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INTERNATIONAL PLATINUM GROUP METALS ASSOCIATION

PGM Fact Sheet Platinum

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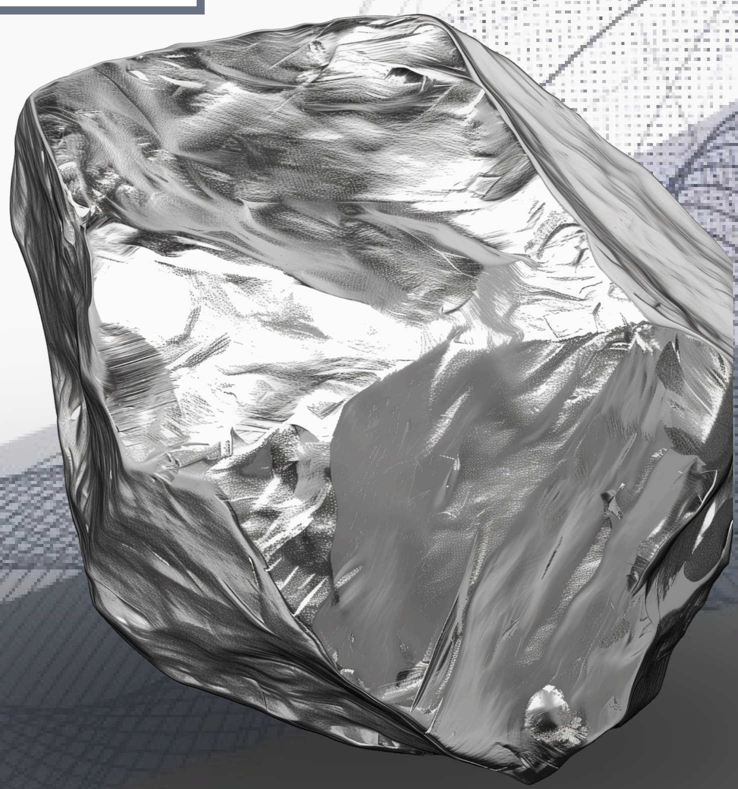
Pt
Platinum



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PGM FACTSHEETS 2026 - PLATINUM

Written by SFA (Oxford)

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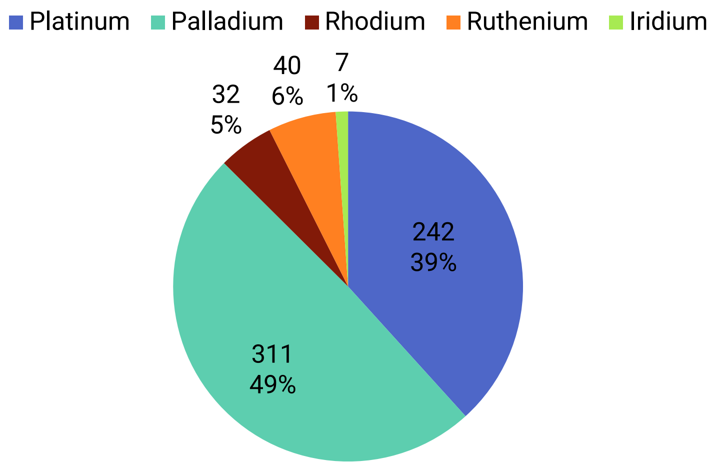
OVERVIEW

Platinum group metals (PGMs)— platinum (Pt), palladium (Pd), iridium (Ir), rhodium (Rh), ruthenium (Ru) and osmium (Os)— share similar chemical characteristics and are considered precious metals like gold and silver yet are equally widely used and essential for many industrial applications.

PGMs' unique properties enable a wide range of technologies, from long-established chemical processes that make familiar products, through the autocatalysts (catalytic converters) in every gasoline/diesel vehicle tailpipe, which have dramatically improved urban air quality over the past decades, to emerging end uses in the hydrogen economy and other technologies towards net zero. European companies continue to play a leading role in operating processes based on PGMs, with manufacturing plants in Europe and around the globe. These companies, along with an innovative set of Europe-based start-ups and spin-offs, often using computational techniques, are developing new catalysts and novel materials for low-carbon applications.

The current demand split among the five main metals is shown below; palladium accounts for nearly half of demand, followed by platinum at nearly 40%. Together, these two metals comprise almost 90% of demand by mass of metal.

Global PGM demand by metal: 2025 tonnes



Source: Johnson Matthey (January 2026); demand excluding closed loop recycling and reuse

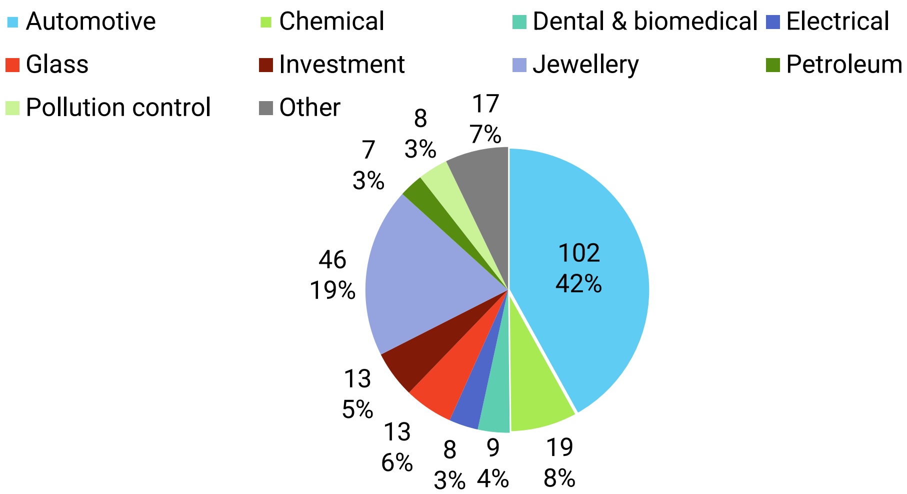
All PGMs, typically in combination with each other or with other metals, can act as highly efficient catalysts, which are exploited in a wide range of applications, including automotive catalysts for emissions control, chemical and petroleum processing and many large-volume industrial reactions. Their catalytic use in automotive exhaust aftertreatment alone has enabled very large reductions in pollutants such as carbon monoxide, hydrocarbons, and nitrogen oxides from internal-combustion engines. As life cycle assessments on autocatalysts performed by IPA have demonstrated, over two tonnes of harmful emissions can be reduced by the catalytic converter systems in one Euro 6d-TEMP 1.4 litre gasoline and one Euro 6d-TEMP 2.0 litre diesel vehicle in use over 160,000 km (Source: IPA - The Life Cycle Assessment of Platinum Group Metals).

Although it is a highly active catalyst, in certain settings Platinum's extreme underactivity and stability is advantageous. Platinum is also ductile, malleable, dense and valuable. It has a high melting point, exceptional corrosion resistance even at high temperatures, and good biocompatibility, durability, and electrical conductivity, making it suitable for demanding applications such as medical devices, electronics, and high-temperature glass production equipment. Platinum is one of the rarest elements in the Earth's crust, with an average abundance of about 5 micrograms per kilogram (about 5 parts per billion by mass), making primary deposits geologically rare and underpinning its high value as both a strategic and an investment metal.

Source: IPA Environmental Fact Sheet

Platinum demand is dominated by autocatalysts, which clean up tailpipe emissions from diesel and gasoline light- and heavy-duty combustion engines (including hybrid vehicles). The two largest demand sectors, autocatalysts and jewellery, comprise 60% of demand, with the remaining 40% made up of a diverse set of industrial applications.

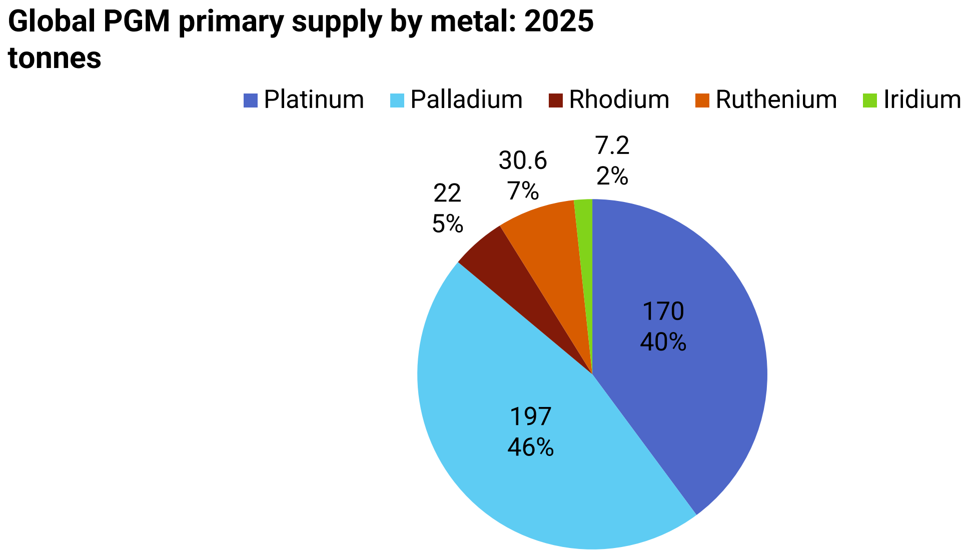
Global platinum demand by sector: 2025 tonnes



Source: Johnson Matthey (January 2026); demand excluding closed loop recycling and reuse

PGM mine production is highly concentrated in just a few countries. In general, PGMs are always produced together, as they occur together in nature. Pt and Pd are considered the main metals, with the other PGMs (Rh, Ru, Ir, Os) considered by-products. Most PGM imports from primary sources are concentrated materials after several refining stages.

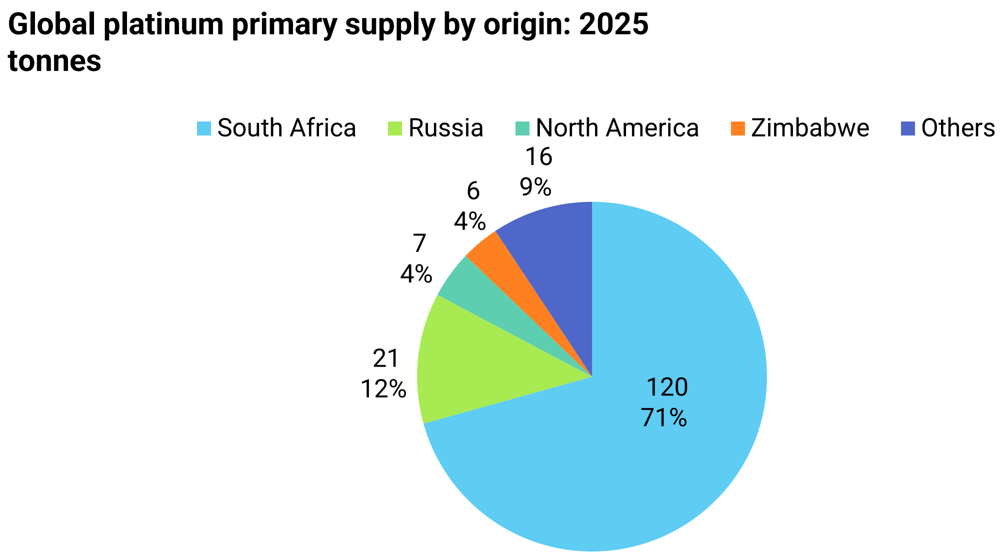
Globally platinum and palladium mine production makes up 86% of the PGM basket by mass of metal produced:



Source: Johnson Matthey (January 2026)

<u>South Africa dominating global primary platinum supply – no primary supply from Europe</u>

South Africa dominates global primary platinum supply, comprising nearly three quarters of platinum output by mass, followed by Russia (12%). There is essentially no primary supply from Europe other than minor by-product supply from nickel mining in Finland.



Source: Johnson Matthey (January 2026)

<u>Largest source of secondary platinum supply: autocatalysts from vehicles</u>

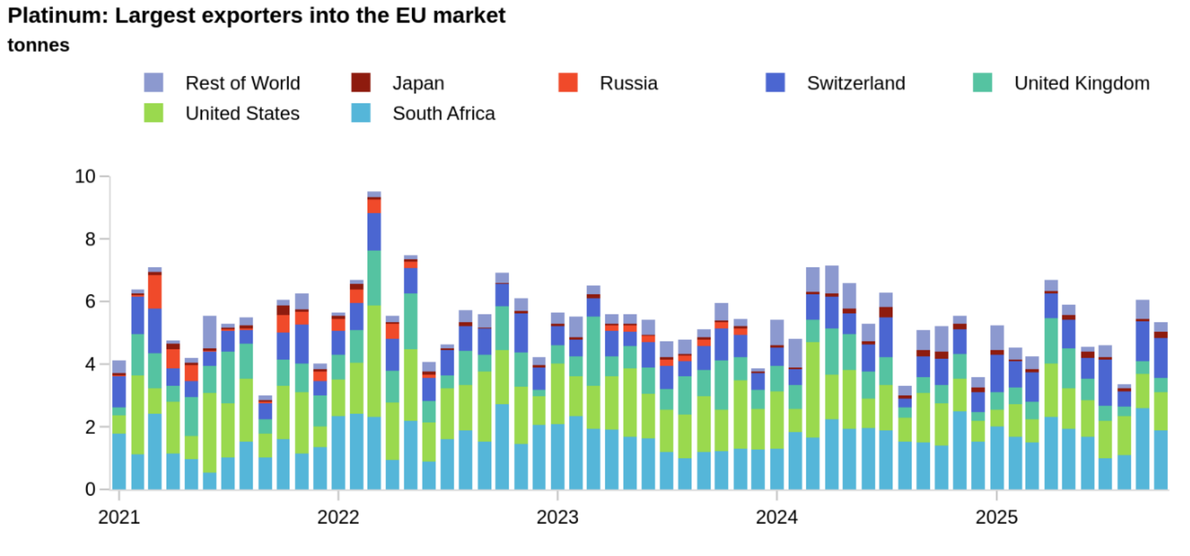
Secondary supply refers to platinum recovered from scrap and end-of-life products rather than from newly mined (primary) ore. The largest source is spent autocatalysts from vehicles, followed by jewellery and industrial scrap. This segment is strategically valuable as recycled metal supply can respond faster than new mining projects and usually carries a lower environmental burden.

Secondary supply from spent autocatalysts is complex, and depends on collection rates, scrap prices, vehicle scrappage patterns, technology mix of the vehicle fleet, recycling capacity and the economics of recovery.

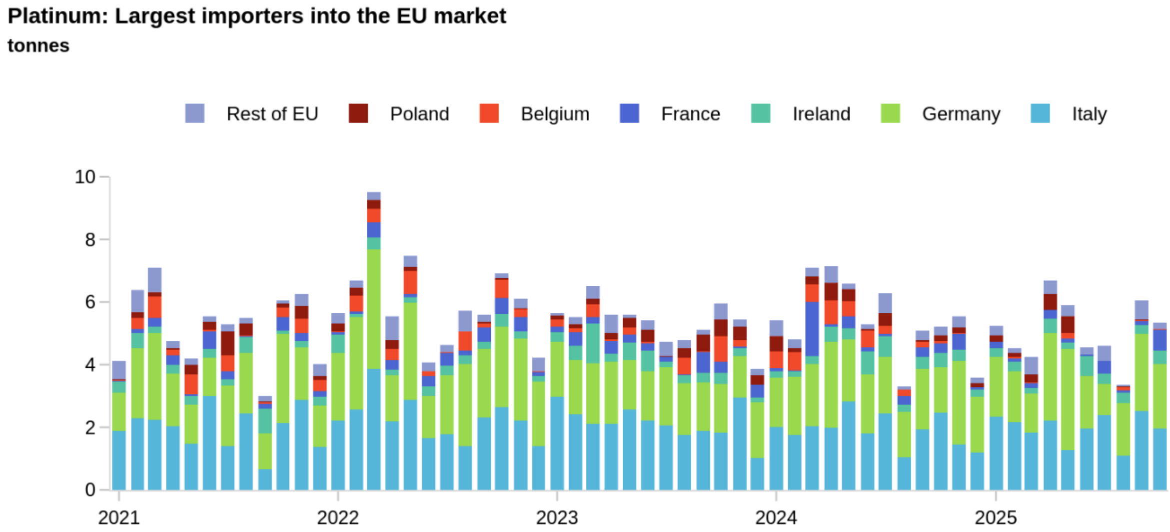
EU TRADE & PRICES

EU TRADE

The EU imports and exports large volumes of platinum in unwrought or powder-form (HS 711011) and semi manufactured form (HS 711019) but overall is a significant net importer. South Africa and the US are the largest sources for EU imports of platinum, with Germany and Italy being the largest recipients.



Source: Eurostat



Source: Eurostat

EU IMPORT RELIANCE

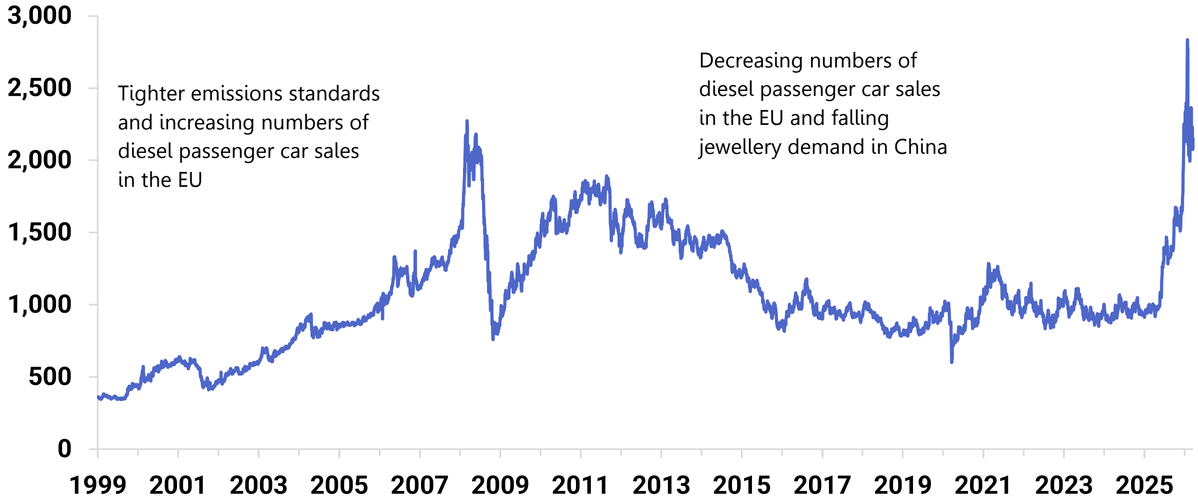
The EU is reliant on imports of platinum to meet its automotive, industrial and jewellery requirements. The EU's total demand for platinum (ex. investment) has averaged 51 tonnes per year since 2020. Secondary supply of platinum from autocatalysts sourced in the EU is around 16 tonnes per year, and with little primary supply or by-product production, the EU's import requirement has been around 35 tonnes per year.

PRICE & PRICE VOLATILITY

PGMs are highly priced due to their geological rarity and the relatively high mining costs in their key production region, South Africa. Prices are sensitive and often volatile due to demand and supply shocks: the PGM markets are relatively small, both individually and collectively, compared to other metals. A significant portion of primary metal produced is committed to long-term offtake contracts. Also, miners' ability to respond quickly to changes in demand is limited as setting up a PGM mine is a capital-intensive, multi-phase process with a long lead time.

The price volatility observed in PGMs is often driven by various events that can affect global supply and demand (although the recent price spike of end 2025 – beginning of 2026 was driven by speculation rather than the underlying fundamentals). Some of these events are associated with government policies and legislation, such as the widespread adoption of catalytic converters from the mid-1970s, which led to a surge in PGM demand [Hagelüken C., 2019]. Others are related to changing global economic conditions, such as the 2008 worldwide recession. Other events are related to supply disruption such as miners' strikes in South Africa (1986, 2011, and 2012 and particularly 2014), power supply disruption in South Africa from 2008, and issues causing bottlenecks in mineral processing such as at Valterra Platinum Converter Plant (ACP) in 2020, where successive operational failures at its Phase A and Phase B units halted matte conversion and caused a substantial build-up of un-refined metal, reducing liquidity of refined metal available to the market. Global supply was also impacted by lockdowns during the COVID-19 pandemic in 2020, when the South African government stopped all mining activities for a month.

Platinum price
$/oz



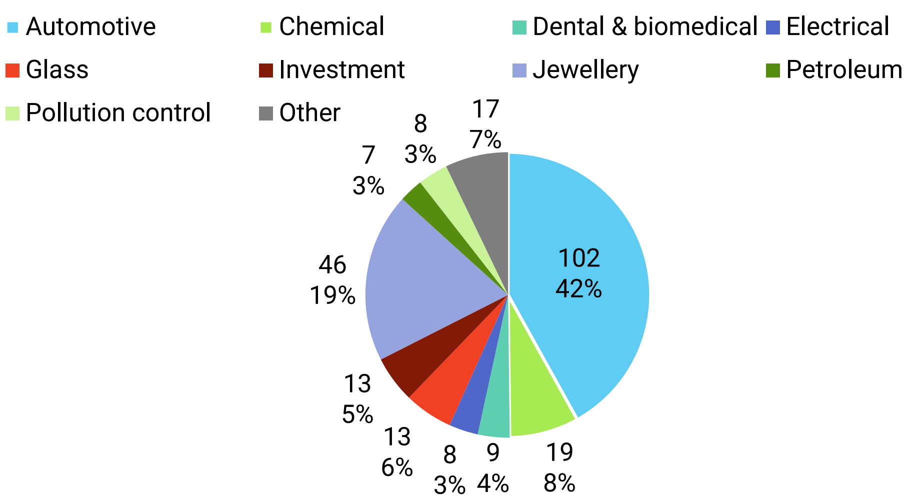
Source: Bloomberg Finance LP

DEMAND OUTLOOK

GLOBAL AND EUROPEAN END-USES

Automotive and jewellery dominate demand globally, followed by a diverse set of industrial applications. All the end uses vary in scale and importance by region.

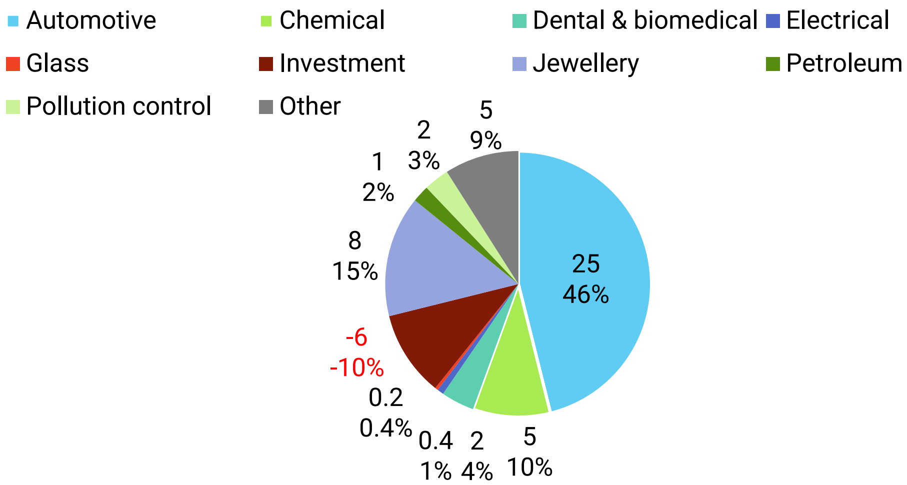
Global platinum demand by sector: 2025
tonnes



Source: Johnson Matthey (January 2026)

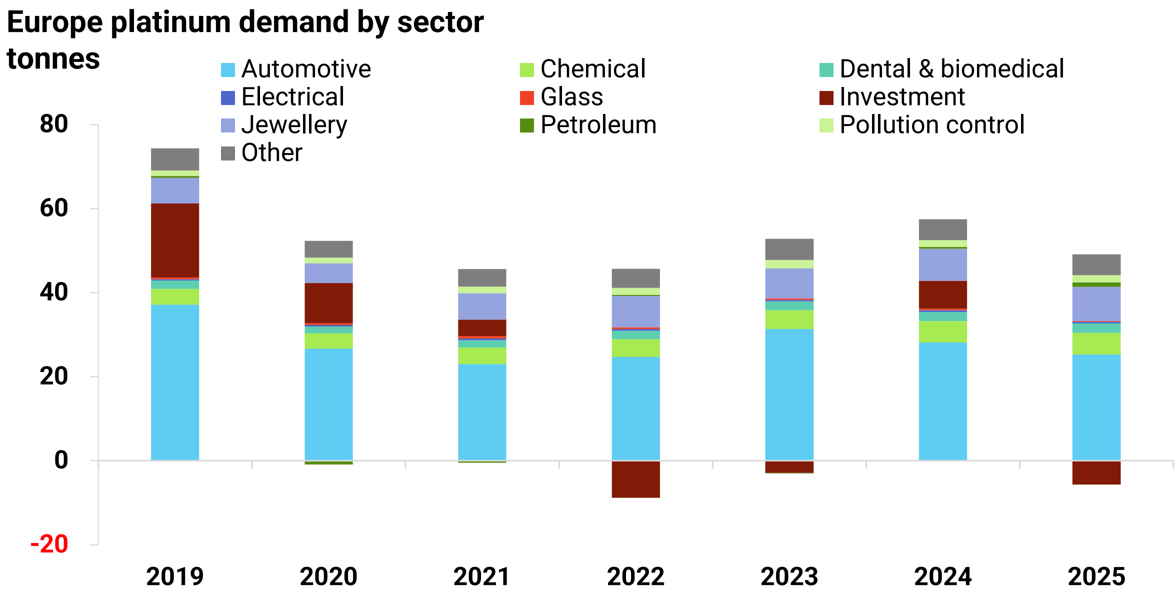
In the EU27, the autocatalyst manufacturing industry is well developed, representing a slightly higher share than globally, while the EU27 is a slightly less significant jewellery manufacturer. Several industrial end-uses, such as glass fabrication, are barely represented in Europe, while others, including petroleum refining, account for a small share of global activity. There was a significant Platinum disinvestment in Europe at the end of last year, due to ETF profit-taking among European and South African funds (after the platinum price surged by nearly 50% in 2025), and because of weak retail bar and coin demand in Europe last year.

Europe platinum demand by sector: 2025
tonnes



Source: Johnson Matthey (January 2026); Note: Europe defined here as EU+ (includes UK and Turkey but excludes Russia)

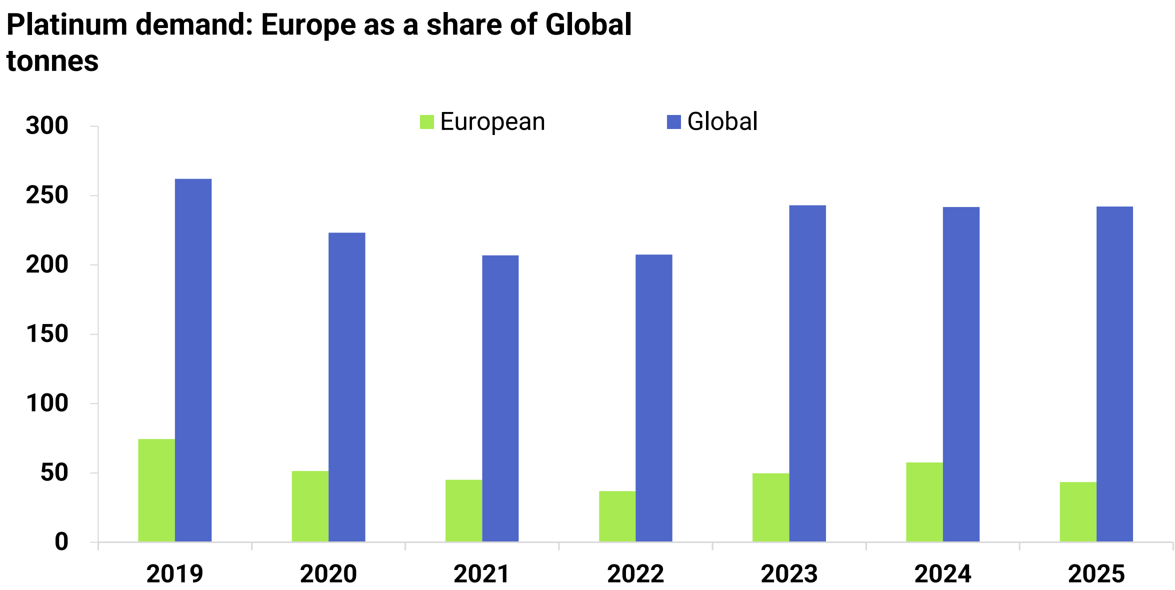
Demand is relatively stable, having recovered from the post-pandemic low in 2021 but not to the previous 2019 high. Global demand has declined from 262 tonnes in 2019 to 242 tonnes in 2025. Automotive demand grew by 21 tonnes during this period, while jewellery demand declined by 18 tonnes.



Source: Johnson Matthey (January 2026); Note: Europe defined here as EU+ (includes UK and Turkey but excludes Russia)

European demand has recovered to some extent post-pandemic, but demand declined slightly in 2025, with some activity transferred to other regions. Automotive demand declined by 12 tonnes, with some vehicle production shifting to battery-electric vehicles.

Europe's share of global platinum demand has decreased slightly, from 28% in 2019 to 24% in 2025, suggesting new industrial process capacity additions may be underway in some lower-cost regions.



Source: Johnson Matthey (January 2026); Note: Europe defined here as EU+ (includes UK and Turkey but excludes Russia)

APPLICATIONS & SUBSTITUTION POTENTIAL

AUTOMOTIVE - AUTOCATALYST

Current applications: platinum is used in light- and heavy-duty autocatalysts to reduce harmful exhaust emissions and meet increasingly stringent air quality regulations. It has long been the main PGM in diesel systems but is also used in gasoline systems, especially recently as automakers have increased platinum-for-palladium substitution in response to prices and market balances. Gasoline hybrid powertrains, increasingly popular for reducing carbon dioxide emissions from combustion powertrains, use similar autocatalyst formulations to those of internal combustion engine-only vehicle autocatalysts. The PGMs remain effective under harsh thermal and chemical conditions, with durability to match expected vehicle lifetimes.

Substitution potential: platinum can be partially replaced by palladium and rhodium, depending on engine type, fuel quality, emissions rules, relative metal prices, and market balances. Palladium had largely displaced platinum in gasoline catalysts, but more recently, platinum has been returning to some gasoline applications. Battery electric powertrains, which do not require an autocatalyst, are increasingly taking market share from combustion engine powertrains, so reducing autocatalyst PGM demand long term.

JEWELLERY

Current applications: platinum is widely used in bridal rings and other fine jewellery, typically with small quantities of other PGMs as alloying agents to improve properties. It is popular as a jewellery metal because it is naturally white, has a high density, strong wear resistance, good corrosion resistance, and is hypoallergenic. Platinum metal holds stones securely, so it is sought after for high-value engagement rings.

Substitution potential: jewellery buyers can easily switch to other white metals (mainly white gold or silver) or yellow gold based on price, fashion, and weight preferences. Jewellery is generally considered a discretionary purchase, so is at risk from purchases of other luxury items.

CHEMICAL

Current applications: platinum is used as a catalyst in bulk and speciality chemical manufacture, including nitric acid, silicones, and some hydrogen-related processes. Platinum catalysts accelerate reactions, can improve yield (selectivity and quantity) and can reduce process energy input. It tolerates aggressive chemical environments and high temperatures better than many base metal catalysts.

Substitution potential: some processes can switch to other PGMs or to base-metal catalysts where chemistry permits. But the risk is process-specific: in many plants, the catalyst is tightly optimised around platinum performance, lifetime and selectivity, which limits easy switching.

ELECTRICAL

Current applications: platinum is used in a range of products, including hard disk drives, hybrid integrated circuits, electrodes, and high-temperature sensing, such as thermocouples.

Substitution potential: In some electronics applications, platinum can often be displaced by palladium, gold, or cheaper nickel. In hard disk drives, platinum confers optimal properties to the disk coatings, with minimal scope for substitution.

PETROLEUM REFINING

Current applications: platinum is widely used as a refinery catalyst, particularly in reforming processes and related upgrading reactions that add value to crude oil to produce petrochemical feedstocks and high-value fuels. Platinum delivers high catalytic activity, good selectivity, and realistic durability under severe operating conditions.

Substitution potential: Individual refinery catalysts can be reformulated using other metals or supports, but switching is usually constrained as the process plant and catalyst are designed to work together. Alternative catalysts would require changes to the complex process design, risk performance guarantees, and regeneration economics.

GLASS PRODUCTION

Current applications: platinum, often alloyed with rhodium, is used in the tooling for producing glass fibre and high-quality flat glass. Molten glass is extremely chemically and thermally aggressive. Platinum alloys are prized for their high resistance to corrosion, erosion, and chemical contamination of the glass, while still retaining strength at very high temperatures. This gives platinum/rhodium a competitive edge over other materials by reducing defects and extending equipment life.

Substitution potential: some lower-cost engineering solutions do exist, particularly using PGMs only on the most critical parts of the equipment and lower-cost materials such as molybdenum on the bulk equipment.

MEDICAL AND DENTAL

Current applications: platinum is used in chemotherapy drugs, biomedical devices such as stents and implantable electronic components, and some dental alloys/materials. Key properties are biocompatibility, corrosion resistance, radiopacity, and stable electrochemical behaviour. These are vital for long-term implants, electrodes, and devices that may function in the human body.

Substitution potential: in many structural implant and dental applications, titanium, cobalt-chromium, or nickel-chromium alloys are effective, safe, and widely used in preference to platinum. For certain implantable electrodes, neurostimulation, pacemaker leads, and platinum-based drugs, substitution is much less feasible, and applications are less price-sensitive.

HYDROGEN

Current applications: platinum is central to several parts of the hydrogen value chain, especially PEM electrolyser and fuel cell technologies. It plays a key role too in several midstream hydrogen transport and storage processes. Demand is expected to grow in the long term from a small base. Platinum is a highly effective electrocatalyst, with strong activity, conductivity and corrosion resistance under acidic conditions.

Substitution potential: platinum demand can be reduced through thrifting/lower loadings, recycling and improved catalyst design. Some competing technologies may not yet be at the same commercial scale but use lower PGM levels, so a technology mix may emerge as the market grows.

INVESTMENT

Platinum is a precious, inert, and geologically rare metal considered an acceptable investment asset. Several investment products have been introduced to meet demand, including physical assets (e.g. bars, coins) or financial assets (e.g. physically backed exchange-traded funds, ETFs). ETFs simplify investing by allowing investors to own platinum without the storage/insurance challenges of physically holding the metal. Global ETF holdings exceed 95 tonnes and can serve as a source of supply as well as a component of demand, depending on the investment climate.

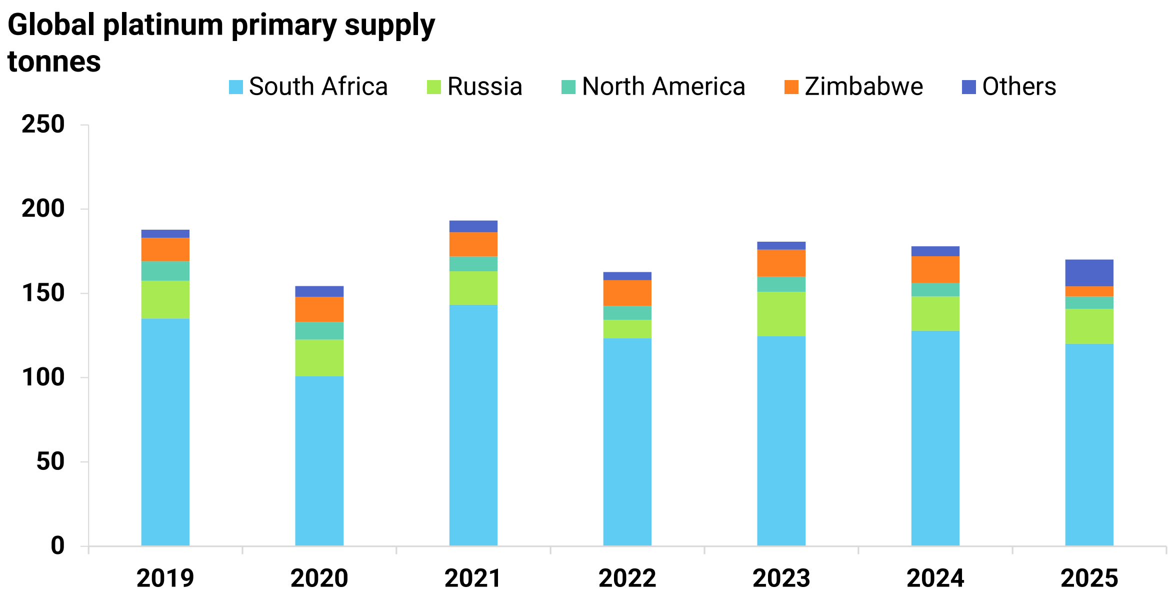
SUPPLY OUTLOOK

SUPPLY FROM PRIMARY MATERIALS

GLOBAL & EU MINE PRODUCTION

Global primary platinum supply has been relatively stable, just below around 190 tonnes, over recent years, with inevitable perturbation through the pandemic years. Global production in 2025 stood at 178 tonnes.

Global primary platinum supply is dominated by South Africa, accounting for around 70% of production, with year-to-year variation driven by labour and power supply issues and other disruptions. In 2025, South African production reached 121 tonnes, 68% of global production.



Source: Johnson Matthey (January 2026)

Global PGM mining is led by a handful of key producers. Platinum is marketed as a refined metal. The extracted ores contain low concentrations of platinum, so several processing steps are required after extraction to increase their content. Refining takes place primarily in mining countries, which are also major exporting countries. Metallurgical processing and refining to produce high-purity PGM products are a complex, costly, and time-consuming process; producing refined metal can take up to six months from the extraction of the first PGM-containing ore at the mine. Different physical and chemical concentration techniques are applied depending on the mineralogical characteristics of the ore, including crushing and grinding, froth flotation, and, in some cases, magnetic separation and dense media separation.

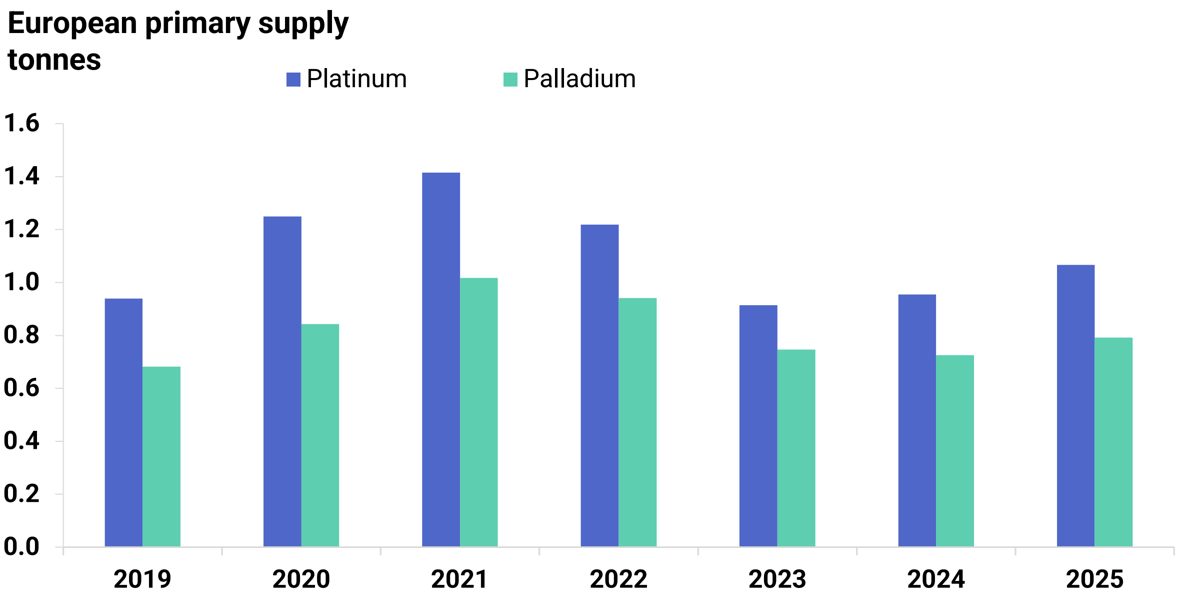
Deposits containing PGMs are generally mined using underground or, less commonly, open-pit methods. The choice depends on the deposit's size, grade, and morphology. For most mining companies or projects, average ore grades have gradually declined, a function of the combination of reef types mined, increased safety measures, and mining profitability, i.e., shallower, lower-grade ores versus deeper, higher-grade ores.

Most PGM mines in South Africa are mined at depths ranging from less than 500 m to 2.2 km. In South Africa, PGM-bearing ores generally have a PGM content of between 2 and 6 grams per tonne. It can require between 10 to 40 tonnes of ore to produce one troy ounce of platinum (31.10 g). Underground mining is also practised in Russia and at several sites in Zimbabwe, Canada, and the United States.

In Russia, platinum is mainly produced as a by-product of its nickel and copper mining activities at the Norilsk-Talnakh area. Since Russia's invasion of Ukraine in 2022, Russian platinum mine production has stayed broadly stable at around 20-22 tonnes per year, but trade flows have shifted: sanctions, self-sanctioning by Western customers, and higher import duties in the UK and US have reduced direct Western purchases, while exports have been increasingly redirected to Hong Kong and mainland China. Part of their metal remained in unsold inventories in 2022 before shipments normalised again in 2023–2024. Russia thus remains the second-largest platinum miner, accounting for around 12% of global primary platinum, even though its traditional role as a supplier to the EU27 has weakened. Zimbabwe, Canada, and the USA have consistently ranked third to fifth in global platinum mine production over the past decade.

Only marginal amounts of palladium and platinum are extracted from European mines as by-products (see chart below). Between 2018 and 2025, about 1–1.4 tonnes of platinum per year were produced in the EU, almost entirely from Finland's Kevitsa mine (Boliden), representing well below 1% of global primary platinum supply, while Polish production remained below 0.008 tonnes (8 kgs) of platinum per year from KGHM's copper-refining residues.

In addition, some PGM mined outside Europe is processed by European refiners. This includes PGM mined by Glencore in Canada that is refined in Norway, while PGM mined by Northam in South Africa is refined in Germany and the UK. This metal is counted in the North America and South Africa primary supply numbers, respectively.



Source: Johnson Matthey (January 2026)

PGM production facilities are extensive and complex, with many steps from approval to fully operational. Brownfield restarts and shallower mechanised decline projects with existing infrastructure typically take from 8-18 months, mechanised shallow greenfield projects can take 3-4 years, while large deep level vertical shafts can take around 6–8 years.

The platinum supply chain in the EU is complex and difficult to quantify. Platinum supplies come from both primary and secondary sources. Most PGM imports from primary sources are concentrated materials after a first stage refining process. The second refining step is generally carried out in the EU27 (e.g., Belgium, Germany, Italy) and in the United Kingdom.

Almost all PGMs derived from mining production are marketed as refined metal from integrated mining/metallurgical operations. Since refining primarily takes place in the mining countries, these are also the main exporting countries.

The platinum group metals value chain is also highly concentrated at the manufacturing stage. The global platinum group metals manufacturing industry is led by a handful of key companies, which account for approximately 85% of the manufactured goods market. Four of these companies have a strong presence in the EU27 (and in the UK). These companies operate large, integrated facilities that source from both primary and secondary sources. They supply the global market with a diverse range of platinum group metal materials and products from specialised plants located in different regions of the world, including the EU27.

Concentration is typically performed at or near the mine site. The concentrate is then transported to a centralised facility for processing into metal or to a refining plant. PGM concentrates are too low-grade to be refined directly and must undergo a beneficiation step. The beneficiation process typically includes a pyrometallurgical and a hydrometallurgical step and typically takes place near the mine site. The process used depends on the nature of the concentrate. For PGM-dominated ores, the processes include: smelting (at least 1350°C), matte production and conversion; magnetic separation, and multi-stage leaching. For nickel ores, which are rich in sulfides, the metallurgical process is designed around the production of nickel, while maximising the recovery of PGMs, and includes many steps.

Subsequent smelting and refining can be carried out on-site or near the mine. The concentrate is transferred to the precious metals refinery for PGM separation and purification through a series of hydrometallurgical steps. The PGM concentrate is dissolved in hydrochloric acid, and the six PGMs are refined to high purity through selective precipitation or separation using techniques such as solvent extraction, distillation, and ion exchange. Refined PGMs have a purity greater than 99.95% and can be produced in several forms: ingots, grains, or a fine powder known as sponge.

Once refined to sponge (or ingot), primary and secondary PGMs are indistinguishable and are traded and used as equivalents.

GEOLOGY, GLOBAL RESOURCES & RESERVES

GEOLOGY

Platinum group metals (PGMs) are rare elements on Earth, with an overall abundance of approximately 1.5 ppb in the upper continental crust and 3.7 ppb in the lower continental crust.

The abundance of platinum in the Earth's crust is estimated to range from 1.5 ppb to approximately 5 ppb, while in the upper crust it is 0.5 ppb.

The geology and formation of PGM ores are complex and typically involve unique geological settings and mineralisation processes: tectonic, magmatic, hydrothermal, or secondary (weathering, erosion, sedimentation, transport, accumulation). In some cases, platinum and/or palladium constitute the primary product, the main economic driver supporting mining operations, while other PGMs are by-products that make a minor contribution to revenue. When PGMs are produced as by-products (e.g., from nickel production), they make a significant contribution to the overall economics of the operation.

Deposits associated with commercial grades of PGM are of several types, mainly found in mafic or ultramafic rocks where the PGMs have been concentrated as a result of igneous processes [Mudd G.M. ,2018]. The majority of global PGM resources and reserves are hosted in two deposit classes: the PGM-dominant class and the nickel-copper sulphide class. In the PGM-dominant class, platinum is generally the main economic product (though this can vary depending on the orebody), with lesser amounts of palladium and rhodium providing the main bulk of revenue.

PGMs are found primarily in base-metal sulfide minerals, in a wide variety of minerals containing PGMs bound to other metals in alloy form, or to elements such as sulfur, arsenic, antimony, and tellurium. They are therefore extracted simultaneously from the same deposit, as a primary or by-product. The most common platinum minerals are sperrylite ($PtAs_2$), generally found in nickel and copper sulfide deposits; braggite (Pt,Pd)S) in layered intrusions and ultramafic rocks; and cooperite (PtS), often associated with other platinum minerals in ultramafic rocks.

PGM deposits are relatively rare and occur in limited geographical areas around the world. Most of the world's PGM production comes from a few countries, with the largest reserves and production occurring in South Africa, Russia, and Zimbabwe. Enrichment of PGM concentrations occurs in deposits of several types developed in a limited range of geological settings. Mineable deposits of PGMs are geologically rare, and most PGM-bearing ores are extremely low-grade. Ore grades typically range from 1 to 10 grams (PGMs and gold content) per tonne in the main commercial deposits in South Africa, Russia, and Zimbabwe. Substantial and extensive PGM deposits are known to exist, beyond what has already been estimated as reserves and resources, sufficient to support PGM mining for many decades; however, their exact are not precisely known.

GLOBAL RESOURCES & RESERVES

World resources of PGMs are estimated to total more than 100 million kilograms. The largest resources and reserves are in the Bushveld Complex in South Africa.

South Africa is the world’s leading producer of platinum, accounting for approximately 70–80% of global production. The largest platinum ore deposits are in the Bushveld Complex of South Africa. The Bushveld Igneous Complex consists primarily of two PGE-rich layers, the Merensky Reef and the UG2 Chromitite Reef.

The Merensky Reef type is extensive, layered, mafic to ultramafic intrusions located in the north of the country and containing platinum, palladium, rhodium, and other platinum group elements (PGEs). These deposits are characterised by a thin layer of platinum-rich sulfide ores within layered mafic to ultramafic intrusions. Current mill-head grades of the Merensky Reef are typically 4-7 parts per million (ppm) of “6E” (i.e. combined platinum + palladium + rhodium + ruthenium + iridium + gold) or 4-6 ppm of combined platinum, palladium, rhodium and gold (“4E”), with a platinum-palladium-ratio between 2.0:1 and 2.5:1 at the largest operating mines.

The Chromitite Reef type has a similar morphology to the Merensky Reef, but it comprises thin continuous layers of chromite. Typical mined 4E grades (i.e. platinum + palladium including rhenium, and gold) are in the range 2.5 ppm to 4 ppm with a platinum-palladium-ratio of 2:1, but in some cases can be closer to 1:1 and significantly higher amounts of rhodium, ruthenium and iridium in comparison to the Merensky Reef. The UG2 Chromitite in the Bushveld Igneous Complex is the largest repository of known PGM resources in the world and contains more than 75% of the world's known platinum. Considering platinum alone, for every kilometre of depth in the Earth, the Bushveld complex contains approximately 11,000 tonnes of platinum, with a current annual production of approximately 187 tonnes.

Although the Merensky and UG2 reefs are the most important, the Platreef, the northern outcrop of the Bushveld complex, is currently open pit mined. It appears that the Platreef extends to at least 2 km depth, which could provide access to significant quantities of platinum group metals in the future if underground mining methods suitable for this reef are developed. Typically, palladium is more abundant than platinum in Platreef ore.

South African production dipped slightly in 2024 due to electricity disruptions, higher costs and asset restructuring, but stabilised without major load shedding (load shedding is South Africa's controlled, scheduled power outages to prevent the national grid from collapsing when supply can’t meet demand). Load shedding in South Africa improved dramatically in 2025, with only 26 hours total across four days early in the year and over 231 consecutive days without outages by year-end, driven by Eskom's Generation Recovery Plan. No significant shifts have altered the Bushveld's dominance or the geological details provided. *Source: Semafor*

Zimbabwe is another major platinum producer, with deposits located in the Great Dyke, a geological formation that runs north to south across the country. The Great Dyke is a layered mafic to ultramafic complex containing platinum, palladium, and other valuable minerals. The Great Dyke, a major PGM deposit in Zimbabwe, is similar to the Merensky Reef, but its intrusion area is much smaller.

EU RESOURCES & RESERVES

Only a very small share of global PGM production takes place within the EU. Between 2018 and 2022, only palladium and platinum were extracted from EU mines. Palladium production amounted to less than 2 tonnes per year and came mainly from mines in Finland.

The largest PGM resources in the EU are in Finland and Sweden, where they occur in nickel-copper sulphide ores at concentrations ranging from a few ppm to a few tens of ppm. Most platinum group minerals occur as very small individual grains, either enclosed within silicates (57%) or located along sulphide grain boundaries. Between 2018 and 2025, about 1–1.4 tonnes of platinum per year were produced in the EU, almost entirely from Finland's Kevitsa mine (Boliden), representing well below 1% of global primary platinum supply. The remainder of EU PGM production (0.008 tonnes, or 8 kgs, of platinum per year) has come from Poland, where there is no PGM mining, but platinum is recovered from KGHM's copper-refining residues.

SUPPLY FROM SECONDARY MATERIALS/PRODUCTION

RECYCLING

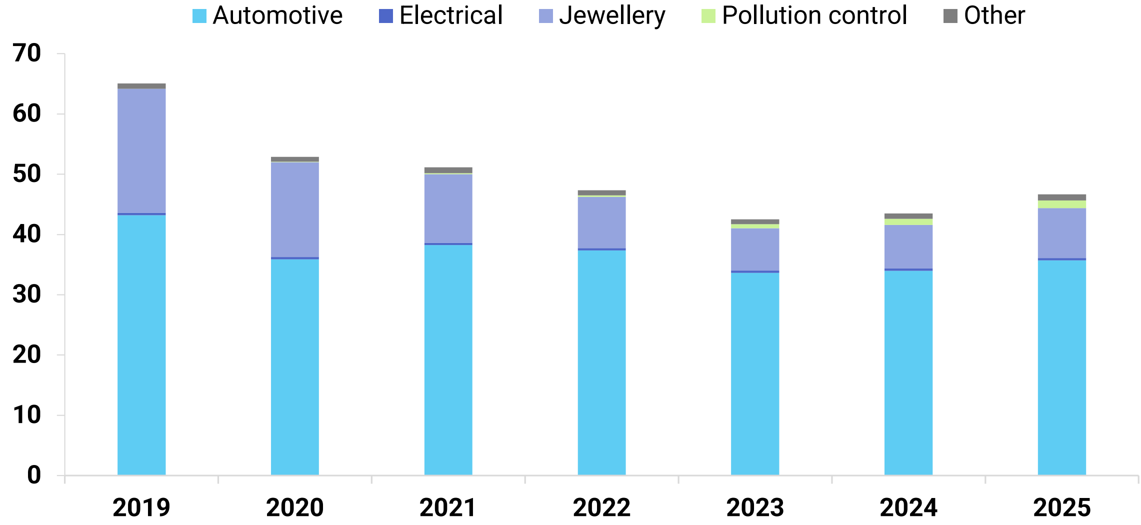
Secondary sourcing is of critical importance to the PGM market. Platinum's high value and relative rarity lead to value-driven recycling. In addition, secondary production of PGMs has significantly lower environmental impacts than primary production because PGM concentrations in many end-of-life products are much higher than in ore grades.

Sophisticated technology has been developed for highly efficient recovery of platinum from various waste streams. Recycling is a significant and growing contributor to global platinum supply.

The secondary supply shown in the Global and Europe charts below is from open-loop recycling only; closed-loop recycling is not included as it is often not visible to the market (see 'Definitions' in the references for explanation of open-loop vs. closed-loop). Automotive recycling captures only the PGM recovered from vehicles first sold in the European region. Thus, the actual quantity of PGM treated by European refiners may differ due to scrap and vehicle imports/exports (source: Johnson Matthey, January 2026).

Autocatalyst material dominates global secondary supply, by virtue of a highly developed spent autocatalyst value chain including dismantlers, collectors and refiners. Recycling of automotive catalysts is the most important contributor to secondary supply. Around 95% of the PGM content in spent autocatalysts can be recovered during refining using current recycling technologies, with average PGM loadings in autocatalysts of between 3-9 grams, varying by engine type, emissions standard, and technology generation. Jewellery is the only other substantial open-loop source of platinum; volumes have decreased somewhat as consumer appetite for platinum jewellery has declined. Consumers in China tended to return their jewellery for recycling when new designs emerged, during periods when the market was very fashion-driven.

Global platinum secondary supply
tonnes

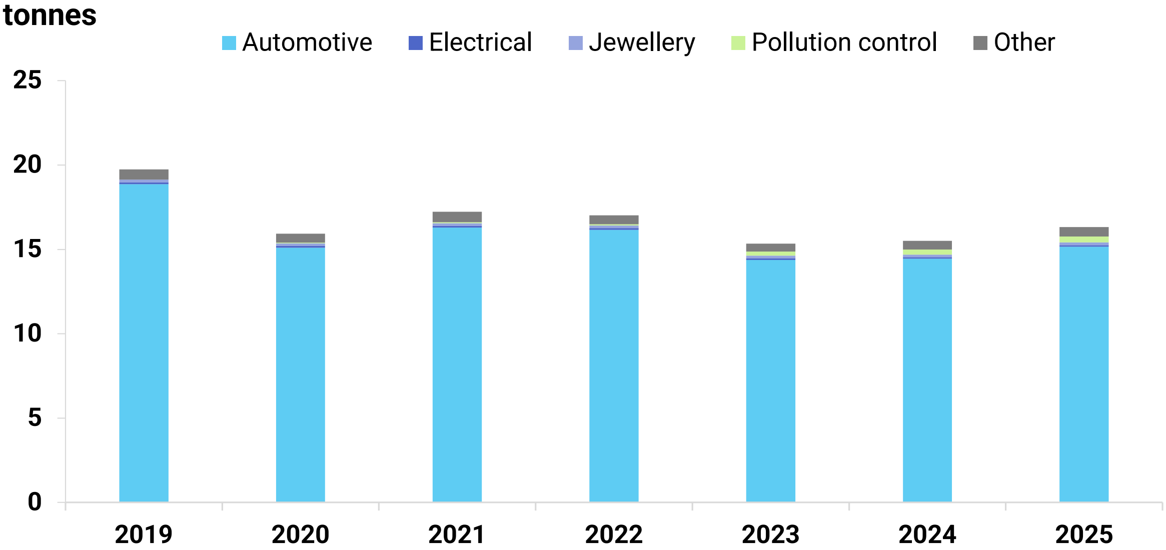


Source: Johnson Matthey (January 2026)

Autocatalyst recycling typically is incentivised when metal prices are higher, as the value of the metal contained in the autocatalyst is higher, offering more margin for players at each step of the value chain. Autocatalyst recycling is typically lower when consumers keep their vehicles for longer; when the availability of new vehicles is constrained due to problems in the supply chain or logistics chain, or during economic headwinds, when consumers may be unwilling/unable to commit to an expensive purchase or a high-interest-rate lease/loan plan.

In Europe, the secondary supply market consists almost entirely of scrapped autocatalysts.

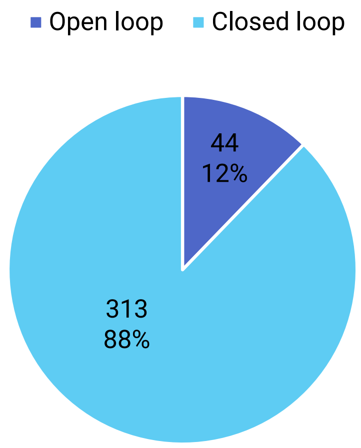
Europe platinum secondary supply
tonnes



Source: Johnson Matthey (January 2026); Note: Europe defined here as EU+ (includes UK and Turkey but excludes Russia)

Historically, closed-loop recycling volumes have not been very visible. In its 2024 Circularity Whitepaper, Johnson Matthey has provided estimates of the total (open and closed-loop) global recycling volumes, shown below. In its 2026 Whitepaper, Heraeus Precious Metals shows similar results. The closed-loop accounts for nearly 90% of platinum recycling, despite the substantial open-loop volumes shown above from autocatalyst recycling.

Global platinum total (open + closed loop) recycling: 2024 tonnes



Source: Johnson Matthey (January 2026)

OTHER CONSIDERATIONS

HEALTH AND SAFETY ISSUES

Bulk metallic platinum is relatively inert and non-bioavailable, with no health concerns for consumer uses of the metal. Potential health risks are more apparent in occupational settings where there is potential for exposure to soluble platinum salts and certain processing stages. Occupational health guidance identifies inhalation, skin, and eye exposure as relevant routes of concern, with symptoms including irritation and dermatitis. The most significant concern is the potential for certain platinum compounds found as intermediates in refining and catalyst manufacture to cause sensitisation of the respiratory tract, with consequent risk of developing occupational asthma if controls are inadequate. In practice, it has been demonstrated that this concern is limited to chloroplatinates intermediates in which halogen atoms are coordinated directly to a central platinum atom. Other industrial soluble platinum salts, even those containing halogen atoms not directly coordinated to platinum to not cause sensitisation. The sensitisation potential of chloroplatinates is well documented and over recent decades industry has taken progressive action to limit the potential for exposure to these intermediates. The consequent success in substantially reducing the incidence of platinum salt sensitisation to low levels has been confirmed by studies reported in the scientific literature.

The International Platinum Group Metals Association (IPA) has developed comprehensive guidance on the safe use of PGMs in the workplace, including recommendations on exposure monitoring, medical surveillance and best practices for controlling occupational exposures to certain soluble PGM compounds that can cause respiratory sensitisation. This guidance is used by PGM producers and downstream users to design and continually improve occupational health and safety programmes, helping to ensure that the benefits of palladium-containing technologies are delivered while protecting workers along the supply chain.

Source: IPA

ENVIRONMENTAL ISSUES

The IPA routinely conducts Life Cycle Assessments of the PGMs to assess the potential environmental impacts of their production and makes the results for key impact categories available on its website.

In 2025, the IPA has published a CO_2 scenario for primary production in 2030, based on investments by South African producers and the South African government into renewable energy, which shows a potential decrease in the CO_2 footprint of mining of between 35% and 61%, depending on the metal (Bossi/Gediga, Decarbonisation in the Mining of Platinum Group Metals – A CO2 Outlook to 2030 | Johnson Matthey Technology Review).

The environmental footprint of primary platinum production remains material, but intensity metrics have improved over time through operational efficiency gains, increased secondary supply from recycling, and the progressive adoption of recognised responsible mining frameworks. Leading PGM producers are implementing structured water and energy management systems, enhanced tailings governance in line with the Global Industry Standard on Tailings Management (GISTM), and biodiversity programmes. These efforts are increasingly aligned with frameworks such as the IRMA Standard for Responsible Mining, ICMM Performance Expectations, ISO 14001 environmental management systems, and climate disclosure and target-setting initiatives including TCFD and the Science Based Targets initiative (SBTi).

In parallel, secondary supply from high-grade recycling, particularly of spent automotive catalysts, has grown to a meaningful share of global platinum supply (around one quarter of total supply in recent years), with substantially lower environmental impacts per unit of metal produced and up to roughly 95–98% lower carbon footprint than primary material according to recent life cycle assessments. The industry increasingly sees efficient recovery of PGMs from end-of-life products as a core pillar of its environmental strategy and a practical way to support circular-economy objectives while maintaining reliable metal availability for critical applications.

The results for the key impact categories of the primary production of PGMs, as assessed in IPA's last LCA on production year 2022, can be found below:

Summary of primary production results per kg of metal					
Impact Category	**Pt**	**Pd**	**Rh**	**Ir**	**Ru**
Global Warming Potential [kg CO_2 eq.]	36,828	28,094	38,027	42,096	42,000
Primary Energy Demand [MJ]	494,563	425,546	508,222	548,987	547,114
Acidification Potential [Mole of H+ eq.]	1,687	4,507	1,446	887	926
Eutrophication Potential [Mole of N eq.]	687	450	715	812	811
Photochemical Ozone Creation Potential [kg NMVOC eq.]	258	380	249	236	238
Blue Water Con-sumption [kg]	297,006	243,960	305,879	335,220	329,931

Sources: Johnson Matthey: and IPA

For the secondary production route (recycling), the IPA has published the following values for Pt, Pd, and Rh (results for Ir and Ru could not be published as a minimum of three participating companies could not be met):

Summary of secondary production results per kg of metal			
Impact category	**Pt**	**Pd**	**Rh**
Global Warming Potential [kg CO_2 eq.]	477	497	497
Primary Energy Demand [MJ]	9,976	10,370	10,402
Acidification Potential [Mole of H+ eq.]	1.26	1.29	1.30
Eutrophication Potential [Mole of N eq.]	3.68	3.70	3.77
Photochemical Ozone Creation Potential [kg NMVOC eq.]	0.95	0.95	0.97
Blue Water Consumption [kg]	2,419	3,654	3,458

NORMATIVE REQUIREMENTS

Platinum production and trade are subject to a wide range of regulatory and voluntary requirements covering environmental protection, workplace safety, human rights and responsible sourcing. Major PGM producers participate in assurance frameworks such as IRMA, the Responsible Minerals Initiative and the London Platinum and Palladium Market's Responsible Sourcing Standard, in addition to complying with national legislation and EU due-diligence and non-financial-reporting rules. Downstream, platinum-containing products such as catalysts and fuel cell components must comply with EU product legislation (including chemicals, automotive and industrial-emissions regulations), helping to ensure that environmental and health aspects are carefully managed over the life cycle.

Normative requirements include REACH compliance (EC 1907/2006) for handling, strict particulate ventilation, personal protective equipment (PPE), and waste disposal in accordance with local environmental regulations. Safety Data Sheets must be provided with materials.

At the sector level, the International Platinum Group Metals Association (IPA) has developed comprehensive guidance on the safe use of PGMs in the workplace, including recommendations on exposure monitoring, medical surveillance and best practices for controlling occupational exposures to certain soluble PGM compounds that can cause respiratory sensitisation. This guidance is used by PGM producers and downstream users to design and continually improve occupational health and safety programmes, helping to ensure that the benefits of palladium-containing technologies are delivered while protecting workers along the supply chain.
Source: IPA

SOCIOECONOMIC AND ETHICAL ISSUES

Platinum and PGM supply are highly geographically concentrated, so social and governance issues in producer countries are more focused than for many other commodities. These include worker safety, wage bargaining, electricity reliability, water stress, community relations, local economic dependence on mining, and the distribution of value along the chain. Governments in the major producing countries in Southern Africa expect companies mining there to increase the amount of beneficiation and value-adding processes performed in-country, rather than exporting for these processes. PGM mining companies operate under comprehensive mining legislation, environmental regulation, and binding social and labour obligations. Mining companies adhere to rigorous sustainability reporting, environmental permitting and labour compliance requirements.

All IPA PGM mining companies are publicly listed (LSE, JSE, NSE) companies which routinely report about their environmental, social and governance performance and abide by the regulations set out by national/local authorities and the respective stock exchanges.

IPA members apply sustainability reporting principles to ensure organizations communicate and demonstrate accountability for their environmental, economic, and social impacts, in line with global best practices such as the UN Sustainable Development Goals (UN SDGs), the Global Reporting Initiative (GRI), and the UN Global Compact.

Ethical sourcing issues in platinum and the PGMs are therefore less about artisanal-mining narratives common in some other minerals and more about industrial-scale mining conditions, labour relations, community impacts, and geopolitical exposure. Customers increasingly expect assurance not only on origin but also on processing integrity, responsible sourcing, and sanction screening.

South Africa's PGM industry has experienced periods of severe labour conflict but has also seen important changes over the past decade. The most tragic episode was the Marikana Tragedy in August 2012, when 34 striking miners were killed and many others injured after the police opened fire during a wage dispute at Lonmin's mine. The subsequent Marikana (Farlam) Commission of Inquiry found serious failings in police planning and conduct, recommended that killings and assaults by the police be investigated, and highlighted shortcomings in how the company, unions and the state had managed the dispute and underlying social conditions.

The 2014 platinum strike, involving around 70,000 workers at Anglo American Platinum, Impala Platinum and Lonmin, was the longest wage strike in South African history but, unlike 2012, ended through negotiation on a multi-year wage agreement rather than large-scale violence. Since then, protests and work stoppages have continued to occur in the platinum belt, often driven by unemployment, service-delivery concerns and local socio-economic issues, but recent reporting points to a situation that is generally more stable than during the 2012–2014 peak, with disputes more often handled through established bargaining structures and social and labour plan processes. Today, South African PGM producers operate under strengthened health and safety rules and social performance expectations, and there is ongoing work by companies, unions, government and communities to address legacy grievances, improve living conditions and prevent a recurrence of events on the scale of Marikana.

Sources: Gov.UK, IPA and South Africa's Minerals Council

The extraction and refining of PGMs can place significant pressure on local environments; however, industry takes the environmental and social impacts of PGM extraction very seriously and has focused on substantial improvements in recent years, particularly in water stewardship, air emissions control, and waste management. Water remains a critical input to flotation and processing, but major PGM mines in South Africa and elsewhere now operate closed-loop systems that recycle a large share of process water, supported by site-specific water balances and dedicated treatment plants that repurpose mine water for cooling and other uses. Recent case studies from deep-level PGM operations in Limpopo show that membrane-based treatment and reuse can replace a significant portion of potable "board" water, delivering both cost savings and reduced pressure on local water resources, in line with IRMA's detailed requirements for water management. South Africa continues to face structural water stress in some areas, with renewable water resources of around 800–900 m^3 per person per year, but national water use efficiency and mine water management programmes, together with company-level integrated water and waste management plans, are designed to ensure that mining does not crowd out essential domestic and agricultural uses.

Sources: PGM mining and processing in the circular economy: A framework towards circularity (J. Kruger, 2022) and UN

Tailings and waste rock are an inherent by-product of all hard-rock mining, but in the PGM sector, they are managed as engineered storage facilities rather than unmanaged "waste dumps", with design, monitoring and closure governed by international standards such as the Global Industry Standard on Tailings Management and, increasingly, IRMA requirements. Leading PGM producers report full conformance with these standards for high-consequence facilities and are investing in tailings retreatment, revegetation, and long-term stability measures to reduce legacy impacts and recover additional metal value. Through the IPA, member companies have committed and continue to align their operations with recognised responsible mining and sourcing frameworks, including IRMA and other sustainability assurance schemes (such as the forthcoming Consolidated Mining Standard Initiative - CMSI), demonstrating measurable progress over time and helping to ensure that PGM production supports local development while minimising environmental impacts.

Source: IPA

ECONOMIC IMPORTANCE OF PLATINUM FOR EXPORTING COUNTRIES

Platinum and the PGM industry are economically significant for South Africa and, to a lesser extent, for Zimbabwe and Russia. In South Africa, platinum group metals are a major mining industry, a source of export earnings, industrial employment and fiscal revenue, and an anchor for local refining and fabrication capabilities.

PGM mines in South Africa and Zimbabwe are not government-owned but are owned by publicly listed companies and their shareholders.

For producers and their downstream customers, the government policies, infrastructure performance and macroeconomic conditions in the countries where they mine can significantly affect supply. Such issues may cause short-term disruptions, while, of course, the fundamental geology determines the long-term potential of a mine region.

RESEARCH AND DEVELOPMENT TRENDS

Platinum and all the PGMs continue to feature in R&D projects, from the highly academic to those close to market.

A new collaboration was launched in February 2026 to develop high-impact PGM technologies and drive the next wave of industrial innovation. This recognises that currently, some 60% of global PGM supply is used in autocatalysts; in the long term, this is threatened by the increasing share of battery electric vehicles (BEVs). Johnson Matthey, Sibanye-Stillwater, and Valterra Platinum launched the programme to explore and scale technologies that leverage the exceptional performance and durability of PGMs, as well as their robust, circular supply chains. Expected to expand with additional partners in the coming months, the collaboration will explore uses across multiple sectors, including clean hydrogen, enhanced emissions detection and reduction across stationary and mobile sources, new electronic materials, and high-performance alloys and other advanced materials.

Heraeus Precious Metals and Sibanye Stillwater also announced in April 2026 a joint research and development project on Pt/Pd glass fibre bushings. The initiative focuses on platinum-palladium (PtPd) alloys enhanced through Heraeus' proprietary dispersion hardening (DPH) technology, with the goal of enabling more economical glass fibre production for E-glass fibres while supporting the development of new palladium applications. Traditionally, bushings are made from platinum due to the metal's excellent high-temperature stability. The collaboration aims to partially substitute platinum with palladium to achieve lower material costs and increase demand for palladium.

APPENDIX: RELEVANT HS/CN CODES

PLATINUM METAL, SEMI-MANUFACTURED AND SCRAP

Level	Code	Description
PGM metal/sponge/semi-finished codes (currently exempt by the U.S. from U.S. tariffs)		
	71101100	Platinum, unwrought or in powder form
	71101900	Platinum in semi manufactured forms
Scrap, Waste, and Residues codes (currently exempt by the U.S. from U.S. tariffs)		
	71129201	Platinum waste and scrap, incl. metal clad w/ platinum, excluding sweepings containing other precious metals, other than goods of e-waste heading 8549
	71123000	Waste and scrap of PGMs (e.g. from used catalytic converters)
	71129900	Other waste and scrap of precious metal or of metal clad with precious metal
Jewellery and Finished Goods		
	71131921–29	Jewellery and parts of precious metals incl. platinum and palladium
	71151000	Articles of precious metal or metal clad, including PGM items
PGM-using Industrial Products **Catalytic Converters and Related Items**		
3815		Tariff Classification of reaction initiators, reaction accelerators and catalytic preparations, not elsewhere specified or included
	38151200	Supported catalysts with precious metal or precious metal compounds (e.g., PGM-coated ceramics for auto use)
	38151100	Catalysts with nickel or precious metals, other than for auto use
	38151900	Other supported catalysts (may include PGM uses)
	38159090	Other catalysts and catalytic preparations (includes precious metals not elsewhere classified)
	841790	codes for PGM parts used for glass furnaces
Electronic Waste (WEEE) and Recoverable PGM sources		
	85491100	Waste & scrap of electrical and electronic equipment (household type)
	85491900	Waste and scrap of electrical and electronic equipment (other)

	85489090	Parts of electrical machines and apparatus not elsewhere classified (may include WEEE with PGMs)

PLATINUM COMPOUNDS (SALTS ETC)

Level	Code	Description
2843	**2843.10**	Colloidal precious metals. Covers colloidal platinum suspensions used in fuel cells, coatings and biomedical applications.
	2843.90	Other inorganic or organic compounds of precious metals; amalgams. Primary code for all platinum salts and chemical intermediates — chloroplatinic acid (H_2PtCl_6), platinum(II) chloride, platinum(IV) chloride, platinum acetylacetonate ($Pt(acac)_2$), diaminedinitritoplatinum (cisplatin precursor), and organometallic platinum complexes. China's national tariff adds a named sub-split 2843.90.00.39 specifically for "other platinum compounds".

PLATINUM REAGENT SOLUTIONS AND KITS

Level	Code	Description (short)
3815	3815.12	Supported precious metal catalysts where the active substance is a precious metal or compound. The dominant code for heterogeneous platinum catalysts — Pt/C, Pt/Al_2O_3, Pt/SiO_2 — used extensively in hydrogenation, fuel cells, and automotive catalysis.
	3815.90	Other reaction initiators and accelerators not elsewhere specified. Used for homogeneous platinum catalyst systems (e.g. Karstedt's catalyst, Speier's catalyst for hydrosilylation) where 3815.12 does not apply.
3822	3822.19	Prepared diagnostic or laboratory reagents (other), including kits. Standard code for platinum ICP/AAS standard solutions and analytical reagent preparations without certified reference material status.
	3822.90	Certified reference materials. Covers platinum single-element CRM standards (e.g. 1,000 mg/L Pt in HCl). Plain platinum chloride solutions without CRM certification remain under 2843.90.

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DEFINITIONS & METHODOLOGY FOR DATA

The demand, primary, and secondary data used to create charts and quoted in the text are based on Johnson Matthey's PGM Market Report dataset (most recent edition: May 2025) and have been updated with estimates to reflect the situation as of December 2025.

Primary supply

Supply figures represent producers' sales of primary PGM and are allocated to the region where mining took place, rather than to the region of subsequent processing.

Secondary supply

Secondary supply is the quantity of metal recovered from open-loop recycling (i.e. where the original purchaser does not retain ownership of the PGM).

Outside the automotive, jewellery and electronics markets, open-loop recycling is negligible.

Automotive recycling represents the weight of metal recovered from end-of-life vehicles and aftermarket scrap. It does not include warranty or production scrap.

Demand

Demand figures for any given application represent the sum of industry demand for new metal in that application, net of any closed-loop recycling (i.e. where industry participants retain ownership of the metal: an example would be recycling of spent chemical catalysts, where the metal is retained to be used on fresh catalyst that replaces the spent charge).

Automotive demand is allocated to the region where the vehicle is manufactured and is accounted for at the time of vehicle production. It includes emissions catalysts on vehicles, motorcycles and three-wheelers, as well as fuel cell vehicles. Non-road mobile machinery is counted as industrial demand, in the pollution control category.

Jewellery demand is allocated to the region where the finished jewellery is manufactured, not to the region where it is sold.

Regional definitions

Europe: EU+ (includes UK and Turkey but excludes Russia)

Open-loop recycling

When the original purchaser of the metal does not retain control over the PGM, the metal is available to the market again once recovered. The main source of open-loop metal is automotive catalytic converters, which are widely recovered from scrapped vehicles and recycled to recover the contained platinum, palladium or rhodium contained. Some metal is also recovered from the jewellery and electronics markets.

Closed-loop recycling

Refers to the situation where the metal remains within the application, e.g., when metal is recovered from used chemical catalysts and is used to produce fresh catalysts to replace the spent charge. While this metal is processed by PGM refiners, the equivalent amount of metal is usually returned to the original owner, who retains the metal value. As the net amount of metal in use has not changed, this returned metal is not counted towards market supply. Re-using metal in such way avoids the need for virgin mined metal, thereby contributing to make demand more sustainable.