

# **Solar Encapsulation Market – Global Industry Size, Share, Trends, Opportunity, and Forecast Segmented by Material (Ethylene Vinyl Acetate, Non-ethylene Vinyl Acetate, UV Curable Resin, and Others), by Technology (Polycrystalline Silicon Solar, Cadmium Telluride, Copper Indium Gallium Selenide, and Amorphous Silicon), by Application (Construction, Electronics, Automotive, and Others), By Region, Competition 2018-2028.**

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## **Abstracts**

Global Solar Encapsulation Market was valued at USD 3.93 Billion in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 7.71% through 2028, The solar module back sheets contain multiple layers of barrier films and adhesives. The back sheet construction is important in protecting the solar cells from different environmental conditions such as moisture, UV exposure, and other performance threats, while improving solar module efficiency by aiding the reduction of partial module cost. The encapsulation film protects the solar cell and ensures its reliability and performance. Its role is to provide optical and electrical transmissivity by keeping the moisture out. Encapsulants provide an opportunity for realizing enhanced efficiencies in the module manufacturing process. Encapsulation is a key step in the production of solar cells. Without a good encapsulation process, even the best solar cells cannot produce good solar modules.

### **Key Market Drivers**

Increasing Solar Energy Adoption

The increasing adoption of solar energy is a potent driver propelling the growth of the global solar encapsulation market. As the world seeks cleaner and more sustainable energy sources, solar power has emerged as a frontrunner, and its burgeoning popularity is reshaping the energy landscape. One of the key factors driving solar energy adoption is the growing awareness of environmental issues and the imperative to reduce greenhouse gas emissions. Solar power is inherently clean and produces no harmful emissions, making it an attractive choice for those concerned about climate change and air quality. This heightened environmental consciousness has led to a surge in demand for solar installations, boosting the market for solar encapsulation materials.

The declining cost of solar panels is another significant driver. Technological advancements and economies of scale have led to substantial reductions in the cost of producing solar panels over the years. This cost-effectiveness has made solar energy more accessible to a wider range of consumers, from homeowners to large-scale industrial facilities. Consequently, the solar encapsulation market is experiencing increased demand, as more solar panels are being manufactured and installed. Government incentives and policies have also played a pivotal role in promoting solar energy adoption. Many governments across the globe offer financial incentives, tax credits, and rebates to encourage individuals and businesses to invest in solar installations. These incentives not only make solar energy more affordable but also provide a strong incentive for consumers to opt for encapsulation materials that enhance the performance and longevity of their solar panels.

Furthermore, advancements in technology have improved the efficiency and reliability of solar panels, making them a more attractive investment. Solar encapsulation materials have evolved to protect panels from harsh environmental conditions, ensuring they remain efficient and durable over time. As consumers witness the tangible benefits of these technological improvements, their confidence in solar energy grows, driving further adoption.

In summary, the increasing adoption of solar energy is a powerful force driving the global solar encapsulation market. Environmental awareness, cost reductions, government support, and technological advancements all contribute to the rise of solar power as a dominant energy source. This growth in solar energy adoption creates a sustained demand for high-quality encapsulation materials, underscoring the integral role they play in the renewable energy revolution. As solar energy continues to gain momentum, the solar encapsulation market is poised for substantial growth in the years

to come.

## Government Incentives and Policies

Government incentives and policies play a pivotal role in driving the global solar encapsulation market. These initiatives have a profound impact on the growth and adoption of solar energy technologies, including the materials and technologies used for encapsulating solar panels. Here's a comprehensive 300-word paragraph highlighting the importance of government incentives and policies, Government incentives and policies are instrumental in propelling the global solar encapsulation market to new heights. In an era where the world is grappling with climate change and the urgent need for sustainable energy sources, governments worldwide have recognized the critical role of solar energy in reducing greenhouse gas emissions and fostering energy security. Consequently, they have introduced a range of supportive measures to encourage the deployment of solar technologies.

One of the most impactful drivers is financial incentives, such as tax credits, rebates, and subsidies, which directly reduce the upfront costs of installing solar panels. These incentives make solar energy more financially accessible for residential, commercial, and industrial consumers, spurring a surge in demand for solar installations. As a result, manufacturers and suppliers of solar encapsulation materials and technologies benefit from this increased demand. Additionally, feed-in tariffs (FiTs) and net metering policies incentivize solar power generation by offering fair compensation for excess electricity fed back into the grid. These policies not only encourage the installation of solar panels but also prompt consumers to invest in high-quality encapsulation materials that enhance the durability and longevity of their solar systems.

Furthermore, renewable energy mandates and Renewable Portfolio Standards (RPS) impose targets for utilities to generate a certain percentage of their energy from renewable sources, including solar. To meet these requirements, utilities invest in solar projects, creating a stable market for solar encapsulation materials. Environmental regulations and sustainability goals also drive the adoption of solar energy. Governments implement policies to reduce carbon emissions and promote clean energy alternatives, aligning with international agreements like the Paris Agreement. Solar energy, supported by effective encapsulation, contributes significantly to meeting these environmental objectives. In conclusion, government incentives and policies are pivotal drivers of the global solar encapsulation market. By reducing costs, guaranteeing fair compensation, and aligning with environmental goals, these measures foster a conducive environment for the growth of the solar energy sector, ultimately benefiting

manufacturers and stakeholders in the solar encapsulation industry. As governments continue to prioritize clean energy and sustainability, their role in advancing the solar encapsulation market remains paramount.

## Key Market Challenges

### Price Volatility of Raw Materials

The price volatility of raw materials is a significant challenge that can potentially hamper the growth and stability of the global solar encapsulation market. Solar encapsulation materials, such as ethylene-vinyl acetate (EVA), backsheet materials, and protective coatings, are essential components in the manufacturing of solar panels. The cost and availability of these materials can have a direct and profound impact on the overall economics of solar energy projects, and here's how, Firstly, price fluctuations in raw materials can lead to uncertainty in production costs. Manufacturers often operate on tight profit margins in the competitive solar industry. When the prices of key encapsulation materials rise unexpectedly, it can erode profit margins and make it challenging for companies to offer competitive pricing to consumers. This can, in turn, slow down the adoption of solar energy technologies.

Secondly, price volatility can disrupt supply chains. The solar encapsulation industry relies on a global supply chain, with materials sourced from various regions. Sudden price spikes or shortages of raw materials can disrupt production schedules and lead to delays in project completion. This not only affects manufacturers but also impacts solar installers and project developers, potentially causing project cancellations or postponements. Thirdly, cost fluctuations can deter investments in solar projects. Large-scale solar projects often require significant upfront capital investments. When raw material prices are unstable, project developers may become hesitant to commit to long-term solar installations, fearing that costs may rise unpredictably over time, making the projects financially less attractive.

Moreover, price volatility can hinder the ability of governments to predict and plan for the implementation of solar energy policies and incentives. Sudden cost increases in solar materials may necessitate adjustments in subsidy programs or incentives, affecting the overall attractiveness of solar energy for consumers and businesses. To mitigate the impact of raw material price volatility, the solar encapsulation industry must focus on strategies such as diversifying supply sources, investing in research and development for alternative materials, and establishing long-term partnerships with suppliers. Additionally, governments and industry associations can collaborate to

develop stability mechanisms and trade policies that help maintain consistent prices for essential encapsulation materials. In conclusion, the price volatility of raw materials presents a notable challenge for the global solar encapsulation market. It can disrupt production, raise uncertainty about project economics, and deter investments in solar energy projects. Addressing this challenge requires proactive measures from manufacturers, policymakers, and industry stakeholders to ensure the long-term sustainability and growth of the solar energy sector.

### Quality Control and Product Reliability

Quality control and product reliability are critical concerns that have the potential to hamper the global solar encapsulation market. Ensuring the consistent and high-quality performance of solar encapsulation materials is essential for the long-term viability and trustworthiness of solar energy systems. Several key factors highlight the challenges associated with quality control and product reliability, Firstly, the durability of solar encapsulation materials is paramount. Solar panels are typically exposed to harsh environmental conditions, including extreme temperatures, UV radiation, moisture, and mechanical stress. If encapsulation materials degrade prematurely or fail to protect the solar cells effectively, it can result in reduced energy production and increased maintenance costs. This can erode the confidence of consumers and investors in the technology.

Secondly, product reliability directly impacts the overall performance of solar panels and their expected lifespan. Solar energy systems are designed to operate for 20 to 30 years or more. Inconsistent quality control practices or the use of subpar encapsulation materials can lead to early degradation, reduced efficiency, and shorter lifespans for solar panels, diminishing their economic viability and sustainability. Thirdly, inadequate quality control can lead to variations in product quality across different manufacturers and suppliers. This can create uncertainty for solar project developers and installers when selecting encapsulation materials. The lack of standardized quality assurance measures can hinder the industry's ability to meet performance expectations consistently.

Moreover, in some cases, insufficient quality control can result in safety concerns. Encapsulation materials that do not meet safety standards may pose fire risks or other hazards when exposed to extreme conditions, potentially leading to safety incidents and liabilities. To address these challenges and maintain the trust of consumers and the industry, solar encapsulation manufacturers must invest in robust quality control processes and adhere to stringent quality standards. Comprehensive testing and

certification protocols should be established to ensure that encapsulation materials meet performance, durability, and safety criteria.

Collaboration between industry stakeholders, research institutions, and regulatory bodies is essential to develop and update industry standards and best practices for quality control and product reliability. Transparent reporting of product performance data can also help consumers and solar project developers make informed decisions when selecting encapsulation materials. In conclusion, quality control and product reliability are pivotal factors that can significantly impact the global solar encapsulation market. Ensuring the consistent high-quality performance and durability of encapsulation materials is essential for the continued growth and success of the solar energy industry. Industry-wide commitment to rigorous quality control measures and standards will be crucial in addressing these challenges and fostering the long-term sustainability of solar energy systems.

### Intense Competition

Intense competition is a challenging aspect that has the potential to hamper the global solar encapsulation market. The solar industry has experienced rapid growth and expansion in recent years, driven by increasing demand for clean energy and sustainability. This growth has attracted numerous manufacturers and suppliers to the solar encapsulation sector, resulting in a highly competitive landscape. Here's a closer look at how intense competition can impact the industry, Price Pressure: In a fiercely competitive market, companies may engage in price wars to gain a competitive edge. While this may benefit consumers in the short term by driving down prices, it can lead to reduced profit margins for manufacturers. Lower prices can also result in compromises in product quality as companies look to cut costs, potentially affecting the long-term reliability of solar encapsulation materials.

Innovation and R&D: Intense competition can drive innovation, as companies strive to differentiate themselves from their competitors. However, this also necessitates significant investments in research and development (R&D) to stay ahead in terms of technology and product offerings. Smaller companies may find it challenging to keep up with these R&D expenses, potentially limiting their ability to compete effectively. Market Saturation: As the number of companies in the solar encapsulation market grows, the market may become saturated with various products and solutions. This can make it more challenging for consumers, installers, and project developers to navigate the options and select the most suitable encapsulation materials.

**Supply Chain Challenges:** Intense competition can lead to fluctuations in demand for raw materials, such as ethylene-vinyl acetate (EVA) and backsheet materials, which can disrupt supply chains. This, in turn, can cause delays in production and project completion, affecting the overall efficiency of the solar industry.

**Consolidation and Market Share:** In response to intense competition, some companies may seek to merge or acquire others to gain a larger market share or achieve economies of scale. This consolidation can reduce the number of players in the market, potentially limiting choices for consumers and installers.

To address the challenges posed by intense competition, companies in the solar encapsulation market must focus on several key strategies, **Differentiation:** Manufacturers can set themselves apart by offering innovative products that enhance performance, durability, and efficiency. This can help justify premium pricing and create a competitive advantage.

**Quality Assurance:** Ensuring consistent product quality and reliability is crucial. Investing in robust quality control processes and adhering to industry standards can help build trust among consumers and industry stakeholders.

**Global Reach:** Expanding into emerging markets and diversifying customer bases can help mitigate the effects of intense competition in mature markets.

**Sustainable Practices:** Embracing sustainability and environmentally responsible manufacturing can be a point of differentiation and appeal to environmentally conscious consumers.

In conclusion, while intense competition in the global solar encapsulation market presents challenges, it can also drive innovation and lead to better products for consumers. Companies must navigate this competitive landscape by focusing on differentiation, quality, global reach, and sustainable practices to ensure their long-term success in the dynamic solar industry.

## Key Market Trends

### Bifacial Solar Panels

Bifacial solar panels are emerging as a driving force behind the growth of the global solar encapsulation market. These innovative panels, capable of capturing sunlight from both the front and rear sides, have gained significant traction in the solar industry due to their potential to significantly boost energy output. Here's how bifacial solar panels are driving the market for solar encapsulation materials, **Increased Energy Generation:** Bifacial solar panels can capture sunlight from both sides, allowing them to harvest reflected and diffused light from the ground or nearby surfaces. This additional source of energy can increase the overall electricity production of solar installations, making them

more attractive to consumers and investors. To maximize this capability, specialized encapsulation materials that enhance light transmission and protect the rear side of the panels are required.

**Enhanced Efficiency:** Bifacial panels typically feature improved efficiency compared to their monofacial counterparts. This increased efficiency is due to the utilization of additional sunlight, making bifacial panels an appealing choice for solar projects aiming to maximize power output within limited space. Encapsulation materials must be designed to support the enhanced efficiency and reliability of bifacial panels. **Diverse Applications:** Bifacial solar panels are versatile and can be deployed in various environments, including ground-mounted systems, building-integrated photovoltaics (BIPV), and solar carports. This versatility expands the range of applications for solar panels, increasing their demand and driving the need for compatible encapsulation materials suitable for different installation types.

**Technological Advancements:** Manufacturers are continually developing and refining bifacial panel technologies, resulting in more efficient and cost-effective solutions. This rapid innovation requires encapsulation materials that can adapt to evolving panel designs and requirements, such as improved transparency and robust rear-side protection. **Environmental Considerations:** Bifacial panels align with sustainability goals, as they can generate more energy using the same number of materials, reducing the environmental impact of solar installations. Eco-friendly encapsulation materials that support these green initiatives are in high demand.

**Market Competitiveness:** The attractiveness of bifacial panels in terms of increased energy yield and cost-effectiveness makes them a competitive choice in the solar market. Solar encapsulation manufacturers that provide materials tailored to bifacial panels gain a competitive edge.

**Government Support:** Some governments and regulatory bodies are recognizing the benefits of bifacial solar panels and providing incentives and subsidies to encourage their adoption. This governmental support further stimulates the market for bifacial panels and, consequently, the encapsulation materials needed to protect and enhance their performance. In conclusion, bifacial solar panels are driving the global solar encapsulation market by offering increased energy generation, enhanced efficiency, diverse applications, technological advancements, environmental sustainability, market competitiveness, and government support. As the solar industry continues to evolve, the demand for encapsulation materials specifically designed to meet the unique requirements of bifacial panels is expected to grow, making this trend a pivotal factor in



the industry's development and expansion.

### Thinner and Lighter Materials

The trend toward thinner and lighter materials is poised to be a significant driver of the global solar encapsulation market. As the solar industry continues to expand and evolve, the demand for more efficient, lightweight, and cost-effective materials has become increasingly pronounced. Here's how thinner and lighter materials are driving the growth of the solar encapsulation market, Improved Efficiency: Thinner and lighter encapsulation materials can enhance the overall efficiency of solar panels. With reduced weight, panels are easier to handle and install. Additionally, thinner materials allow for more effective light transmission to the solar cells, which can lead to increased energy production. This improved efficiency is particularly valuable in areas with limited space for solar installations.

**Lower Installation Costs:** The reduced weight of encapsulation materials simplifies transportation, handling, and installation processes. This translates into lower labor and logistics costs for solar projects. As a result, solar energy becomes more cost-competitive and attractive to both residential and commercial customers. **Increased Design Flexibility:** Thinner materials offer greater design flexibility, allowing manufacturers to create innovative and aesthetically pleasing solar panels. Panels with slim profiles and customized shapes can be integrated into various architectural and industrial designs, expanding their applications beyond traditional solar farms and rooftops.

**Reduced Environmental Impact:** Lighter materials require fewer resources for production and transportation, reducing their carbon footprint. Sustainability is a growing concern for consumers and businesses alike, and using thinner and lighter encapsulation materials aligns with eco-friendly practices. **Space-Efficient Installations:** Thin and lightweight solar panels can be installed in areas with limited structural support, such as rooftops with weight constraints or on buildings with older infrastructure. This space efficiency opens up new possibilities for solar deployment in urban and densely populated areas.

**Competitive Advantage:** Manufacturers that specialize in thinner and lighter encapsulation materials can gain a competitive edge in the market. As the solar industry continues to mature, companies offering innovative materials that meet the demand for efficiency and cost-effectiveness will likely see increased market share. **Global Expansion:** Thinner and lighter materials can be particularly beneficial in emerging

markets where infrastructure constraints and transportation challenges may exist. Their adaptability to diverse conditions and ease of installation make them suitable for global expansion efforts.

While the trend toward thinner and lighter materials offers numerous advantages, manufacturers must also ensure that these materials maintain high levels of durability, reliability, and protection for solar panels. Balancing the quest for lightweight solutions with the need for robust performance is crucial to the success of thinner and lighter encapsulation materials in the global solar market. In conclusion, the drive toward thinner and lighter materials in solar encapsulation is poised to be a significant growth driver for the global solar energy industry. These materials offer improved efficiency, lower installation costs, enhanced design flexibility, and a reduced environmental footprint. As the demand for solar energy continues to surge, the adoption of thinner and lighter encapsulation materials is likely to play a pivotal role in advancing the accessibility and sustainability of solar power worldwide.

## Segmental Insights

### Application Insights

The construction segment holds a significant market share in the Global Solar Encapsulation Market. The construction segment dominated the global market in 2020 and is projected to remain the fastest-growing segment during the forecast period. This is attributed due to urbanization and expansion of cities & road network.

### Regional Insights

Asia Pacific plays a significant role in the global Solar Encapsulation market; Asia-Pacific region represents the largest market and is also expected to be the fastest-growing market over the forecast period owing to the increasing consumption from countries such as China, India, and Japan.

China has the world's largest electronics production base. Electronic products, such as smartphones, OLED TVs, tablets, and so on, have the highest growth prospects in the electronics segment. With the increase in the demand for these, the market for encapsulant in China is projected to grow in the near future.

Additionally, the Asia-Pacific semiconductor industry accounts for the largest share and is expected to be the fastest-growing region in semiconductors production, owing to

innovations in microchip technologies, which are expected to boost demand for integrated circuits in the region, which, in turn, is likely to boost the demand for the market studied.

According to India Electronics and Semiconductor Association, the semiconductor component market in the country is expected to be worth USD 32.35 billion by 2025, exhibiting a CAGR of 10.1% (2018 - 2025). Thus, the ongoing Make in India initiative by the government, is expected to result in investments in the semiconductor industry in the country.

### Key Market Players

3M COMPANY

AKCOME

STR HOLDING INC

BRIDGESTONE CORPORATION

Elbit Systems Limited

DNP SOLAR

DOW INC.

DUPONT DE NEMOURS INC

FIRST SOLAR

HANGZHOU FIRST PV MATERIAL CO. LTD.

### Report Scope:

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

#### Global Solar Encapsulation Market, By Material:

Ethylene Vinyl Acetate

Non-ethylene Vinyl Acetate

UV Curable Resin

Others

Global Solar Encapsulation Market, By Technology:

Polycrystalline Silicon Solar

Cadmium Telluride

Copper Indium Gallium Selenide

Amorphous Silicon

Global Solar Encapsulation Market, By Application:

Construction

Electronics

Automotive

Others

Global Solar Encapsulation Market, By Region:

North America

United States

Canada

Mexico

Asia-Pacific

China

India

Japan

South Korea

Indonesia

Europe

Germany

United Kingdom

France

Russia

Spain

South America

Brazil

Argentina

Middle East & Africa

Saudi Arabia

South Africa

Egypt

UAE

Israel

### Competitive Landscape

Company Profiles: Detailed analysis of the major companies presents in the Global Solar Encapsulation Market.

### Available Customizations:

Global Solar Encapsulation 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).

## Contents

### **1. PRODUCT OVERVIEW**

- 1.1. Market Definition
- 1.2. Scope of the Market
- 1.3. Markets Covered
- 1.4. Years Considered for Study
- 1.5. Key Market Segmentations

### **2. RESEARCH METHODOLOGY**

- 2.1. Objective of the Study
- 2.2. Baseline Methodology
- 2.3. Key Industry Partners
- 2.4. Major Association and Secondary Sources
- 2.5. Forecasting Methodology
- 2.6. Data Triangulation & Validation
- 2.7. Assumptions and Limitations

### **3. EXECUTIVE SUMMARY**

### **4. VOICE OF CUSTOMERS**

### **5. GLOBAL SOLAR ENCAPSULATION MARKET OUTLOOK**

- 5.1. Market Size & Forecast
  - 5.1.1. By Value
- 5.2. Market Share & Forecast
  - 5.2.1. By Material (Ethylene Vinyl Acetate, Non-ethylene Vinyl Acetate, UV Curable Resin, and Others)
  - 5.2.2. By Technology (Polycrystalline Silicon Solar, Cadmium Telluride, Copper Indium Gallium Selenide, and Amorphous Silicon)
  - 5.2.3. By Application (Construction, Electronics, Automotive, and Others)
  - 5.2.4. By Region
- 5.3. By Company (2022)
- 5.4. Market Map

## **6. NORTH AMERICA SOLAR ENCAPSULATION MARKET OUTLOOK**

### 6.1. Market Size & Forecast

#### 6.1.1. By Value

### 6.2. Market Share & Forecast

#### 6.2.1. By Material

#### 6.2.2. By Technology

#### 6.2.3. By Application

#### 6.2.4. By Country

### 6.3. North America: Country Analysis

#### 6.3.1. United States Solar Encapsulation Market Outlook

##### 6.3.1.1. Market Size & Forecast

###### 6.3.1.1.1. By Value

##### 6.3.1.2. Market Share & Forecast

###### 6.3.1.2.1. By Material

###### 6.3.1.2.2. By Technology

###### 6.3.1.2.3. By Application

#### 6.3.2. Canada Solar Encapsulation Market Outlook

##### 6.3.2.1. Market Size & Forecast

###### 6.3.2.1.1. By Value

##### 6.3.2.2. Market Share & Forecast

###### 6.3.2.2.1. By Material

###### 6.3.2.2.2. By Technology

###### 6.3.2.2.3. By Application

#### 6.3.3. Mexico Solar Encapsulation Market Outlook

##### 6.3.3.1. Market Size & Forecast

###### 6.3.3.1.1. By Value

##### 6.3.3.2. Market Share & Forecast

###### 6.3.3.2.1. By Material

###### 6.3.3.2.2. By Technology

###### 6.3.3.2.3. By Application

## **7. ASIA-PACIFIC SOLAR ENCAPSULATION MARKET OUTLOOK**

### 7.1. Market Size & Forecast

#### 7.1.1. By Value

### 7.2. Market Share & Forecast

#### 7.2.1. By Material



- 7.2.2. By Technology
- 7.2.3. By Application
- 7.2.4. By Country
- 7.3. Asia-Pacific: Country Analysis
  - 7.3.1. China Solar Encapsulation Market Outlook
    - 7.3.1.1. Market Size & Forecast
      - 7.3.1.1.1. By Value
    - 7.3.1.2. Market Share & Forecast
      - 7.3.1.2.1. By Material
      - 7.3.1.2.2. By Technology
      - 7.3.1.2.3. By Application
  - 7.3.2. India Solar Encapsulation Market Outlook
    - 7.3.2.1. Market Size & Forecast
      - 7.3.2.1.1. By Value
    - 7.3.2.2. Market Share & Forecast
      - 7.3.2.2.1. By Material
      - 7.3.2.2.2. By Technology
      - 7.3.2.2.3. By Application
  - 7.3.3. Japan Solar Encapsulation Market Outlook
    - 7.3.3.1. Market Size & Forecast
      - 7.3.3.1.1. By Value
    - 7.3.3.2. Market Share & Forecast
      - 7.3.3.2.1. By Material
      - 7.3.3.2.2. By Technology
      - 7.3.3.2.3. By Application
  - 7.3.4. South Korea Solar Encapsulation Market Outlook
    - 7.3.4.1. Market Size & Forecast
      - 7.3.4.1.1. By Value
    - 7.3.4.2. Market Share & Forecast
      - 7.3.4.2.1. By Material
      - 7.3.4.2.2. By Technology
      - 7.3.4.2.3. By Application
  - 7.3.5. Indonesia Solar Encapsulation Market Outlook
    - 7.3.5.1. Market Size & Forecast
      - 7.3.5.1.1. By Value
    - 7.3.5.2. Market Share & Forecast
      - 7.3.5.2.1. By Material
      - 7.3.5.2.2. By Technology
      - 7.3.5.2.3. By Application

## **8. EUROPE SOLAR ENCAPSULATION MARKET OUTLOOK**

### 8.1. Market Size & Forecast

#### 8.1.1. By Value

### 8.2. Market Share & Forecast

#### 8.2.1. By Material

#### 8.2.2. By Technology

#### 8.2.3. By Application

#### 8.2.4. By Country

### 8.3. Europe: Country Analysis

#### 8.3.1. Germany Solar Encapsulation Market Outlook

##### 8.3.1.1. Market Size & Forecast

###### 8.3.1.1.1. By Value

##### 8.3.1.2. Market Share & Forecast

###### 8.3.1.2.1. By Material

###### 8.3.1.2.2. By Technology

###### 8.3.1.2.3. By Application

#### 8.3.2. United Kingdom Solar Encapsulation Market Outlook

##### 8.3.2.1. Market Size & Forecast

###### 8.3.2.1.1. By Value

##### 8.3.2.2. Market Share & Forecast

###### 8.3.2.2.1. By Material

###### 8.3.2.2.2. By Technology

###### 8.3.2.2.3. By Application

#### 8.3.3. France Solar Encapsulation Market Outlook

##### 8.3.3.1. Market Size & Forecast

###### 8.3.3.1.1. By Value

##### 8.3.3.2. Market Share & Forecast

###### 8.3.3.2.1. By Material

###### 8.3.3.2.2. By Technology

###### 8.3.3.2.3. By Application

#### 8.3.4. Russia Solar Encapsulation Market Outlook

##### 8.3.4.1. Market Size & Forecast

###### 8.3.4.1.1. By Value

##### 8.3.4.2. Market Share & Forecast

###### 8.3.4.2.1. By Material

###### 8.3.4.2.2. By Technology

###### 8.3.4.2.3. By Application

### 8.3.5. Spain Solar Encapsulation Market Outlook

#### 8.3.5.1. Market Size & Forecast

##### 8.3.5.1.1. By Value

#### 8.3.5.2. Market Share & Forecast

##### 8.3.5.2.1. By Material

##### 8.3.5.2.2. By Technology

##### 8.3.5.2.3. By Application

## 9. SOUTH AMERICA SOLAR ENCAPSULATION MARKET OUTLOOK

### 9.1. Market Size & Forecast

#### 9.1.1. By Value

### 9.2. Market Share & Forecast

#### 9.2.1. By Material

#### 9.2.2. By Technology

#### 9.2.3. By Application

#### 9.2.4. By Country

### 9.3. South America: Country Analysis

#### 9.3.1. Brazil Solar Encapsulation Market Outlook

##### 9.3.1.1. Market Size & Forecast

##### 9.3.1.1.1. By Value

##### 9.3.1.2. Market Share & Forecast

##### 9.3.1.2.1. By Material

##### 9.3.1.2.2. By Technology

##### 9.3.1.2.3. By Application

#### 9.3.2. Argentina Solar Encapsulation Market Outlook

##### 9.3.2.1. Market Size & Forecast

##### 9.3.2.1.1. By Value

##### 9.3.2.2. Market Share & Forecast

##### 9.3.2.2.1. By Material

##### 9.3.2.2.2. By Technology

##### 9.3.2.2.3. By Application

## 10. MIDDLE EAST & AFRICA SOLAR ENCAPSULATION MARKET OUTLOOK

### 10.1. Market Size & Forecast

#### 10.1.1. By Value

### 10.2. Market Share & Forecast

#### 10.2.1. By Material

- 10.2.2. By Technology
- 10.2.3. By Application
- 10.2.4. By Country
- 10.3. Middle East & Africa: Country Analysis
  - 10.3.1. Saudi Arabia Solar Encapsulation Market Outlook
    - 10.3.1.1. Market Size & Forecast
      - 10.3.1.1.1. By Value
    - 10.3.1.2. Market Share & Forecast
      - 10.3.1.2.1. By Material
      - 10.3.1.2.2. By Technology
      - 10.3.1.2.3. By Application
  - 10.3.2. South Africa Solar Encapsulation Market Outlook
    - 10.3.2.1. Market Size & Forecast
      - 10.3.2.1.1. By Value
    - 10.3.2.2. Market Share & Forecast
      - 10.3.2.2.1. By Material
      - 10.3.2.2.2. By Technology
      - 10.3.2.2.3. By Application
  - 10.3.3. UAE Solar Encapsulation Market Outlook
    - 10.3.3.1. Market Size & Forecast
      - 10.3.3.1.1. By Value
    - 10.3.3.2. Market Share & Forecast
      - 10.3.3.2.1. By Material
      - 10.3.3.2.2. By Technology
      - 10.3.3.2.3. By Application
  - 10.3.4. Israel Solar Encapsulation Market Outlook
    - 10.3.4.1. Market Size & Forecast
      - 10.3.4.1.1. By Value
    - 10.3.4.2. Market Share & Forecast
      - 10.3.4.2.1. By Material
      - 10.3.4.2.2. By Technology
      - 10.3.4.2.3. By Application
  - 10.3.5. Egypt Solar Encapsulation Market Outlook
    - 10.3.5.1. Market Size & Forecast
      - 10.3.5.1.1. By Value
    - 10.3.5.2. Market Share & Forecast
      - 10.3.5.2.1. By Material
      - 10.3.5.2.2. By Technology
      - 10.3.5.2.3. By Application

## **11. MARKET DYNAMICS**

- 11.1. Drivers
- 11.2. Challenge

## **12. MARKET TRENDS & DEVELOPMENTS**

## **13. COMPANY PROFILES**

### **13.1. 3M COMPANY**

- 13.1.1. Business Overview
- 13.1.2. Key Revenue and Financials
- 13.1.3. Recent Developments
- 13.1.4. Key Personnel
- 13.1.5. Key Product/Services

### **13.2. AKCOME**

- 13.2.1. Business Overview
- 13.2.2. Key Revenue and Financials
- 13.2.3. Recent Developments
- 13.2.4. Key Personnel
- 13.2.5. Key Product/Services

### **13.3. STR HOLDING INC**

- 13.3.1. Business Overview
- 13.3.2. Key Revenue and Financials
- 13.3.3. Recent Developments
- 13.3.4. Key Personnel
- 13.3.5. Key Product/Services

### **13.4. BRIDGESTONE CORPORATION**

- 13.4.1. Business Overview
- 13.4.2. Key Revenue and Financials
- 13.4.3. Recent Developments
- 13.4.4. Key Personnel
- 13.4.5. Key Product/Services

### **13.5. DNP SOLAR**

- 13.5.1. Business Overview
- 13.5.2. Key Revenue and Financials
- 13.5.3. Recent Developments

- 13.5.4. Key Personnel
- 13.5.5. Key Product/Services

#### 13.6. DOW INC.

- 13.6.1. Business Overview
- 13.6.2. Key Revenue and Financials
- 13.6.3. Recent Developments
- 13.6.4. Key Personnel
- 13.6.5. Key Product/Services

#### 13.7. DUPONT DE NEMOURS INC

- 13.7.1. Business Overview
- 13.7.2. Key Revenue and Financials
- 13.7.3. Recent Developments
- 13.7.4. Key Personnel
- 13.7.5. Key Product/Services

#### 13.8. FIRST SOLAR

- 13.8.1. Business Overview
- 13.8.2. Key Revenue and Financials
- 13.8.3. Recent Developments
- 13.8.4. Key Personnel
- 13.8.5. Key Product/Services

#### 13.9. HANGZHOU FIRST PV MATERIAL CO. LTD.

- 13.9.1. Business Overview
- 13.9.2. Key Revenue and Financials
- 13.9.3. Recent Developments
- 13.9.4. Key Personnel
- 13.9.5. Key Product/Services

### **14. STRATEGIC RECOMMENDATIONS**

### **15. ABOUT US & DISCLAIMER**

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