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Transcritical Co2 Market Report by Function (Refrigeration, Heating, Air Conditioning), Application (Supermarkets and Convenience Stores, Ice Skating Rinks, Food Processing and Storage Facilities, Heat Pumps, and Others), and Region 2025-2033

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Abstracts

The global transcritical CO2 market size reached USD 60.3 Billion in 2024. Looking forward, IMARC Group expects the market to reach USD 210.2 Billion by 2033, exhibiting a growth rate (CAGR) of 14.9% during 2025-2033. The extensive traction within diverse retail establishments for refrigeration applications, continual advancements in automotive transcritical CO2 technology, and increasing consumer awareness regarding the manifold advantages of transcritical CO2 are some of the major factors propelling the market.

Transcritical CO2 is a state of carbon dioxide (CO2) where its temperature and pressure exceed the critical point. CO2 exhibits unique properties that make it an environmentally friendly and versatile working fluid in various applications, particularly in refrigeration, heating, and power generation systems. In transcritical CO2 systems, CO2 operates in a cycle that involves both subcritical and supercritical phases, which allows for efficient heat transfer and energy exchange. One of the most notable advantages of transcritical CO2 systems is their potential for high energy efficiency and reduced environmental impact. They have gained attention as an alternative to conventional refrigerants due to their low global warming potential and ozone depletion potential, contributing to the mitigation of climate change.

The global market is primarily driven by the extensive traction within diverse retail establishments for refrigeration applications, due to its low maintenance demands, energy efficiency enhancements, and economic attributes. This trend is further amplified

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by the widespread adoption of these systems in food processing and commercial cold storage facilities. These adoptions serve the dual purpose of preserving product freshness and extending shelf life, contributing significantly to the market growth. Moreover, the market is supported by the escalating demands in the hospitality and residential sectors for air conditioning, building heating, and hot water supply applications. Also, advancements in automotive transcritical CO2 technology have added a new dimension to market expansion. This technology's ability to fulfill a vehicle's thermal management needs, encompassing passenger compartment temperature control, battery pack temperature regulation, and cooling of motor and electrical components, has left a positive impact. Furthermore, the market's upward trajectory is propelled by increasing consumer awareness regarding the manifold advantages of transcritical CO2 systems, growing concerns about global warming, and their wide-ranging adoption in industries such as margarine production, beer brewing, and ice-making.

Transcritical CO2 Market Trends/Drivers:

Environmental Regulations and Sustainability Initiatives

With the rising global concern over climate change and its far-reaching impacts, governments and international bodies have taken a more assertive stance on curbing greenhouse gas emissions. Transcritical CO2 systems have garnered substantial attention due to their environmental benefits. They have a remarkably low GWP and is non-ozone depleting. As industries confront stricter emission targets and regulatory mandates, transcritical CO2 offers a compelling solution that aligns with these goals. By adopting transcritical CO2 systems, industries not only meet regulatory requirements but also demonstrate their commitment to sustainable practices and responsible resource management. The urgency of climate change mitigation has imbued transcritical CO2 systems with a sense of imperative, transforming them into a preferred choice for various applications such as commercial refrigeration, air conditioning, and heat pumps.

Energy Efficiency and Operational Cost Savings

With escalating energy costs and heightened environmental consciousness, businesses across sectors are actively seeking ways to optimize their energy consumption while minimizing operational expenses. Transcritical CO2 systems offer an attractive value proposition in this context. Transcritical CO2 maintains its efficiency across a wide range of temperatures, ensuring consistent and reliable operation. This characteristic

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translates to substantial energy savings over the long term, as well as reduced carbon footprints. Industries that require intensive cooling and refrigeration, such as supermarkets, food processing facilities, and pharmaceutical companies, stand to benefit significantly from the adoption of transcritical CO2 systems. The reduced energy consumption directly impacts their bottom line, improving profitability while simultaneously aligning with their environmental and sustainability goals.

Continuous Technological Advancements and Innovation

Researchers, engineers, and manufacturers are collaboratively pushing the boundaries of transcritical CO2 technology to address challenges and unlock new possibilities. Compressors are at the heart of any refrigeration system, and tailored designs optimized for transcritical CO2 are being developed. These advancements focus on enhancing efficiency, durability, and reliability, thereby contributing to the overall system performance. Moreover, novel heat exchanger designs are being explored to facilitate efficient heat transfer in transcritical CO2 systems, ensuring seamless operation and improved energy utilization. System controls and optimization algorithms also play a pivotal role in maximizing the benefits of transcritical CO2 systems. As these systems involve complex thermodynamics and fluid dynamics, sophisticated control strategies are being developed to adapt to varying operating conditions and loads.

Transcritical CO2 Industry Segmentation:

IMARC Group provides an analysis of the key trends in each segment of the global transcritical CO2 market report, along with forecasts at the global, regional and country levels from 2025-2033. Our report has categorized the market based on function and application.

Breakup by Function:

- Refrigeration
- Heating
- Air Conditioning

Refrigeration holds the largest share in the market

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A detailed breakup and analysis of the market based on the function has also been provided in the report. This includes refrigeration, heating, and air conditioning. According to the report, refrigeration accounted for the largest market share.

Refrigeration systems are integral to a wide range of industries, including food and beverage, retail, pharmaceuticals, and logistics, making them essential components of global supply chains and daily life. Transcritical CO2 systems have gained considerable traction in the refrigeration sector due to their exceptional efficiency, environmental benefits, and adaptability to varying operating conditions. In the food and beverage industry, where precise temperature control and preservation of perishable goods are paramount, transcritical CO2 refrigeration systems offer a distinct advantage. These systems maintain consistent cooling even in high-temperature environments, ensuring food safety, extending shelf life, and minimizing waste. Moreover, the pharmaceutical and healthcare sectors benefit immensely from transcritical CO2 refrigeration systems. These industries require strict temperature control for storing and transporting sensitive medical supplies, vaccines, and medications. Additionally, the logistics and cold storage industry relies heavily on refrigeration to maintain the quality of goods during transportation and storage.

Breakup by Application:

Supermarkets and Convenience Stores

Ice Skating Rinks

Food Processing and Storage Facilities

Heat Pumps

Others

Supermarkets and convenience stores hold the largest share in the market

A detailed breakup and analysis of the market based on the application has also been provided in the report. This includes supermarkets and convenience stores, ice Skating rinks, food processing and storage facilities, heat pumps, and others. According to the report, supermarkets and convenience stores accounted for the largest market share.

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Supermarkets and convenience stores have a substantial energy footprint attributed to their 24/7 operations, extensive refrigeration needs, and temperature-controlled environments for perishable goods. Transcritical CO2 systems offer a transformative solution to these challenges, addressing energy efficiency, environmental concerns, and economic considerations. Transcritical CO2 technology's ability to operate efficiently across a wide range of temperatures, including high ambient conditions, resonates profoundly with the needs of supermarkets and convenience stores. Transcritical CO2 systems maintain consistent performance, ensuring reliable and cost-effective cooling even in demanding climates. This consistency directly translates to reduced energy bills, a crucial factor for retail businesses focussing to optimize profitability. Furthermore, the eco-friendly attributes resonate with consumers increasingly seeking environmentally responsible shopping experiences. By adopting transcritical CO2 technology, supermarkets and convenience stores showcase their commitment to sustainability, responding to consumer expectations for greener alternatives and reduced carbon footprints.

Breakup by Region:

North America

United States

Canada

Asia-Pacific

China

Japan

India

South Korea

Australia

Indonesia

Others

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Europe

Germany

France

United Kingdom

Italy

Spain

Russia

Others

Latin America

Brazil

Mexico

Others

Middle East and Africa

Europe exhibits a clear dominance, accounting for the largest transcritical CO2 market share

The report has also provided a comprehensive analysis of all the major regional markets, which include North America (the United States and Canada), Asia Pacific (China, Japan, India, South Korea, Australia, Indonesia, and others), Europe (Germany, France, the United Kingdom, Italy, Spain, Russia, and others), Latin America (Brazil, Mexico, and others), and the Middle East and Africa. According to the report, Europe accounted for the largest market share.

Europe's commitment to environmental preservation and sustainable practices aligns

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seamlessly with the inherent benefits of transcritical CO2 systems. As the region endeavors to mitigate the impacts of climate change, CO2's low global warming potential (GWP) and zero ozone depletion potential (ODP) make it an appealing choice for industries looking to transition away from conventional high-GWP refrigerants. Moreover, stringent regulatory frameworks play a pivotal role in augmenting the adoption of transcritical CO2 systems. This legislation imposes limitations on the use of fluorinated gases, including HFCs, within the region. This regulatory environment has prompted businesses to explore sustainable alternatives, such as transcritical CO2, which not only meets compliance requirements but also aligns with the ethos of responsible production and consumption. Furthermore, Europe's diverse industrial landscape, spanning from retail and food sectors to industrial and commercial applications, provides a broad canvas for the deployment of transcritical CO2 technology.

Competitive Landscape:

Companies in the transcritical CO2 market are actively engaged in a multifaceted range of activities aimed at advancing the adoption, innovation, and optimization of transcritical CO2 technology across various industries. Major players in the field, including multinational corporations and innovative startups are heavily investing significantly in research and development efforts. These endeavors focus on refining the efficiency, reliability, and safety of transcritical CO2 systems. R&D initiatives encompass the development of advanced compressor technologies, heat exchangers, and system controls that are tailored to the unique thermodynamic properties of CO2 in transcritical conditions. Companies are also focussing to enhance the scalability and applicability of transcritical CO2 solutions. They are collaborating with different sectors, such as commercial refrigeration, industrial processes, and heating applications, to design systems that cater to a wider array of operational needs. This involves engineering adaptable configurations that can efficiently manage diverse temperature requirements and operational loads.

The report has provided a comprehensive analysis of the competitive landscape in the market. Detailed profiles of all major companies have also been provided. Some of the key players in the market include:

Baltimore Aircoil Company Inc. (AMSTED Industries Incorporated)

Bitzer SE

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Carnot Refrigeration (M&M Refrigeration)

Carrier Global Corporation

Danfoss

Dorin S.p.A.

Emerson Electric Co.

Hill Phoenix Inc. (Dover Corporation)

Mayekawa Mfg. Co. Ltd.

Panasonic Holdings Corporation

SCM Frigo S.p.A.

Recent Developments:

In August 2023, SCM Frigo S.p.A. launched higher capacity transcritical CO2, “smart booster 2.0” racks for commercial applications. It offers a new configuration with a total of five compressors to provide a higher cooling capacity for both low and medium temperatures.

In March 2023, Emerson Electric Co launched new transcritical CO2 screw compressor unit. The new transcritical CO2 compressor utilizes established single-screw compression with an all-inclusive design, integrating controller, suction valve, inverter motor, and oil management, while maintaining adaptable scalability and using a consistent oil system and controller.

In June 2022, Carrier Global Corporation launched new energy efficient versatile EasyCube solution for chilled or frozen products. It is a highly energy-efficient plug-in island cabinet with the versatility to switch between chilled or frozen refrigeration and offer outstanding product visibility.

Key Questions Answered in This Report

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1.How big is the transcritical CO2 market?

2.What is the expected growth rate of the global transcritical CO2 market during 2025-2033?

3.What are the key factors driving the global transcritical CO2 market?

4.What has been the impact of COVID-19 on the global transcritical CO2 market?

5.What is the breakup of the global transcritical CO2 market based on the function?

6.What is the breakup of the global transcritical CO2 market based on the application?

7.What are the key regions in the global transcritical CO2 market?

8.Who are the key players/companies in the global transcritical CO2 market?

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