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Europe Oxy-fuel Combustion Technology Market Size and Forecast (2021 - 2031)

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Abstracts

The Europe Oxy-fuel Combustion Technology Market is projected to grow significantly, reaching an estimated US$ 328.3 million by 2031, up from US$ 185.0 million in 2024. This growth reflects a compound annual growth rate (CAGR) of 8.8% from 2025 to 2031.

Executive Summary and Market Analysis

The oxy-fuel combustion technology market in Europe is divided into several key regions, including Germany, France, Russia, Italy, the UK, and the Rest of Europe. Western European nations are generally more advanced in adopting new technologies compared to Nordic and Eastern European countries, which is driving the uptake of oxy-fuel combustion solutions in these regions. Economically robust countries like Germany, Italy, and the UK have seen notable advancements in the implementation of these technologies.

Despite the increasing prevalence of renewable energy sources, fossil fuels are expected to remain a significant part of Europe’s energy mix in the near to medium term. In fact, CO2 emissions from fossil fuel combustion in power generation account for approximately 30% of total CO2 emissions within the European Union (EU). Various process industries, including cement, iron and steel, aluminum, pulp and paper, and refineries, contribute to CO2 emissions due to raw material conversion processes. To address this, carbon capture and storage (CCS) technologies aim to capture up to 90% of CO2 emissions from power plants and heavy industries, subsequently transporting and securely storing it deep underground.

CCS initiatives have received support through research and development funding

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mechanisms at both EU and national levels. The Joint Research Centre (JRC) has played a pivotal role in advancing CCS-related policies, including the development of the first EU CO2 storage atlas in collaboration with European Geological Surveys. The JRC is also involved in evaluating infrastructure and assessing the economic and environmental impacts of CO2 utilization.

Market Segmentation Analysis

The Europe Oxy-fuel Combustion Technology Market is categorized by offerings into Solutions and Services, with the Solutions segment leading the market in 2024. Additionally, the market is segmented by industry into Oil and Gas, Power Generation, Manufacturing, Metals and Mining, and Others, with Power Generation being the dominant sector in 2024.

Market Outlook

Oxy-fuel combustion technology is revolutionizing the performance of heavy industries by facilitating lower emissions and enhancing energy efficiency through the integration of continuous carbon capture technologies. In the steel sector, for instance, oxy-fuel combustion technology is instrumental in decarbonizing blast furnaces. This process involves replacing air with approximately 95% pure oxygen, which reduces nitrogen dilution and generates a concentrated CO2 stream for capture.

In July 2022, Taiyo Nippon Sanso Corporation (TNSC) announced initiatives aimed at reducing greenhouse gas and CO2 emissions in industrial furnaces through oxygen combustion technologies. Similarly, Nippon Steel is actively pursuing the COURSE50 project, which aims to significantly lower CO2 emissions from blast furnaces by replacing carbon with hydrogen-rich gases. This initiative is a crucial component of the company’s Carbon Neutral Vision 2050, which includes developing technologies for hydrogen injection into blast furnaces and exploring innovative methods for high-grade steel production in electric arc furnaces.

Oxy-fuel combustion involves burning hydrocarbon fuel in a nearly pure oxygen environment, utilizing a portion of the flue gas to dilute the oxygen instead of nitrogen for temperature control. In coal-fired power plants, this technology is employed to produce flue gas with high concentrations of CO2 and water vapor, facilitating the separation or capture of CO2 through low-temperature dehydration and desulfurization processes. The benefits of oxy-fuel combustion technology include reduced NOx emissions, high CO2 purity, and lower gas volumes due to increased density, making it

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advantageous for metal and power generation facilities.

Oxy-fuel combustion is recognized as a cost-effective and technically feasible method for carbon capture. The most prevalent oxy-fuel process involves burning pulverized coal in nearly pure oxygen (greater than 95% purity) mixed with recycled flue gas. This process significantly reduces emissions of industrial gases such as carbon dioxide and nitrous oxide, contributing to the growing popularity of oxy-fuel combustion technology across various industries, including manufacturing, metal and mining, oil and gas, and power generation.

European regulations aimed at minimizing industrial emissions, particularly those concerning large combustion plants, have led to substantial reductions in pollutants like nitrogen oxides, sulfur dioxide, and particulate matter. Furthermore, oxy-fuel combustion technology is viewed as a critical element of the EU's strategy to meet its climate objectives, which include reducing greenhouse gas emissions by approximately 55% by 2030 and achieving net-zero emissions by 2050. Global initiatives such as China’s 2060 Net-Zero Goal, the US Inflation Reduction Act (IRA) of 2022, and the EU's Carbon Border Adjustment Mechanism (CBAM) are all designed to mitigate carbon emissions and prevent carbon leakage from industrial operations, which is expected to positively influence the demand for oxy-fuel combustion technology worldwide.

Country Insights

In terms of country-specific insights, Germany is the largest market for oxy-fuel combustion technology in Europe as of 2024. The German government has committed to establishing a CCS program as part of its Climate Change Program 2030, which was approved in late 2019. Studies indicate that CCS technology is essential for achieving greenhouse gas neutrality by 2050. The Federal Institute for Geosciences and Natural Resources (BGR) is collaborating with state agencies to assess geological conditions in Germany to evaluate carbon storage potential. In January 2023, the German government announced plans to legislate for carbon storage and aims to reduce emissions by 65% by 2030 compared to 1990 levels, reflecting the country’s commitment to reducing emissions in its energy-intensive industries by 2045.

Company Profiles

Key players in the Europe Oxy-fuel Combustion Technology Market include Air Liquide, Encon Thermal Engineers Pvt Ltd, Falorni Gianfranco SRL, Jupiter Oxygen Corp, Linde Plc, Heidelberg Materials AG, ESA SpA, Messer SE & Co KGaA, Babcock & Wilcox

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Enterprises Inc, and Air Products and Chemicals Inc. These companies are pursuing various strategies such as expansion, product innovation, and mergers and acquisitions to enhance their market presence and offer innovative solutions to their customers.

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