

# Global Hydrogen-Based CCUS Technologies Market Growth (Status and Outlook) 2023-2029

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## Abstracts

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According to our (LP Info Research) latest study, the global Hydrogen-Based CCUS Technologies market size was valued at US\$ 1191.5 million in 2022. With growing demand in downstream market and recovery from influence of COVID-19 and the Russia-Ukraine War, the Hydrogen-Based CCUS Technologies is forecast to a readjusted size of US\$ 6749.1 million by 2029 with a CAGR of 28.1% during review period.

The research report highlights the growth potential of the global Hydrogen-Based CCUS Technologies market. With recovery from influence of COVID-19 and the Russia-Ukraine War, Hydrogen-Based CCUS Technologies are expected to show stable growth in the future market. However, product differentiation, reducing costs, and supply chain optimization remain crucial for the widespread adoption of Hydrogen-Based CCUS Technologies. Market players need to invest in research and development, forge strategic partnerships, and align their offerings with evolving consumer preferences to capitalize on the immense opportunities presented by the Hydrogen-Based CCUS Technologies market.

CCUS is an enabler of least-cost low-carbon hydrogen production. CCUS can remove CO<sub>2</sub> from the atmosphere by combining it with bioenergy or direct air capture to balance emissions that are unavoidable or technically difficult to abate. Hydrogen technologies are technologies that relate to the production and use of hydrogen as a part hydrogen economy.

CCUS (Carbon Capture, Utilization and Storage) carbon capture, utilization and storage

technology

surgery. It is a new development trend of CCS (Carbon Capture and Storage) technology, that is, to purify the carbon dioxide emitted in the production process, and then put it into the new production process, which can be recycled instead of simply stored. Compared with CCS, carbon dioxide can be resourced, which can generate economic benefits and is more practical. Challenges of CCUS Technology

At present, CCUS technology is still in the initial stage of research and development and demonstration, and is facing difficulties and problems in the aspects of economy, market, technology, environment and policy. There are still many obstacles and challenges to achieve large-scale development.

### 1 Economic aspects

The important contribution of CCUS technology lies in its irreplaceable ability to reduce carbon emissions, but the cost is too high. Firstly, the investment cost of the CCUS project is huge, and the investment amount is tens of millions or even hundreds of millions of yuan; secondly, the installation of carbon capture devices will generate additional operation and maintenance costs; finally, for carbon utilization and storage, the price of captured CO<sub>2</sub> is too high. High, the price is very uneconomical for oil production companies. With regard to the CCUS demonstration projects currently in operation in China, under such huge cost pressures, the corporate rate of return can only be maintained at 2% or below. If the emission reduction benefits cannot be realized, it will seriously affect the enthusiasm of enterprises to carry out CCUS demonstration projects.

### 2 Technical aspects

CCUS technology is a highly integrated collection, transportation, utilization and storage of various technologies, and it needs to promote the development of all links in an orderly and balanced manner. First of all, the introduction of the CCUS capture link will increase additional energy consumption. Under the current technical level, the primary energy consumption will increase by 10%~20% or even more, resulting in a great loss of efficiency. Secondly, because CO<sub>2</sub> is chemically inert and thermally stable, a large amount of energy must be re-invested in order to effectively convert and utilize CO<sub>2</sub>, which limits the utilization of CO<sub>2</sub> as a resource, and it is necessary to find a suitable catalyst system. There are risks of uncertainty in the geological exploration of the second geological utilization and storage link. The information support for CO<sub>2</sub>

geological storage is not enough, and the enterprise cannot make a comprehensive assessment of the stratum structure, storage potential, storage risk and detection plan, which increases the business risk of the enterprise. Finally, under the goal of carbon neutrality, CCUS technology needs to complete the cumulative emission reduction task of 17.5 to 31.5 billion tons of CO<sub>2</sub>. However, most of the current CCUS demonstration projects can capture CO<sub>2</sub> from 10,000 to 100,000 tons, and there is a lack of large-scale, replicable A full-process integration demonstration project with obvious economic benefits. Therefore, research and development of low-cost, low-energy CCUS technology and large-scale full-process CCUS integration demonstration will promote the deployment and promotion of CCUS technology.

### 3 Market aspects

The development of the CCUS industry requires long-term and large capital investment. However, due to the high cost of CCUS emission reduction and the uncertainty of technology, companies are often unwilling to bear the risk of investing in CCUS research and development and demonstration alone. In addition, the global carbon market is in its infancy, there is no large-scale CO<sub>2</sub> demand market, the carbon tax policy is not clear, and it is impossible to measure the emission reduction capacity of this part economically. Therefore, the foundation for the commercial development of CCUS projects is weak, and many Businesses and potential investors balk at it. On the other hand, the CCUS industry chain covers almost all links of energy production and consumption, such as electric power, steel, cement, petroleum, chemical industry and other industries. At present, there are few CCUS full-process demonstration projects, and there is a lack of cross-industry and cross-departmental cooperation models. There is a problem of poor connection between CO<sub>2</sub> capture projects and utilization and storage projects. Therefore, under the existing market environment and policy framework, how to reasonably solve the problem of cooperation and benefit distribution among multiple enterprises on the benefit chain will directly affect CCUS development process.

### 4 Environmental aspects

Due to the nature of CO<sub>2</sub> itself, any leakage of CO<sub>2</sub> in each link of CCUS technology will have an impact on the ecological environment. Under the current technical level, the environmental risks in the general capture and transportation links are small, and the main environmental risks come from the geological storage and utilization of CO<sub>2</sub>. From the perspective of geological time scale, due to complex unforeseen and uncontrollable geological movements (such as earthquakes) and the corrosiveness of CO<sub>2</sub> to the

formation, CO<sub>2</sub> leaks and escapes to the surface, forming a catastrophic suffocation area and a sudden increase in The greenhouse effect causes a series of environmental problems such as soil, groundwater and atmosphere near the leakage area, and poses a fatal threat to animals, plants and human health. This also seriously restricts the understanding and acceptance of CCUS by the government and the public.

### Prospect of CCUS Technology Application

The technical links of CCUS are closely connected and complement each other. The front-end carbon capture link provides CO<sub>2</sub> for the utilization and storage link, the intermediate transportation link provides CO<sub>2</sub> transportation guarantee, and the back-end CO<sub>2</sub> utilization turns CO<sub>2</sub> into treasure, forming a downstream related industrial chain with commercial value. , to create a huge CO<sub>2</sub> demand market, to achieve a win-win situation of CO<sub>2</sub> fixation and economic benefits, which in turn will promote the development of carbon capture projects.

Most of the current carbon capture projects are industrialized centralized capture, and there are demonstration projects for pre-combustion, post-combustion, and oxygen-enriched combustion technologies; while CO<sub>2</sub> utilization and storage projects are mainly CO<sub>2</sub>-EOR, resource utilization projects are rare . CO<sub>2</sub>-EOR is a mature technology that has been applied by the oil industry for decades, and currently occupies a dominant position in CCUS projects around the world, but its income is heavily dependent on oil prices, and its economic sustainability is poor. In terms of resource utilization of CO<sub>2</sub>, it has been reported in the literature that only 1.1 million tons of CO<sub>2</sub> is industrially utilized and converted into chemicals every year, of which 90% is converted into urea, inorganic carbonate, etc., and very little is converted into other high-addition materials. valuable chemicals. At present, the vast majority of CO<sub>2</sub> resource utilization industries have not yet achieved commercial application, and have not established relevant industrial chain clusters. Despite the high cost and high energy consumption of carbon capture projects, the disconnection between them and the carbon utilization stage makes it difficult to generate economic benefits, which has become the fundamental reason restricting the development of carbon capture projects. Therefore, while researching and developing low-cost, low-energy carbon capture technology, we must accelerate the layout of CO<sub>2</sub> resource utilization, in order to accelerate the implementation, development and large-scale promotion of CCUS projects.

### CO<sub>2</sub> Utilization Industry Development Trend

#### 1. Utilization of high value-added carbon-based new materials

CO<sub>2</sub> conversion to manufacture high value-added carbon-based new materials (carbon nanotubes and graphene, etc.) will be part of an effective path to carbon neutrality such as coal power plants. It will provide a sustainable economic basis for overall carbon neutrality. Carbon nanomaterials have been widely used in lithium battery conductive pastes and conductive plastics, and can also be used in solar conductive silver pastes, anti-corrosion coatings, and thermal greases. At present, this technology has been successfully applied to industrial demonstration projects, with remarkable economic benefits. Due to the limited demand for high-tech materials, billions of tons of CO<sub>2</sub> need to find another way out. One of the important directions of green chemistry research is to regard CO<sub>2</sub>, biomass, coal, oil, and natural gas as the five basic industrial raw materials, which are used to produce tens of thousands of daily-needed end products.

## 2. Chemical utilization

Incorporate CO<sub>2</sub> into the industrial system, together with biomass materials, coal, oil and natural gas, as the five basic raw materials of industry, and build a new CO<sub>2</sub> economic industrial chain, which is not only used to produce basic chemicals such as methanol and olefins, but also involves various intermediates and tens of thousands of end products (as shown in Figure 3). For example, Shanxi Clean Carbon Research Institute purifies CO<sub>2</sub> in industrial flue gas, not only converting it into chemical products such as carbonate, ethylene glycol, and methanol fuel, but also using supercritical CO<sub>2</sub> to manufacture lightweight materials for aircraft and automobile interior parts, Energy-saving and environment-friendly products such as packaging materials. With technological progress and cost reduction, CO<sub>2</sub> resource utilization is gradually promoted, and the chemical industry is expected to accelerate greening.

### Key Features:

The report on Hydrogen-Based CCUS Technologies market reflects various aspects and provide valuable insights into the industry.

**Market Size and Growth:** The research report provide an overview of the current size and growth of the Hydrogen-Based CCUS Technologies market. It may include historical data, market segmentation by Type (e.g., Carbon Capture and Storage (CCS), Carbon Capture and Utilization (CCU)), and regional breakdowns.

**Market Drivers and Challenges:** The report can identify and analyse the factors driving the growth of the Hydrogen-Based CCUS Technologies market, such as government

regulations, environmental concerns, technological advancements, and changing consumer preferences. It can also highlight the challenges faced by the industry, including infrastructure limitations, range anxiety, and high upfront costs.

**Competitive Landscape:** The research report provides analysis of the competitive landscape within the Hydrogen-Based CCUS Technologies market. It includes profiles of key players, their market share, strategies, and product offerings. The report can also highlight emerging players and their potential impact on the market.

**Technological Developments:** The research report can delve into the latest technological developments in the Hydrogen-Based CCUS Technologies industry. This include advancements in Hydrogen-Based CCUS Technologies technology, Hydrogen-Based CCUS Technologies new entrants, Hydrogen-Based CCUS Technologies new investment, and other innovations that are shaping the future of Hydrogen-Based CCUS Technologies.

**Downstream Procumbent Preference:** The report can shed light on customer procumbent behaviour and adoption trends in the Hydrogen-Based CCUS Technologies market. It includes factors influencing customer ' purchasing decisions, preferences for Hydrogen-Based CCUS Technologies product.

**Government Policies and Incentives:** The research report analyse the impact of government policies and incentives on the Hydrogen-Based CCUS Technologies market. This may include an assessment of regulatory frameworks, subsidies, tax incentives, and other measures aimed at promoting Hydrogen-Based CCUS Technologies market. The report also evaluates the effectiveness of these policies in driving market growth.

**Environmental Impact and Sustainability:** The research report assess the environmental impact and sustainability aspects of the Hydrogen-Based CCUS Technologies market.

**Market Forecasts and Future Outlook:** Based on the analysis conducted, the research report provide market forecasts and outlook for the Hydrogen-Based CCUS Technologies industry. This includes projections of market size, growth rates, regional trends, and predictions on technological advancements and policy developments.

**Recommendations and Opportunities:** The report conclude with recommendations for industry stakeholders, policymakers, and investors. It highlights potential opportunities for market players to capitalize on emerging trends, overcome challenges, and

contribute to the growth and development of the Hydrogen-Based CCUS Technologies market.

Market Segmentation:

Hydrogen-Based CCUS Technologies market is split by Type and by Application. For the period 2018-2029, the growth among segments provides accurate calculations and forecasts for consumption value by Type, and by Application in terms of value.

Segmentation by type

Carbon Capture and Storage (CCS)

Carbon Capture and Utilization (CCU)

Carbon Capture and Conversion (CCC)

Segmentation by application

Oil and Gas

Power Generation

Others

This report also splits the market by region:

Americas

United States

Canada

Mexico

Brazil

## APAC

China

Japan

Korea

Southeast Asia

India

Australia

## Europe

Germany

France

UK

Italy

Russia

## Middle East & Africa

Egypt

South Africa

Israel

Turkey

GCC Countries



The below companies that are profiled have been selected based on inputs gathered from primary experts and analyzing the company's coverage, product portfolio, its market penetration.

Exxonmobil Corporation

Schlumberger

Linde AG

BASF

General Electric

Siemens

Honeywell UOP

Equinor

Aker Solutions

Shell

Fluor

Sinopec

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