

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

FROST & SULLIVAN BEST PRACTICES AWARD

UV-LED POINT OF USE SYSTEMS FOR WATER
PURIFICATION - GLOBAL

New Product Innovation 2019



FROST & SULLIVAN

2019

BEST
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Contents

Background and Company Performance	3
<i>Industry Challenges</i>	3
<i>New Product Attributes and Customer Impact</i>	4
<i>Conclusion</i>	6
Significance of New Product Innovation.....	7
Understanding New Product Innovation.....	7
<i>Key Benchmarking Criteria</i>	8
<i>New Product Attributes</i>	8
<i>Customer Impact</i>	8
Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices	9
The Intersection between 360-Degree Research and Best Practices Awards.....	10
<i>Research Methodology</i>	10
About Frost & Sullivan	10

Background and Company Performance

Industry Challenges

Concerns over water quality, increasing awareness about the benefits of hydration, proliferating smart homes, and sustainability efforts are all rising. The concerns are driving the need for water treatment systems in the global residential, light commercial, and hotel/restaurant/café (HoReCa) space, which Frost & Sullivan projects will develop into a \$30 billion market by 2025.¹ In particular, point-of-use (PoU) systems, which purify water at the point of dispensation rather than at the source, are becoming increasingly popular. PoU contributed about \$5 billion in 2018 to the overall market (the largest contributing system type in terms of revenue). Frost & Sullivan independent analysis reveals that attractive pricing, ease of installation, and portability are the primary drivers for PoU systems implementation. However, the added benefit of sustainability that comes from replacing single-use plastic water bottles—reducing the amount of pollution—also plays a crucial role.

Providers often disagree on which treatment method is the most effective in these systems. Filtration systems degrade with use, and sometimes they allow certain bacteria, viruses, or cysts, to pass through them. Filters also require replacement. Many people will agree that ultraviolet (UV) radiation is the most viable disinfection method for PoU applications, as UV delivers the value of disinfection without using chemicals. However, traditional UV mercury lamps are expensive—they require a lot of energy (high voltage, high power, and warm-up time) and need frequent maintenance (cleaning and lamp replacement).

Legacy UV-lamps also contain mercury, a toxic chemical element, which can spill into the environment when lamps break. Growing concerns over mercury contamination has led to the United Nations Minamata Convention on Mercury, an international treaty designed to protect human health and environment from emissions and releases of mercury and mercury compounds through the entire lifecycle of mercury. These provisions include controls over a myriad of products containing mercury, the manufacture, import and export of which will be altogether prohibited by 2020, except in countries that have filed a temporary exception for an initial 5 year period.

To mitigate the issue, some solution providers are replacing mercury lamps with light-emitting diode (LED) technology in their systems. In contrast to mercury lamps, Frost & Sullivan points out that LEDs are safe, turn on instantly, and (more importantly) are more energy-efficient in comparison to mercury-vapour UV lamps. They are also versatile, compact, durable, and environmentally friendly. As a nascent technology, ultraviolet light-emitting diodes (UV-LEDs) must overcome market challenges related to their reliability and performance and demonstrate benefits over the long-term. Simply replacing a UV-lamp with a UV-LED is not enough to deliver industry certifiable disinfection performance. A key challenge is to design a suitable system to take full advantage of what UV-LEDs can offer. Once they prove that they can contend with the incumbent solutions, Frost & Sullivan

¹ *Global Residential, Light Commercial, and HoReCa Water Hydration Treatment Systems Market, Forecast to 2025* (Frost & Sullivan, January 2019)

analysis concludes that they will quickly gain acceptance as the best solutions in the PoU water disinfection market.

New Product Attributes and Customer Impact

Founded in Vancouver, British Columbia, in 2014, Acuva Technologies Inc. (Acuva) aimed to solve the global need for safe drinking water while creating an incredible business opportunity. Acuva was formed to commercialize UV-LED water disinfection technology developed in partnership with the University of British Columbia. The founders' made it their mission to provide clean drinking water to remote communities and water-stressed areas around the world. The company has since grown to a team of over 25 employees specializing in the design, manufacture and integration of safe, convenient, and environmentally friendly PoU UV-LED water purification systems.

With an Intellectual Property portfolio including 15 granted and pending patents, Acuva's innovative reactor design combines the proven disinfection performance of ultraviolet germicidal irradiation (UVGI) with the efficiency of UV light emitting diodes (LEDs). Acuva's patented design allows for precise control of optics, hydrodynamics and kinetics within the UV chamber to deliver an intense beam of UV directly into flowing water.

Acuva has since developed a suite of products that integrate its patented IntenseBeam™ technology to provide reliable UV-LED water disinfection solutions that offer industry-leading performance certifiable against top industry standards. Many of Acuva's products are certified by the International Association of Plumbing and Mechanical Officials (IAPMO) against two key international standards: NSF/ANSI 55 for Ultraviolet Microbiological Water Treatment Systems and NSF/ANSI 372 for Drinking Water System Components – Lead Content.

Enabling New Applications with NSF-certified Technology

Acuva introduced its first consumer PoU system, the Arrow UV-LED Water Purifier, in 2016, targeting recreational boat, vehicle, and cottage markets in North America with reduced maintenance and lower cost alternatives to other competing solutions. After significant success in the UV-LED water disinfection solution market, the company developed even more compact consumer PoU systems with the introduction of its Eco series of UV-LED Water Purifiers.

In 2018, Acuva released the Eco 1.5 Water Purifier system, the world's first NSF/ANSI 55 Class B certified UV-LED water purification system. The Eco 1.5 uses Acuva's patented IntenseBeam™ technology. The technology sterilizes water-borne pathogens such as bacteria, viruses, and cysts that are able to pass through filters to protect health and safety. The Eco 1.5 is much smaller and more compact than the Arrow system, comfortably fitting into tight spots or beneath sinks. It also has a flow rate of 1.5 litres per minute, and grew in popularity in the recreational Marine and RV markets for its compact size and ability to make access to safe drinking water easy in off-grid applications. A blue light indicates when it is in operation.

Acuva's IntenseBeam™ technology is also featured in the company's Strike UV-LED Module Platform for Original Equipment Manufacturers (OEMs). Strike incorporates a flexible design that is customizable to OEM-specific flow rate and disinfection requirements. This enables

easy integration into a wide range of water, ice and beverage dispensing appliances. Because the Strike Platform is UV-LED agnostic, Acuva can work with any UV-LED manufacturer to offer the best possible disinfection performance to its customers. Strike modules can be configured to various flow rates up to 6 litres per minute and can deliver disinfection rates up to 99.9999% to protect health and safety. Acuva's systems are scalable to support higher flow PoU systems.

Frost & Sullivan notes that Acuva's proven, proprietary water purification systems have several key benefits, providing clean and safe water without harming the environment. They also do not contain mercury or chemicals. They are also manufactured with high-quality stainless steel, offering superior durability while reducing product degradation and maintenance. Product performance is not affected by scaling as Acuva's IntenseBeam™ technology does not rely on reflective surface properties. Their systems also have a self-cleaning feature that activates every 12 hours, ensuring the required maintenance is minimal.

Acuva released its next generation Eco system with added features and a lower price tag to meet customer demand at Aquatech Amsterdam in November 2019. The new version will enable the company to reach a much larger segment of price-sensitive markets requiring access to safe drinking water urgently. Acuva also announced the development of a high flow point-of-entry (PoE) UV-LED water disinfection system. This marks a significant development in the UV-LED technology space that can potentially displace legacy UV-lamps for full home and industrial applications. Set for launch in July 2020, Acuva's PoE UV-LED systems will offer certifiable water disinfection performance at 8 to 20 gallons per minute.

Ensuring Customer Success through Seamless Integration and Support

Acuva backs up its solutions with seamless customer service experiences. The company's customer service process for its OEM customers includes a thorough needs analysis and engineering support for integration, through to marketing support. Before integration, the company guides its customers through its evaluation stage to discuss their budgets, testing and engineering needs. All products have warranties—a one-year warranty for consumer products and customized warranties for Acuva's modular product. Acuva provides instruction manuals with diagrams and information on testing protocols for companies not familiar with regulations. In some cases, clients even send Acuva their technology, and Acuva integrates it with its system and sends it back to them with detailed documentation on how to install the module. Acuva also offers support on the market side. The company provides educational materials that its customers can white-label or repurpose, as well as graphic assets (such as branding and logo materials).

Acquiring Reliable Customer Base through Brand Promotions

In addition to its consumer product side of the business, Acuva has also seen significant growth in business-to-business original equipment manufacturer integrations. Many users already have UV devices that contain mercury lamps, and with mercury lamps being decommissioned in many countries, they need to replace their lamps with LEDs. These users learn about Acuva's technology through trade shows and events or referrals from trade commissioners and existing clients.

Acuva recently participated in the latest Water Quality Association Convention and Exposition in Las Vegas, which clearly increased its visibility with other participants in the water purification industry. At the show, the company performed demonstrations, including a transparent version of its reactors to show how its technology works inside versus non-UV-LED lights. Social media marketing is also delivering extensive popularity to Acuva. The company's social media campaigns influence connection with business-to-business customers to showcase its technology to them. The company also participates in various thought leadership, putting together workshops to explain how its technology works and how clients can benefit from it. As a result, many of Acuva's customers arrive by way of inbound inquiries.

Expanding Abroad to Serve Global Communities' Need for Potable Water

With success in North America, Acuva has set its sights on other parts of the world. The company aims to impact communities that do not have access to potable water. In 2019, the company entered a partnership the largest drinking water fountain and water dispenser manufacturer in the Philippines to install Strike UV-LED water disinfection modules in schools, shopping malls, restaurants, factories, and resorts. With each installation reducing the need for 1.2 million single-use plastic drinking water over its lifetime, this partnership meant a significant win against the war on plastic waste in the region.

Acuva is currently replicating this success in other parts of the world through new partnerships. The company's business development team has grown to include personnel with focus areas in the Asia-Pacific region—specifically Japan, Korea, China, Taiwan—Europe, and Latin America. Even larger partnerships with major manufacturers of residential and commercial water treatment systems have been secured in India, Europe and the Asia Pacific region, strengthening the positive health and environmental impact both Acuva and its growing global customer base can make through improved drinking water treatment, eliminating chemical emissions associated with legacy UV-lamp technologies, and single-use plastic waste reduction.

Conclusion

While ultraviolet light-emitting diode (UV-LED) water purifications provide several key advantages over conventional mercury lamp LEDs, Frost & Sullivan points out that they have yet to gain widespread acceptance.

Acuva Technologies (Acuva)'s innovative optical lensing technology, IntenseBeam™, enables applications and benefits on a whole new level, such as the Eco 1.5 and Strike Module Platform—currently the world's first and only UV-LED water purification systems certified by the International Association of Plumbing and Mechanical Officials (IAPMO) against NSF/ANSI 55 standards. Aside from practical applications in recreational vehicles or boats, the technology also provides access to clean drinking water in water-stressed communities that would otherwise not have it.

With aspirations abroad, Acuva has set a path to bring its technology to the world. As a result of these efforts, Acuva earns the 2019 Frost & Sullivan Global New Product Innovation Award.

Significance of New Product Innovation

Ultimately, growth in any organization depends upon 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 Global New Product Innovation Award, Frost & Sullivan analysts independently evaluated two key factors—New Product Attributes and Customer Impact—according to the criteria identified below.

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 most 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.

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 practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

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



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