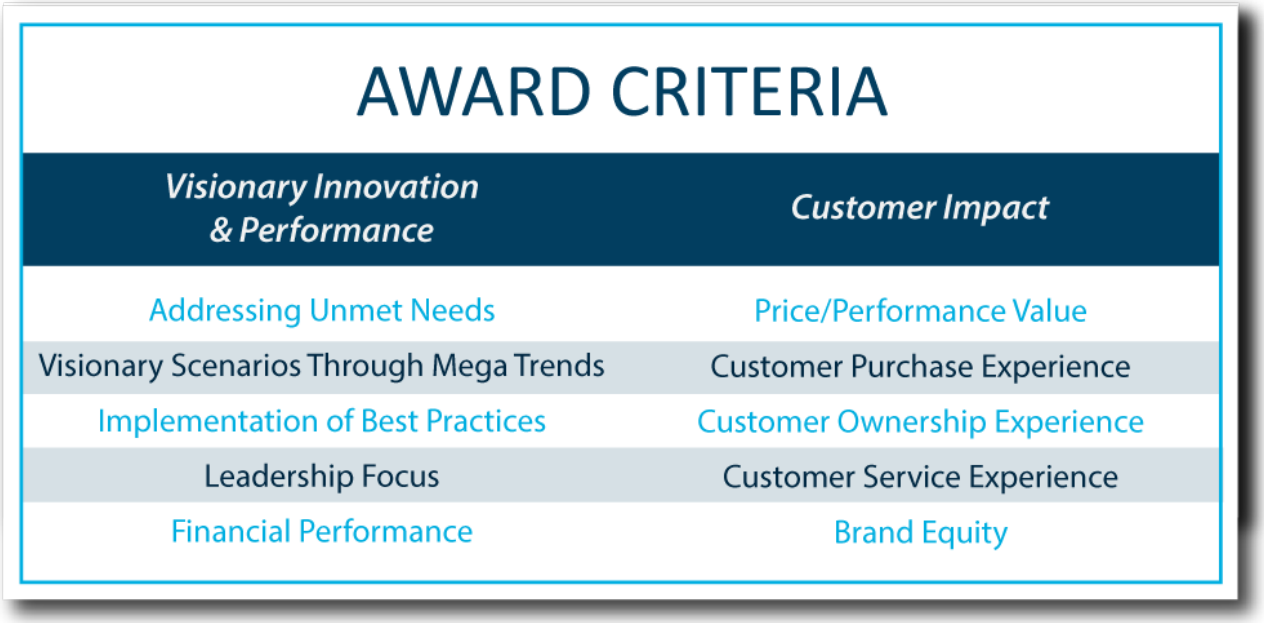
FROST & SULLIVAN

MITSUBISHI HEAVY INDUSTRIES AIR-CONDITIONING EUROPE, LTD. RECEIVES THE 2023 COMPANY OF THE YEAR AWARD

Identified as best in class in the European commercial heat pumps industry

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Mitsubishi Heavy Industries Air-Conditioning Europe, Ltd. excels in many of the criteria in the commercial heat pumps space.



A Market Snapshot

Accounting for approximately 50% of global energy consumption[1] and about 80% of the construction sector's direct carbon emissions[2] in 2021, heating remains an extremely energy-intensive and highly carbon-emissive activity. As a result, decarbonizing heat is central to driving Europe's ongoing transition towards net-zero carbon emissions. Moreover, unfavorable geopolitical situations, supply chain disruptions, and the associated fuel price volatility further reinforce the urgency of the shift away from fossil fuel-based heating.

Despite supportive regulatory frameworks and shifting consumer attitudes, replacing fossil fuel-based heating with low-carbon alternatives remains a significant challenge, with renewables accounting for only 23% of the global thermal demand[3]. Currently, low- or zero-emission technologies, such as heat pumps (HP) and solar thermal, remain the most viable options to support the shift toward secure and sustainable heating. HPs enjoy increasing popularity, especially in the European market, due to their high-performance efficiencies (up to five times more energy efficient than equivalent natural gas boilers). According to the International Energy Agency, HPs can potentially reduce global carbon emissions by at

[1] https://www.iea.org/fuels-and-technologies/heating, accessed January 2023.
[2] https://www.iea.org/reports/heating, accessed January 2023.
[3] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20220211-1#:~:text=In%202020%2C%20renewable%20energy%20accounted,2004%20to%2022%25%20in%202020, accessed January 2023.

least 500 million tons and decrease heating-based natural gas demand by more than 21 billion cubic meters by 2030.[4]

However, several challenges, such as skilled worker shortage, high upfront costs, low consumer awareness, and market preference for conventional heating technologies, continue to hinder HP's mass-market adoption. Similarly, the technology's unsuitability for integration into existing building stock and the prevalent grid stability implications restrain market growth.

MHIAE: Decarbonizing Heat

Founded in 1884 and headquartered in Tokyo, Japan, Mitsubishi Heavy Industries (MHI) is one of the world's leading industrial groups, serving the energy, smart infrastructure, industrial machinery, aerospace, and defense markets. Working towards its goal of decarbonizing operations by 2040 (including emissions from sold products), MHI Group offers solutions for both the energy supply and demand sides. On the supply side, the company built on its leadership in heavy-duty gas turbine systems to develop the world's highest-efficiency hydrogen-ready gas turbine to decarbonize power generation gradually. Similarly, on the demand side, specifically in the building sector, the MHI Group focuses on HPs as integral tools in advancing the ongoing energy transition - through Group companies such as Mitsubishi Heavy Industries Thermal Systems, Ltd. (MTH), which specializes in the design and manufacture of heating and cooling solutions, and its subsidiary Mitsubishi Heavy Industries Air-Conditioning Europe, Ltd. (MHIAE), which provides them in the European market.

> *"MHIAE's spectrum of high-efficiency systems for cooling and heating air and water for residential, commercial, and industrial applications (including air-to-water HPs and chillers for space heating, cooling, and hot water production) remains a vital part of the company's offering. More specifically, it provides an impressive range of air-to-water HPs to meet Europe's growing demand for low-carbon, energy-efficient, and cost-effective water heating solutions from the domestic, commercial, and industrial sectors."*
>
> ***- Neha Tatikota,***
> ***Industry Analyst- Energy & Environment***

MHI entered the heating, ventilation, and air conditioning space in 1920 by pioneering the design and production of refrigeration systems and started manufacturing HPs in 1961. Today, MHIAE continues to leverage the group's considerable industry expertise, extensive market experience, and comprehensive product portfolio to deliver innovative and reliable solutions that positively impact customers and communities globally. For instance, the company combined two different compression mechanisms – 'Scroll' and 'Rotary' types into a single groundbreaking compressor. This innovative compressor facilitates high coefficient of performance (COP) and water temperatures (90 °C) establishing MHIAE's HPs as ideal alternatives to natural gas boilers in Europe.

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[4] https://iea.blob.core.windows.net/assets/01324438-d634-4d49-95d8-3d08aaab00d5/TheFutureofHeatPumps.pdf, accessed January 2023.

impressive range of air-to-water HPs to meet Europe's growing demand for low-carbon, energy-efficient, and cost-effective water heating solutions from the domestic, commercial, and industrial sectors.

Among MHIAE's robust HP product offerings, the Q-ton air-to-water HP system remains the company's most popular product designed for commercial use. Unlike most commercial HPs, this system uses carbon dioxide, a natural refrigerant with ultra-low global warming potential, to produce sanitary hot water at temperatures up to 90 °C (in the 60 °C to 90 °C range) in an environmentally responsible manner. Moreover, the Q-ton can heat up to 12,000 litres of water daily (producing 500 litres of 60 °C water per hour) from a single 30-kilowatt unit at the industry's highest COP (seasonal COP of 4.3). Furthermore, customers can connect and control up to 16 Q-ton HP units (generating approximately 100,000 litres of 90 °C water per day) through a single controller and install one or more storage tanks in series to meet their specific heating demands.

Some of Q-ton's key differentiating features include:

- **High Performance:** This HP retains the hot water temperature within the 60 °C to 90 °C range, even with outdoor temperatures dropping to -25 °C. Moreover, the HP maintains 100% heating capacity down to -7 °C.
- **High Efficiency:** Q-ton system offers the industry's highest COP in hot water production, substantially reducing running costs and carbon emissions.
- **Environmentally Responsible:** This product facilitates eco-friendly and low-emission water heating with a global warming potential of 1 and ozone depletion potential of 0.

Built with high-quality, robust technology and designed for long-life expectancy, the Q-ton features an advanced, easy-to-use touchscreen panel, a user-friendly schedule setting, and a one-touch fill-up operation. Q-ton is equipped with Remote Monitoring System (where an optional gateway is required), a tool that monitors the system's operation, generates quarterly reports comparing energy usage and efficiencies against gas and electric equivalents, and highlights any potential operation or maintenance requirements. As a result, the Q-ton HP system is simple to operate and ensures optimal user experience.

Impressively, MHIAE's Q-ton system reduces annual running costs by 76% and 46% compared to electric heaters and gas boilers, respectively. Similarly, the HP decreases annual carbon emissions by 74% and 76% compared to equivalent electric heaters and gas boiler systems. Moreover, customers can use the Q-ton product in the combined mode for indoor heating and sanitary hot water applications, enhancing its overall adoptability.

MHIAE is also part of several industry associations and trade organizations to ensure its products conform to prevalent industry standards. For instance, the company is an active member of the European Partnership for Energy and the Environment, Japan Business Council in Europe, and the United Kingdom's (UK) Federation of Environmental Trade Associations (including memberships in the Heat Pump Association and the HEVAC Association). In the UK, the Q-ton HP is approved under the Water Regulations Advisory Scheme, ensuring compliance with the requirements outlined in the Water Supply (Water Fittings) regulations and amendments of 1999.

Furthermore, Mitsubishi Heavy Industries Thermal Systems, Ltd. (MTH), is part of the International Organization for Standardization (ISO)-9001 and ISO-14001-certified company, actively implementing high standards across design, manufacturing, and commissioning processes for all heating and cooling solutions for MHIAE.

A Customer-focused Growth Strategy

With its product-led customer-focused strategy, MHIAE consistently brings best-in-class HP systems to the market. The company incorporates customer feedback into its solution development roadmap to maximize short-term growth opportunities while providing a path to future revenues. To this end, MHIAE leverages its extensive distribution networks (including MHI Group's over 50 year-collaboration with Stulz GmbH Germany and MHIAE's 2018 Joint Venture with Beijer Ref group in the UK) to gather insights into local customer needs. The company's regional technical teams collaborate with the MHI Group's research and development headquarters in Japan to utilize customer insights to inform and direct its ongoing product development efforts. As a result, MHIAE successfully delivers solutions customized to local preferences and specific customer needs. In addition, the company utilizes distributor networks to offer excellent after-sales service for its HP systems, ensuring optimal customer experience over the product's lifetime.

> *"Over the years, MHIAE has registered sustained growth owing to its differentiated product portfolio, continual innovation-based approach, and customer-centric operations. For instance, the company secured a record number of Q-ton sales in its European market in 2022, with sales growing by an impressive 40% between 2021 and 2022."*
>
> ***- Sama Suwal,***
> ***Best Practices Research Analyst***

Furthermore, MHIAE addresses the market's trained staffing shortage through its Continuing Professional Development (CPD) program. By building, monitoring, and authenticating the workforce's skills and experience, the company enhances its knowledge and understanding of heating and hot water systems and appliances. MHIAE offers CPD seminars regularly to assist engineering companies in staying updated with its latest technologies, ensuring its customers receive the best possible experience consistently.

Case Study: Citadines Holborn

MHIAE supported the London-based Citadines Holborn hotel chain, a part of The Ascott Limited portfolio (CapitaLand's wholly owned lodging business unit), to upgrade and decarbonize its hot water generation by replacing the incumbent gas-fired boilers across its UK locations. Starting with the customer's Covent Garden site, the company provided three Q-ton heat pump units and six 1,000-liter storage vessels to deliver potable hot water for the facility's 192 apartments and communal breakfast area. MHIAE supported the project's principal contractor Nationwide Air Conditioning and engineering consultancy KiPO throughout the design, delivery, and commissioning process, ensuring a seamless and successful transition to the new system with minimal disruption to the hotel's operations. Satisfied with the company's product, Citadines Holborn plans to deploy Q-ton systems at their other sites. These additions are part of a phased installation program to achieve CapitaLand's 2030 Sustainability Master Plan of a 78% carbon emissions reduction by 2030.[5]

[5] https://mhi-hvac.co.uk/wp-content/uploads/Case-Study-Citadines-Draft-4.pdf, accessed January 2023.

"We are delighted to be using heat pump technology as a primary method for our hot water generation. The Q-ton's operation has been perfect, and we're looking forward to seeing how efficiently the system works during its first winter compared to the gas boilers we previously had."

- Germana Genovese, Residence Manager at Citadines Holborn-Covent Garden[6]

Over the years, MHIAE has registered sustained growth owing to its differentiated product portfolio, continual innovation-based approach, and customer-centric operations. For instance, the company secured a record number of Q-ton sales in its European market in 2022, with sales growing by an impressive 40% between 2021 and 2022. Moving forward, MHIAE seeks to capitalize on the region's rapidly increasing demand for low-carbon heating solutions by focusing strongly on the European market. Moreover, for the commercial sector, the company strives to improve the Q-ton's capabilities by maintaining the temperature of the stored hot water automatically and more efficiently. Thereby streamlining operations and reducing energy consumption further. Similarly, the company is researching novel natural refrigerants to enhance the overall eco-friendliness of its HP product range.

Frost & Sullivan believes the company is well-positioned to drive the commercial HP space into its next growth phase, capturing market share and sustaining its leadership in the coming years.

Conclusion

Heat pumps are increasingly popular as eco-friendly and low-carbon alternatives to natural gas-based heating to support Europe's ongoing shift towards secure and sustainable heating. However, several challenges, such as skilled worker shortage, relatively high upfront costs, low consumer awareness, and market preference for conventional heating technologies, continue to hinder HPs' mass-market adoption.

Overall, Mitsubishi Heavy Industries Air Conditioning Europe, Ltd. addresses these unmet needs with a strong leadership focus that incorporates customer-centric strategies and exemplifies best practice implementation. The company offers an impressive range of differentiated air-to-water HPs to meet Europe's growing demand for low-carbon, energy-efficient, and cost-effective domestic, commercial, and industrial water heating solutions. For instance, MHIAE's Q-ton system uses carbon dioxide, a natural refrigerant with ultra-low global warming potential, to produce sanitary hot water at temperatures up to 90 °C at the industry's highest coefficient of performance (4.3 in intermediate seasons). As a result, the system delivers substantial reductions in running costs and carbon emissions.

MHIAE builds on the competitive differentiation afforded by its innovative HP products through its product-led customer-focused strategy. The company leverages its extensive distribution networks to gather insights into local customer needs. MHIAE's regional technical teams collaborate with the Mitsubishi Heavy Industries Group's research and development headquarters in Japan to utilize these customer insights to inform and direct its ongoing product development efforts. As a result, the company consistently delivers solutions customized to local preferences and specific customer needs, solidifying its reputation for offering the overall best in the commercial HP market. For its strong overall performance, Mitsubishi Heavy Industries Air-Conditioning Europe, Ltd. earns Frost & Sullivan's 2023 European Company of the Year Award in the commercial heat pumps market.

[6] https://mhi-hvac.co.uk/wp-content/uploads/Case-Study-Citadines-Draft-4.pdf, accessed January 2023.

What You Need to Know about the Company of the Year Recognition

Frost & Sullivan's Company of the Year Award is its top honor and recognizes the market participant that exemplifies visionary innovation, market-leading performance, and unmatched customer care.

Best Practices Award Analysis

For the Company of the Year Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Visionary Innovation & Performance

Addressing Unmet Needs: Customers' unmet or under-served needs are unearthed and addressed by a robust solution development process

Visionary Scenarios Through Mega Trends: Long-range, macro-level scenarios are incorporated into the innovation strategy through the use of Mega Trends, thereby enabling first-to-market solutions and new growth opportunities

Leadership Focus: Company focuses on building a leadership position in core markets and on creating stiff barriers to entry for new competitors

Best Practices Implementation: Best-in-class implementation is characterized by processes, tools, or activities that generate a consistent and repeatable level of success

Financial Performance: Strong overall business performance is achieved in terms of revenue, revenue growth, operating margin, and other key financial metrics

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

About Frost & Sullivan

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The Growth Pipeline Engine™

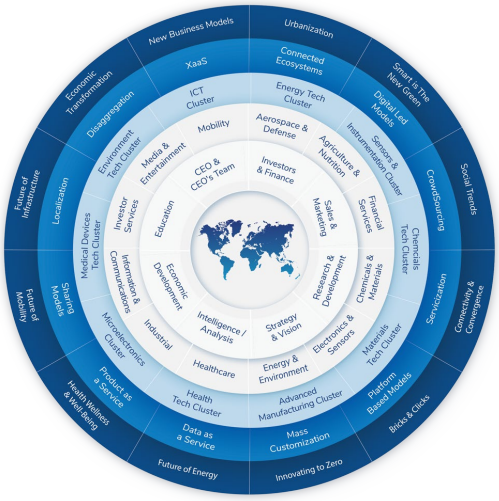
Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.
Learn more.

Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.



Analytical Perspectives:

- Mega Trend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)