

Advanced Materials for Direct Air Capture (DAC) Market Forecasts to 2032 – Global Analysis By Material Type (Solid Sorbents, Liquid Solvents, Membranes and Electrochemical Materials), Deployment Scale, Technology, Application, End User and By Geography

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Abstracts

According to Statistics MRC, the Global Advanced Materials for Direct Air Capture (DAC) Market is accounted for \$38.64 million in 2025 and is expected to reach \$1083.47 million by 2032 growing at a CAGR of 61.0% during the forecast period. Advanced materials used in Direct Air Capture (DAC) systems are enhancing carbon removal by offering superior CO₂ binding strength, selective uptake, and easier regeneration. Cutting-edge options—including metal-organic frameworks, amine-based adsorbents, and optimized ionic liquids—help shorten capture cycles while minimizing the energy required for CO₂ release. Designed to function efficiently under varied environmental conditions, these materials support global deployment of DAC infrastructure. Progress in engineered composites, nanoscale coatings, and adaptable material architectures also improves longevity and customization potential. With continuing innovation, these materials are expected to reduce operating costs and play a critical role in scaling DAC solutions for long-term climate goals.

According to the International Energy Agency (IEA), as of 2022, 18 direct air capture (DAC) plants were operating worldwide, collectively capturing 0.01 Mt CO₂ per year. The IEA projects that DAC capacity must scale to 85 Mt CO₂ per year by 2030 and exceed 980 Mt CO₂ annually by 2050 to align with net-zero pathways.

Market Dynamics:

Driver:**Rising global climate commitments**

Growing global climate pledges strongly influence the Advanced Materials for Direct Air Capture (DAC) market as nations and corporations push to meet net-zero timelines. Stricter national policies and updated climate frameworks are increasing investments into high-performance DAC materials that enhance energy efficiency and capture rates. This includes support for advanced sorbents, resilient material structures, and optimized surface chemistries suited for continuous operation. As carbon pricing mechanisms expand and emission reduction rules intensify, demand rises for materials that can improve DAC system durability and scalability. These evolving climate mandates encourage rapid innovation, making advanced materials essential for regulatory compliance and long-term decarbonization.

Restraint:**High cost of advanced material development**

The elevated costs associated with creating advanced materials remain a key obstacle in the Direct Air Capture (DAC) market, as new sorbents, hybrid composites, and nano-enhanced surfaces require heavy investment in R&D and scale-up activities. Many cutting-edge materials involve intricate fabrication steps, demanding equipment, and controlled production conditions, greatly increasing manufacturing expenses. Since DAC technologies already face high operational energy demands, costly materials amplify the overall price, slowing market growth. The shortage of affordable substitutes and the need for long-lasting performance add further financial pressure. These cost-related issues delay commercialization, reduce competitive participation, and limit the broader rollout of advanced DAC solutions.

Opportunity:**Development of low-energy, high-efficiency sorbents**

The creation of sorbents that deliver high capture efficiency with low energy requirements offers a strong growth opportunity for the Advanced Materials for Direct Air Capture (DAC) market. Innovations such as improved MOFs, humidity-tolerant amine systems, and durable solid-state materials help lower regeneration energy,

reducing overall operating expenses. These advanced sorbents also support quicker adsorption cycles, increased CO₂ selectivity, and improved longevity, making large-scale DAC installation more practical. Continued scientific progress targeting material durability, structural tuning, and reduced decay rates will drive commercially attractive solutions. Such improvements position advanced sorbents as key enablers for affordable, energy-efficient DAC expansion worldwide.

Threat:

Competition from alternative carbon-reduction technologies

The presence of other carbon-reduction technologies represents a major threat to the Advanced Materials for Direct Air Capture (DAC) market. Approaches like point-source capture, afforestation, BECCS, and mineralization often deliver lower upfront costs and less complex infrastructure requirements. These methods frequently gain stronger policy backing and financial investment, shifting attention away from DAC-based solutions that rely on specialized, expensive materials. Because many alternative technologies provide additional economic benefits—such as energy generation, biomass value, or marketable carbon credits—they may be preferred over DAC. This competitive pressure can reduce market momentum, constrain funding availability, and limit the broader advancement of next-generation DAC materials.

Covid-19 Impact:

The COVID-19 pandemic created both challenges and opportunities for the Advanced Materials for Direct Air Capture (DAC) market. Global disruptions in manufacturing, logistics, and research operations slowed material development and hindered experimental progress. Many climate-focused budgets were temporarily redirected toward public health and economic stabilization. Yet the crisis also increased awareness of environmental sustainability, prompting renewed support for carbon-removal solutions. As recovery efforts progressed, funding for green technologies strengthened, boosting R&D in advanced sorbents, composites, and regeneration materials. Governments and industries emphasized low-carbon recovery, enabling new partnerships, pilot deployments, and technological advancements that helped the DAC materials market recover and move forward.

The solid sorbents segment is expected to be the largest during the forecast period

The solid sorbents segment is expected to account for the largest market share during

the forecast period because they deliver strong CO₂ capture efficiency with comparatively lower energy demands. Materials such as amine-coated solids, structured porous frameworks, and engineered composite sorbents provide reliable, repeatable performance across numerous regeneration cycles. Their flexibility in system integration supports both modular and large-scale DAC installations, increasing their appeal for deployment. Solid sorbents also perform effectively under varied climate conditions, reducing operational challenges. Their long service life, customizable properties, and compatibility with next-generation DAC technologies contribute to their dominant presence within current carbon-removal solutions.

The emerging sectors segment is expected to have the highest CAGR during the forecast period

Over the forecast period, the emerging sectors segment is predicted to witness the highest growth rate because new-age industries are integrating carbon-removal solutions as part of their foundational strategies. These fast-developing fields—spanning climate-tech startups to sustainable infrastructure innovators—actively embrace advanced DAC materials to meet future-oriented environmental targets. Their openness to experimentation and rapid technology adoption supports wider use of advanced sorbents, membranes, and electrochemical materials. With strong emphasis on sustainability, these sectors deploy DAC systems more quickly and effectively than traditional industries. Their rapid growth trajectory and commitment to decarbonized operations position emerging sectors as the quickest-expanding users of advanced DAC materials.

Region with largest share:

During the forecast period, the North America region is expected to hold the largest market share, owing to robust regulatory backing, generous investments, and early-stage commercialization. The U.S. is a central hub, leveraging tax incentives and public funding to boost DAC research and deployment. Leading academic institutions and a thriving climate-tech sector drive innovation in next-generation sorbents, membranes and electrochemical solutions. Additionally, the region's advanced infrastructure and convenient access to CO₂ storage facilities make it ideal for scaling DAC systems. These combined strengths make North America the leading region in the global growth of advanced-material DAC technologies.

Region with highest CAGR:

Over the forecast period, the Asia Pacific region is anticipated to exhibit the highest CAGR, driven by fast-growing industrial sectors, ambitious climate targets, and increasing funding for green technologies. Regional governments and companies are prioritizing advanced DAC materials, including innovative sorbents, membrane systems, and electrochemical solutions, to support large-scale emissions reduction. Expanding research programs, technology partnerships, and clean-energy initiatives enhance material development and accelerate commercialization. The region's pursuit of cost-effective, high-efficiency DAC platforms strengthens adoption across multiple industries. With strong policy direction and rising sustainability investments, Asia-Pacific emerges as the fastest-growing market for advanced DAC materials.

Key players in the market

Some of the key players in Advanced Materials for Direct Air Capture (DAC) Market include Climeworks, Carbon Engineering Inc, Heirloom Carbon Technologies, Soletair Power Inc, CarbonCapture Inc., Avnos, Inc., Skytree, RepAir, Exxon Mobil Corporation, Occidental Petroleum Corporation, GE Vernova, Sunfire GmbH, Carbon Clean Solutions Pvt Ltd, Global Thermostat and NuAria.

Key Developments:

In November 2025, Exxon Mobil Corporation announced the execution of an underwriting agreement with several financial institutions, including RBC Capital Markets, LLC, Citigroup Global Markets Inc., Deutsche Bank Securities Inc., J.P. Morgan Securities LLC, and UBS Securities LLC. This agreement facilitates the issuance and sale of \$111,949,000 in aggregate principal amount of Floating Rate Notes due in 2075.

In September 2025, Climeworks Secures Largest-To-Date Portfolio CDR Sale With Schneider Electric. The two companies have signed a multi-year offtake agreement, under which Climeworks is expected to remove 31,000 tons of atmospheric CO₂ emissions by 2039. For Climeworks, this deal represents the largest agreement to date signed through its CDR portfolio services.

In November 2023, Avnos, Inc. began its first operational commercial pilot project in Bakersfield, California. Developed in partnership with Southern California Gas Company (SoCalGas) and with funding from the U.S. Department of Energy (DOE), the HDAC pilot delivers the world's first water-positive Direct Air Capture (DAC) solution.

Material Types Covered:

Solid Sorbents

Liquid Solvents

Membranes

Electrochemical Materials

Deployment Scales Covered:

Pilot-Scale Demonstration Plants

Commercial-Scale Centralized Facilities

Modular Distributed Units

Technologies Covered:

Sorbent-Based DAC Systems

Solvent-Based DAC Systems

Membrane-Based DAC Systems

Electrochemical DAC Systems

Hybrid DAC Systems

Applications Covered:

Carbon Sequestration & Geological Storage

Synthetic Fuels

Food & Beverage

Chemicals & Industrial Feedstocks

Agriculture

End Users Covered:

Oil & Gas

Energy & Utilities

Fertilizer & Chemical Producers

Industrial Manufacturing

Emerging Sectors

Regions Covered:

North America

US

Canada

Mexico

Europe

Germany

UK

Italy

France

Spain

Rest of Europe

Asia Pacific

Japan

China

India

Australia

New Zealand

South Korea

Rest of Asia Pacific

South America

Argentina

Brazil

Chile

Rest of South America

Middle East & Africa

Saudi Arabia

UAE

Qatar

South Africa

Rest of Middle East & Africa

What our report offers:

- Market share assessments for the regional and country-level segments
- Strategic recommendations for the new entrants
- Covers Market data for the years 2024, 2025, 2026, 2028, and 2032
- Market Trends (Drivers, Constraints, Opportunities, Threats, Challenges, Investment Opportunities, and recommendations)
- Strategic recommendations in key business segments based on the market estimations
- Competitive landscaping mapping the key common trends
- Company profiling with detailed strategies, financials, and recent developments
- Supply chain trends mapping the latest technological advancements

Free Customization Offerings:

All the customers of this report will be entitled to receive one of the following free customization options:

Company Profiling

Comprehensive profiling of additional market players (up to 3)

SWOT Analysis of key players (up to 3)

Regional Segmentation

Market estimations, Forecasts and CAGR of any prominent country as per the client's interest (Note: Depends on feasibility check)

Competitive Benchmarking

Benchmarking of key players based on product portfolio, geographical presence, and strategic alliances

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Note: Tables for North America, Europe, APAC, South America, and Middle East & Africa Regions are also represented in the same manner as above.

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