



**2014 European Advanced Filtration Technology
Innovation Leadership Award**



FROST & SULLIVAN



50 Years of Growth, Innovation & Leadership

Background and Company Performance

Industry Challenges

Water scarcity and the decreasing number of freshwater sources have led to an increased demand for treatment technologies that enable the reuse of effluents and thus negate the necessity of fresh water for all activities to some extent. Produced water is water that is produced as a byproduct along with oil and gas: water trapped in underground formations that is brought to the surface during oil and gas exploration and production and water which is injected into the formation to help force the oil out of the production wells. Due to the large quantum of water generated, produced water possess enormous potential to be reused as a source of water. Other potential sources of water reclamation are industrial wastewaters.

Membrane technologies of late have been used to a large extent to treat domestic wastewater, industrial effluents, and produced water. One of the drawbacks of membrane technologies is the clogging of membranes, which necessitates chemical treatment. Off-site treatment units require transportation of the effluent or waste liquid to the treatment units, which involves cost and safety procedures.

APATEQ, with its innovative membrane technology, addresses the aforementioned challenges. APATEQ is involved in 4 sectors of wastewater treatment: oil water separation, industrial wastewater treatment, leachate treatment, and compact municipal wastewater treatment. These systems enable customers in the oil and gas industry to achieve treated produced water characteristics of less than 1 ppm of both, free oil and suspended solids. The treated water is suitable for re-injection and, depending on salt concentrations, for direct discharge or irrigation. In case of the salt concentration being too high, a post treatment can be added to bring the water to levels acceptable for direct discharge or irrigation. First, APATEQ's pre-treatment technology removes a majority of the suspended solids from produced water. Then, state-of-the-art membranes are integrated into the system in a way that they do not clog when the pre-treated water flows through. Almost no chemicals or, in some cases, little amounts of chemicals are used and therefore the oil that is recovered through this process is one hundred percent re-usable in refineries. APATEQ also addresses the treatment of leachate through its innovative LeachPaq system, which is a modular unit capable of treating the leachate onsite.

Technology Excellence and Visionary Innovation of APATEQ

Criterion 1: Unmet Needs

Some of the unmet needs of the produced water treatment and industrial effluent treatment technologies domain using membrane technologies are the following:

- Clogging of Membranes: The complex nature of produced water, which has primarily hydrocarbons and high levels of total dissolved solids (TDS) and other suspended solids, causes clogging of membranes.

- High operating cost: Cost of treatment of produced water is generally observed to be very high. The complex nature of produced water necessitates integration of treatment units, which may lead to increased cost if not optimally chosen. Conventional systems also require the use of chemicals and are energy intensive in nature.
- Lack of mobile, on-site treatment equipment: Treatment of leachate generated at the landfill or produced water produced during oil and gas drilling is usually taken offsite, which involves cost and requires safe handling procedures.

The unique treatment system of APATEQ prevents membrane clogging, due to its special anti-clogging and anti-fouling properties. The operating cost of treatment is also relatively low and a single pre-treatment unit is used prior to the membrane treatment. APATEQ's technology for produced water negates the requirement of additional chemicals. The systems are available as stationary plants or mobile, containerized systems.

Criterion 2: Use of Mega Trends

APATEQ's innovative produced water technology is ideally positioned to utilize the advantage of the 3 Mega Trends "Innovating to Zero," "Smart is the New Green," and "Future Infrastructure Development."

"Innovating to Zero" refers to a futuristic zero concept world, which corresponds to a sustainable way of living such as zero emissions, zero pollutants, and zero accidents.

The innovative technology of APATEQ achieves less than 1 ppm of free hydrocarbons and suspended solids, and this water can be easily reused directly for reinjection or with further treatment steps, in industrial processes or for agricultural use. APATEQ's "PrePaq" used for primary treatment of industrial effluent separates up to 99% of suspended solids from various industrial wastewaters and thus is poised towards achieving less than 1 ppm suspended solids.

"Smart is the New Green" refers to the use of intelligent products in the system that provide feedback to the system and hence help improve the efficiency of the system and its adaptability. APATEQ's integrated system uses a graphic user interface, which helps system automation and also enables monitoring and control of the system remotely.

The "Future Infrastructure Development" Mega Trend represents the futuristic trend of infrastructure growth. The technology by APATEQ definitely has the potential to be part of the future infrastructure for water treatment, as the mobile treatment units will be a fixture in the future where space would be a constraint.

Criterion 3: Pioneering Best Practices

APATEQ'S proprietary pre-treatment and ultrafiltration technology removes even emulsified oil without the need of additional chemicals and the recovered oil could be entirely used in refineries. In addition, APATEQ's integrated system has smaller plant dimensions and lower capital and operating costs.

Criterion 4: Blue Ocean Strategy

The operating cost of the treatment technology is found to be much lower than the various conventional options for produced water. The operational cost for treatment of the produced water with APATEQ's systems is around \$0.50 to \$1.50 per barrel, which is approximately one-eighth of conventional oil water separation systems. It also enables onsite treatment, thus avoiding storage and transportation costs. Earlier treatment strategies would require transportation of produced water to far-off locations for treatment.

For a flowrate of 250 m³/d, the power consumption is around 40 kWh. As the flowrate increases, the power consumption to flowrate ratio is seen to decrease. Almost no chemical or little amounts of chemicals are used. One hundred percent oil recovery is possible from the process.

The technology is able to effectively handle the fluctuations in the characteristics and qualities of the produced water. This is a significant achievement of the technology that is possible due to a fine balance of the parameters.

Criterion 5: Application Diversity

APATEQ's membrane technology with anti-clogging properties can be used in many diverse applications. In general, the use of membrane technologies is limited especially in the oil and gas industry, due to its clogging tendencies, because oil often tends to cover and clog the membranes pores. Usually membranes are frequently cleaned and backwashed and chemicals are added to facilitate unclogging. Due to APATEQ's special know-how integrated into the process technology, their membrane systems run many months before they need to be cleaned.

APATEQ's systems are compact, mobile systems that can be used in any location. They thus serve as an ideal solution for produced water treatment in oil and gas production and exploration and also for leachate treatment. This is because space would be a limitation in the case of offshore oil and gas platforms or landfill sites.

Criterion 6: Aspirational Ideals

APATEQ aspires to be a comprehensive provider of water and wastewater treatment solutions. The company strives to provide customers maximum efficiency by offering simple treatment and low investments.

APATEQ collaborates with the Luxembourgish Agency for Innovation and Research "Luxinnovation," the Luxembourgish Public Research Center Henri Tudor, and the University of Luxembourg. It envisages continually improving its processes, broadening the scope of its applications, and at the same time specializing in the existing domains.

APATEQ also provides tailor-made solutions as per clients' requirements. APATEQ currently addresses the European, US, and Canadian markets. It also plans to expand to the Middle East and South America and after that to Asia.

Conclusion

APATEQ is looking to predominantly expand its operation in the domain of produced water, industrial effluent treatment, and leachate treatment. Its pioneering integrated membrane system has great potential to make a breakthrough in a market that is presently dominated by technologies largely dependent on chemical usage or enormous energy usage. The ease of operation of APATEQ's treatment units and its low operating costs are also an added advantage. After analyzing the mentioned factors, Luxembourg-based APATEQ is a deserving award recipient for advanced filtration technology.

Significance of Technology Innovation Leadership

Ultimately, growth in any organization depends upon finding new ways to excite the market, and upon maintaining a long-term commitment to innovation. At its core, Technology Innovation Leadership is therefore about three key things: understanding demand, nurturing the brand, differentiating from the competition. This three-fold approach to delivering Technology Innovation Leadership is explored further below.



Frost & Sullivan's Global Research Platform

Frost & Sullivan maintains more than 50 years in business and is a global research organization of 1,800 analysts and consultants who monitor more than 300 industries and 250,000 companies. The Company's research philosophy originates with the CEO's 360 Degree Perspective, a holistic research methodology that encourages us to consider growth challenges, and the solutions companies employ to solve them, from every angle. This unique approach enables us to determine how best-in-class companies worldwide manage growth, innovation and leadership. Based on the results of our research in technology innovation leadership, Frost & Sullivan is proud to present the 2014 European Technology Innovation Leadership Award in advanced filtrations to APATEQ.

Key Benchmarking Criteria

For the Technology Innovation Leadership Award, we evaluated the total client experience and strategy implementation excellence according to the criteria detailed below.

Technology Excellence

- Criterion 1: Commitment to Innovation
- Criterion 2: Commitment to Creativity
- Criterion 3: Stage Gate Efficiency
- Criterion 4: Commercialization Success
- Criterion 5: Application Diversity

Visionary Innovation

- Criterion 1: Unmet Needs
- Criterion 2: Use of Mega Trends
- Criterion 3: Pioneering Best Practices
- Criterion 4: Blue Ocean Strategy
- Criterion 5: Aspirational Ideals

The Intersection between 360-Degree Research and Best Practices Awards

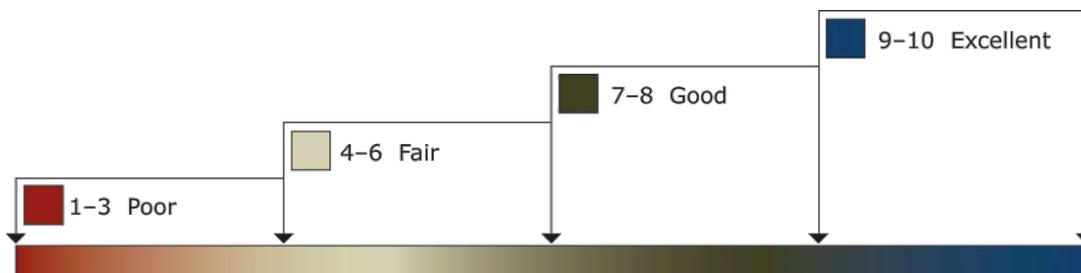
Research Methodology

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 players and for identifying those performing at best-in-class levels.

360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS

Decision Support Scorecard and Matrix

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Scorecard and Matrix. This analytical tool compares companies’ performance relative to each other. It features criteria unique to each award category and ranks importance by assigning weights to each criterion. The relative weighting reflects current market conditions and illustrates the associated importance of each criterion according to Frost & Sullivan. This tool allows our research and consulting teams to objectively analyze performance, according to each criterion, 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.



Best Practice Award Analysis for APATEQ

The Decision Support Scorecard, shown below, includes all performance criteria listed on page 7 and illustrates the relative importance of each criterion and the ratings for each company under evaluation for the Technology Innovation Leadership Award. The research team confirms the veracity of the model by ensuring 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.

Finally, to remain unbiased and to protect the interests of all organizations reviewed, we have chosen to refer to the other key players in as Company 2 and Company 3.

DECISION SUPPORT SCORECARD FOR TECHNOLOGY INNOVATION LEADERSHIP AWARD (ILLUSTRATIVE): TECHNOLOGY EXCELLENCE

Measurement of 1-10 (1 = poor; 10 = excellent)	Award Criteria					Weighted Rating
	Commitment to Innovation	Commitment to Creativity	Stage Gate Efficiency	Commercialization Success	Application Diversity	
Technology Excellence						
Relative Weight (%)	20%	20%	20%	20%	20%	100%
APATEQ	9	9	9	9	9.5	9.1
Company 2	8	8	9	9	8	8.4
Company 3	8	9	8	9	7	8.2

Criterion 1: Commitment to Innovation

Requirement: Conscious, ongoing development of an organization culture that supports the pursuit of groundbreaking ideas

Criterion 2: Commitment to Creativity

Requirement: Employees known for pushing the limits of form and function, and who are unafraid to pursue “white space” innovation

Criterion 3: Stage Gate Efficiency

Requirement: A process that moves creative, groundbreaking concepts quickly and profitably from early-stage investments to late-stage prototyping

Criterion 4: Commercialization Success

Requirement: A proven track record of taking new technologies to market with a high rate of success

Criterion 5: Application Diversity

Requirement: The development of technologies that serve multiple purposes and can be embraced by multiple user types

DECISION SUPPORT SCORECARD FOR TECHNOLOGY INNOVATION LEADERSHIP AWARD (ILLUSTRATIVE): VISIONARY INNOVATION

Measurement of 1-10 (1 = poor; 10 = excellent)	Award Criteria					Weighted Rating
	Unmet Needs	Use of Mega Trends	Pioneering Best Practices	Blue Ocean Strategy	Aspirational Ideals	
Visionary Innovation						
Relative Weight (%)	20%	20%	20%	20%	20%	100%
APATEQ	9.5	9.5	9	9	9.5	9.3
Company 2	9	8	7	7	8	7.8
Company 3	8	8.5	8	8	7	7.9

Criterion 1: Unmet Needs

Requirement: A clear understanding of customers’ desired outcomes, the products that currently help them achieve those outcomes, and where key gaps may exist

Criterion 2: Use of Mega Trends

Requirement: Ability to incorporate long-range, macro-level scenarios into strategic plans, thereby anticipating and preparing for multiple futures that could occur

Criterion 3: Pioneering Best Practices

Requirement: A nothing-ventured-nothing-gained approach to strategy implementation that results in processes, tools, or activities that generate a consistent and repeatable level of success.

Criterion 4: Blue Ocean Strategy

Requirement: Proven track record of creating new demand in an uncontested market space, rendering the competition obsolete

Criterion 5: Aspirational Ideals

Requirement: A willingness to look beyond the simple goal of generating a profit to embrace a more powerful ideal of bringing greater value to customers or the planet

Impact of Technology Innovation Leadership Award on Key Stakeholders

The Technology Innovation Leadership Award recognizes APATEQ's accomplishments in the advanced filtration sector. Unbiased, third-party recognition can help enhance credibility and brand value, thereby supporting APATEQ's standing in the market. By researching, ranking, and recognizing those who define excellence in their respective endeavors, Frost & Sullivan hopes to inspire and influence the following three constituencies:

Investors

Investors and shareholders always welcome impartial third-party recognition. Similarly, prospective investors and shareholders are drawn to companies with a well-established reputation for excellence. Unbiased validation is a highly credible way to showcase an organization worthy of investment.

Customers

Third-party validation can help assure prospective customers of a company's value and reputation. It can also help lower the level of risk that a customer may feel in engaging for the first time with an organization.

Employees

This Award represents the creativity and dedication of APATEQ's executive team and employees. Such public recognition can boost morale and inspire your team to continue its pursuit of excellence in technology innovation leadership for APATEQ.

BEST PRACTICES LEVERAGE FOR
GROWTH ACCELERATION

About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to 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 practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages almost 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from 31 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.

Disclaimer

Quantitative market information is based primarily on interviews and therefore is subject to fluctuation. Frost & Sullivan is not responsible for incorrect information supplied to us by manufacturers or users. Our research services are limited publications containing valuable market information provided to a select group of customers. Our customers acknowledge, when ordering, subscribing or downloading, that Frost & Sullivan research services are for customers' internal use and not for general publication or disclosure to third parties.

No part of this research service may be given, lent, resold, or disclosed to noncustomers without written permission. Furthermore, no part may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the permission of the publisher.

For information regarding permission, write to:

Best Practices Group

Frost & Sullivan

7550 IH 10 West, Suite 400

San Antonio, TX 78229-5616 USA