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Global Electricity-free Cooling Films Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global Electricity-free Cooling Films market size is expected to reach $ 139 million by 2032, rising at a market growth of 20.7% CAGR during the forecast period (2026-2032).

Electricity-free Cooling Film refers to functional flexible films, membranes or film-based surface materials engineered to control solar radiation while enhancing thermal emission through the atmospheric transparency window, primarily around 8–13 ?m, thereby enabling a covered surface to reject heat to the sky without active refrigeration or direct electricity consumption. The technical principle combines spectral regulation of incoming solar energy with high mid-infrared emissivity: reflective products are designed to suppress solar heat absorption through high solar reflectance, while transmission-oriented products balance visible-light transmission, solar/infrared rejection and thermal emission for applications such as glazing. Commercial products may use multilayer polymer structures, inorganic functional particles, micro/nanostructures, reflective layers and protective or adhesive layers to achieve the required optical, mechanical and weathering performance. Current products are increasingly designed as installable engineering materials rather than laboratory optical structures, with durability, adhesion, flame resistance, surface cleanliness and compatibility with different substrates becoming important commercial specifications. This study focuses on Electricity-free Cooling Films used in construction, logistics and warehousing, transportation equipment, energy and power facilities and other thermal-management applications, and evaluates the market by transmission/reflection structure, reflectivity level and color or optical appearance.

Key Findings

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Global Electricity-free Cooling Film sales volume reached 939.23 K Sqm in 2025 and is projected to reach 6,684.32 K Sqm in 2032

The average global selling price of Electricity-free Cooling Film was approximately US$26.19 per Sqm in 2025

MG Energy, Radi-Cool, SPACE COOL, SkyCool and i2Cool collectively represented approximately 85.89% of global sales value in 2025

Commercial products are expanding from highly reflective white films toward transparent, colored and multifunctional optical film solutions

Market Trends

The Electricity-free Cooling Film industry is transitioning from a performance-driven emerging-material market toward a broader thermal-management platform characterized by application-specific optical design, longer service life and easier installation. Early commercial products concentrated primarily on maximizing solar reflectance and mid-infrared emissivity, whereas newer products increasingly balance radiative-cooling performance with visible-light transmission, color, flame resistance, adhesion, corrosion resistance, self-cleaning properties and weatherability. Transparent window films and colored solutions are expanding the addressable market beyond white roofs and industrial surfaces, while improved durability is reducing lifecycle concerns for building-envelope applications. SPACE COOL, for example, has introduced a film product with an indicated weather-resistance life of approximately 15 years, while i2Cool markets transparent film with visible-light transmittance of up to 75% and mid-infrared emissivity of up to 94%. The development direction therefore increasingly emphasizes “cooling performance + functional integration + installation reliability,” enabling film products to penetrate windows, vehicles, electrical equipment, warehouses and other surfaces where conventional white reflective materials have practical or aesthetic limitations.

Market Dynamics

Drivers

Growing cooling requirements in buildings and industrial assets are the fundamental

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demand driver for Electricity-free Cooling Films. Space cooling has become one of the fastest-growing electricity end uses in buildings, increasing pressure on electricity systems during hot periods and strengthening the economic value of technologies that reduce thermal loads without additional power consumption. For building envelopes, high solar reflectance and high thermal emittance are established mechanisms for lowering surface temperature and cooling demand, creating a favorable technical foundation for radiative-cooling films. Demand is also expanding because passive cooling can be applied directly to existing roofs, façades, glass, storage facilities, containers and outdoor equipment, allowing users to retrofit thermal-management performance without redesigning the primary refrigeration or HVAC system. Commercial demonstrations across buildings, electrical facilities, logistics, new-energy equipment and transportation further support the transition from material validation to application deployment.

Restraints

Commercial performance remains highly dependent on climate, installation environment and long-term optical stability. Radiative-cooling effectiveness can be affected by humidity, cloud cover, atmospheric conditions, solar exposure and convective heat transfer, while the energy-saving benefit of highly reflective exterior surfaces is generally more favorable in hot climates and may be reduced in colder regions where winter solar heat gain can be beneficial. Dust accumulation, surface contamination, ultraviolet exposure, salt spray, moisture and mechanical damage can gradually influence optical properties, making weather resistance and maintenance important lifecycle considerations. Transparent and colored films face an additional design constraint because visible-light transmission or color requirements must be balanced against solar reflection and thermal emission. Installation quality, substrate compatibility and adhesive durability can also determine field performance, particularly on curved vehicle surfaces, industrial equipment, aging roofs and façades. These factors mean that laboratory optical performance alone is insufficient to determine commercial competitiveness.

Opportunities

The strongest expansion opportunities are emerging where cooling demand is high, exposed surface area is large and active thermal management carries meaningful energy or operating costs. Building retrofits provide a particularly scalable opportunity because film products can be incorporated into roofs, façades and windows without

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major equipment replacement. Logistics and warehousing offer another attractive field: warehouses, grain-storage facilities, containers and refrigerated transportation assets can use passive surface cooling to reduce solar heat gain and stabilize internal temperatures. Energy and power facilities provide opportunities in outdoor electrical cabinets, energy-storage systems, power rooms and related equipment where excessive temperature can affect operating efficiency and equipment reliability. Transparent and colored films expand the addressable market further by enabling radiative-cooling functions in glazing, vehicles and architecturally sensitive surfaces. The commercialization of high-transmission films, specialized logistics products and power-sector products indicates that application-specific product development is likely to become an important source of incremental demand.

Challenges

The principal long-term challenge is converting technically strong cooling performance into predictable lifecycle economics across different operating environments. The industry still needs broader standardization of performance testing, accelerated aging evaluation and field-based measurement methodologies so that customers can compare products under consistent solar irradiance, humidity, wind, substrate and installation conditions. Producers must simultaneously improve optical performance, durability, flame resistance, mechanical properties and manufacturability without driving costs to levels that weaken payback economics. Scaling production also requires consistent micro/nanostructure control and stable coating, lamination or roll-to-roll processing over large film areas. In addition, the market competes indirectly with cool-roof coatings, thermal-insulation materials, reflective membranes, conventional window films and active HVAC efficiency upgrades. Suppliers therefore need to demonstrate not only temperature reduction but also measurable energy savings, reliable service life and installation economics to accelerate large-scale procurement.

Industry Chain Analysis

The upstream industry chain mainly consists of polymer films and resins, inorganic functional particles, optical fillers, reflective materials, adhesives, protective layers and other specialty chemical or optical materials. Different technical routes use different combinations: commercial and developmental designs include multilayer polymer optical structures, polymer-inorganic composites, micro/nanostructured functional layers and reflective metallic layers. Midstream value creation is concentrated in spectral

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design, formulation development, coating or film formation, lamination, roll-to-roll processing, surface treatment, converting and performance testing. At this stage, the competitive advantage lies not only in achieving high reflectance or emissivity but also in maintaining those properties across large-area production with acceptable yield, mechanical strength and weatherability. Downstream activities include product converting, distribution, engineering design, substrate pretreatment and installation for buildings, logistics assets, transportation equipment and power facilities. As commercialization advances, a larger portion of value is increasingly associated with proprietary optical design, application engineering, certification, durability assurance and integrated thermal-management solutions rather than basic film substrate production alone.

Segment Insights

By product structure, reflection-type and transmission-type films address fundamentally different thermal-management requirements. Reflection-type products prioritize suppression of solar heat gain and are particularly suitable for opaque roofs, façades, warehouses, containers and outdoor equipment; products with reflectivity above 96% represent the high-performance end of this route and are attractive where maximum daytime heat rejection is required. Products below the 96% reflectivity threshold can include designs in which other performance attributes—such as color, transparency, mechanical characteristics or substrate compatibility—are optimized alongside cooling performance. MG Energy, for example, reports solar reflectance above 96% for one of its micro/nanostructured radiative-cooling material routes, demonstrating the technical feasibility of the higher-reflectivity segment.

Color segmentation is increasingly linked to application rather than appearance alone. White films remain technically favorable for maximizing broadband solar reflection and therefore retain strong suitability for roofs, storage and outdoor industrial surfaces. Colored products address architectural integration, transportation and equipment appearance requirements but require more sophisticated spectral engineering to preserve cooling performance. Transparent films constitute a differentiated high-value direction because they must maintain visibility while controlling solar and infrared energy. Commercial products with high visible-light transmission are already being targeted at architectural and vehicle glazing, indicating that the transparent segment can broaden radiative cooling from opaque exterior surfaces into fenestration and mobility applications.

Downstream Market Opportunities

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Construction represents a foundational commercialization field because roofs, façades and glazing provide large exposed areas where passive thermal control can directly reduce solar heat gain. The retrofit characteristic of film materials is particularly relevant to existing industrial buildings, commercial facilities and warehouses where replacement of the complete envelope or HVAC system would require materially higher capital expenditure. As the market develops, requirements are shifting from maximum laboratory cooling performance toward long-term reflectance retention, flame resistance, waterproofing, self-cleaning, visual appearance and compatibility with established construction methods. Products that satisfy building-code and durability requirements are therefore better positioned for larger engineering projects; SPACE COOL’s newer film, for example, combines radiative-cooling performance with improved weather resistance and non-combustible-material certification in Japan.

Logistics and warehousing, transportation equipment and energy and power facilities provide additional high-value opportunities because these applications frequently combine direct solar exposure with temperature-sensitive assets. Radiative-cooling films can be deployed on warehouse roofs, grain-storage buildings, containers, vehicle surfaces and outdoor electrical equipment to reduce heat accumulation and supplement existing cooling systems. For power and energy infrastructure, lower enclosure temperatures can support thermal management of outdoor cabinets, electrical rooms and energy-storage equipment. Transportation creates a further opportunity for transparent or colored products capable of maintaining visibility and appearance while reducing solar heat load. The expansion of commercial product portfolios specifically designed for logistics, power equipment, glazing and vehicles demonstrates increasing downstream specialization.

Regional Insights

Commercialization is developing along different regional pathways. North America has been important in the development and early commercialization of daytime radiative-cooling technology, with U.S.-based companies advancing multilayer films and integration with building and refrigeration systems. East Asia is becoming particularly active in product industrialization: Chinese suppliers have expanded into films, coatings and other radiative thermal-management materials for buildings, logistics, electrical equipment, new-energy systems and consumer products, while Japanese suppliers are emphasizing building-grade durability, non-combustibility and engineered film solutions. These developments indicate a transition in East Asia from laboratory material

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development toward diversified commercial portfolios and larger-scale manufacturing.

Hot and high-solar-irradiance markets represent a structurally attractive deployment opportunity because passive solar heat rejection has stronger economic relevance where cooling loads are persistent. This creates potential in the Middle East and other hot-climate markets for warehouses, industrial facilities, logistics assets and energy infrastructure. Nevertheless, regional commercial potential depends on local building standards, fire requirements, UV and sand resistance, installation channels and customer willingness to evaluate lifecycle energy savings rather than initial material cost alone. Consequently, suppliers capable of adapting optical performance, durability and installation systems to regional climate conditions are likely to have stronger market-entry potential than standardized single-product suppliers.

Competitive Landscape Analysis

The Electricity-free Cooling Film market is currently characterized by relatively high concentration. In 2025, MG Energy, Radi-Cool, SPACE COOL, SkyCool and i2Cool collectively accounted for approximately 85.89% of global Electricity-free Cooling Film sales value. Competition among leading suppliers is increasingly differentiated by technical route and target application rather than by a single optical-performance parameter. MG Energy has developed film-based and micro/nanostructured thermal-management products across consumer electronics, buildings, electrical equipment and new-energy applications; SPACE COOL emphasizes multilayer reflective/radiative films with long-term weather resistance; SkyCool has developed specialized multilayer polymer film as a core technology for building and heat-rejection systems; and i2Cool is extending its portfolio into transparent architectural and automotive films alongside other passive-cooling materials.

The competitive threshold is therefore rising from proprietary material formulation toward scalable manufacturing, certification, application engineering and channel access. Strategic participation by established materials companies is also increasing: Chongqing Sanxia Paint completed the acquisition of a 51% interest in Azure Era in July 2025 and subsequently identified building energy efficiency, cold-chain logistics and new-energy supporting applications as key development fields for the radiative-cooling business. This type of industrial integration can provide emerging radiative-cooling technologies with established production infrastructure, engineering channels and customer relationships, while increasing competitive pressure on independent technology companies. Over time, companies capable of combining differentiated

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optical intellectual property with mass-production capability, long-duration field performance and application-specific commercial channels are expected to establish more defensible positions.

Report Scope

This report studies the global Electricity-free Cooling Films production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for Electricity-free Cooling Films and provides market size (US$ million) and Year-over-Year (YoY) Growth, considering 2025 as the base year. This report explores demand trends and competition, as well as details the characteristics of Electricity-free Cooling Films that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global Electricity-free Cooling Films total production and demand, 2021-2032, (K Sqm)

Global Electricity-free Cooling Films total production value, 2021-2032, (USD Million)

Global Electricity-free Cooling Films production by region & country, production, value, CAGR, 2021-2032, (USD Million) & (K Sqm), (based on production site)

Global Electricity-free Cooling Films consumption by region & country, CAGR, 2021-2032 & (K Sqm)

U.S. VS China: Electricity-free Cooling Films domestic production, consumption, key domestic manufacturers and share

Global Electricity-free Cooling Films production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (K Sqm)

Global Electricity-free Cooling Films production by Type, production, value, CAGR, 2021-2032, (USD Million) & (K Sqm)

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Global Electricity-free Cooling Films production by Application, production, value, CAGR, 2021-2032, (USD Million) & (K Sqm)

This report profiles key players in the global Electricity-free Cooling Films market based on the following parameters - company overview, production, value, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include MG Energy, Radi-Cool, SPACE COOL, SkyCool, i2Cool, SolCold, Azure Era, Shandong Huacheng, SVG Optoelectronics, etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Stakeholders would have ease in decision-making through various strategy matrices used in analyzing the World Electricity-free Cooling Films market

Detailed Segmentation:

Each section contains quantitative market data including market by value (US$ Millions), volume (production, consumption) & (K Sqm) and average price (US$/Sq m) by manufacturer, by Type, and by Application. Data is given for the years 2021-2032 by year with 2025 as the base year, 2026 as the estimate year, and 2027-2032 as the forecast year.

Global Electricity-free Cooling Films Market, By Region:

United States

China

Europe

Japan

South Korea

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ASEAN

India

Rest of World

Market Segmentation

Global Electricity-free Cooling Films Market, Segmentation by Type:

Transmission Type

Reflection Type

Global Electricity-free Cooling Films Market, Segmentation by Reflectivity:

Reflectivity Greater Than 96%

Reflectivity Less Than 96%

Global Electricity-free Cooling Films Market, Segmentation by Color:

White

Colored

Transparent

Global Electricity-free Cooling Films Market, Segmentation by Application:

Construction Industry

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Logistics and Warehousing

Transportation Equipment

Energy and Power Facilities

Others

Companies Profiled:

MG Energy

Radi-Cool

SPACE COOL

SkyCool

i2Cool

SolCold

Azure Era

Shandong Huacheng

SVG Optoelectronics

Key Questions Answered

1. How big is the global Electricity-free Cooling Films market?
2. What is the demand of the global Electricity-free Cooling Films market?
3. What is the year over year growth of the global Electricity-free Cooling Films market?
4. What is the total value of the global Electricity-free Cooling Films market?
5. Who are the Major Players in the global Electricity-free Cooling Films market?
6. What are the growth factors driving the market demand?

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