

Data Center Cooling Market - A Global and Regional Analysis: Focus on Product, Application, and Country-Level Analysis - Analysis and Forecast, 2024-2034

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Abstracts

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This report will be delivered in 7-10 working days. Global Data Center Cooling Market Overview

The global data center cooling market is projected to reach \$107.13 billion by 2034 from \$21.50 billion in 2023, growing at a CAGR of 15.72% during the forecast period 2024-2034. The growth in the global data center cooling market is expected to be driven by the increasing number of data centers and government initiatives for energy-efficient data centers. The need to address the water scarcity issue has further resulted in the adoption of data center cooling technologies.

Introduction to the Data Center Cooling Market

The global data center cooling market is poised for significant growth, driven by the increasing number of data centers and government initiatives promoting energy-efficient solutions. As data centers generate substantial heat, advanced cooling systems are essential for maintaining optimal temperatures and preventing equipment failure. The market encompasses various cooling methods, including air, liquid, and free cooling systems, each suited to different data centers, such as hyperscale, colocation, and edge facilities. Demand for efficient cooling technologies is intensifying with the rise of data-intensive applications such as artificial intelligence (AI), big data, and cloud computing. Liquid cooling solutions, particularly direct-to-chip and immersion cooling, are gaining traction due to their superior heat management and sustainability benefits.

This market is expected to increase, with companies investing in innovative cooling technologies to reduce operational costs and environmental impact.

Introduction to Data Center Cooling Systems

Data center cooling systems are critical infrastructure components designed to manage the substantial heat generated by servers and other IT equipment within data centers. As data centers grow in size and complexity, handling this heat becomes essential to maintaining operational efficiency and preventing equipment failure. These cooling systems employ various technologies, including air-based cooling systems, which use air conditioning units, chillers, and cooling towers to regulate temperatures, and liquid cooling systems, which directly cool the equipment using advanced methods such as direct-to-chip and immersion cooling. Liquid cooling is gaining popularity due to its superior heat management capabilities, which are increasingly needed as high-performance computing and data-intensive applications become more common. Additionally, free cooling systems, which leverage external air in colder climates, offer energy-efficient alternatives to traditional methods.

The choice of the cooling system can significantly impact a data center's energy consumption and operational costs, making it a key consideration for businesses aiming to improve sustainability and reduce expenses. The industry is evolving toward more eco-friendly and efficient solutions, driven by regulatory pressures and the pursuit of reduced carbon footprints. Innovations such as AI-driven cooling optimization and modular cooling systems are becoming more prevalent, allowing businesses to fine-tune their cooling infrastructure for maximum efficiency. As the demand for data centers continues to rise globally, driven by cloud computing, artificial intelligence, and big data, the market for advanced cooling systems is set to grow, with companies increasingly investing in new technologies to enhance both performance and sustainability.

North America has the maximum number of data centers in the world. This is due to enormous industrial and commercial enterprises that have significantly impacted the demand for data centers in the region. North America is followed by Asia-Pacific and Europe in terms of market size. North America is expected to have a massive demand for data center cooling technologies due to numerous data centers and the growing demand for innovative technologies and spending in the region.

Market Segmentation:

Segmentation 1: End-Use Industry

IT and Telecom

Healthcare

Retail

Banking, Financial Services, and Insurance

Government and Public Sector

Manufacturing

Others

IT and Telecom to Dominate the Global Data Center Cooling Market (by End-Use Industry)

The IT and telecom segment is the dominating application segment. With new technologies such as 5G, IoT, virtual and augmented reality, and artificial intelligence, the telecommunications industry is evolving to cater to huge data processing. As a result, telecom data centers are also transforming to handle high data volume and low latency needs. The banking, financial services, and insurance (BFSI) segment is expected to anticipate the highest growth rate due to digitization, which involves utilizing the most cutting-edge technology to boost data center usage, thereby augmenting the data center cooling solutions.

Segmentation 2: by Data Center Type

Centralized Data Center

Hyperscale

Colocation

Enterprise

Edge Data Centers

Segmentation 3: by Solution

Air Cooling

Air Conditioner

Air Handling Unit

Chiller

Cooling Tower

Economizer System

Others

Liquid Cooling

Direct

Indirect

Free Cooling

Segmentation 4: by Rack Density

Low Rack Density (1-4 kW)

Medium Rack Density (5-9 kW)

High Rack Density (Above 9 kW)

Segmentation 5: by Region

North America

Europe

Asia-Pacific

Rest-of-the-World

Recent Developments in the Global Data Center Cooling Market

In June 2021, Microsoft transitioned to evaporative cooling in its Iowa DC, significantly reducing water consumption by leveraging cooler ambient temperatures. This shift lowered electricity bills and aligned with environmental sustainability goals, making it an attractive option for DCs looking to reduce their carbon footprint.

Google announced plans to invest \$9.5 billion in U.S. data centers and offices in 2022. Over the past five years (2018-2022), Google has invested over \$37 billion in data centers and offices across 26 states in the U.S. These investments are part of Google's strategy to enhance its infrastructure to support digital tools and services and aim for carbon-free energy operations by 2030.

In January 2024, ZutaCore, Inc. and Valeo announced a four-year commercial agreement to deliver advanced liquid cooling systems for high-density servers. Their technology offers a 50% reduction in total cost of ownership, 100% heat reuse, and significant reductions in CO2 emissions. This partnership highlights the increasing demand for efficient and sustainable data center cooling solutions in Mexico, driven by the expanding data center infrastructure and the need for high-performance computing.

Demand – Drivers, Restraints, and Opportunities

Market Driver: Increasing Number of Data Centers and Spendings

The significant rise in data generation across various industries has spurred the demand for data servers and centers. As of January 2021, CloudScene data showed nearly 8,000 data centers globally, with six countries hosting the majority, i.e., the U.S. (33%), the U.K. (5.7%), Germany (5.5%), China (5.2%), Canada (3.3%), and the Netherlands (3.4%). About 77% are in OECD member states, and 64% are in NATO countries.

In 2021, the U.S. data center market absorbed 493.4 megawatts (MW), a 31% increase from 2019 and a 50% rise from 2020, according to CBRE. Jones Lang LaSalle Inc. (JLL) reported 885.7 MW absorption across 14 domestic markets, a 44.3% year-on-year increase driven by expansions from major cloud and tech companies.

The outlook for data centers remains optimistic due to the surging use of streaming services, virtual collaboration tools, and remote work, leading to record demands in 2020 and 2021. Major operators saw increased enterprise-level demand from the technology, financial, and healthcare sectors. The accompanying figure highlights the rise in data center spending from 2012 to 2023.

Market Challenge: High Investment Costs for Non-Conventional Cooling Systems

While it costs money to buy the equipment needed to cool and power the servers, the recurring costs start to add up. Standard data centers operate at around 20°C to 22°C to optimize performance. When running a data center in a hot climate, up to 33% of the energy consumed is dedicated to operating the cooling systems and infrastructure, and electricity costs may contribute more than 50% of the operating expenses. The spread-out locations and lack of infrastructure make edge data centers tougher to cool. For example, real estate and electricity may cost much more for an edge site in a busy urban area. As of 2021, an investigation revealed that between 30% and 55% of the total energy is used to cool the IT equipment in data centers.

To maximize performance, typical data centers run at temperatures between 20°C and 22°C. When operating a data center in a warm climate, up to 33% of the energy used is just for running the infrastructure and cooling systems, and electricity costs may make up more than 50% of operating costs. It is more challenging to cool edge data centers due to their dispersed locations and lack of infrastructure. For instance, a busy urban edge site might have much higher real estate and electricity costs.

Market Opportunity: Growing Emphasis for Retrofit Data Center

As processor capacities grow, they generate more heat, increasing the thermal loads in colocation data centers due to higher packing densities. Additionally, continuous workloads necessitate replacing or upgrading servers and devices with the latest designs. According to Moore's Law, electronic devices become obsolete within years. Many data centers built in the past decade seek modernization to enhance efficiency and incorporate AI, IoT, and other digital advancements. Consequently, periodic upgrades are essential to prevent devices from becoming obsolete and to maintain optimal performance.

Retrofitting data centers might gradually become a persuasive idea for operators over the forecast period 2024-2034. The factors driving retrofitting of data centers are expanding IT densities, new technological advancements, aging hardware, the need for better cooling systems, and the need for energy-efficient and power-saving technologies. When retrofitting a data center, a rating of 1.8 PUE is acceptable, and 1.6 PUE is attainable. Retrofitting can also help provide powerful new layers of security, intelligence, and automation. Therefore, even cloud or hyperscale data centers built recently or sooner are being retrofitted to address the abovementioned requirements.

How can this report add value to an organization?

Product/Innovation Strategy: The product segment helps the reader understand the different applications of data center cooling systems and their global potential. Moreover, the study gives the reader a detailed understanding of the end-use industries and different products offered by different regulations, consortiums and associations, and government programs impacting data center cooling solution manufacturers for various purposes.

Growth/Marketing Strategy: The global data center cooling market has seen significant development by key players operating in the market, such as business expansion, partnership, collaboration, and joint venture. The favored strategy for the companies has been partnership, collaboration, and joint venture activities to strengthen their position in the global data center cooling market.

Competitive Strategy: Key players in the global data center cooling market analyzed and profiled in the study involve cooling solution providers, including market segments covered by distinct product kinds, applications served, and regional presence, as well as the influence of important market tactics employed. Moreover, a detailed competitive

benchmarking of the players operating in the global data center cooling market has been done to help the reader understand how players stack against each other, presenting a clear market landscape. Additionally, comprehensive competitive strategies such as partnerships, agreements, and collaborations will aid the reader in understanding the untapped revenue pockets in the market.

Research Methodology

Data Sources

Primary Data Sources

The primary sources involve industry experts from the air, evaporative, and immersion cooling industries, as well as various stakeholders and service providers. Respondents such as CEOs, vice presidents, marketing directors, and technology and innovation directors have been interviewed to obtain and verify both qualitative and quantitative aspects of this research study.

The key data points taken from primary sources include:

- validation and triangulation of all the numbers and graphs
- validation of reports segmentation and key qualitative findings
- understanding the competitive landscape
- validation of the numbers of various markets for market type
- percentage split of individual markets for regional analysis

Secondary Data Sources

This research study uses extensive secondary research, directories, company websites, and annual reports. It also uses databases, such as ITU, Hoovers, Bloomberg, Businessweek, and Factiva, to collect useful and effective information for an extensive, technical, market-oriented, and commercial study of the global data center cooling market. In addition to the data sources, the study has been undertaken with the help of other data sources and websites, such as the International Energy Agency,

DatacenterDynamics, data center magazines, and government websites.

Secondary research was done to obtain crucial information about the industry's value chain, revenue models, the market's monetary chain, the total pool of key players, and the current and potential use cases and applications.

The key data points taken from secondary research include:

- segmentations and percentage shares

- data for market value

- key industry trends of the top players of the market

- qualitative insights into various aspects of the market, key trends, and emerging areas of innovation

- quantitative data for mathematical and statistical calculations

Key Market Players and Competition Synopsis

In recent years (2018-2023), the global data center cooling market has seen numerous strategic and technological advancements by various market players aiming to capture market share. Strategies include product development, innovation, partnerships, collaborations, business expansions, product launches, and receiving awards. Companies often prioritize business expansions, partnerships, joint ventures, and collaborations to solidify their market position. Manufacturers are also launching new products and focusing on sustainable growth. For example, Vertiv Group Corp. introduced the Powerbar iMPB in September 2022, which offers high-density power distribution and maximizes cooling airflow. Emerging cooling technologies present opportunities for retrofitting data centers, enhancing data center infrastructure management (DCIM), and increasing the number of edge data centers.

Some prominent names established in the data center cooling market are:

- Vertiv Group Corp.

- Schneider Electric

Asetek, Inc.

Submer

Munters

ZutaCore, Inc.

Coolcentric

Midas Immersion Cooling

Motivair Corporation

PEZY Computing, Inc.

ALFA LAVAL

Condair Group

Fujitsu

Danfoss

MODINE MANUFACTURING COMPANY

Boyd

Johnson Controls International plc.

Carrier

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