

Global Carbon-11 Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global Carbon-11 market size is expected to reach \$ 379 million by 2032, rising at a market growth of 14.0% CAGR during the forecast period (2026-2032).

Global carbon-11 production is projected to reach approximately 45,000 grams in 2025, with an average global market price of about US\$3,500 per gram. Total global carbon-11 production capacity is expected to reach approximately 65,000 grams in 2025. The industry average gross margin for this product is estimated at around 50%. Carbon-11 is an artificial radioactive isotope and a radioactive nuclide of carbon, with an atomic number of 6 and a mass number of 11. It is mainly produced using cyclotrons through proton irradiation of nitrogen-14 targets. Carbon-11 has a very short half-life of approximately 20.3 minutes and decays primarily through positron emission (?? decay) into boron-11 while releasing positrons. Because Carbon-11 has chemical properties similar to naturally occurring carbon, it can be incorporated into a wide range of organic molecules as a radioactive tracer. It is therefore widely used in positron emission tomography (PET) imaging, pharmaceutical research, neuroscience studies, and metabolic investigations. Carbon-11-labeled tracers allow researchers to visualize the distribution and behavior of biological molecules in living organisms, making them valuable tools in oncology, neuroscience, and precision medicine. Due to its extremely short half-life, Carbon-11 production generally requires dedicated facilities equipped with cyclotrons located close to hospitals or research centers for rapid on-site production and application.

The upstream segment of the Carbon-11 industry chain mainly includes radioactive isotope production equipment, target material supply, nuclear technology facilities, and radiochemical preparation systems. Due to its short half-life, Carbon-11 is primarily produced using medical cyclotrons, where high-energy proton beams irradiate enriched nitrogen gas targets or other nitrogen-containing target materials. Upstream participants

include cyclotron manufacturers, target system suppliers, radiochemical synthesis equipment providers, and suppliers of high-purity gases and chemical reagents. Production requires precise control of nuclear reaction conditions, followed by rapid separation, purification, and tracer synthesis using automated radiochemistry systems. Therefore, the industry requires advanced equipment capabilities, technical expertise, and nuclear medicine experience. Global Carbon-11 production capacity is mainly concentrated in major hospitals, research institutions, and nuclear medicine research centers. The midstream segment of the Carbon-11 industry chain mainly involves radiopharmaceutical production, tracer synthesis, quality control, and clinical supply services. Because Carbon-11 has a half-life of only about 20 minutes, production typically follows a "produce-and-use immediately" model. After generation in a cyclotron, Carbon-11 is rapidly incorporated into biologically active molecules through automated radiochemical synthesis to produce PET imaging tracers. Representative products include Carbon-11 choline (^{11}C -Choline), Carbon-11 methionine (^{11}C -Methionine), and Carbon-11 acetate (^{11}C -Acetate), which are used in prostate cancer imaging, brain tumor research, neurodegenerative disease studies, and cardiac metabolism investigations. Midstream operations require compliance with strict pharmaceutical manufacturing standards and radioactive drug quality control procedures, including radiochemical purity testing, sterility testing, activity measurement, and clinical safety evaluation. The downstream applications of Carbon-11 mainly include nuclear medicine diagnosis, clinical disease research, pharmaceutical development, and life science studies. PET molecular imaging represents the largest application area, where Carbon-11 tracers provide unique advantages due to their ability to label naturally occurring biological molecules. They are widely used in brain function studies, research on neurological disorders such as Alzheimer's disease and Parkinson's disease, tumor metabolism analysis, and validation of new drug targets. Furthermore, the development of precision medicine and personalized treatment approaches continues to increase demand for PET-based early diagnosis and therapeutic evaluation, supporting broader Carbon-11 applications. In the future, the Carbon-11 market is expected to benefit from the expansion of nuclear medicine equipment, increased clinical research investment, and development of innovative tracers. However, due to its short half-life, transportation limitations, and high infrastructure requirements, commercial applications will remain primarily concentrated in major medical centers and research institutions.

The rapid development of precision medicine and molecular imaging technologies represents one of the key drivers for Carbon-11 applications. Compared with conventional imaging methods, PET (positron emission tomography) enables visualization of biological molecule distribution, metabolic processes, and disease

progression through radioactive tracers. Carbon-11 offers unique advantages because it has the same chemical properties as natural carbon and can be incorporated into a wide range of biologically active molecules. With increasing demand for early cancer diagnosis, neurological disease research, and brain function imaging, Carbon-11-labeled tracers are becoming increasingly important in medical research and clinical translation. In particular, Carbon-11-based PET tracers have demonstrated significant value in studies of Alzheimer's disease, Parkinson's disease, brain tumors, and prostate cancer.

Growing investment in life science research and innovative drug development is creating additional growth opportunities for Carbon-11. As demand increases for drug mechanism studies, target validation, and pharmacokinetic analysis, researchers increasingly rely on PET tracer technologies to evaluate candidate drug distribution, binding characteristics, and metabolic behavior in living organisms. Carbon-11 is widely used because it can be rapidly incorporated into complex organic molecules while preserving their biological activity. It has applications in neurotransmitter research, receptor imaging, evaluation of blood-brain barrier penetration, and preclinical drug development. Meanwhile, increasing demand from pharmaceutical companies and research institutions for accurate drug evaluation is driving advancements in Carbon-11 production facilities, automated synthesis systems, and related analytical technologies.

The expansion of nuclear medicine infrastructure and cyclotron capabilities worldwide provides an important foundation for Carbon-11 industry development. Due to its extremely short half-life, Carbon-11 cannot be transported over long distances and therefore relies heavily on localized production capabilities at hospitals, research institutions, and regional nuclear medicine centers. In recent years, the increasing adoption of PET/CT systems, improvements in nuclear medicine services, and expansion of medical research platforms have increased the number of facilities equipped with cyclotrons and radiochemistry laboratories. At the same time, advances in automated radiochemical synthesis systems have improved the efficiency, safety, and reproducibility of Carbon-11 tracer production, supporting the industry's move toward greater standardization and operational optimization.

This report studies the global Carbon-11 production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for Carbon-11 and provides market size (US\$ million) and Year-over-Year (YoY) Growth, considering 2025 as the base year. This report explores demand trends and competition, as well as

details the characteristics of Carbon-11 that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global Carbon-11 total production and demand, 2021-2032, (Gram)

Global Carbon-11 total production value, 2021-2032, (USD Million)

Global Carbon-11 production by region & country, production, value, CAGR, 2021-2032, (USD Million) & (Gram), (based on production site)

Global Carbon-11 consumption by region & country, CAGR, 2021-2032 & (Gram)

U.S. VS China: Carbon-11 domestic production, consumption, key domestic manufacturers and share

Global Carbon-11 production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (Gram)

Global Carbon-11 production by Type, production, value, CAGR, 2021-2032, (USD Million) & (Gram)

Global Carbon-11 production by Application, production, value, CAGR, 2021-2032, (USD Million) & (Gram)

This report profiles key players in the global Carbon-11 market based on the following parameters - company overview, production, value, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include TRIUMF, ANSTO, Cambridge Isotope Laboratories, Eckert & Ziegler, etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Stakeholders would have ease in decision-making through various strategy matrices used in analyzing the World Carbon-11 market

Detailed Segmentation:

Each section contains quantitative market data including market by value (US\$ Millions), volume (production, consumption) & (Gram) and average price (US\$/g) by manufacturer, by Type, and by Application. Data is given for the years 2021-2032 by year with 2025 as the base year, 2026 as the estimate year, and 2027-2032 as the forecast year.

Global Carbon-11 Market, By Region:

United States

China

Europe

Japan

South Korea

ASEAN

India

Rest of World

Global Carbon-11 Market, Segmentation by Type:

Purity?98%-99%

Purity??99%

Global Carbon-11 Market, Segmentation by Production Method:

Alternative Nuclear Reaction Production

Accelerator-produced Thallium-204

Global Carbon-11 Market, Segmentation by Chemical Form:

C-11 Carbon dioxide ($^{11}\text{C-CO}_2$)

C-11 Methane ($^{11}\text{C-CH}_4$)

C-11 Carbon monoxide (^{11}C -CO)

C-11 Cyanide (^{11}C -CN?)

Global Carbon-11 Market, Segmentation by Radioactivity:

Low Activity

Intermediate Activity

High Activity

Global Carbon-11 Market, Segmentation by Application:

Medical Imaging

Scientific Research

Companies Profiled:

TRIUMF

ANSTO

Cambridge Isotope Laboratories

Eckert & Ziegler

Key Questions Answered:

1. How big is the global Carbon-11 market?
2. What is the demand of the global Carbon-11 market?
3. What is the year over year growth of the global Carbon-11 market?
4. What is the production and production value of the global Carbon-11 market?
5. Who are the key producers in the global Carbon-11 market?
6. What are the growth factors driving the market demand?

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