

FROST & SULLIVAN

BEST PRACTICES

AWARDS

FROST & SULLIVAN

2020 BEST PRACTICES AWARD

TMEiC

2020 AMERICAS
MEDIUM VOLTAGE DRIVES
NEW PRODUCT INNOVATION AWARD

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Background and Company Performance

Industry Challenges

Medium voltage (MV) drives have an industry average efficiency rating of 96 to 97%. The remaining 4% is lost as heat. For an MV drive of power rating 2.0MW, heat loss is approximately 80kW, which is very high. Unless managed properly, the heat can cause major damage to the life and performance of MV drives.

The conventional approach to remove this heat has been to place the drive in an air conditioned building, called an industrial control building, or in an indoor unit called an e-house. However, the cost of running a heating, ventilation and air conditioning (HVAC) system significantly increases the drive's total cost of ownership (TCO). As such, a trend is picking up momentum among end users to minimize the TCO of their equipment.

Reliability and safety are the other major challenges faced by end users of MV drives. For end users in heavy industries such as oil and gas, chemicals, and mining, protecting drives from harsh operational environments is a daunting task when trying to maintain cleanliness. This difficulty affects the reliable performance of drives significantly.

Moreover, remaining safe from arc flash is another issue that concerns end users in the region. Operator injury caused by arc flash from the MV drive can lead to lawsuits against the end-user companies and result in hefty financial compensation paid by them. Moreover, there are no established standards to test for arc flash protection in outdoor MV drives.

Frost & Sullivan recognizes that in today's changing landscape, a company that manufactures MV drives with particular attention paid to addressing the challenges outlined above will contribute the much-desired value end users seek and enhance their ownership experience.

New Product Attributes and Customer Impact

Matched to Needs

The global industrial solutions company Toshiba Mitsubishi-Electric Industrial Systems Corporation (TMEIC) has introduced an innovative thermal management solution for MV drives, the TMdrive-Guardian (Guardian, for short). Guardian encapsulates an indoor electric drive with an NEMA-3R rated enclosure that enables deployment of the drive outdoors, close to the motor it controls. This design helps customers significantly reduce the installation cost, which includes the cost of cabling between motor and drive.

Through its unique heat dissipation design, Guardian's MV drive cabinet obviates the need for an HVAC system to manage the waste heat from the drive; thereby, Guardian drastically minimizes the drive's operational expense for end users, which can result in operational cost savings to the tune of USD10,000 to USD15,000 per year.

Guardian achieves cooling through a unique and patented air-flow technique. The design of the drive enclosure has been adopted from TMEIC's solar inverters that are largely deployed outdoors. Frost & Sullivan is impressed that TMEIC has exhibited its innovative

edge by cross-pollinating the thermal management techniques used in its solar inverter product with its variable frequency drive (VFD) line to deliver solutions that rightly match the needs of its global customer base.

Guardian resulted from TMEIC's continuous focus on research and development (R&D) to match customer needs. The budget for developing Guardian was from TMEIC's America's budget for R&D to achieve product enhancement, new features, and localization of the product.

Reliability and Quality

TMEIC is one of the few manufacturers that provides outdoor MV drives, and it is the sole solution provider that supplies MV drives with their own enclosures. This makes Guardian the only solution in the market that is NEMA-3R rated, in which the MV drive is protected from harsh outdoor conditions such as dirt, rain, sleet, snow, windblown dust, and water, in the temperature range of -40 degrees C to +50 degrees C. The robust product design ensures reliable operation of the drive under such conditions.

Similarly, Guardian ensures safe operation of the drives as they can be placed outside in a separate enclosure, away from the control room where the operator stands. This feature represents an additional layer of safety for the operator and is not offered by competing products.

Guardian achieves superior thermal management through in-built intelligence within the enclosure and the drive. The enclosure control unit monitors critical conditional parameters such as temperature of the enclosure, temperature of the transformer, and relative humidity. Based on the three inputs, the controller regulates the exhaust air flow. For instance, the fan in the enclosure can be operated in exhaust mode or recirculation mode based on the inside and ambient temperature. Similarly, the drive has a control unit to monitor key parameters such as temperature of the power semiconductor device, temperature of the transformer, and current drawn by the blower fans. These data sets can be utilized to auto-adjust the air flow mechanism or to identify underlying faults. For instance, the blower fan drawing more current than the threshold allows indicates that air filters have been clogged and need to be serviced or replaced. This feature makes Guardian more reliable by enabling end users to identify defects quicker.

Furthermore, all data can be made available on the local area network (LAN) at the customer site using standard communication protocols such as ModBus, Ethernet Global Data (EGD), and Transmission Control Protocol/Internet Protocol, (TCP/IP) based on customer requirements. Impressively, users can collect and analyze the data to implement Industrial Internet of Things (IIoT) environments—a consideration makes Guardian future-proof.

Positioning and Brand Equity

TMEIC has ardently marketed its Guardian solution through a series of road show sessions in 13 cities across in the United States since June 2019. At these road shows, the company invited its existing customers and contacts (such as end-users, original

equipment manufacturers (OEMs) and engineering, procurement and construction (EPC) firms) in the neighboring regions to attend and learn about pertinent aspects such as the basics of drives, the typical application considerations, installation requirements for drives, power harmonics in drives, impact of drives on motor performance, and value-adding features of Guardian. It also included Guardian demo sessions.

Frost & Sullivan's interaction with some potential customers of Guardian reveals how users are impressed by TMEIC's marketing approach. During the road shows and demonstrations, customers have been able to get a hands-on experience with Guardian, which is much preferred over simply reading about specifications and looking at pictures on a brochure. This customer-centricity has been TMEIC's unique approach to promote its new product category.

On the merits of the product itself, one prospective customer noted, *"Guardian is unique because it doesn't take the approach as other NEMA-3R rated products. It has taken a middle ground approach between NEMA 1 and NEMA 3R. We (customers) get the convenience that comes with NEMA-1, the ability to go inside the building and service the drive directly. At the same time it provides the safety of NEMA 3R standard equipment."*

Customer Purchase and Ownership Experience

During the road shows, TMEIC showcased to potential customers various product features, such as the working of temperature control, airflow, and circulation, thereby customers got a real-world feel for the product. TMEIC stands ahead of its competitors in providing a superior purchasing experience for a new product.

TMEIC has gone a step ahead in delivering superior customer ownership experience by combining in Guardian the advantages of an indoor MV drive unit with being standardized in terms of installation and operational specifications (including the ability to use the drive in outdoor locations), and an innovative cooling mechanism that minimizes customers' TCO.

Frost & Sullivan's interview with one of TMEIC's prospective customers (the customer has requested a quotation from TMEIC for Guardian) expressed enthusiasm about Guardian being a product that can solve the major challenges end users of MV drives face at present.

Conclusion

TMEIC has exhibited innovation by cross-pollinating ideas from parallel product lines and solar inverters to address key customer challenges in the MV drives space, such as the high operational cost for drive cooling mechanisms. Its unique brand message and new product marketing approach to Guardian have struck a positive chord with prospective buyers and have increased TMEIC's overall brand value in the Americas region.

For its strong overall performance, TMEIC has earned Frost & Sullivan's 2020 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

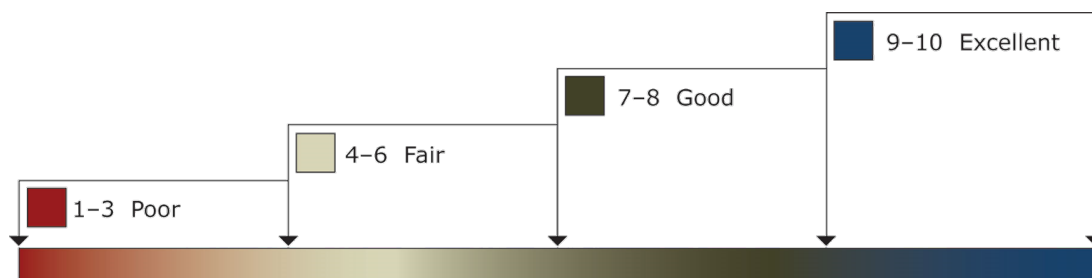
- Criterion 1: Price/Performance Value
- Criterion 2: Customer Purchase Experience
- Criterion 3: Customer Ownership Experience
- Criterion 4: Customer Service Experience
- Criterion 5: Brand Equity

Best Practices Award Analysis for TMEIC

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 1 and Competitor 2.

<i>Measurement of 1-10 (1 = poor; 10 = excellent)</i>			
New Product Innovation	New Product Attributes	Customer Impact	Average Rating
TMEIC	9.5	9.5	9.5
Competitor 1	8.0	7.5	7.8
Competitor 2	7.0	6.0	6.5

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

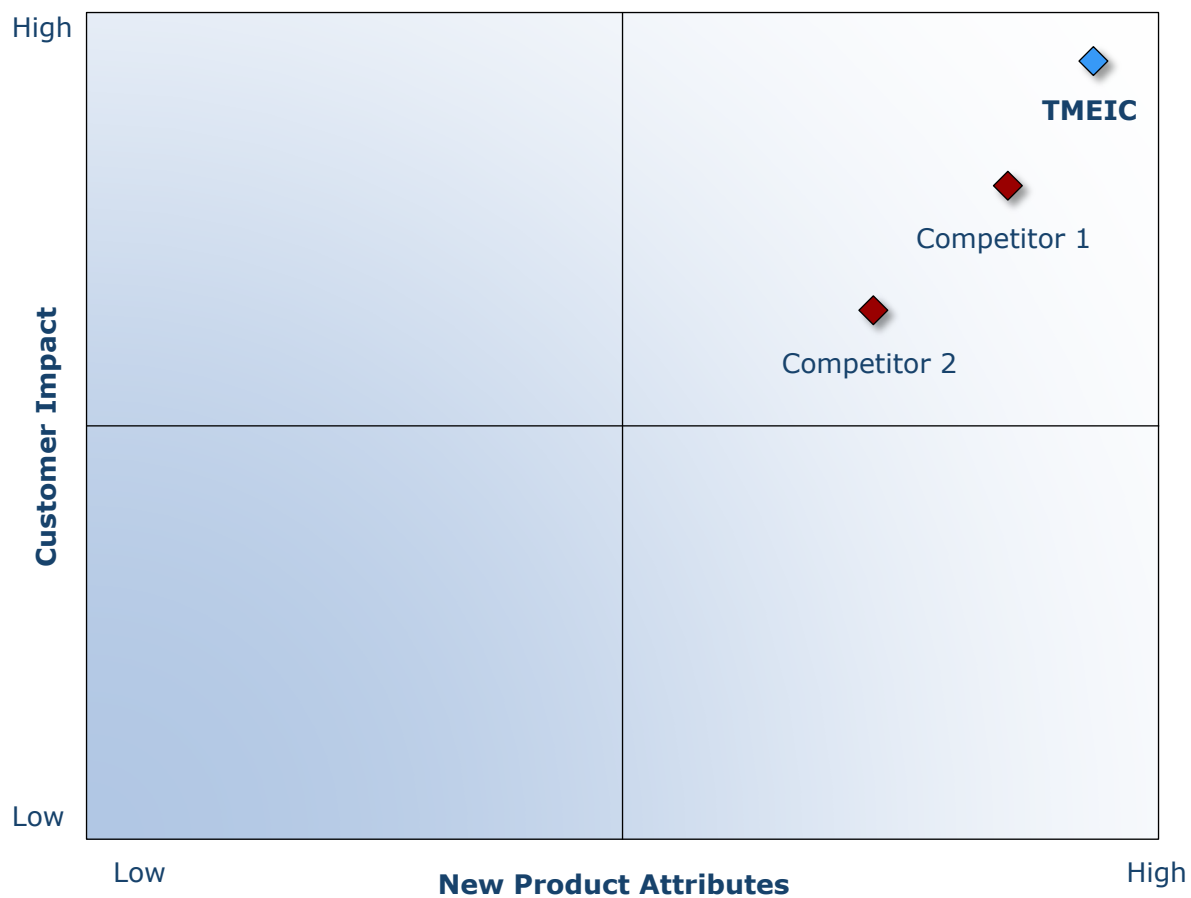
Requirement: Customer service is accessible, fast, stress-free, and of high quality.

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 Monitor, target, and screen	Identify award recipient candidates from around the world	<ul style="list-style-type: none"> • Conduct in-depth industry research • Identify emerging industries • Scan multiple regions 	Pipeline of candidates that potentially meet all best practices 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 practices 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 practices 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 practices 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 practices 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 practices criteria
9 Communicate recognition	Inform award recipient of 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 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 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>.