

Global Neptunium-238 Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global Neptunium-238 market size is expected to reach \$ 31.52 million by 2032, rising at a market growth of 14.4% CAGR during the forecast period (2026-2032).

In 2025, global Neptunium-238 production was approximately 630 grams, with an average global market value of around \$19,000 per gram. That year, global theoretical production capacity for Neptunium-238 reached approximately 1,200 grams. The average gross profit margin for the industry stood at about 60%. Neptunium-238 (^{238}Np) is an artificial radioactive transuranic isotope belonging to the actinide series, with an atomic number of 93 and a mass number of 238. It is mainly produced through neutron capture reactions involving uranium-238 (^{238}U) or neptunium-237 (^{237}Np) in nuclear reactors or accelerator environments. ^{238}Np is a relatively short-lived neptunium isotope with a half-life of approximately 2.1 days and primarily undergoes beta-minus decay to form plutonium-238 (^{238}Pu). Its primary importance lies not in direct applications but as a key intermediate in the production pathway of plutonium-238, which is used in radioisotope power systems for deep-space exploration, nuclear power sources, and advanced fuel-cycle research. Due to its strong radioactivity, short half-life, and limited storage capability, ^{238}Np is generally not traded as an independent commercial product but exists mainly within nuclear material production and research systems.

The upstream segment of the Neptunium-238 (Np-238) industry chain primarily encompasses uranium resource supply, nuclear fuel fabrication, reactor operations, and the supply of Neptunium-237 (Np-237) target materials. Np-238 is generally not obtained through direct mining but is instead produced via neutron irradiation of uranium or neptunium materials during nuclear reactions. In Plutonium-238 (Pu-238) production systems, Np-237 typically serves as the target material; it undergoes neutron capture to

form Np-238, which subsequently decays rapidly into Pu-238. Consequently, upstream supply capabilities rely heavily on national-level nuclear facilities equipped with research reactors, high-flux reactors, and nuclear material processing capabilities. Due to the involvement of the nuclear fuel cycle, special nuclear material management, and irradiation production technologies, the upstream segment is characterized by extremely high technical barriers and stringent regulatory requirements. The midstream segment primarily involves the irradiation-based production of Np-238, radiochemical separation, and the conversion process into Pu-238. Inside a nuclear reactor, Np-237 absorbs neutrons to form Np-238; given its half-life of only approximately 2.1 days, it rapidly undergoes beta decay to produce Pu-238. Therefore, the actual industry chain typically revolves around the continuous process of "Np-237 target irradiation—Np-238 production—Pu-238 separation and purification," rather than the standalone production and sale of Np-238. The midstream segment requires complex radiochemical separation technologies, equipment for handling highly radioactive materials, and rigorous nuclear safety management systems. Currently, institutions possessing these capabilities are primarily national laboratories, nuclear industry enterprises, and research institutes that hold nuclear fuel cycle technologies and advanced nuclear facilities. The primary downstream value of Np-238 lies in its role as an intermediate nuclide in the production of Pu-238. Pu-238, generated from the decay of Np-238, possesses high specific power and the ability to provide stable, long-term heat output; it serves as a core material for radioisotope thermoelectric generators (RTGs) and is widely used in deep-space exploration missions, power systems for long-range spacecraft, and long-term power supply equipment for specialized environments. Furthermore, the relevant nuclide transformation processes are utilized in research on advanced nuclear fuel cycles, actinide element behavior, and nuclear materials science. With the increase in deep-space exploration missions, rising demand for space-based energy, and the development of advanced nuclear technologies, the strategic importance of production systems for Neptunium-238 continues to grow.

As a key intermediate radionuclide in the production pathway of plutonium-238 (^{238}Pu), neptunium-238 development is primarily driven by deep-space exploration missions and demand for space nuclear power systems. The ^{238}Pu generated from ^{238}Np decay is the core fuel material for radioisotope thermoelectric generators (RTGs), providing long-term and reliable power in environments with limited sunlight or extreme conditions. Continuous lunar exploration, Mars missions, outer-planet exploration, and deep-space scientific programs in regions such as the United States and Europe are increasing demand for reliable space power systems, indirectly supporting investment in ^{237}Np irradiation, ^{238}Np generation, and ^{238}Pu supply capabilities.

Because global plutonium-238 production capacity remains limited, several countries are strengthening domestic radioisotope power supply capabilities. Although ^{238}Np itself is not used as the final power source, it plays a critical role in the conversion pathway from ^{237}Np to ^{238}Pu , making it an important component of the plutonium-238 supply chain. As future deep-space missions become longer, spacecraft lifetimes increase, and demand for space power systems grows, the need for reliable ^{238}Pu production is driving advances in nuclear material preparation, reactor irradiation, and post-processing technologies.

Beyond space power applications, ^{238}Np -related research is also supported by developments in advanced nuclear fuel cycles and actinide science. Neptunium isotopes are important for studying nuclear reactions, transuranic element transformations, and nuclear material behavior. With the advancement of Generation IV reactors, advanced fuel cycles, nuclear waste reduction technologies, and separation-transmutation strategies, research on the transformation mechanisms of actinides such as neptunium, plutonium, and americium is becoming increasingly important. As a short-lived intermediate radionuclide, ^{238}Np provides valuable insights into isotope production pathways and decay behavior, supporting the development of advanced nuclear technologies.

Report Scope

This report studies the global Neptunium-238 production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for Neptunium-238 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 Neptunium-238 that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global Neptunium-238 total production and demand, 2021-2032, (Gram)

Global Neptunium-238 total production value, 2021-2032, (USD Million)

Global Neptunium-238 production by region & country, production, value,

CAGR, 2021-2032, (USD Million) & (Gram), (based on production site)

Global Neptunium-238 consumption by region & country, CAGR, 2021-2032 & (Gram)

U.S. VS China: Neptunium-238 domestic production, consumption, key domestic manufacturers and share

Global Neptunium-238 production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (Gram)

Global Neptunium-238 production by Type, production, value, CAGR, 2021-2032, (USD Million) & (Gram)

Global Neptunium-238 production by Application, production, value, CAGR, 2021-2032, (USD Million) & (Gram)

This report profiles key players in the global Neptunium-238 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 NIDC(DOE IP), Eckert & Ziegler, Oak Ridge National Laboratory, 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 Neptunium-238 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 Neptunium-238 Market, By Region:

United States

China

Europe

Japan

South Korea

ASEAN

India

Rest of World

Global Neptunium-238 Market, Segmentation by Type:

Purity:98%-99%

Purity:~99%

Global Neptunium-238 Market, Segmentation by Production Route:

Neptunium-237 Neutron Irradiation

Uranium Fuel Conversion

Experimental Reactor Production

Accelerator-based Production

Global Neptunium-238 Market, Segmentation by Chemical Form:

Neptunium-238 Solution

Solid Neptunium-238 Compounds

Global Neptunium-238 Market, Segmentation by Purity Grade:

Research-grade Neptunium-238

Pharmaceutical-grade Neptunium-238

Global Neptunium-238 Market, Segmentation by Application:

Isotope Production

Scientific Research

Companies Profiled:

NIDC(DOE IP)

Eckert & Ziegler

Oak Ridge National Laboratory

Key Questions Answered:

1. How big is the global Neptunium-238 market?
2. What is the demand of the global Neptunium-238 market?
3. What is the year over year growth of the global Neptunium-238 market?
4. What is the production and production value of the global Neptunium-238 market?
5. Who are the key producers in the global Neptunium-238 market?
6. What are the growth factors driving the market demand?

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