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FROST & SULLIVAN BEST PRACTICES AWARD

SLUDGE TREATMENT - NORTH AMERICA

Product Leadership 2019

centrisys cnp

FROST & SULLIVAN
2019 BEST PRACTICES AWARD

Contents

Background and Company Performance

Industry Challenges

Anaerobic digestion is a key strategic addition to the sludge treatment process at wastewater utilities across North America. The process helps lower energy consumption in sludge treatment and reduces its volume, and the process produces usable and odorless biogas and solid material that can be used in fertilizers. Frost & Sullivan observes how because of these attractive features, investment in anaerobic digestion has grown in North America. However, anaerobic digestion still faces distinct challenges in performance and output that require further enhancements to ensure optimal processing. These challenges include the need for more efficient processing, to increase solids' quantity and quality, and the need for more capacity as sludge treatment volumes grow — all while limiting added complexity to the process. Frost & Sullivan feels that properly addressing these challenges will further help sludge treatment facilities improve their effectiveness in deriving value from waste and promoting a more sustainable future.

Anaerobic digestion is an effective and beneficial process that transforms waste into valuable products, such as biogas, fertilizers, and nutrients. However, commitment to this process faces challenges as populations grow and capacity begins to run low. This is a typical bottleneck of all wastewater and sludge treatment facilities. Capital investments can only be planned with so much foresight, and resistance to new, large capital improvements is often strong. Due to this, operators look to strategies that allow them to do more with less or with what they already have.

There are fundamental factors that determine the capacity of anaerobic digesters. This includes volatile solids loading rate, energy loading rate, hydraulic detention time, and solids residence time. To start delivering more with the same anaerobic digesters, innovators need to find newer technologies or operational measures that influence these factors in a manner that will further reduce the volumes going into the anaerobic digesters. Delivering innovation that positively influences these factors will help limit the requirement of new capital programs - while also delivering additional capacity.

Frost & Sullivan notes that what can undermine positive innovation, however, is the insertion of added complexity to sludge treatment operations and additional potential points of human error in operations. Additional training is often required, and sometimes even additional personnel are needed to operate new systems. The added complexity of introducing emerging technology and the additional costs of requiring dedicated staff is a significant hurdle to innovation in the conservative wastewater and sludge treatment industry.

Frost & Sullivan believes that industry leaders need to take up the challenge of producing innovation exactly where customers need it - and must do so in a way that the barriers to adoption of new technology are not prohibitively high. Centrisys/CNP is one such company

actively doing this. Centrisys Corporation was founded in the USA as a centrifuge service and repair company for decanter centrifuges used in sludge treatment in 1987, Centrisys worked closely with customers and their process equipment to intimately understand challenges and then innovated to alleviate those pain points through the development of its own sludge dewatering and thickening equipment and solutions.

In 2014 Centrisys established its CNP division to capitalize on its equipment and to expand on what they believed are best in class biosolids processes. It's thru the company's proficiency with both equipment and processes that Centrisy/CNP can more quickly bring working innovation to the market. One such technology, PONDUS, brings thermochemical hydrolysis process (TCHP) technology from Germany to the North American market. PONDUS TCHP is an alkaline process that optimizes sludge treatment for plants of all sizes. -This affordable treatment uses low grade heat (160F to 180F) to increase biogas production, reduce the viscosity of thickened WAS, reduce anaerobic digestion volume and improve biosolids dewatering avoiding the complexities and capital expense of other similar solutions that use the thermal hydrolysis process (THP).

Product Family Attributes and Business Impact

Match to Needs through Improved Design

THP offered by other competitors uses steam to help raise temperatures and break down cell structures to improve digester performance. The use of high-temperature steam, however, increases safety concerns, requiring a specialized steam operator. Additionally, the steam raises the temperature of the sludge during THP - so that heat exchangers are needed to cool the material before it can proceed into anaerobic digestion. Both operator and steam exchangers raise operations and energy costs in THP.

Centrisys/CNP, through its licensing agreement to distribute PONDUS TCHP in North America, offers the market a steam-free process alternative. TCHP replaces steam with safe caustic soda, and the simplified system uses only a heat efficiency exchanger, progressive cavity pumps, and a reactor with no moving parts. Through a chemical reaction, the caustic soda works to break down cell membranes in the sludge in the same manner as steam. As a result, PONDUS TCHP improves operational simplicity over THP, avoids further personnel training, and reduces process carbon footprint.

Product/Service Value

Central to Centrisys/CNP's PONDUS TCHP is the ability to overcome the concerns of traditional THP, while delivering the same core benefits to the anaerobic digestion process. TCHP offers reduces solids volumes, which increases availability of digester capacity, and greater quality in outputs in biogas and solids. Biogas can be captured and turned into heat, while the solid cake can be turned into fertilizer, soil amendments, or nutrients. TCHP enables wastewater and sludge treatment facilities to pursue a more sustainable

future through a waste-to-value strategy that promotes a triple bottom line opportunity: economic and profitable opportunity, while improving environmental care and offering communities a better future. Centrisys/CNP's PONDUS TCHP is an important component to the shift sludge treatment facilities' need to be a crucial part of the global shift towards a more sustainable, less negatively impactful future.

Growth Potential

PONDUS TCHP originated in Germany and currently is used in 6 installations in Europe and 1 in China. Centrisys/CNP introduced TCHP in North America through an agreement with the sludge processing facility in Kenosha, Wisconsin in 2015. The TCHP process was integrated into the existing facility and up and running within 15 months, and has been faster than other installations of conventional THP in North America. The Kenosha facility, which serves a regional population of 100,000, is capable of handling 26.8 million gallons of wastewater per day. Importantly, an installation of this size provides a practical case study for many other facilities of this size in North America. Conventional THP installations in the region often find themselves in large treatment facilities. In an industry where operators constantly demand close possible comparisons to their own facilities in references lists, PONDUS TCHP has gained a foothold in the market where there are a large number of similarly sized treatment plants (as opposed to other competitors).

Human Capital

The importance of human capital is central to the story of Centrisys/CNP and to the story of PONDUS TCHP. As described earlier, the story of Centrisys/CNP is that of people working closely with wastewater treatment facilities to improve operations and maintenance of existing equipment. Those individuals gained great insights from equipment and clients to innovate and improve on the status quo. The process allowed the Centrisys/CNP team to see the value of future advancements and gave the organization the impetus to deliver that innovation.

In similar fashion, Centrisys/CNP has partnered with German innovator, Dr. Andreas Dünnebeil. Dr. Dünnebeil has spent his career researching and innovating in sludge treatment. His focus on value and need in the industry resulted in the creation of PONDUS TCHP. Frost & Sullivan appreciates how the confluence of values of the individuals behind Centrisys/CNP and PONDUS TCHP brought about a natural partnership and the introduction of TCHP in the North American market.

Operational Efficiency

Key to substantiating the benefits of Centrisys/CNP's PONDUS TCHP are the core improvements that can be attained through implementation. The process can reduce the viscosity of thickened sludge up to 80%. This is quite critical, as it helps pass on up to 50% reductions in volume for anaerobic digesters, freeing up capacity for additional

handling. The produced sludge in the digesters is improved and can offer up to 30% more biogas generation, increasing value resource recovery. Furthermore, biosolid dewatering can see improvements up to 5% in processing, and polymer consumption can be reduced up to 20%. In addition, the process helps reduce foul odors in the facility and reduces foaming in anaerobic digestion.

Conclusion

Frost & Sullivan ongoing analysis concludes that Centrisys/CNP offers the North American sludge treatment industry not just needed benefits to accelerate the sustainability of anaerobic digestion, but also important improvements on the THP process. Centrisys/CNP PONDUS TCHP delivers safety, simplicity, and reduced costs for customers. Frost & Sullivan points out that these are all core components to a value proposition that customers in a conservative market demand.

With its strong overall performance, Centrisys/CNP has earned the 2019 Frost & Sullivan Product Leadership Award.

Significance of Product Leadership

Ultimately, growth in any organization depends upon customers purchasing from a company and then making the decision to return time and again. A comprehensive product line, filled with high-quality, value-driven options, is the key to building an engaged customer base. To achieve and maintain product excellence, an organization must strive to be best-in-class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.

Understanding Product Leadership

Demand forecasting, branding, and differentiating all play a critical role in finding growth opportunities for a leading product line. This three-fold focus, however, must be complemented by an equally rigorous focus on pursuing those opportunities to a best-in-class standard. Customer communications, customer feedback, pricing, and competitor actions must all be managed and monitored for ongoing success. If an organization can successfully parlay product excellence into positive business impact, increased market share will inevitably follow over time.

Key Benchmarking Criteria

For the Product Leadership Award, Frost & Sullivan analysts independently evaluated two key factors—Product Family Attributes and Business Impact—according to the criteria identified below.

Product Family Attributes

Criterion 1: Match to Needs
Criterion 2: Reliability and Quality
Criterion 3: Product/Service Value
Criterion 4: Positioning
Criterion 5: Design

Business Impact

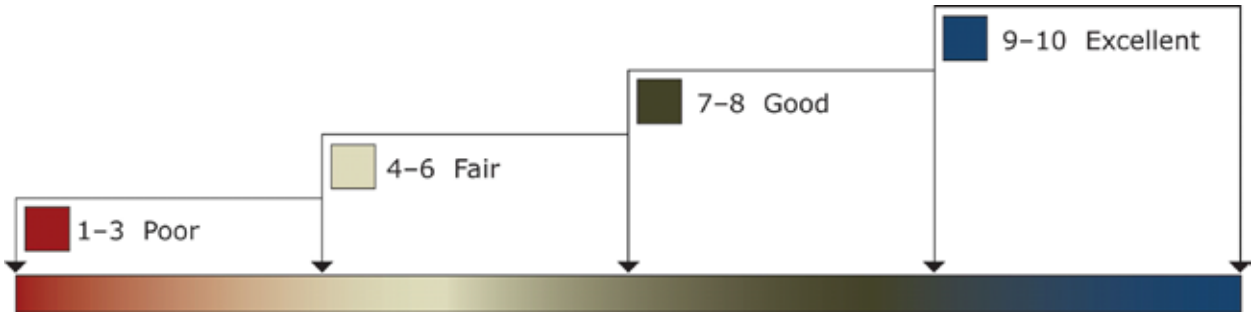
Criterion 1: Financial Performance
Criterion 2: Customer Acquisition
Criterion 3: Operational Efficiency
Criterion 4: Growth Potential
Criterion 5: Human Capital

Best Practices Award Analysis for Centrisys/CNP

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 Product Family Attributes and Business 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)			
Product Leadership	Product Family Attributes	Business Impact	**Average Rating**
Centrisys/CNP	**10.0**	**10.0**	**10.0**
Competitor 2	8.0	9.0	8.5
Competitor 3	7.0	7.0	7.0

Product Family Attributes

Criterion 1: Match to Needs

Requirement: Customer needs directly influence and inspire the design and positioning of the product family.

Criterion 2: Reliability and Quality

Requirement: Products consistently meet or exceed customer expectations for performance and length of service.

Criterion 3: Product/Service Value

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

Criterion 4: Positioning

Requirement: Products or services address unique, unmet need that competitors cannot easily replicate or replace.

Criterion 5: Design

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

Business Impact

Criterion 1: Financial Performance

Requirement: Overall financial performance is strong in terms of revenues, revenue growth, operating margin, and other key financial metrics.

Criterion 2: Customer Acquisition

Requirement: Product strength enables acquisition of new customers, even as it enhances retention of current customers.

Criterion 3: Operational Efficiency

Requirement: Staff is able to perform assigned tasks productively, quickly, and to a high quality standard.

Criterion 4: Growth Potential

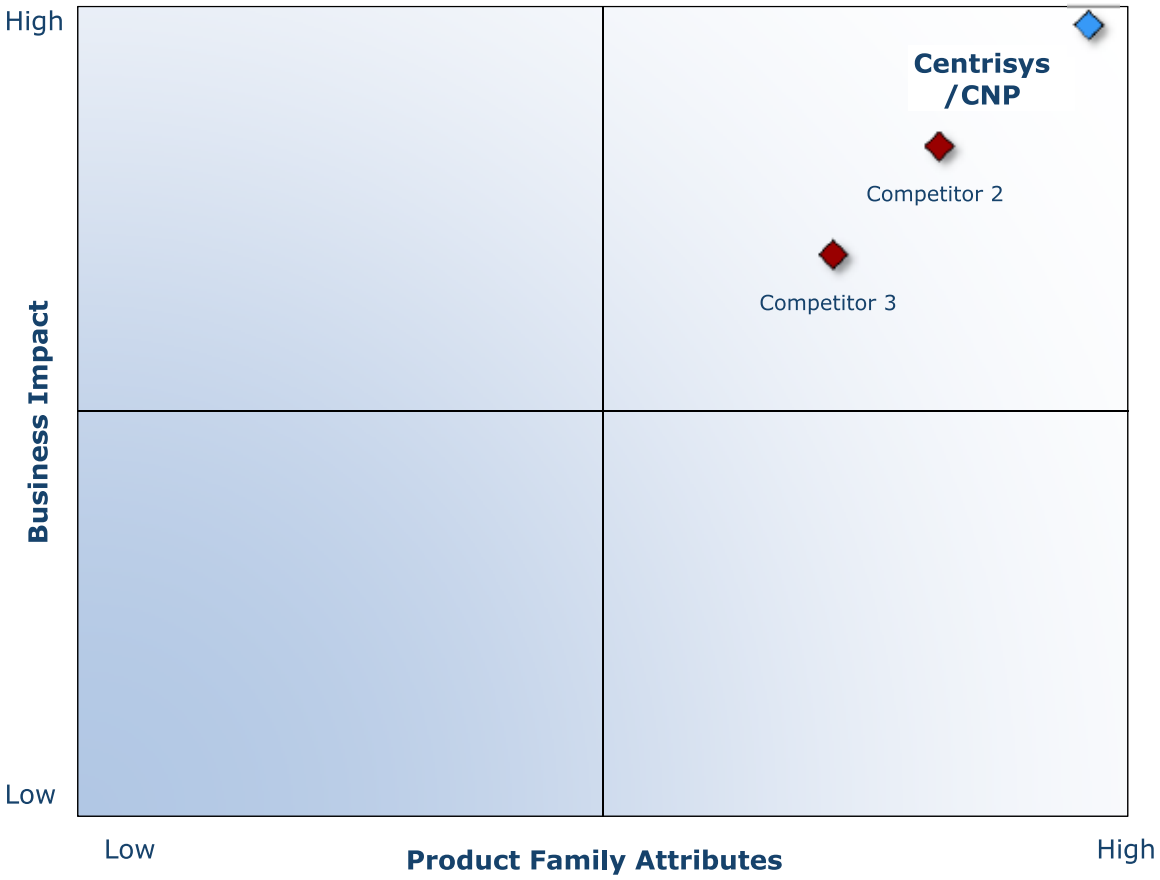
Requirements: Product quality strengthens brand, reinforces customer loyalty, and enhances growth potential.

Criterion 5: Human Capital

Requirement: Company culture is characterized by a strong commitment to product quality and customer impact, which in turn enhances employee morale and retention.

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

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
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

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