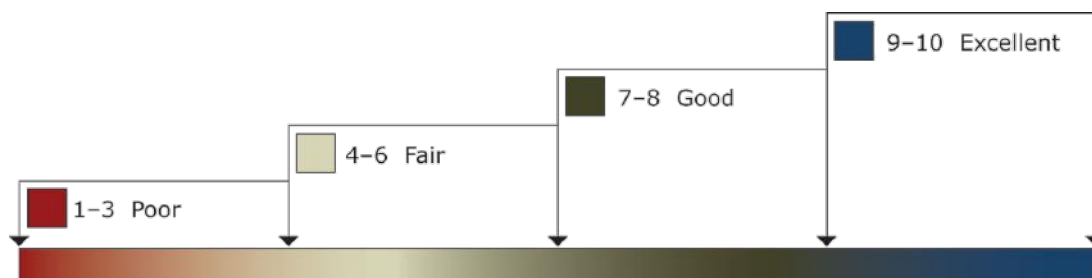
- Criterion 1: Price/Performance Value
- Criterion 2: Customer Purchase Experience
- Criterion 3: Customer Ownership Experience
- Criterion 4: Customer Service Experience
- Criterion 5: Brand Equity

## Best Practices Award Analysis for Fibracast

### Decision Support Scorecard

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Scorecard. This tool allows research and consulting teams to objectively analyze performance according to the key benchmarking criteria listed in the previous section, and to assign ratings on that basis. The tool follows a 10-point scale that allows for nuances in performance evaluation. Ratings guidelines are illustrated below.

#### RATINGS GUIDELINES



The Decision Support Scorecard considers New Product Attributes and Customer Impact (i.e., the overarching categories for all 10 benchmarking criteria; the definitions for each criterion are provided beneath the scorecard). The research team confirms the veracity of this weighted scorecard through sensitivity analysis, which confirms that small changes to the ratings for a specific criterion do not lead to a significant change in the overall relative rankings of the companies.



The results of this analysis are shown below. To remain unbiased and to protect the interests of all organizations reviewed, Frost & Sullivan has chosen to refer to the other key participants as Competitor 2 and Competitor 3.

<i>Measurement of 1-10 (1 = poor; 10 = excellent)</i>			
<b>New Product Innovation</b>	New Product Attributes	Customer Impact	Average Rating
<b>Fibracast</b>	9.0	9.5	9.25
Competitor 2	8.5	9.0	8.75
Competitor 3	8.0	8.5	8.25

### *New Product Attributes*

#### **Criterion 1: Match to Needs**

Requirement: Customer needs directly influence and inspire the product’s design and positioning.

#### **Criterion 2: Reliability**

Requirement: The product consistently meets or exceeds customer expectations for consistent performance during its entire life cycle.

#### **Criterion 3: Quality**

Requirement: Product offers best-in-class quality, with a full complement of features and functionalities.

#### **Criterion 4: Positioning**

Requirement: The product serves a unique, unmet need that competitors cannot easily replicate.

#### **Criterion 5: Design**

Requirement: The product features an innovative design, enhancing both visual appeal and ease of use.

### *Customer Impact*

#### **Criterion 1: Price/Performance Value**

Requirement: Products or services offer the best value for the price, compared to similar offerings in the market.

#### **Criterion 2: Customer Purchase Experience**

Requirement: Customers feel they are buying the optimal solution that addresses both their unique needs and their unique constraints.

#### **Criterion 3: Customer Ownership Experience**

Requirement: Customers are proud to own the company’s product or service and have a positive experience throughout the life of the product or service.

**Criterion 4: Customer Service Experience**

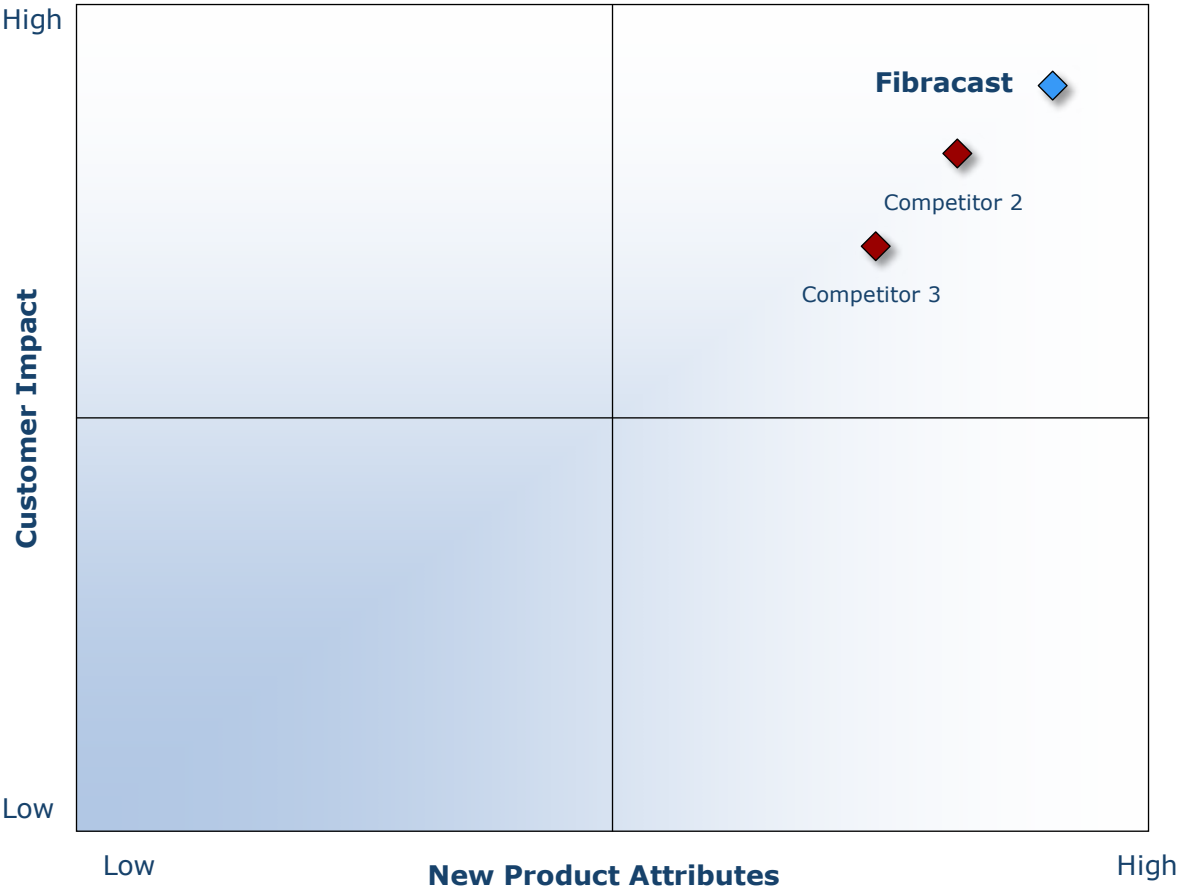
Requirement: Customer service is accessible, fast, stress-free, and of high quality.

**Criterion 5: Brand Equity**

Requirement: Customers have a positive view of the brand and exhibit high brand loyalty.

*Decision Support Matrix*

Once all companies have been evaluated according to the Decision Support Scorecard, analysts then position the candidates on the matrix shown below, enabling them to visualize which companies are truly breakthrough and which ones are not yet operating at best-in-class levels.



## Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan analysts follow a 10-step process to evaluate Award candidates and assess their fit with select best practices criteria. The reputation and integrity of the Awards are based on close adherence to this process.

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
1 <b>Monitor, target, and screen</b>	Identify Award recipient candidates from around the world	<ul style="list-style-type: none"> <li>• Conduct in-depth industry research</li> <li>• Identify emerging industries</li> <li>• Scan multiple regions</li> </ul>	Pipeline of candidates that potentially meet all best practices criteria
2 <b>Perform 360-degree research</b>	Perform comprehensive, 360-degree research on all candidates in the pipeline	<ul style="list-style-type: none"> <li>• Interview thought leaders and industry practitioners</li> <li>• Assess candidates' fit with best practices criteria</li> <li>• Rank all candidates</li> </ul>	Matrix positioning of all candidates' performance relative to one another
3 <b>Invite thought leadership in best practices</b>	Perform in-depth examination of all candidates	<ul style="list-style-type: none"> <li>• Confirm best practices criteria</li> <li>• Examine eligibility of all candidates</li> <li>• Identify any information gaps</li> </ul>	Detailed profiles of all ranked candidates
4 <b>Initiate research director review</b>	Conduct an unbiased evaluation of all candidate profiles	<ul style="list-style-type: none"> <li>• Brainstorm ranking options</li> <li>• Invite multiple perspectives on candidates' performance</li> <li>• Update candidate profiles</li> </ul>	Final prioritization of all eligible candidates and companion best practices positioning paper
5 <b>Assemble panel of industry experts</b>	Present findings to an expert panel of industry thought leaders	<ul style="list-style-type: none"> <li>• Share findings</li> <li>• Strengthen cases for candidate eligibility</li> <li>• Prioritize candidates</li> </ul>	Refined list of prioritized Award candidates
6 <b>Conduct global industry review</b>	Build consensus on Award candidates' eligibility	<ul style="list-style-type: none"> <li>• Hold global team meeting to review all candidates</li> <li>• Pressure-test fit with criteria</li> <li>• Confirm inclusion of all eligible candidates</li> </ul>	Final list of eligible Award candidates, representing success stories worldwide
7 <b>Perform quality check</b>	Develop official Award consideration materials	<ul style="list-style-type: none"> <li>• Perform final performance benchmarking activities</li> <li>• Write nominations</li> <li>• Perform quality review</li> </ul>	High-quality, accurate, and creative presentation of nominees' successes
8 <b>Reconnect with panel of industry experts</b>	Finalize the selection of the best practices Award recipient	<ul style="list-style-type: none"> <li>• Review analysis with panel</li> <li>• Build consensus</li> <li>• Select recipient</li> </ul>	Decision on which company performs best against all best practices criteria
9 <b>Communicate recognition</b>	Inform Award recipient of recognition	<ul style="list-style-type: none"> <li>• Present Award to the CEO</li> <li>• Inspire the organization for continued success</li> <li>• Celebrate the recipient's performance</li> </ul>	Announcement of Award and plan for how recipient can use the Award to enhance the brand
10 <b>Take strategic action</b>	Upon licensing, company is able to share Award news with stakeholders and customers	<ul style="list-style-type: none"> <li>• Coordinate media outreach</li> <li>• Design a marketing plan</li> <li>• Assess Award's role in strategic planning</li> </ul>	Widespread awareness of recipient's Award status among investors, media personnel, and employees

## The Intersection between 360-Degree Research and Best Practices Awards

### Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of the research process. It offers a 360-degree view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often companies make important growth decisions based on a narrow understanding of their environment, resulting in errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry participants and for identifying those performing at best-in-class levels.

### 360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS



### About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, helps clients accelerate growth and achieve best-in-class positions in growth, innovation, and leadership. The company's Growth Partnership Service provides the CEO and the CEO's growth team with disciplined research and best practices models to drive the generation, evaluation, and implementation of powerful growth strategies. Frost & Sullivan leverages nearly 60 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on 6 continents. To join Frost & Sullivan's Growth Partnership, visit <http://www.frost.com>.