

North America Natural Refrigerants Market By Type (Carbon Dioxide, Ammonia, Hydrocarbons, Others), By Application (Industrial, Commercial, Domestic), By Country, Competition, Forecast & Opportunities, 2019-2029F

Market Report | 2024-08-22 | 125 pages | TechSci Research

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Report description:

The North America Natural Refrigerants Market was valued at USD 377.71 Million in 2023 and is anticipated to project robust growth in the forecast period with a CAGR of 2.75% through 2029. Conventional refrigerants, including R407A, R410A, R134a, and R544, have significant potential to contribute to global warming and ozone depletion. The escalating apprehension regarding global warming and related environmental concerns stands as the primary driving force behind the market's expansion. Natural refrigerants are synthesized through a biochemical process that harnesses naturally occurring resources. Among the most widely utilized natural refrigerants in HVAC/R applications are carbon dioxide (CO₂, R-744), hydrocarbons such as propane (R-290), isobutene (R-600a), and propylene (R-1270), as well as ammonia (NH₃, R-717). Additionally, water (H₂O, R-718) and air (R-729) are among other natural refrigerants in use.

These natural refrigerants are considered the ultimate solution to mitigate the environmental harm caused by synthetic refrigerants, primarily due to their extremely low or non-existent global warming potential (GWP) and zero ozone depletion potential (ODP) result in driving the growth of the North America Natural Refrigerants Market in the forecast period.

Key Market Drivers

Growing Demand for Sustainability

As the world intensifies its efforts to combat climate change and embrace sustainable practices, there is a growing demand for environmentally friendly solutions across diverse industries. In North America, the adoption of natural refrigerants is witnessing a substantial increase as businesses, policymakers, and consumers seek alternatives to traditional synthetic refrigerants, which have been associated with detrimental environmental consequences. This shift towards natural refrigerants reflects a broader commitment to sustainability, energy efficiency, and the reduction of greenhouse gas emissions. The escalating demand for sustainability in refrigeration and cooling systems has propelled natural refrigerants to the forefront. These substances, sourced from naturally occurring reservoirs, exhibit significantly lower environmental impacts compared to synthetic refrigerants notorious

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for their contributions to ozone depletion and global warming. Various compelling factors contribute to the growing use of natural refrigerants. The negative environmental effects of synthetic refrigerants, particularly hydrofluorocarbons (HFCs), have raised widespread concerns. These chemicals have been linked to ozone layer depletion and their role in exacerbating climate change. Consequently, there is a pressing need to seek greener and more environmentally responsible alternatives. International agreements like the Kigali Amendment to the Montreal Protocol have spurred action in multiple countries, including North America. Such agreements aim to phase out refrigerants with high global warming potential (GWP) and promote the adoption of low-GWP alternatives, such as natural refrigerants.

Natural refrigerants often demonstrate higher energy efficiency compared to their synthetic counterparts. This inherent efficiency can lead to reduced energy consumption and, consequently, lower operational costs for businesses, reinforcing the economic viability of natural refrigerants. With an increasing number of consumers prioritizing environmentally conscious choices, there is a growing market demand for sustainable products and services. This trend extends to refrigeration and cooling solutions, encouraging businesses to embrace natural refrigerants to meet consumer expectations.

The versatility of natural refrigerants has led to their application in various sectors, including supermarkets, restaurants, and convenience stores are increasingly adopting natural refrigerants for cooling and storing products. This transition not only reduces their carbon footprint but also aligns with their commitment to environmental responsibility. Large industrial facilities are making the switch to natural refrigerants for their cooling processes. This shift improves efficiency and environmental performance, contributing to more sustainable operations. Natural refrigerants are being explored for use in both residential and commercial air conditioning systems. By doing so, they help maintain comfortable indoor environments while minimizing their ecological impact. Therefore, increasing focus on sustainability regarding the use of natural refrigerants led to the growth of North America Natural Refrigerants Market.

Rising Demand of Natural Refrigerants in Commercial Sector

The commercial sector plays a pivotal role in shaping the demand for natural refrigerants, driven by a confluence of factors that underscore the sector's growing commitment to sustainability and environmental responsibility. As businesses, institutions, and enterprises seek to reduce their carbon footprint and adopt more eco-friendly practices, the adoption of natural refrigerants has become a prominent feature in the commercial sector's transition towards greener and more sustainable cooling and refrigeration systems. At the heart of this demand surge is an environmental imperative. The detrimental effects of synthetic refrigerants, particularly hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs), have been widely documented. These chemicals are notorious for their role in ozone layer depletion and their significant contributions to global warming. In response to these concerns, regulatory authorities have imposed stringent regulations aimed at phasing out high-global-warming-potential (GWP) refrigerants, compelling businesses to seek eco-friendlier alternatives. Natural refrigerants, characterized by their minimal environmental impact, have emerged as the preferred choice for many commercial entities.

Commercial refrigeration systems encompass a wide range of applications, from supermarkets and grocery stores to restaurants and convenience stores. In these settings, natural refrigerants have found extensive use. For instance, transcritical CO₂ systems, which utilize carbon dioxide as a refrigerant, have gained popularity in large supermarkets. These systems offer both excellent cooling performance and the advantage of significantly lower GWP compared to HFC alternatives. Businesses in the commercial refrigeration sector have recognized that embracing natural refrigerants aligns with consumer expectations and regulatory requirements while contributing to operational efficiency. Air conditioning systems in commercial buildings, including offices, hotels, and shopping malls, are also witnessing a shift towards natural refrigerants. Innovations in technology have made it increasingly feasible to deploy natural refrigerants like hydrocarbons (R-290 and R-600a) in air conditioning units, ensuring comfortable indoor environments with minimal ecological impact. As businesses prioritize the comfort and well-being of occupants while reducing their carbon footprint, natural refrigerants have become a viable and sustainable choice for commercial air conditioning.

Supportive Regulatory Scenario

In North America, the push for sustainability and environmental responsibility has fostered the creation of a supportive regulatory framework to promote the use of natural refrigerants. These regulations are designed to reduce greenhouse gas emissions, safeguard the ozone layer, and promote energy efficiency, thus driving the adoption of natural refrigerants across various industries. This proactive approach aligns with global efforts to combat climate change and transition towards more

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environmentally friendly alternatives. Several regulatory measures, such as the American Innovation and Manufacturing Act (AIM Act), enacted in December 2020, focus on phasing out high-global-warming-potential (GWP) synthetic refrigerants known as hydrofluorocarbons (HFCs). The AIM Act brings the United States in line with the Kigali Amendment to the Montreal Protocol, establishing targets for HFC phase-down and encouraging the transition to low-GWP alternatives, including natural refrigerants. The Environmental Protection Agency (EPA) has implemented regulations under the Clean Air Act to control emissions of ozone-depleting substances and high-GWP refrigerants. These regulations mandate the use of eco-friendly alternatives, such as natural refrigerants, in various applications like air conditioning and refrigeration. The EPA's Significant New Alternatives Policy (SNAP) program evaluates and approves substitute chemicals, including refrigerants, with a focus on identifying safe and environmentally friendly alternatives. SNAP plays a crucial role in promoting the adoption of natural refrigerants as replacements for high-GWP synthetic refrigerants.

Government agencies like the Department of Energy (DOE) establish energy efficiency standards for appliances and equipment, including cooling and refrigeration systems. Natural refrigerants often surpass these standards in terms of energy efficiency, further incentivizing their use. As a result, the multitude of government initiatives related to natural refrigerants is expected to drive demand in the North American Natural Refrigerants Market in the forecast period.

Increasing Energy Efficiency

As North America strives to diminish energy consumption and mitigate its environmental footprint, the adoption of natural refrigerants is emerging as a strategic solution. These refrigerants not only offer environmental benefits but also play a significant role in enhancing energy efficiency across various sectors. Whether in commercial refrigeration or air conditioning, natural refrigerants are ushering in a new era of sustainable cooling that aligns with the nation's dedication to conserving energy and safeguarding the environment. Energy efficiency is a fundamental element of sustainable development, and North America recognizes its pivotal role in addressing climate change and lowering energy expenditures. Derived from environmentally friendly sources, natural refrigerants serve as a prime illustration of how advancements in cooling technologies can effectively address environmental concerns while achieving energy efficiency objectives.

Natural refrigerants boast several advantages with regard to energy efficiency when compared to synthetic counterparts like hydrofluorocarbons (HFCs). They possess substantially lower Global Warming Potential (GWP), resulting in a diminished impact on global warming, thus aligning with the country's emissions reduction objectives. Moreover, natural refrigerants frequently exhibit superior thermodynamic properties, leading to more efficient heat transfer and cooling processes. This, in turn, can result in decreased energy consumption and reduced operational expenses. The improved thermodynamic properties of natural refrigerants can play a significant role in lowering energy demand, a particularly critical factor in energy-intensive sectors such as air conditioning and refrigeration. Thus, these factors dominate the growth of the North America Natural Refrigerants Market in the forecast period.

Key Market Challenges

Limited Infrastructure & Availability

The lack of infrastructure to support the use of natural refrigerants is another significant challenge. For example, the availability of CO2 refrigerant suppliers and charging stations in North America is not as extensive as that of synthetic refrigerants. This limitation can hinder the widespread adoption of natural refrigerants, particularly in remote or underserved areas. Moreover, the adoption of natural refrigerants holds immense promise for a more sustainable and environmentally friendly approach to cooling and refrigeration. However, one of the challenges in transitioning to these alternatives is their limited availability. As industries and governments prioritize sustainability and reduced carbon footprints, addressing this challenge becomes crucial for a successful and widespread adoption of natural refrigerants. The limited availability of natural refrigerants can be attributed to several factors such as the production and distribution of natural refrigerants may not be as established or widespread as their synthetic counterparts, leading to limitations in supply, regulations and standards governing the use of refrigerants vary across regions. Some natural refrigerants might be restricted due to safety concerns or lack of regulatory approval, some existing cooling and refrigeration systems are designed to work with specific synthetic refrigerants, making it challenging to retrofit them for natural refrigerants, and limited demand for natural refrigerants in the past has resulted in a smaller market size, which, in turn, impacts availability.

Safety Concern

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Safety concerns associated with the use of natural refrigerants are a critical challenge in the North America Natural Refrigerants market. While natural refrigerants are generally considered safe when handled correctly, they can pose risks if mishandled, especially in confined spaces or poorly ventilated areas. For example, ammonia is known for its toxicity and flammability, requiring rigorous safety measures in its use. Hydrocarbons can be highly flammable, making proper storage and leak prevention essential. Carbon dioxide systems operate at high pressures, necessitating robust equipment design and maintenance. Addressing safety concerns requires stringent adherence to safety protocols, regular inspections, and ongoing training of personnel. Enhanced safety standards and guidelines specific to natural refrigerants should be developed and widely promoted which might hamper the growth of North America Natural Refrigerants market in the projected period.

Key Market Trends

Regulatory Initiatives

One of the most significant drivers of the Natural Refrigerants market in North America is the robust regulatory framework aimed at curbing the use of synthetic refrigerants with high GWP. Governments and environmental agencies have been instrumental in pushing for stricter regulations and standards, aligning with international agreements like the Kigali Amendment to the Montreal Protocol. This commitment has created a favorable environment for the adoption of natural refrigerants. In the United States, the Environmental Protection Agency (EPA) has implemented regulations that phase down the use of hydrofluorocarbons (HFCs) while promoting the transition to low-GWP alternatives. Similarly, Canada is actively pursuing measures to limit the use of synthetic refrigerants. These regulations have propelled the adoption of natural refrigerants, including carbon dioxide (CO₂), ammonia (NH₃), and hydrocarbons (HCs), in various applications such as commercial refrigeration, air conditioning, and industrial cooling. Energy efficiency has become a paramount concern in the cooling industry, driving the demand for natural refrigerants. Natural refrigerants, particularly CO₂ and ammonia, are known for their excellent thermodynamic properties, resulting in more energy-efficient systems. In the North America Natural Refrigerants market, there is a growing recognition that environmentally friendly cooling solutions can also lead to significant energy savings and operational cost reductions.

Commercial and industrial sectors are increasingly adopting natural refrigerant-based systems to meet sustainability goals and reduce their carbon footprint. Supermarkets, for instance, are transitioning to CO₂-based refrigeration systems due to their superior energy efficiency and lower environmental impact. The combination of reduced emissions and operational cost savings makes natural refrigerants an attractive choice for businesses looking to align with green initiatives.

Advancement in Technology

The pursuit of sustainable and environmentally friendly cooling solutions has driven remarkable advancements in the field of natural refrigerants. As industries and researchers seek to address climate change and reduce carbon footprints, technology has played a pivotal role in making natural refrigerants more efficient, safe, and accessible. From improved system designs to cutting-edge manufacturing processes, these advancements are reshaping the way we think about cooling and refrigeration. Moreover, advanced technologies are optimizing the performance of cooling systems that use natural refrigerants. Innovations in heat exchangers, compressors, and system controls enhance energy efficiency and overall system performance. Microchannel Heat Exchangers which are compact and efficient heat exchangers improve heat transfer and reduce refrigerant charge, contributing to more energy-efficient systems. In addition to this, variable speed compressors that adjust their speed based on cooling demands, providing precise and efficient cooling while minimizing energy consumption.

Smart controls and Internet of Things (IoT) technology is enabling remote monitoring and control of cooling systems, optimizing their performance, and detecting issues in real-time. Transcritical CO₂ systems, for example, have become more efficient and cost-effective, making them suitable for a wider range of applications, including hot climates. Moreover, the development of advanced heat exchangers and controls has improved the overall reliability and performance of natural refrigerant systems. This technological evolution has accelerated the acceptance of natural refrigerants in North America. Transport refrigeration is a particularly promising sector where natural refrigerants are gaining traction. The use of ammonia-based systems in refrigerated trucks and trailers is increasing, offering a sustainable solution for cold chain logistics. Additionally, propane (R-290) is making inroads in domestic refrigeration and small-scale air conditioning due to its low GWP and energy efficiency.

Segmental Insights

Type Insights

Based on the type, the carbon dioxide segment is expected to register the highest growth during the forecast period 2025-2029.

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Carbon dioxide serves as an environmentally benign, non-toxic, and non-flammable natural refrigerant. Possessing a Global Warming Potential (GWP) value of 1, carbon dioxide serves as the benchmark for evaluating the comparative environmental impact of various refrigerants on global warming. As carbon dioxide is generated as a by-product of various production processes, it is readily accessible for use as a refrigerant. This accessibility contributes to the expansion of the North America Natural Refrigerants Market in the projected period.

Application Insights

Based on the application, the industrial segment is expected to register the highest growth during the forecast period, 2025-2029. The industrial sector encompasses refrigeration systems utilized in extensive industrial settings, including chemical manufacturing, pharmaceuticals, and food processing. Presently, carbon dioxide refrigeration technology finds its primary applications in three key areas: heat pumps, automotive air conditioning, and multi-stage refrigeration systems. Given carbon dioxide's environmentally friendly nature, the development and production of carbon dioxide compressors for diverse industries have been undertaken. This development is expected to drive the expansion of the North America Natural Refrigerants Market in the anticipated period.

Country Insights

The United States will witness the fastest growth during the forecast period, 2025-2029. This is attributed to the widespread adoption of natural refrigerants as government has been implementing regulations to phase down the use of high-GWP synthetic refrigerants. For example, the American Innovation and Manufacturing Act (AIM Act) aligns the country with the Kigali Amendment to the Montreal Protocol, which sets targets for reducing HFC emissions. This has led to a push for the adoption of natural refrigerants as alternatives.

Key Market Players

- Emerson Electric Co.
- Airgas Inc.
- Daikin U.S. Corporation
- SWEP North America, Inc.
- Messer North America, Inc.
- National Refrigerants Inc.

Report Scope:

In this report, the North America Natural Refrigerants Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

□□ North America Natural Refrigerants Market, By Type:

- o Carbon Dioxide
- o Ammonia
- o Hydrocarbons
- o Others

□□ North America Natural Refrigerants Market, By Application:

- o Industrial
- o Commercial
- o Domestic

□□ North America Natural Refrigerants Market, By Country:

- o United States
- o Mexico
- o Canada

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the North America Natural Refrigerants Market.

Available Customizations:

The North America Natural Refrigerants Market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

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Company Information

□ Detailed analysis and profiling of additional market players (up to five).

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