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Carbon Capture and Sequestration Market – Global Industry Size, Share, Trends, Opportunity, and Forecast, 2018-2028Segmented By Type (EOR Process, Industrial and Agricultural), By Application (Capture, Transportation and Storage), By Technology (Pre-combustion, Post-Combustion and Oxy-fuel Combustion), By End-Use Industry (Oil & Gas, Chemicals, Cement, Iron & Steel, Pulp & Paper and Others), By Region, Competition

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Abstracts

The Global Carbon Capture and Sequestration Market had a valuation of USD 1.26 billion in 2022 and is anticipated to reach USD 2.42 billion by 2028, with a Compound Annual Growth Rate (CAGR) of 10.58% throughout the forecast period. The increasing concern about the adverse environmental effects of carbon emissions has driven the adoption of Carbon Capture & Storage (CCS) technology. Governments worldwide are actively promoting the implementation of this technology through pilot projects across various industries, recognizing its potential as a large-scale solution for achieving ambitious CO2 emission reduction targets and climate control objectives.

Key Market Drivers

1. Climate Change Mitigation and Emission Reduction Imperative: The foremost driver behind the growth of the global Carbon Capture and Sequestration (CCS) market is the urgent necessity to combat climate change and reduce greenhouse gas emissions. As the world grapples with the severe consequences of rising global temperatures, nations and industries face mounting pressure to take concrete actions to reduce their carbon

footprint. CCS technology offers a viable pathway to achieving this goal by capturing CO2 emissions from various sources, such as power plants and industrial facilities, before they are released into the atmosphere. The increasing concentration of CO2 in the atmosphere is a primary contributor to global warming and its associated impacts, including more frequent and severe heatwaves, rising sea levels, and disruptions in ecosystems. CCS plays a crucial role in addressing this challenge by enabling large-scale carbon capture from major emission sources. The technology not only facilitates a transition towards cleaner energy sources but also provides an immediate solution to reduce emissions from existing infrastructure that is challenging to replace in the short term. Governments and international organizations are setting ambitious emissions reduction targets, often enshrined in policies like the Paris Agreement. These commitments are driving the adoption of CCS as an essential tool to achieve the necessary emissions cuts. Financial incentives, carbon pricing mechanisms, and regulatory frameworks are being developed to accelerate the deployment of CCS projects across industries. As nations strive to meet their targets and avoid the worst effects of climate change, the CCS market gains momentum as a pivotal solution in the fight against global warming.

2. Government Policies, Incentives, and Regulatory Frameworks: Government policies, incentives, and regulatory frameworks play a crucial role as key drivers of the global Carbon Capture and Sequestration (CCS) market. As nations strive to meet emissions reduction targets and combat climate change, regulatory actions are being taken to promote the widespread adoption of CCS technologies across various industries and sectors. Governments worldwide are recognizing the critical role of CCS in achieving emissions reduction goals. To facilitate the deployment of CCS projects, governments are implementing financial mechanisms such as grants, subsidies, tax incentives, and low-interest loans. These financial incentives not only attract private investments but also help mitigate the high upfront costs associated with CCS infrastructure development. Moreover, carbon pricing mechanisms play a vital role in driving the CCS market forward. By assigning a monetary value to CO2 emissions, carbon pricing provides a financial incentive for industries to proactively reduce their carbon footprint. By factoring the cost of emissions into production and operational decisions, companies are motivated to explore and implement CCS solutions to minimize their carbon-related expenses. Furthermore, regulatory frameworks and emissions reduction targets established by international agreements like the Paris Agreement compel industries to explore and adopt innovative technologies like CCS to comply with stringent emission limits. Governments are also considering legislation that mandates the use of CCS in sectors with significant CO2 emissions. To ensure the success of CCS projects, governments are investing in research and development, knowledge sharing, and the

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establishment of CCS infrastructure. A clear and supportive policy environment, along with regulatory clarity, provides the necessary confidence for industries to commit to CCS projects, thereby driving growth in the market.

Key Market Challenges

1. High Capital Costs and Economic Viability: One of the primary challenges faced by the global Carbon Capture and Sequestration (CCS) market is the significant capital costs associated with the widespread deployment of CCS technologies. The substantial investment required for the development and implementation of CCS infrastructure can act as a deterrent for industries and governments considering adoption. These costs encompass various aspects, including the construction of capture facilities, transportation networks, and secure storage sites. The expenses associated with CCS arise from the complexity of the technology and the need for specialized equipment to capture, transport, and store CO2. For instance, the construction of carbon capture units necessitates advanced engineering and materials, leading to increased construction and operational expenses. Additionally, geological storage sites require extensive evaluation, monitoring, and verification processes to ensure the secure containment of stored CO2. The economic feasibility of CCS projects is often challenged by the relatively low price of carbon emissions in many regions. If carbon pricing mechanisms fail to adequately reflect the true cost of carbon pollution, the financial incentive for industries to invest in CCS diminishes. This discrepancy can impede the business case for CCS projects and result in slower adoption of the technology.

2. Regulatory and Legal Frameworks for Storage: A significant challenge in the global Carbon Capture and Sequestration (CCS) market is the establishment of comprehensive and harmonized regulatory and legal frameworks for the storage of captured CO2. The successful deployment of CCS relies on securely storing CO2 in geological formations for extended periods without any adverse environmental impacts or leakage. Although underground storage of CO2 has been proven technically feasible, concerns regarding the long-term stability and safety of storage sites persist. Regulatory uncertainty and gaps in legal frameworks can impede investment in CCS projects by creating ambiguity surrounding liability, property rights, and long-term responsibilities. The task at hand is to develop regulations that strike a balance between promoting CCS deployment and ensuring environmental protection. Robust monitoring and verification mechanisms are vital to track the movement and containment of stored CO2, as well as to detect potential leaks. However, implementing these mechanisms adds complexity to the regulatory landscape. Furthermore, CCS often involves cross-border transportation

and storage of CO2, requiring international agreements and the harmonization of regulations. Differences in legal approaches and liability frameworks across jurisdictions can hinder the development of large-scale CCS infrastructure that spans multiple regions.

Key Market Trends

1. Integration with Renewable Energy and Low-Carbon Solutions: One notable trend in the global Carbon Capture and Sequestration (CCS) market is the increasing focus on integrating CCS technologies with renewable energy sources and other low-carbon solutions. As the world accelerates its transition towards a more sustainable energy landscape, stakeholders are recognizing the synergies between CCS and renewable energy technologies, such as solar and wind power. Renewable energy sources are inherently intermittent, meaning they generate energy when the sun shines or the wind blows. However, energy demand remains constant throughout the day. By integrating CCS with renewable energy, surplus renewable energy can be utilized to power the carbon capture process, addressing the intermittency issue and enhancing the overall system efficiency. One integration approach known as 'green hydrogen' involves using renewable electricity to produce hydrogen through water electrolysis. The resulting hydrogen can then be combined with captured CO2 to generate synthetic fuels or chemicals, leading to a carbon-neutral or even carbon-negative process. Such integrated systems enable the utilization of both renewable energy and CCS to tackle emissions from sectors that are challenging to directly electrify, such as heavy industry and transportation. This trend aligns with the concept of 'sector coupling,' where various sectors like electricity, transportation, and industry are interconnected to optimize energy consumption and reduce emissions. As countries strive to achieve ambitious emissions reduction targets, the integration of CCS with renewable energy and low-carbon solutions presents a comprehensive approach to addressing emissions across multiple sectors while ensuring a reliable energy supply.

Segmental Insights

Type Insights:

The EOR Process segment is expected to dominate the market during the forecast period. Enhanced Oil Recovery (EOR) is a technique that involves the injection of various substances, including carbon dioxide (CO2), into oil reservoirs to enhance oil extraction. Within the global Carbon Capture and Sequestration (CCS) market, EOR holds significant importance due to its potential to merge economic benefits with carbon

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capture and storage objectives. EOR presents an economically appealing option for oil companies as it enables enhanced oil recovery from mature or depleted oil fields. By injecting CO2 or other substances into the reservoir, trapped oil can be displaced, leading to increased production, extended field life, and additional revenue generation for oil producers. The revenues obtained from enhanced oil recovery can help offset the costs associated with CCS infrastructure and operations, thereby enhancing the financial feasibility of CCS projects. The oil and gas industry possesses valuable technical expertise in drilling, reservoir management, and subsurface engineering, which can be effectively exploited for the successful implementation of EOR projects. The industry's adeptness in subsurface geological formations is especially crucial for the selection of suitable reservoirs for CO2 injection and storage. In certain regions, government incentives and regulations support EOR projects as part of broader energy and emissions reduction objectives. Carbon pricing mechanisms, emissions reduction targets, and tax incentives serve as catalysts in encouraging oil companies to adopt CCS technologies such as EOR. The alignment of regulations and economic incentives plays a pivotal role in driving the growth of EOR within the CCS market.

Application Insights:

The Capture segment is expected to dominate the market during the forecast period. It encompasses the technologies and processes utilized to capture carbon dioxide (CO2) emissions from diverse sources prior to their release into the atmosphere. The capture phase is crucial for mitigating climate change and reducing greenhouse gas emissions. The capture segment comprises a wide range of technologies designed to capture CO2 from various sources, including power plants, industrial facilities, and direct air capture. The capture segment plays a pivotal role in achieving emission reduction targets. By capturing CO2 at the source, it effectively prevents a substantial amount of greenhouse gases from entering the atmosphere. The captured CO2 can then be transported and stored underground or repurposed for industrial applications such as enhanced oil recovery or synthetic fuel production. Many governments provide incentives and subsidies to promote the adoption of capture technologies. Carbon pricing mechanisms, emissions reduction goals, and tax incentives offer economic motivation for industries to invest in and implement CCS solutions.

Regional Insights

North America is expected to dominate the market during the forecast period. North America, specifically the United States and Canada, has been leading the way in CCS technological innovation and research. These countries have made substantial

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investments in the development of advanced capture, transportation, and storage technologies. Research institutions, universities, and private companies have been actively involved in seeking more efficient and cost-effective methods to capture and store carbon dioxide emissions. North America has witnessed the implementation of supportive regulatory frameworks and policies that promote the deployment of CCS. For example, in the United States, the 45Q tax credit provides incentives for the capture and storage of carbon dioxide from industrial sources, encouraging companies to invest in CCS infrastructure and expedite emissions reduction efforts. Notable CCS projects have been initiated in North America, such as the Petra Nova project in Texas, which captured CO2 emissions from a coal-fired power plant and utilized them for enhanced oil recovery. Canada's Boundary Dam project was one of the world's first commercial-scale CCS projects, capturing CO2 from a coal-fired power plant and employing it for enhanced oil recovery. In North America, the oil and gas industry has exhibited interest in CCS, particularly for enhanced oil recovery (EOR). The injection of captured CO2 into oil fields can enhance oil production while securely storing the CO2 underground. This dual advantage has attracted investment from the industry, facilitating the development of CCS projects that align with economic and environmental objectives.

Key Market Players

Aker Clean Carbon AS

Alstom SA

Chevron Corp.

Fluor Corp.

General Electric Co.

Hitachi Ltd

Linde AG

Mitsubishi Heavy Industries

Siemens Energy Inc.

Southern Co.

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Report Scope:

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

Global Carbon Capture and Sequestration Market, By Type:

EOR Process

Industrial

Agricultural

Global Carbon Capture and Sequestration Market, By Application:

Capture

Transportation

Storage

Global Carbon Capture and Sequestration Market, By Technology:

Pre-combustion

Post-Combustion

Oxy-fuel Combustion

Global Carbon Capture and Sequestration Market, By End-Use Industry:

Oil & Gas

Chemicals

Cement

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Iron & Steel

Pulp & Paper

Others

Global Carbon Capture and Sequestration Market, By Region:

North America

Europe

South America

Middle East & Africa

Asia Pacific

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Carbon Capture and Sequestration Market.

Available Customizations:

Global Carbon Capture and Sequestration 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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