

Energy-efficient Windows Market – Global Industry Size, Share, Trends, Opportunity, and Forecast Segmented By Glazing Type (Double Glazed, Triple Glazed and Others), By End-use Sector (Non-residential and Residential), By Component (Glass, Frame and Hardware), By Application (New construction and Renovation & reconstruction), By Region, By Competition Forecast & Opportunities, 2018-2028

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Abstracts

The Global Energy-efficient Windows Market was valued at USD 14.96 billion in 2022 and is growing at a CAGR of 7.14% during the forecast period. The market is propelled by the escalating inclination towards enhancing energy efficiency, rising adoption of green building standards, and the surging demand for HVAC applications. Moreover, the expanding urbanization, commercialization, and industrialization, coupled with stringent government regulations, have positively influenced the growth of the energy-efficient windows industry.

Key Market Drivers

Rising Environmental Concerns and Energy Regulations

The global market for energy-efficient windows is witnessing a substantial growth due to the increasing concern for environmental sustainability and the enforcement of stringent energy efficiency regulations worldwide. As countries strive to mitigate their carbon footprint and address climate change, energy-efficient windows have become a pivotal

element in achieving these objectives.

The growing awareness of the environmental impact of energy consumption in buildings is one of the key drivers behind this trend. Buildings account for a significant portion of global energy consumption, and inefficient windows result in substantial energy loss. Consequently, there has been a heightened focus on energy-efficient building practices, with energy-efficient windows at the forefront.

Governments and regulatory bodies in numerous countries have acknowledged the role of energy-efficient windows in reducing energy consumption and greenhouse gas emissions. They have implemented various incentives, tax credits, and building codes that mandate or encourage the use of energy-efficient windows in both residential and commercial buildings. For example, the Energy Star program in the United States certifies products that meet specific efficiency criteria, thereby promoting the use of energy-efficient windows.

Furthermore, international agreements like the Paris Agreement have exerted pressure on countries to decrease their carbon emissions. Consequently, governments are actively endorsing energy-efficient solutions, including windows, as part of their strategies to meet emission reduction targets.

Technological Advancements and Innovation

Another significant driver of the global energy-efficient windows market is the continuous technological advancements and innovation in window manufacturing and materials. Manufacturers are heavily investing in research and development to create windows that offer superior energy efficiency without compromising aesthetics or functionality.

One of the key innovations in this field is the development of advanced glazing technologies. For instance, low-E (low emissivity) coatings are designed to reflect infrared radiation while allowing visible light to pass through, thereby reducing heat transfer. Triple-glazed and vacuum-insulated windows are also gaining popularity, providing even higher levels of insulation and energy efficiency.

Smart windows represent another area of innovation. These windows can dynamically adjust their tint or opacity to control the amount of sunlight and heat entering a building. This not only enhances energy efficiency but also improves occupant comfort while reducing reliance on artificial lighting and heating/cooling systems.

In addition to materials and coatings, frame design and materials are also evolving. The popularity of thermally broken frames is rising as they prevent the transfer of heat or cold through the frame. Composite materials and insulated frames further contribute to the overall energy efficiency of windows.

Economic Benefits and Energy Cost Savings

The adoption of energy-efficient windows in residential and commercial buildings is driven by the economic benefits and potential energy cost savings they offer. While energy-efficient windows may have a higher initial cost compared to traditional windows, the long-term savings make them an attractive investment.

One of the primary economic benefits is the reduction in energy consumption. Energy-efficient windows minimize heat transfer, helping to maintain a stable indoor temperature and reducing the need for heating or cooling. As a result, energy bills are lower, making energy-efficient windows a cost-effective choice over time. The payback period for these windows is often relatively short, particularly in regions with extreme climate conditions.

Additionally, energy-efficient windows can enhance the overall value of a property. Homebuyers and commercial property investors increasingly prioritize energy efficiency when making purchasing decisions. Properties with energy-efficient features, including windows, command higher prices and can be marketed as environmentally responsible.

In conclusion, the global energy-efficient windows market is driven by rising environmental concerns and regulations, ongoing technological advancements, and the economic benefits of energy cost savings. As sustainability becomes a top priority for individuals and organizations, the demand for energy-efficient windows is expected to continue growing, further fueling market expansion.

Key Market Challenges

High Initial Costs and ROI Uncertainty

One of the primary challenges confronting the global energy-efficient windows market is the comparatively higher initial cost of these windows in comparison to traditional, non-energy-efficient alternatives. Energy-efficient windows are typically equipped with advanced glazing technologies, multiple panes, low-emissivity coatings, and other

features designed to enhance insulation and decrease energy consumption. These enhancements come at a cost, thereby making energy-efficient windows a more substantial upfront investment for homeowners and commercial building owners.

The challenge lies in persuading consumers and property developers to surmount this initial cost barrier. While energy-efficient windows offer long-term savings through reduced energy bills, the return on investment (ROI) period can significantly vary depending on factors such as local energy prices, climate conditions, and the size of the building. In some instances, it may take several years to recoup the upfront costs, a factor that can dissuade potential buyers.

Furthermore, the uncertainty surrounding the ROI can pose a challenge. Predicting future energy prices and accurately determining the energy savings of energy-efficient windows can be arduous, making it more difficult for consumers to make informed decisions regarding their investments. Manufacturers and industry stakeholders must strive to educate potential buyers about the long-term advantages and provide transparent information on ROI calculations to effectively address this challenge.

Aesthetic and Design Limitations

Energy-efficient windows have made significant advancements in improving insulation and saving energy. However, a persistent challenge is the perception that they may compromise aesthetics and design flexibility. Traditional windows offer a wide range of design options, including unique shapes, sizes, and architectural styles, which can be difficult to replicate with energy-efficient alternatives.

Some consumers may hesitate to adopt energy-efficient windows due to concerns about their appearance. This challenge is particularly relevant in markets where aesthetics and architectural design play a significant role in building choices, such as historical preservation districts or luxury residential projects.

Manufacturers are actively addressing this challenge by offering a broader range of energy-efficient window styles and designs. The development of customizable frames, various color options, and advanced glazing technologies that allow for different tints and coatings can help alleviate aesthetic concerns. It is crucial to educate consumers about the evolving design possibilities and dispel the notion that energy-efficient windows are limited in terms of aesthetics.

Retrofitting Existing Buildings

Energy-efficient windows are commonly integrated into new construction projects; however, retrofitting existing buildings with such windows presents unique challenges. Many older buildings feature windows of architectural and historical significance, making replacement difficult. This poses challenges to upgrading them to energy-efficient alternatives.

The challenge of retrofitting is often related to the compatibility of new windows with existing building structures and designs. In some cases, retrofitting may necessitate costly modifications to the building envelope, such as altering window openings or reinforcing frames. These factors can discourage property owners from pursuing energy-efficient window upgrades.

Furthermore, window replacement in occupied buildings can cause significant disruption, particularly in commercial or residential settings. Minimizing downtime and ensuring occupant comfort during the retrofitting process is crucial but can be logistically complex.

Addressing this challenge requires the development of innovative retrofit solutions adaptable to different building types and styles while minimizing occupant inconvenience. Collaboration between manufacturers, contractors, and building professionals is key to finding cost-effective and efficient retrofitting methods that make energy-efficient windows a viable option for older structures. Regulatory incentives and rebates for retrofitting projects can also help alleviate the financial burden on property owners.

Key Market Trends

Smart and Connected Energy-Efficient Windows

One of the notable trends in the global market for energy-efficient windows is the integration of smart and connected technologies into window systems. Smart windows, equipped with sensors, actuators, and control systems, are designed to dynamically adjust their properties in response to changing environmental conditions, user preferences, or automation algorithms.

These windows offer several advantages. For example, they can automatically regulate the amount of sunlight entering a building to optimize natural lighting while minimizing heat gain. Smart windows can also adjust their tint or opacity to enhance privacy or

reduce glare. Furthermore, they can be seamlessly integrated into building management systems to optimize energy usage, enhance occupant comfort, and contribute to overall energy efficiency.

Moreover, the connectivity aspect enables remote monitoring and control of window systems through smartphones or building automation platforms. This trend aligns with the increasing demand for smart buildings and sustainable, energy-efficient solutions in both residential and commercial sectors.

The adoption of smart energy-efficient windows is expected to continue to rise as technology advances and becomes more affordable. Manufacturers are prioritizing the enhancement of the intelligence and connectivity features of these windows, which serves as a significant driver of market growth.

Advanced Glazing Technologies for Enhanced Performance

Advanced glazing technologies are continuously evolving, leading to a significant trend in the global energy-efficient windows market. These technologies aim to enhance the performance of windows in terms of thermal insulation, solar control, and overall energy efficiency.

One notable advancement is the development of 'dynamic' glazing solutions, which can switch between different states to optimize performance. Electrochromic, thermochromic, and suspended particle device (SPD) glazings are examples of dynamic technologies that enable windows to adjust their tint or transparency based on environmental conditions. This adaptability can help reduce energy consumption by minimizing the need for heating, cooling, or artificial lighting.

Another key technology that has seen continuous improvement is low-E (low emissivity) coatings. These coatings selectively reflect or absorb specific wavelengths of energy, such as infrared radiation, while allowing visible light to pass through. This property reduces heat transfer, improving thermal insulation without compromising natural light penetration.

Triple-glazed windows, consisting of three layers of glass with insulating gas fillings, have become increasingly prevalent, offering even higher levels of insulation. Vacuum-insulated glazing (VIG) is another emerging technology that provides excellent thermal performance by creating a vacuum gap between two glass layers.

As energy efficiency standards become more stringent and as consumers and businesses strive to reduce energy consumption and costs, the demand for windows equipped with these advanced glazing technologies is expected to grow, driving market expansion.

Segmental Insights

Glazing Type Insights

The Double Glazed segment holds a significant market share in the Global Energy-efficient Windows Market. Energy-efficient windows are specifically designed to minimize heat transfer, enhance insulation, and optimize overall energy performance in buildings. Double-glazed windows, a significant segment of the energy-efficient window market, have witnessed steady growth due to heightened awareness of energy conservation and sustainability.

The widespread adoption of double-glazed windows is observed in regions characterized by extreme temperature variations, such as North America, Europe, and parts of Asia. Typically composed of two glass panes with a sealed space in between, double-glazed windows can be filled with insulating gases like argon or krypton.

Energy efficiency of double-glazed windows is evaluated using various metrics, including U-factor (thermal transmittance), Solar Heat Gain Coefficient (SHGC), and Visible Transmittance (VT). By reducing energy consumption for heating and cooling, energy-efficient double-glazed windows play a crucial role in minimizing a building's carbon footprint.

Multiple global manufacturers offer a diverse range of options in terms of materials, coatings, and designs for double-glazed windows. Furthermore, the integration of smart home technology for automated climate control and energy management is poised to gain significant traction.

End-use Sector Insights

The Residential segment holds a significant market share in the Global Energy-efficient Windows Market. Energy-efficient windows are specifically designed to enhance insulation, reduce energy consumption, and improve overall comfort in homes. The residential segment of the energy-efficient windows market has witnessed substantial growth due to the increased awareness of energy conservation and the desire to lower

utility bills.

The adoption of energy-efficient windows in residential buildings is widespread in regions with extreme weather conditions, such as North America, Europe, and parts of Asia. Common types of energy-efficient windows used in residential settings include double-glazed, triple-glazed, low-E coated, and gas-filled windows.

Energy-efficient windows offer several benefits, including reduced energy consumption for heating and cooling, resulting in lower utility bills. They also contribute to enhanced indoor comfort by regulating temperature and reducing drafts. Although energy-efficient windows may have higher upfront costs compared to standard windows, homeowners often recoup these expenses through energy savings over time. Furthermore, homeowners have a wide range of options in terms of window designs, frame materials, and finishes to match their architectural preferences and interior décor.

It is worth noting that residential energy-efficient windows play a significant role in reducing greenhouse gas emissions by lowering energy consumption.

Regional Insights

The North America region is expected to dominate the market during the forecast period. This growth can be attributed to factors such as escalating energy costs, heightened environmental awareness, and a growing demand for sustainable building practices. The market encompasses both residential and commercial sectors, with residential applications being more prevalent.

In order to promote the use of energy-efficient windows, several U.S. states and Canadian provinces have implemented energy codes and building regulations that either mandate or incentivize their adoption. As a result, these windows have gained traction in new construction projects as well as retrofits.

The importance of green building certifications, such as LEED (Leadership in Energy and Environmental Design) and ENERGY STAR ratings, cannot be understated. These certifications have played a significant role in educating consumers and driving the adoption of energy-efficient building components, including windows.

Consumer awareness of the benefits of energy-efficient windows in North America is steadily increasing. Homeowners and building developers are actively seeking products that can reduce energy consumption, lower utility bills, and contribute to a more

sustainable environment. Energy-efficient windows not only provide energy savings but also enhance indoor comfort and property value.

Key Market Players

Saint-Gobain S.A.

Asahi Glass Co. Ltd.

VKR Holdings A/S

PGT Innovations, Inc.

Cornerstone Building Brands

Andersen Corporation

Rehau Limited

YKK Corporation

Jeld-Wen Holding, Inc.,

Deceuninck Group

Report Scope:

In this report, the Global Energy-efficient Windows Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Global Energy-efficient Windows Market, By Glazing Type:

Double Glazed

Triple Glazed

Others

Global Energy-efficient Windows Market, By End-use Sector:

Non-residential

Residential

Global Energy-efficient Windows Market, By Component:

Glass

Frame

Hardware

Global Energy-efficient Windows Market, By Application:

New construction

Renovation & reconstruction

Global Energy-efficient Windows Market, By Region:

North America

United States

Canada

Mexico

Europe

France

United Kingdom

Italy

Germany

Spain

Asia-Pacific

China

India

Japan

Australia

South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

Saudi Arabia

UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Energy-efficient Windows Market.

Available Customizations:

Global Energy-efficient Windows 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:

Company Information

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

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