FROST & SULLIVAN

CLEARFORD
WATER SYSTEMS INC.

2017 Global Decentralized Water & Wastewater Treatment Enabling Technology Leadership Award

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Background and Company Performance

Industry Challenges

Decentralized packaged/containerized water and wastewater treatment systems have disrupted the water treatment industry by providing a sustainable and economical alternative to conventional centralized treatment systems.

The cost effectiveness of decentralized systems comes from lesser piping network, a reduced footprint, improved treatment efficiency, lower energy requirements, lower capital expenditure (CAPEX), and lower operating expenditure (OPEX).

The key challenge of the decentralized treatment system is the efficiency, which impacts its overall performance. Most decentralized technologies explicitly focus on the efficiency of secondary/biological treatment systems for a quality effluent. The primary treatment is even now mostly conventional. The efficiency of the primary treatment systems directly impacts the overall efficiency of the entire treatment system.

Clearford Water Systems Inc. has developed a complete wastewater system called Clearford One™, which centers on the highly efficient primary treatment unit called ClearDigest™ that reduces and digests more than 75% of the suspended solids and 65% of the biological oxygen demand (BOD) without the use of electricity or chemical additives. This process substantially reduces the size (diameter) of the conveyance piping and requires a much smaller final treatment system. ClearDigest has proved to be a disruptive primary treatment technology in the fast-growing decentralized water and wastewater treatment industry. The Clearford One treatment system was developed to complement the impact of the improved efficiency of the ClearDigest.

Technology Leverage and Customer Impact

Commitment to Innovation

While most companies focus their attention on only improving the efficiency of the final/end treatment systems, Clearford focuses on optimizing the entire wastewater cycle including collection and treatment. By incorporating onsite primary treatment in decentralized ClearDigest units, the efficiency and cost effectiveness of the entire wastewater system is greatly improved.

The Clearford One system was developed from the advancement of ClearDigest. The optimization of decentralized collection and treatment substantially reduces the cost of the entire wastewater treatment cycle by more than 50% and has lower energy, operation, and maintenance requirements.

The Clearford One treatment system constitutes the following:

ClearDigest

This patented smart digester is a primary treatment unit with a proprietary inlet device that helps in the uniform mixing of the sewage as it enters the digester. The smart digester retains the biosolids and anaerobically digests the solids, reducing suspended solids by 75% and removing 65% of the BOD. The patented outflow device releases

wastewater to the conveyance system and modulates the flow during peak hours. Additionally, ClearDigest requires minimal maintenance as the biosolids are efficiently digested, and the digester tanks require pumping only after 7 to 10 years.

ClearConvey™

The effluent from the ClearDigest smart digester requires conveyance pipes of a smaller bore size (diameter) because the liquid effluent is free of solids and the peak flow is modulated from ClearDigest. Cost-effective high-density polyethylene (HDPE) pipes can be laid on variable slopes and require substantially less gradient for conveyance by gravity. The pipe network can easily be inspected by camera or accessed for maintenance through small system access points instead of large manholes. ClearConvey eliminates the need for expensive pumping systems to move wastewater across hilly terrain as the effluent is free of solids and requires only small capacity pumps that can handle liquid effluents, not sewage solids. The ClearConvey system has the added benefits of low energy requirements as well as lower CAPEX and OPEX.

ClearRecover™

The final treatment stage, called ClearRecover, is an optimized treatment plant meeting the project specifications. This can take the form of a membrane bioreactor (MBR) for developed markets such as Canada, or a low cost constructed wetland for developing economies in Asia. The MBR plant is more than 2 times smaller than conventional MBR systems and uses state-of-the-art membrane technology to ensure high treatment efficiency in a compact space, with lower chemical and maintenance requirements than conventional treatment systems. The treated effluent is further polished with Clearford's subsidiary company's (UV Pure Technologies Inc.) Crossfire Technology®, after which it is suitable for discharge to the environment or for reuse for non-potable purposes, such as irrigation and flushing.

Stage Gate Efficiency

Clearford One was first launched in 2014, and by 2016, it was installed at Fetherston Park near Kemptville, Ontario. Fetherston Park's 80 residents were served eviction notices after the Park owner failed to comply with regulations for sewage treatment and discharge. The key challenges included an immediate requirement for a decentralized communal wastewater treatment system that would replace the deteriorating septic systems and comply with Ontario's regulatory standards, and the funding needed to install the wastewater treatment system as the community was unable to raise the necessary funding.

Clearford provided a solution for both these challenges. ClearDigest primary treatment units were installed for every household and connected to a ClearRecover—MBR plant (30m^3/day) through a gravity ClearConvey sewer network. Clearford's design-build-operate-finance (DBOF) scheme provided the required funding for the project.

"The Clearford One decentralized communal wastewater collection and treatment system delivers a complete servicing solution. The system's packaged approach provides flexibility when retrofitting existing sites and allows for easy expansion as developments grow. Clearford One was an affordable solution presented for this project and literally saved Fetherston Park," says Karen Dunlop, Director of Public Works at the Municipality of North Grenville.

Clearford proposed a pay-for-performance model, which completely removed the financial risk of the project from the municipality and the community. Based on the 30-year service agreement, the Fetherston Park community now pays a monthly user fee, and the municipality monitors the performance. Additionally, the Clearford One treatment system successfully meets the Ontario regulator's discharge standards, which include strict limits for nutrients to protect the receiving watercourse. Clearford's cost-effective and highly efficient solution has proved to be a powerful model, which can be replicated in similar communities across Ontario, Canada.

Commercialization Success

The ClearDigest (smart digester), along with the ClearConvey (small bore sewer pipe—SBS®), was first installed in 170 households in Wardsville, Ontario; 90 households in White Tail Ridge, Ontario; 164 units in Loon Lake Resort; and in the Cramahe Industrial Park.

Since the launch of Clearford One in 2014, Clearford has successfully installed and commissioned 3 Clearford One projects: 41 households in Fetherston Park, Ontario; 53

households in Jambudiyapura, Gujarat; and 115 households in Bogotá, Colombia. Additionally, Clearford has commenced the phase 2 construction of Clearford One for the Colombian project.

The Key challenge for Clearford is to convey the benefits of the Clearford One over conventional systems. Clearford has slowly disrupted the entire procurement process for wastewater treatment systems. In most cases, the procurement for design of collection and treatment systems is conducted separately and installed by the respective bidder/solution provider.

Through its Clearford One, Clearford has provided a one-stop solution for the entire wastewater treatment cycle, and its unique business model (pay-for-performance financing scheme) has made the company a reliable and cost-effective solution provider.

Price/Performance Value

The ClearDigest onsite primary treatment system is the core of the Clearford One treatment system. Because of the substantial reduction of biosolids through anaerobic digestion, only the liquid effluent needs to be conveyed and treated through ClearConvey and ClearRecover, respectively.

The small bore sewer (SBS)—HDPE pipes reduce the cost of wastewater conveyance. The final treatment plant connected to the Clearford One system is 2 times smaller than conventional systems, and requires 25% less energy and uses 50% fewer chemicals. Compared to its competitors, Clearford stands out as a unique, cost-effective solution provider in which the impact and efficiency of the ClearDigest positively affects the cost effectiveness of the entire treatment system.

Overall, Clearford's CAPEX is 50% lower than the conventional CAPEX and 50% lower than the conventional OPEX.

Customer Purchase Experience

Clearford signed a contract with India's Infrastructure Leasing & Financial Services Limited (IL&FS) in 2015 to implement the Clearford One in Jambudiyapura, Gujarat. The project was funded by Gujarat Road & Infrastructure Company Limited (GRICL), a subsidiary of IL&FS. The project enabled Clearford to showcase the cost-effective and economic advantages of Clearford One featuring the ClearDigest onsite treatment unit.

Clearford was chosen over competing solutions for its cost-effective smart digester, ClearDigest, which has minimal maintenance and helps in recovering the wastewater that could be reused for non-potable purposes. Because of the community's limited water availability, the Clearford One solution was technologically superior to other collection and treatment system alternatives.

"The construction is very neat and clean, very easy to operate. I am proud to be a part of this Clearford and GRICL project," says Aruna Jain, Social Researcher for the Jambudiyapura project.

Jambudiyapura was declared the first village in Gujarat to be open defecation free, leading to IL&FS funding another project, which is in the final stages of negotiation in Jharkhand, India.

Brand Equity

Through the Fetherston Park community project, Clearford established itself as a disruptive, cost-effective, and highly reliable brand in the industry. By installing the Clearford One treatment system, Clearford showcased its solution's cost effectiveness. Additionally, the company's unique DBOF scheme and pay-for-performance business model removed the financial burden of CAPEX and OPEX from the customer, and the solution met the municipality and regulator's required performance and discharge standards.

Clearford's future strategy for growth and market expansion is through acquisitions. For example, the company is set to acquire a treatment plant design and manufacturing company and two water system operating companies. Through these acquisitions,

Clearford is strengthening its ability to provide customized solutions that can cater to any end-user needs.

Additionally, Clearford is focusing on enhancing its capabilities in the operation and maintenance segment by leveraging its unique pay-for-performance business model, which would enhance its capabilities as a market leader in providing disruptive, cost-effective solutions for the decentralized wastewater treatment market.

Conclusion

The high price sensitivity and demand for sustainable and cost-effective solutions are moving the decentralized water and wastewater treatment industry towards innovative solutions that focus on low CAPEX and OPEX treatment systems.

With its cost-effective and highly efficient Clearford One treatment system, Clearford has taken the lead as a disruptor in the market. Through its innovative business model, Clearford enables customers to pay based on performance, thus increasing the solution's reliability. Additionally, Clearford has expanded its footprint by establishing a regional office in India.

With its disruptive solution, unique business model, and growing footprint, Clearford has earned Frost & Sullivan's 2017 Enabling Technology Leadership Award.

Significance of Enabling Technology Leadership

Ultimately, growth in any organization depends upon customers purchasing from a company and then making the decision to return time and again. In a sense, then, everything is truly about the customer—and making those customers happy is the cornerstone of any long-term successful growth strategy. To achieve these goals through enabling technology leadership, an organization must be best-in-class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.

Understanding Enabling Technology Leadership

Product quality (driven by innovative technology) is the foundation of delivering customer value. When complemented by an equally rigorous focus on the customer, companies can begin to differentiate themselves from the competition. From awareness, to consideration, to purchase, to follow-up support, best-practice organizations deliver a unique and enjoyable experience that gives customers confidence in the company, its products, and its integrity.

Key Benchmarking Criteria

For the Enabling Technology Leadership Award, Frost & Sullivan analysts independently evaluated two key factors—Technology Leverage and Customer Impact—according to the criteria identified below.

Technology Leverage

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

Customer Impact

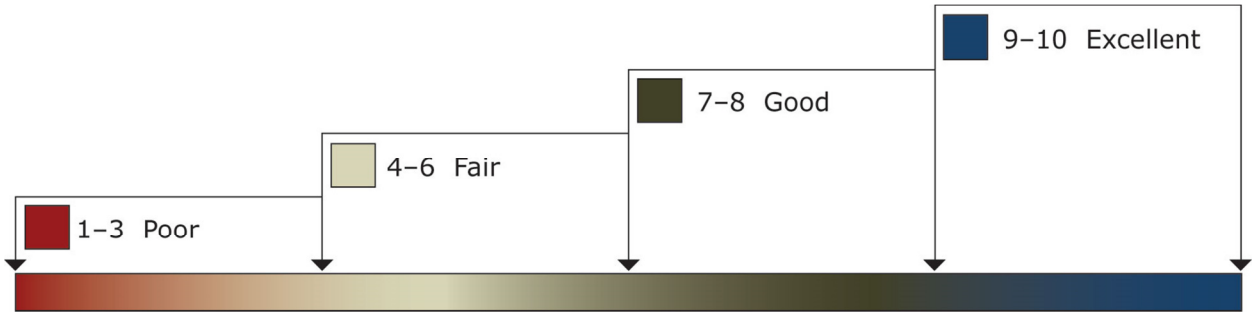
Criterion 1: Price/Performance Value
Criterion 2: Customer Purchase Experience
Criterion 3: Customer Ownership Experience
Criterion 4: Customer Service Experience
Criterion 5: Brand Equity

Best Practices Award Analysis for CLEARFORD WATER SYSTEMS INC.

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 our 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 is organized by Technology Leverage and Customer Impact (i.e., These are 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, we have chosen to refer to the other key participants as Competitor 2 and Competitor 3.

Measurement of 1–10 (1 = poor; 10 = excellent)			
Enabling Technology Leadership	Technology Leverage	Customer Impact	**Average Rating**
Clearford Water Systems Inc.	**9**	**9**	**9**
Competitor 1	7	7	7
Competitor 2	6	6	6

Technology Leverage

Criterion 1: Commitment to Innovation

Requirement: Conscious, ongoing adoption of emerging technologies that enables new product development and enhances product performance

Criterion 2: Commitment to Creativity

Requirement: Technology leveraged to push the limits of form and function in the pursuit of "white space" innovation

Criterion 3: Stage Gate Efficiency

Requirement: Adoption of technology to enhance the stage gate process for launching new products and solutions

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 and/or integration of technologies that serve multiple applications and can be embraced in multiple environments

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

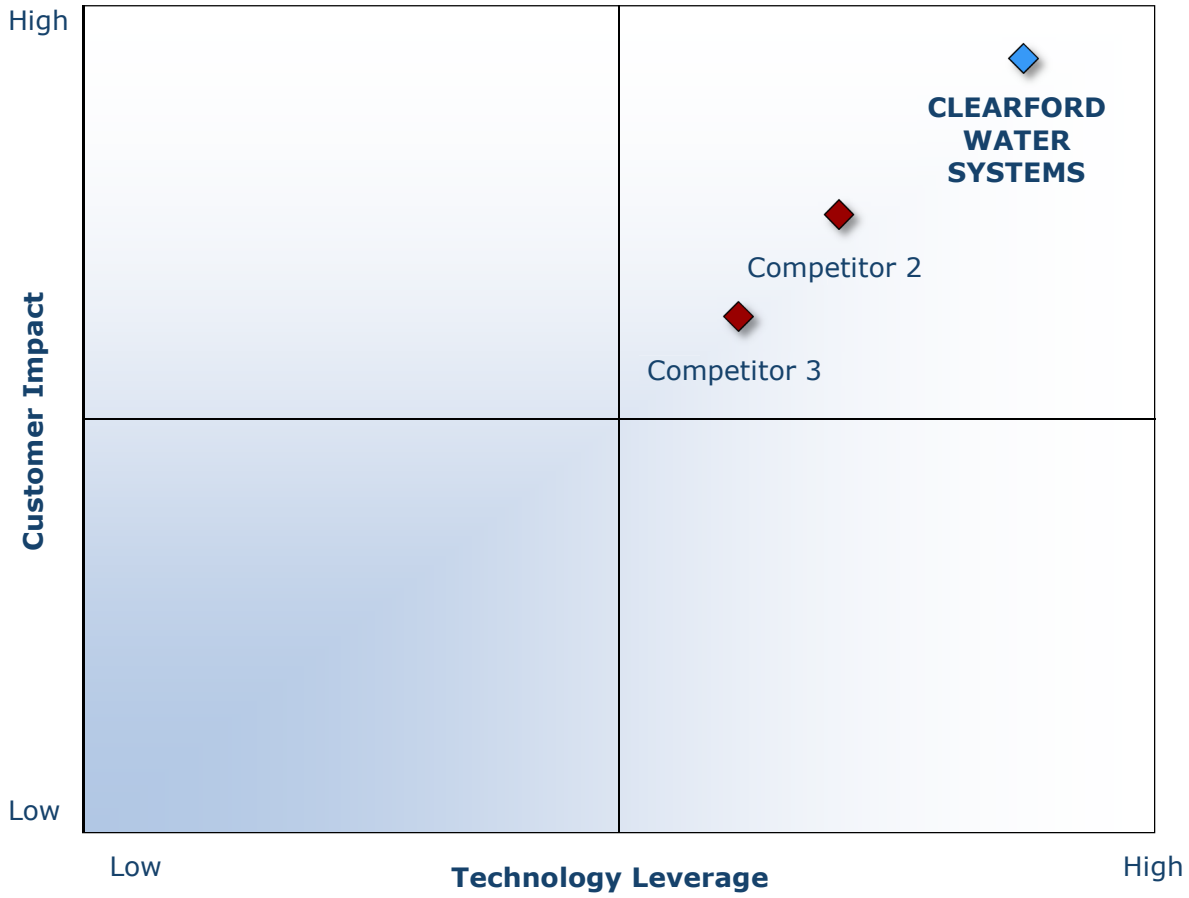
Requirement: Customer service is accessible, fast, stress-free, and of high quality.

Criterion 5: Brand Equity

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

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 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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	• 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

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 more than 50 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on six continents. To join our Growth Partnership, please visit http://www.frost.com.