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Quintessentially PGMs

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KEY TAKEAWAYS

For most of the time since our December 2024 issue, palladium and platinum have remained broadly range-bound, signalling equilibrium between supply and demand. The PGM basket reached its cost support level when a significant share of mines in N. America and South Africa became loss-making. The closure of mines was avoided only through cross-subsidisation and low leverage preserved from earlier windfall years. A brief rally in early March followed the flooding at the Tumela mine in the Amandeuilt complex operated by Valterra Platinum (formerly Anglo Platinum), leading to a six-month shutdown of the project.

In early April, the announcement of the US import tariffs on cars and a wider range of products momentarily unsettled the sentiment because of the potential destructive impact on the automotive sales in the US market. However, prices soon stabilised as anticipatory buying softened the negative impact.

The range finally broke in mid-May, when platinum and, to some extent, palladium prices surged due to a rise in Chinese jewellery imports as fabricators substituted PGMs for record-high gold. Additionally, American investors, worried about the potential imposition of tariffs on PGMs, increased their interest in these metals and boosted their imports by approximately 20% YoY. The supply squeeze drove platinum lease rates above 20% – near historical peaks – while palladium lease rates stayed close to zero, indicating a shortage of immediately available platinum and a sufficient prompt supply of palladium.

Palladium, YoY change	2024	2025E	2026E
Demand ex. investment	-0.6 Moz -6%	-0.2 Moz -2%	+0.3 Moz +3%
Supply ex. stocks sales	+0.1 Moz +1%	-0.2 Moz -2%	+0.1 Moz +1%

Although the exact impact of the US tariffs on the global automotive production is yet to be determined closer to the end of the year, we expect a 1% YoY increase in global automotive production to 92 million units in 2025, which signals a gradual recovery to the pre-COVID levels. This outlook is supported by a 5% YoY sales growth in 5M 2025. At the same time, output of ICE-equipped vehicles (including hybrids) is expected to fall by about 3% in both 2025 and 2026 as a result of slowing down but continuing electrification. Another factor determining the PGM demand in the automotive industry – PGM loadings – is experiencing some downward pressure because of thrifting in the absence of new environmental regulation in most of global regions, excluding the US, but especially so in China where consecutive hybrids (or EREVs) with lower PGM loadings are becoming more popular. However, there may be some adjustments in China's loadings in the near term due to regulatory authorities starting to pay more attention to automakers' compliance with the emission regulations.

Although some forecasts predicted a sharp acceleration in battery electric vehicle (BEV) production, the consensus outlook has been scaled back, as the output is expected now to rise by only low double-digit figures in 2025-2026, and predominantly so in China. This revision reflects at least three policy changes. Firstly, the current US administration, to put it mildly, pays much less attention to transport electrification. Secondly, the European authorities (particularly in Germany and France), amid a difficult budgetary situation, inflation, and rising expenditures, are being forced to reconsider

their programmes offering tax incentives for electric vehicle purchases. And finally, the EU's plans to phase out internal combustion engine vehicles starting from 2035 are currently under revision. Against this backdrop, American automakers such as Ford and GM are reconsidering their electrification targets for vehicle production.

As a result, we expect automotive demand for palladium and platinum to decline by 3% and 7% respectively in 2025, to 7.5 Moz and 2.7 Moz.

The jewellery sector, driven mainly by Chinese fabricators, remains the strongest growth area, although it is not clear yet if the recent spike in the platinum imports to China will become a long-lasting trend.

PGM demand in other industrial uses shows a steady expansion. Electronic demand is driven by rapid semiconductor innovations and the continued expansion of AI-focused data-centre infrastructure, while the chemical sector adds some further support through the rising output of propylene, pyroxene and purified terephthalic acid, all of which sustain PGM use.

Primary supply remains broadly stable across the main producing regions. Norilsk Nickel keeps Russian output steady in 2025, although some incremental growth is anticipated in 2026, when the Chernogorskoye mine comes on stream. South African producers are expected to meet their relatively flat production targets for 2025, although the depressed PGM basket price and some operational issues in H1 2025 may lead to an actual decline in the annual output below the current year's guidances as well as 2024 figures. North America, with its palladium-rich mines, is the only region where output may contract meaningfully, as Stillwater and Impala Canada are unlikely to return to profits with the current basket price.

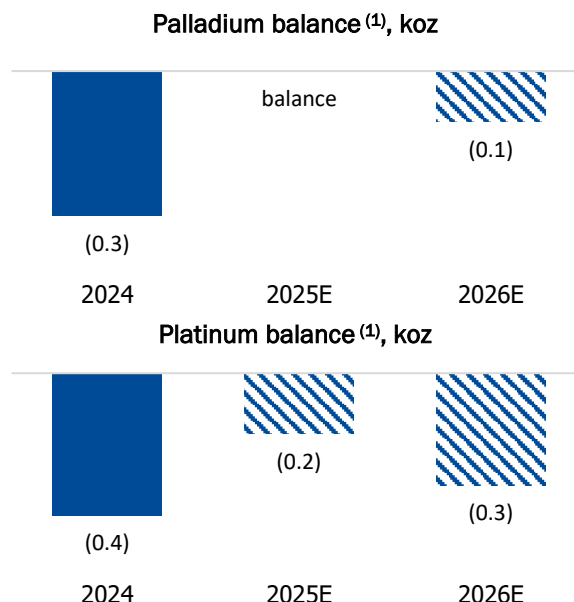
Platinum, YoY change	2024	2025E	2026E
Demand ex. investment	-0.3 Moz -4%	-0.1 Moz -1%	+0.1 Moz +1%
Supply ex. stocks sales	+0.1 Moz +1%	-0.1 Moz -2%	+0.1 Moz +1%

Against the backdrop of sluggish demand in the automotive industry and relatively stable mined production, the PGM markets remain balanced and avoid surpluses, mostly because of low secondary supply. Before COVID, it was expected that by 2025, the volume of PGM recycling would increase to 4 million ounces of palladium and 2.3 million ounces of platinum, but the actual current figures are 3 Moz of Pd and 1.5 Moz of Pt only. Three main forces account for this shortfall. Firstly, prevailing prices encourage processors to withhold metal in anticipation of a price rebound. Secondly, high interest rates discourage new-car purchases, lengthen vehicle life cycles, and postpone end-of-life vehicle decommissioning. Thirdly, persistently high financing costs are undermining the profitability of fabricators, who play a key role in the final stages of recycling. As these players are central to sourcing and processing end-of-life materials, their reduced access to affordable capital – particularly amid stagnation in the autocatalyst segment – is dampening scrap collection volumes.

These conditions leave the platinum and palladium markets nominally balanced in 2025-26, if investment flows are excluded. However, if the investment demand from ETF funds, retail bar & coin buyers, as well as state and corporate institutions, is taken into account, we see

a deficit of 0.2 Moz in the platinum market this year, which is further expanding to 0.3 Moz in 2026. As for palladium, investment demand will not significantly change the picture as supply and demand are seen as pretty equal in 2025-2026.

It should also be noticed that in 5M 2025, South Africa recorded a decline in production and export volumes of approximately 10%. There is still a chance that the production volumes will recover in 2H 2025 and the guidelines set by SA mining companies will be met. However, should the decline be confirmed by the end of the year, a revision of the balance will be required.

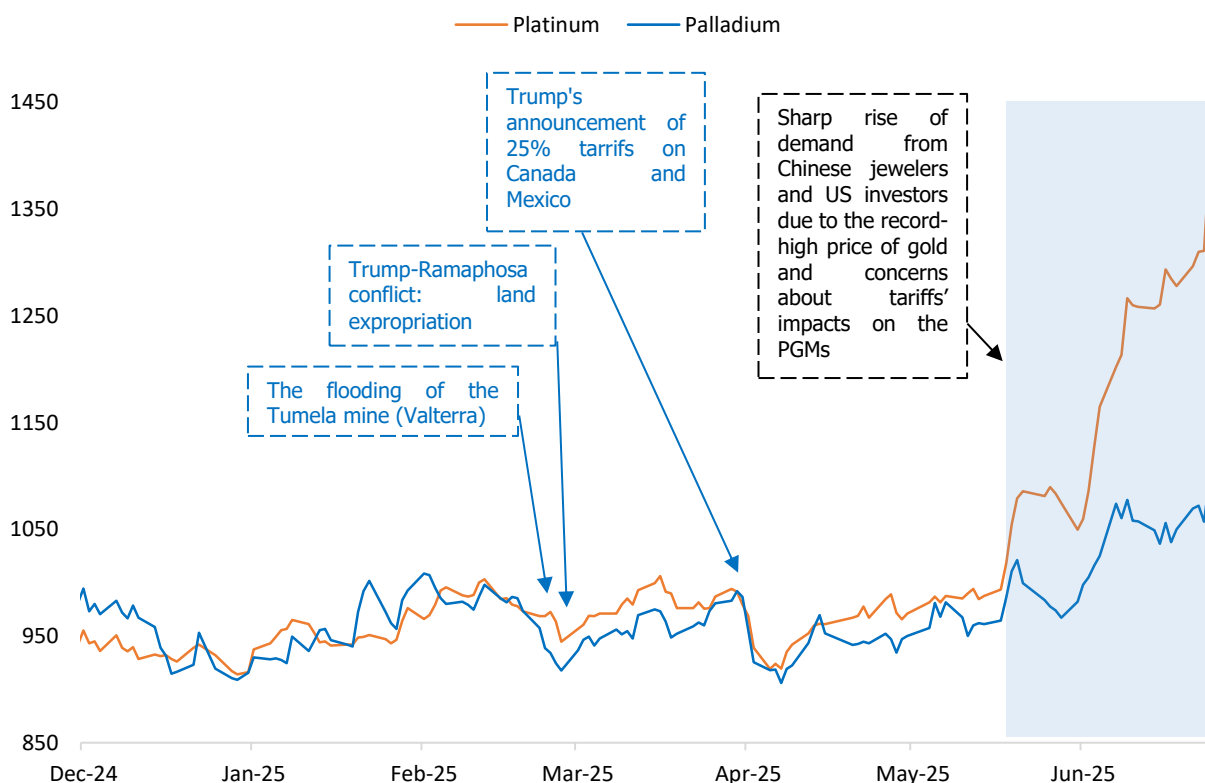


Source: NN analysis

Note: 1. Market balance incl. investment demand and other stock movement

MARKET SENTIMENT

PGM prices in 2024-2025 YTD, USD/oz



Source: LPPM, Johnson Matthey

Since our latest issue, the prices of palladium and platinum have exhibited a broadly sideways trend, fluctuating within a range of \$900 to \$1,030 per ounce. A notable price spike occurred in mid-May 2025, when platinum surged to nearly \$1,400 per ounce and palladium approached \$1,100. The sharp uptick in demand for platinum from Chinese jewellers and American investors has introduced a near-term upward bias.

However, there is currently no clear evidence that the recent rally is firmly supported by the fundamentals, as platinum imports into China and the US remain only modestly above the long-term averages. Importantly, the Chinese jewellery demand is currently driven primarily by jewellery manufacturers' restocking, while end-user demand has yet to show a consistent response.

In January, PGM prices remained relatively stable despite the Trump administration's announcement of new import tariffs on goods from Canada and Mexico, which included automobiles. While these measures were expected to have a significant negative impact on the US automotive market — a key consumer of palladium and platinum — the market reaction was muted. The news had only a limited effect on the PGM price movements, suggesting that investors either anticipated the policy shift or remained unconvinced of its immediate impact on physical demand.

On 24 February 2025, Anglo Platinum (now Valterra Platinum) announced that its Tumela mine at the Amandelbult complex had been flooded, forcing a six-month suspension of operations. Both platinum and palladium prices responded immediately, with palladium rising to \$973 per ounce and platinum to \$991. The mine, responsible for approximately 60% of Amandelbult's total output of 294 koz Pt and 136 koz Pd, is an important part of South Africa's PGM production.

This price movement was further supported by another event that happened just days later, on 28 February 2025, when the US administration signed an executive order terminating all foreign aid to South Africa because of violations of the human rights of the white minority. Allegations surrounding land expropriation laws targeting white landowners intensified diplomatic tensions and stirred investor anxiety over South Africa's stability and reliability as a PGM supplier.

In early April, PGM prices came under pressure amid growing concerns over a potential global economic slowdown triggered by the implementation of reciprocal tariffs. However, by mid-month, prices began to recover following official statements that the introduction of most of these tariffs would be postponed. This shift in sentiment eased market fears and supported a rebound in both platinum and palladium prices.

Platinum prices were on a strong upward trajectory in early May 2025, rising from the levels below \$1,000 per ounce to nearly \$1,400 per ounce by the end of June. This marks a test of a critical long-term resistance level, corresponding to the 50% Fibonacci retracement from the 2008 price peak. A firm breakout above this level could open the path for a further advance toward \$1,600 per ounce, reinforcing the current bullish momentum.

Palladium prices followed suit but with less intensity, climbing from approximately \$950 per ounce in early May to around \$1,100 per ounce by late June. This rally reflects a broader PGM market sentiment, but the platinum market has clearly taken the lead in recent months.

From a fundamental perspective, the price surge in platinum has been driven primarily by a sharp increase in physical demand from China. Direct imports into mainland China reached 10 tonnes per month in both April and May, with additional ~10 tonnes per month entering via Hong Kong. Trading activity on the Shanghai Gold Exchange (SGE) also surged — from an average of 170 kg/day in September–November 2024 to 380 kg/day in May–June 2025, reflecting a spike in local investor and industrial interest.

This uptick in the Chinese demand is being fuelled by two main factors. Firstly, jewellery manufacturers are increasingly moving away from gold and into platinum amid uncertainty surrounding the sustainability of gold's recent price rally. With gold demand weakening and margins tightening, many Chinese jewellers have pivoted toward platinum-based designs. However, according to our industry contacts in Shenzhen — China's jewellery

manufacturing hub — many of these platinum purchases are being made without confidence in sustained downstream demand. There is a risk that unsold platinum jewellery could be scrapped and re-exported to Hong Kong for sale into the secondary market.

Secondly, market speculation suggests that part of the platinum demand in China may stem from strategic buying by investment funds, though such purchases are not publicly confirmed.

In addition, US-based investor interest has contributed to the upward price pressure. Fears of potential PGM import tariffs under a Section 232 investigation have driven higher platinum imports into the US, totalling 740 koz in M4 2025, compared with a five-year average of 610 koz over the same period.

COMEX platinum inventories rose from ~200 koz in December 2024 to a peak of more than 600 koz in April 2025, before retreating to ~350 koz in June as physical demand increased.

The recent rally in platinum prices has been accompanied by a sharp increase in lease rates, which exceeded 20% in May–June 2025. These levels are now approaching the historical highs. This reflects a significant tightening in the availability of immediately accessible physical platinum, suggesting that short-term demand outpaced supply. In contrast, palladium lease rates remained near zero, indicating ample market availability and limited physical tightness for that metal.

On COMEX, the primary exchange for PGM futures, platinum trading volumes were high throughout May and June 2025. This heightened activity was dominated by the opening of long positions, signalling growing bullish sentiment among speculative traders. As a result, net speculative interest turned positive for the first time in several years.

In the case of palladium, trading volumes also rose sharply in May, nearly doubling from the typical levels. However, the underlying dynamics differed: this activity was primarily driven by the closing of short positions rather than the initiation of new longs. This points more toward de-risking by bearish speculators than a fundamental shift toward bullish expectations. Net speculative interest in palladium remains in the negative territory, indicating sustained scepticism about the metal's near-term upside.

Importantly, the PGM markets did not exhibit meaningful backwardation throughout May and June. It suggests that the recent price rises have not been underpinned by the short-term physical supply constraints.

Exchange-traded funds (ETFs) have also played a supportive role. Palladium ETFs continued to accumulate metal in anticipation of a future price recovery, reducing market availability and putting a floor under prices. These holdings are generally liquidated only when spot prices significantly exceed the fund's average acquisition cost. While speculative sentiment around palladium remains cautiously bearish, net short positioning is moderating, which suggests that expectations of price stabilisation or a potential rebound are growing.

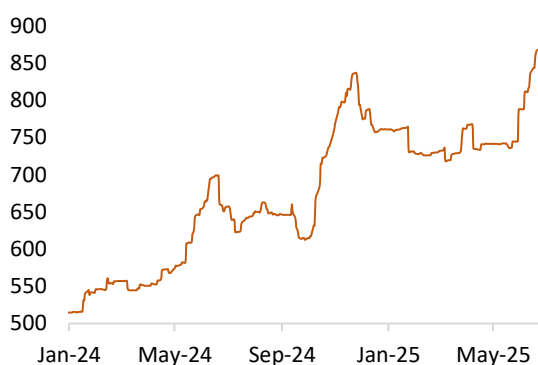
Platinum ETFs, on the other hand, saw steady inflows throughout 2025, underpinned by a positive price performance and rising investor interest. This trend reflects growing conviction in platinum's fundamental outlook, supported by a slightly reduced mine supply, weak secondary recovery, and demand growth across the jewellery and investment sectors.

However, from a fundamental perspective, the recent price surge, especially in platinum, appears intrinsically

weak. Imports into China and the US remain close to historical averages, offering little evidence of a structural shift in demand. The impact of operational disruptions at Valterra Platinum's Amandelbult complex also appears rather limited in scope and not sufficient to justify a sustained rally. Moreover, the recent spot-market activities linked to industrial users transitioning from leasing to direct purchases are likely to be transient rather than a durable driver of appreciation. A critical moderating factor remains the sizable above-ground stocks of platinum, estimated at over 10 Moz (equivalent to more than one year of global consumption), held in ETFs, investment bars, and coins. Should prices reach attractive levels, these reserves may be released into the market, effectively capping further price rises.

While the speculative trend in platinum may continue in the short term, potentially pushing prices into a higher trading range, the lack of a strong fundamental support introduces significant downside risk.

Palladium ETF holdings, koz



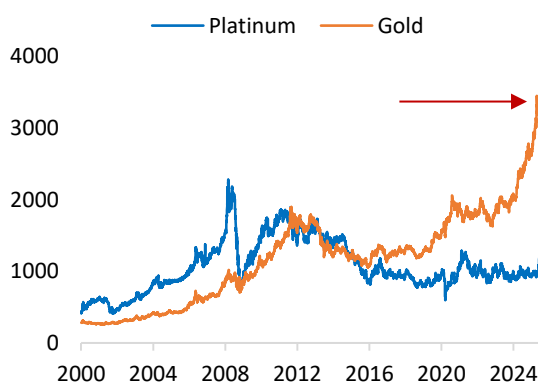
Source: NN analysis

Platinum ETF holdings, Moz



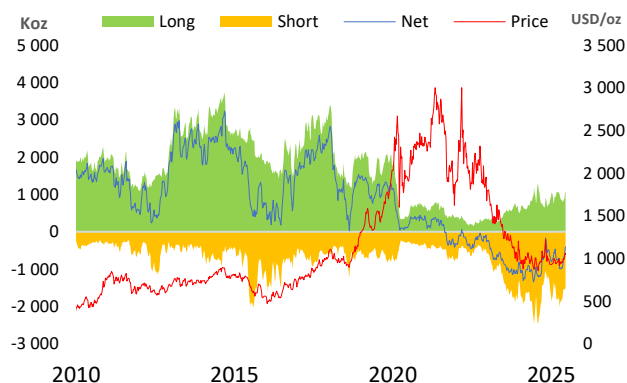
Source: NN analysis

Gold and platinum price, USD/oz



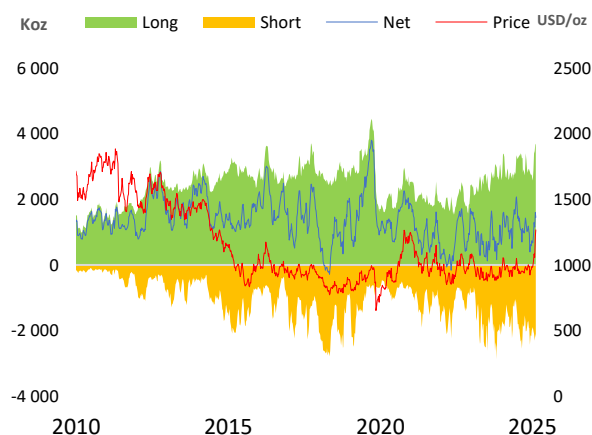
Source: LBMA, LPPM

Palladium: net speculative positions



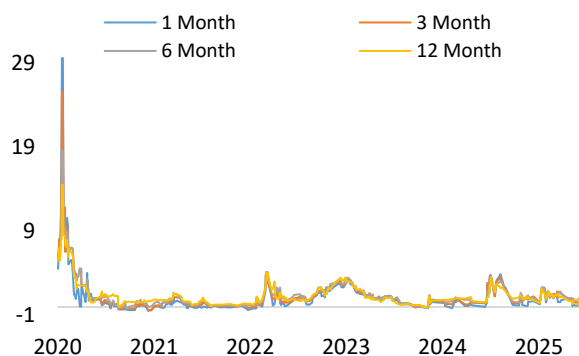
Source: CFTC

Platinum: net speculative positions



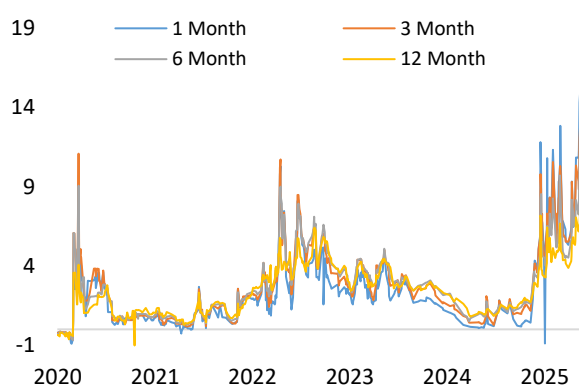
Source: CFTC

Palladium Lease rates, %

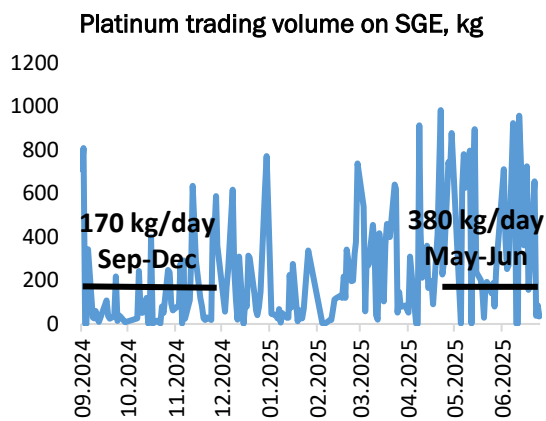


Source: Reuters

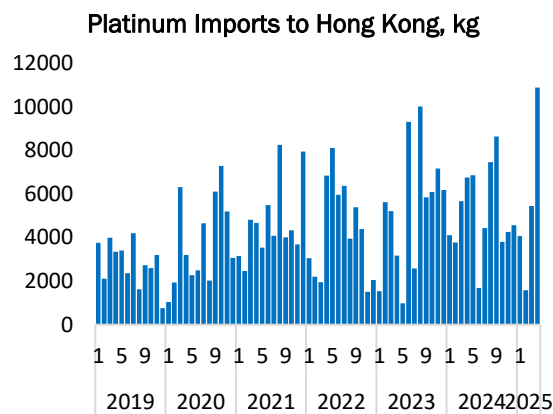
Platinum Lease rates, %



Source: Reuters



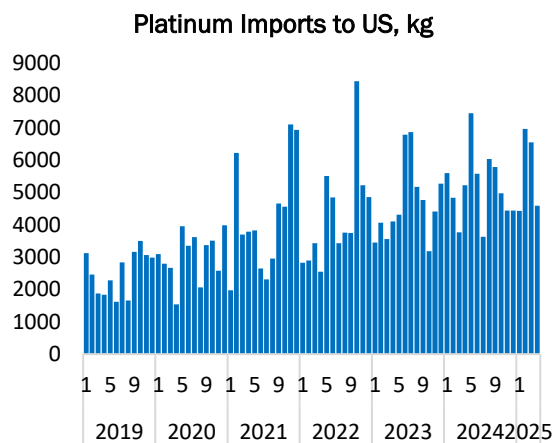
Source: SGE



Source: Trade statistics



Source: Trade statistics



Source: Trade statistics

GLOBAL PGM DEMAND

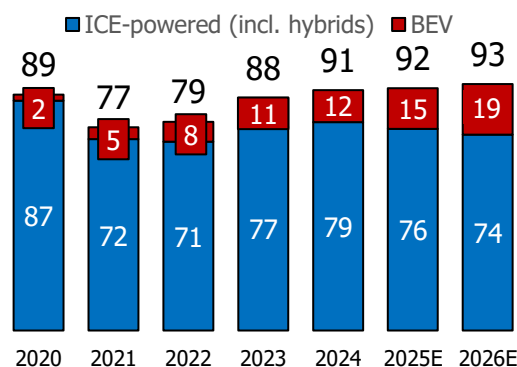
AUTOMOTIVE

Global light vehicle production is expected to increase by 1% in 2025, reaching 91.7 million units. At the same time, the number of ICE-equipped vehicles with PGM-containing catalysts is projected to decline gradually from nearly 79 million units last year to 76 million this year. This reduction is being partially offset by the growing output of the Western-style parallel hybrid vehicles. At the same time, additional pressure on PGM demand is coming from the increasing adoption of a new type of hybrid vehicle in China. While the so-called parallel hybrids, which are predominantly manufactured outside China, typically require higher PGM loadings, the rise of consecutive hybrids in China, where the internal combustion engine functions solely as a generator and the wheels are powered exclusively by electric motors, is leading to lower catalyst metal content per vehicle.

As a result of these trends, we expect automotive demand for palladium and platinum to decline by 3% and 7% respectively in 2025, to 7.5 Moz and 2.7 Moz.

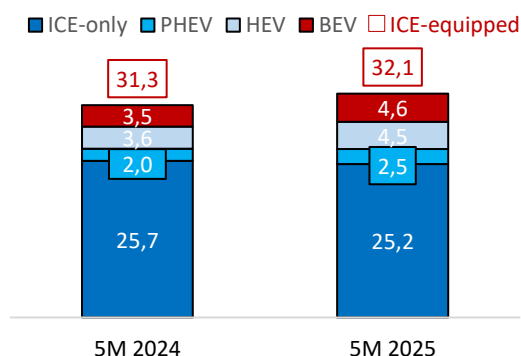
In 2026, the global vehicle production is expected to rise modestly by another 2% YoY, reaching 93.4 million units. However, the production of ICE-equipped vehicles is expected to decrease slightly by 3% compared to 2025. Despite this, palladium demand is projected to rebound to 7.7 Moz, while platinum use is expected to decline further to 2.6 Moz, reflecting the ongoing price-elastic substitution of platinum with palladium in autocatalysts.

Global light vehicle production



Source: NN analysis

Global auto sales in 5M 2025, million units



Source: NN analysis

At the same time, the 5M 2025 results present a more optimistic picture than currently reflected in our models, opening the possibility for stronger year-end figures. During this period, ICE-equipped vehicle production increased by nearly 3%. However, this growth may partly reflect stockpiling in the US ahead of the implementation of new tariffs. Should this positive momentum persist into the second half of the year, we may consider revising our automotive demand forecasts in the next edition of this report.

In North America, vehicle production is expected to increase by 2% in 2025, reaching 15.5 million units. The main driver of this growth will be the plug-in hybrid electric vehicle (PHEV) segment, which is forecast to surge by 48% YoY. Despite this, overall production of ICE-equipped vehicles is projected to decline slightly, falling by 1% to 14 million units.

As previously noted, one of the main risks facing the automotive industry in 2025 is the impact of the new tariffs introduced by the current US administration. The implementation of a 25% import duty on automobiles adds significant complexity to the market, particularly given that the US imports nearly seven million vehicles annually, almost half of its total vehicle sales. This could result in higher prices for new vehicles and components, prompting consumers to delay purchases or shift toward the second-hand market. If sustained, such behaviour may reduce global car production and, consequently, suppress the demand for catalytic converters, which are vital for ICE powertrains.

That said, the negative consequences of the US tariffs have not yet fully materialised. Moreover, vehicle sales in the US increased by 5% YoY in 5M 2025. ICE-equipped vehicle sales rose by nearly 6% compared to the same period last year, while BEV sales grew by only 2%. This divergence suggests that Trump's policies aimed at slowing down the rapid adoption of battery electric vehicles may already be influencing consumer behaviour in favour of internal combustion engine models.

The general accelerated growth of the automotive sales in the US likely reflects a wave of anticipatory buying, as consumers rush to purchase vehicles before the price hikes take effect. The trend has been further supported by three interest rate cuts from the Federal Reserve since mid-2024, which have helped lower borrowing costs and made auto loans more accessible. Nevertheless, a moderation in both production and sales may be expected in the second half of the year as the effects of stockpiling wear off.

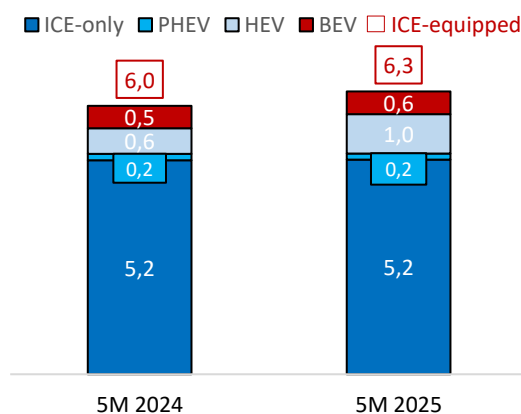
On a more positive note for PGM demand, the rollback of the environmental regulations by the Trump administration could provide a counterbalance to the risks posed by tariffs. The earlier emissions standards, implemented during the Obama and Biden presidencies, were designed to drive aggressive reductions in CO₂ emissions across the national fleet from 2026 onwards, and to accelerate the shift toward zero-emission vehicles. By contrast, Trump has initiated a sweeping regulatory reversal. In January 2025, he signed an executive order under his "Unleashing American Energy" initiative, repealing the Biden-era emissions targets, suspending federal funding for the EV charging infrastructure, and revoking California's authority to impose stricter local emissions rules. These actions, expedited through the Congressional Review Act, are intended to curb BEV adoption by dismantling regulatory support, weakening

tailpipe standards, and slowing the rollout of charging networks.

This policy shift is expected to reduce BEV penetration in the US, at least in the near term, creating a more favourable environment for ICE-powered vehicles. If sustained, this dynamic could strengthen demand for palladium and platinum in automotive catalysts. While legal challenges to these measures are underway, a successful rollback would have far-reaching implications for the powertrain landscape through 2026 and beyond.

In our base case scenario, we expect North American automotive production to grow by 2% in 2026, reaching nearly 16 million units. This modest increase will be supported primarily by the protective effect of tariffs, which are encouraging a shift toward domestic manufacturing. However, despite the overall production growth, output of ICE-equipped vehicles is projected to continue its gradual decline, falling by 2% year-on-year to 13.8 million units. This trend reflects the ongoing structural shift in the powertrain mix, even as the pace of electrification slows.

US auto sales in 5M 2025, million units



Source: NN analysis

In Europe, passenger car production is expected to decline by 1% in 2025, reaching 14.4 million units. Within this total, the output of ICE-equipped vehicles is forecast to fall by 5% to 12 million units, while BEV production is set to rise sharply by 23%, reflecting the ongoing, but very uneven, electrification.

One of the key factors that could influence the European automotive output over the coming years is the changing structure of global trade. In the context of escalating trade wars, some manufacturers have already begun relocating their production to the United States, undermining European sites orientated towards export markets.

The 5M 2025 sales data reveal a 2% year-on-year decline in overall volumes. However, this contraction masks divergent trends in the powertrain mix. Sales of regular hybrids, plug-in hybrids, and BEVs all posted strong growth of 23%, 25%, and 28%, respectively, effectively offsetting a steep 24% drop in conventional ICE vehicle sales. The primary driver behind the broader slowdown appears to be consumer uncertainty, amplified by the phase-out of BEV purchase incentives in major markets like Germany and France.

Despite this, under our base case scenario, we anticipate a moderate recovery in the second half of the year, resulting in slightly improved full-year results and a more robust 2026 growth.

Diesel-powered cars' European market share



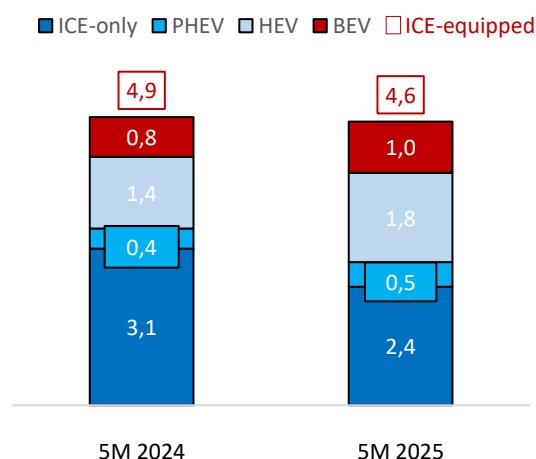
Source: ACEA

As to the evolving powertrain mix, it is particularly notable that parallel hybrids (i.e. vehicles in which both an ICE and an electric motor propel the car) are increasingly displacing conventional ICE models. Since these hybrids tend to have higher PGM loadings, this transition is supportive of palladium and platinum. Historically, diesel-powered vehicles were favoured across much of Europe due to fuel price advantages. However, following the Dieselgate scandal and the rise of gasoline hybrids offering similar fuel efficiency, the diesel segment has contracted significantly. Over the past three years, the market share of diesel vehicles has declined by 8%, exerting downward pressure on platinum demand, as this metal is primarily used in diesel catalysts.

The EU's planned 2035 ban on the sale of new petrol and diesel vehicles, mandated under its zero-emissions target, is now facing growing scrutiny. In March 2025, the European Commission announced that the scheduled review of this policy would be brought forward from 2026 to later this year, though the original 2035 deadline would remain in place for the time being. Mounting political pressure from the key member states and industry stakeholders, including Italy, Germany, and several major automotive associations, has sparked calls for greater regulatory flexibility. Importantly, the 2035 regulation does not explicitly ban internal combustion engines. Instead, it requires the manufacturers to achieve fleet-wide zero CO₂ emissions, opening the door for such technologies as synthetic "e-fuels." The European People's Party and Germany's VDA have proposed alternative compliance paths, such as retaining hybrid models post-2035 or relaxing the target to a 90% CO₂ reduction. The Commission, while reaffirming its commitment to the original deadline, has allowed for interim compliance mechanisms such as multi-year averaging through 2027.

As part of the broader strategic dialogue about the future of the European automotive sector, the pace and structure of the transition to zero-emission mobility are now being reassessed in light of macroeconomic risks, declining industrial competitiveness, and sluggish penetration of electric vehicles. If the 2035 ban is ultimately revised or softened, it would support PGM demand in the automotive sector significantly by extending the lifecycle of the ICE-powered vehicles and hybrids that rely on palladium- and platinum-based catalytic converters.

Europe auto sales in 5M 2025, million units



Source: NN analysis

Looking ahead to 2026, we expect total vehicle production in Europe to increase by 4%, reaching 15 million units. Within this total, the ICE-equipped vehicle output is expected to decline modestly by just 1.5% to 11.9 million units, while BEV production is forecast to grow by 30%, reaching 3 million units. This suggests a more balanced powertrain mix in the near term, with continued relevance for the PGMs.

In China, passenger car production is expected to reach 31 million units in 2025, marking a 2% increase compared to 2024. However, production of ICE-equipped vehicles is forecast to decline by 4% to 22 million units, while BEV output is set to grow by nearly 20%, reaching 9 million units.

China remains the only country to have successfully built a fully integrated and competitive ecosystem for electrified transportation – New Energy Vehicles (NEVs), as they are officially classified in the country. This category includes battery electric vehicles (BEVs), plug-in hybrids (PHEVs), and fuel cell vehicles (FCEVs). China's advantage stems not only from its ability to produce NEVs at costs comparable to or lower than ICE vehicles, but also from its extensive supporting infrastructure, particularly its widespread and rapidly expanding network of charging stations.

As a result, by mid-2024, China had already achieved a 50% NEV share in total vehicle production, a milestone many other markets are still striving to reach. Electrification is expected to continue its rapid advance. However, ICE vehicles will retain a role, particularly in rural regions and in export markets, which are becoming increasingly important to China's automotive sector.

In 5M 2025, the Chinese automotive industry reported robust results, with vehicle production increasing by 11% YoY. Sales of ICE-equipped cars grew by 3% during the same period. These strong figures are mainly attributed to the government's trade-in programme, which provides significant discounts to consumers replacing old vehicles with new ones. Additionally, a series of interest rate reductions have improved access to car loans, further boosting demand. Although there were initial concerns that the recent wave of tariff disputes might weaken consumer confidence, the first half of the year demonstrated a surprisingly healthy business environment. This resilience could be due to front-loaded demand across sectors, as companies and consumers hurried to place orders in anticipation of potential

economic disruptions. However, some slowdown in automotive sales may occur in the second half of 2025, as the full effects of tariff-related pressures start to weigh more heavily on the economy.

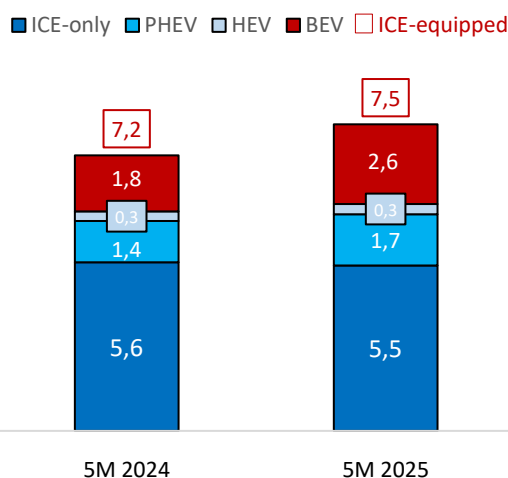
In terms of powertrain mix, a key feature of the Chinese market is the dominance of consecutive hybrid architectures among domestic brands. In these vehicles, the internal combustion engine serves exclusively as a generator to charge the battery, while the wheels are powered solely by electric motors. This configuration results in lower engine loads and, consequently, significantly reduced PGM consumption, often only around 1.5 grams per vehicle. As the share of locally produced hybrids continues to grow, particularly with the Chinese brands expanding their market share from 40% to 60% over the past five years, the average PGM content per vehicle in China is expected to decline.

This trend has recently caught the attention of Chinese regulators responsible for environmental and technical oversight. Investigations have shown that PGM loadings in vehicles produced by domestic automakers are sometimes two to three times lower than those found in similar models made by Western joint venture OEMs in China. Local companies claim this difference arises from proprietary technologies that improve catalyst efficiency, allegedly involving undisclosed rare earth element doping methods. However, industry insiders suggest that these lower loadings may be driven more by intense cost competition within the Chinese automotive market, where relentless pricing pressure can lead to compromises on regulatory compliance.

Chinese authorities have launched an inquiry into these practices, and we are closely monitoring the progress of this investigation. Should it lead to any regulatory changes or stricter enforcement of emissions standards, it could materially impact PGM demand in the region, potentially offering significant upside for the platinum and palladium markets.

Looking ahead to 2026, we expect Chinese automotive production to contract slightly by 0.7% amid a broader economic slowdown, as the effects of tariff pressure become more pronounced. ICE-equipped vehicle output is projected to decline by 6% to 20.5 million units, while BEV production is expected to rise by 14%, surpassing the 10 million mark for the first time.

China auto sales in 5M 2025, million units



Source: NN analysis

JEWELLERY AND OTHER INDUSTRIAL DEMAND

In 2025, global platinum jewellery demand is expected to rise by 5% to reach 1.8 Moz, with China acting as the primary driver of growth. The surge in Chinese demand was a major contributor to the sharp increase in platinum prices observed in May–June 2025. Fundamentally, this price rally has been underpinned by a notable rise in physical imports of the metal into mainland China, reaching approximately 10 tonnes per month in April and May, along with an estimated additional 7–8 tonnes per month being routed through Hong Kong. This trend was further reaffirmed by the Shanghai Gold Exchange trading, where average daily platinum volumes increased from 170 kg/day in September–November 2024 to 380 kg/day in May–June 2025.

The spike in jewellery-related platinum demand in China stems from two primary factors. Firstly, many jewellery manufacturers are moving away from gold, prompted by a growing uncertainty around the sustainability of the recent gold price rally. This hesitancy has driven both jewellery houses and retail buyers to consider platinum as a more stable and affordable alternative, especially as declining gold sales have weighed on the financial performance of jewellery retailers. At the same time, our contacts in Shenzhen, which is the epicentre of the Chinese jewellery industry, indicate that current platinum purchases by jewellery houses are being made without full confidence in downstream consumer demand. There is a real risk that, should end-user interest fail to materialise, some of the unsold platinum jewellery could be scrapped and sent to Hong Kong for resale into the secondary market. A second factor supporting Chinese demand may be related to undisclosed strategic acquisitions by domestic investment funds, although transparency in this area remains limited.

Outside China, platinum jewellery demand is expected to grow modestly across other key markets, including Europe, the United States, and Japan. These regions are likely to see steady, albeit less pronounced, interest in platinum throughout 2025. *Looking ahead into 2026, global platinum jewellery demand is expected to grow further at a moderate pace of around 2% annually, although a lot will depend on the durability of consumer interest in China and the conversion of the current wholesale activities into sustained retail sales.*

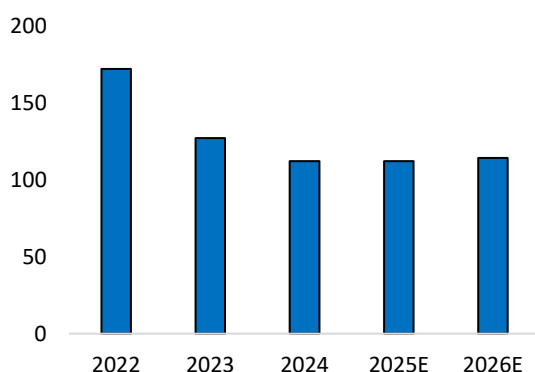
As for palladium, its use in the jewellery sector, primarily as a whitening agent in high-end white gold alloys (18-karat and above), and to a lesser extent in pure palladium pieces, remains stable, with annual demand estimated at around 150 koz in both 2025 and 2026. However, the growing price spread between palladium and gold, as well as between palladium and platinum, may encourage some jewellers to increase their use of palladium in manufacturing, especially if price differentials persist and consumer preferences shift toward more cost-effective precious metal alternatives.

In 2025, industrial demand for palladium is expected to rise by approximately 2% YoY, reaching 1.5 Moz, while platinum industrial demand is projected to increase by 3% to 2.6 Moz. These gains reflect continued growth across several key end-use sectors, particularly electronics, chemicals, petrochemicals, and healthcare, supported by broader trends such as AI adoption, infrastructure expansion in emerging markets, and demographic shifts.

Electronics. Demand for palladium in the electronics sector is forecast to grow by 2% in 2025, reaching 0.5 million ounces. Palladium is widely used in multi-layer ceramic capacitors (MLCCs), high-reliability semiconductors, connectors, and soldering components, particularly in aerospace, defence, medical devices, and other sectors where performance stability is critical. Platinum, though used in smaller quantities, also plays a role in the production of hard disk drives (HDDs), and its consumption in electronics is expected to increase by 5% to 0.2 million ounces in 2025.

PC shipments are projected to remain flat at 112 million units in 2025, reflecting cautious corporate spending at a time of growing economic uncertainty and supply chain disruptions. However, Microsoft Windows 10's end-of-service in late 2025 is expected to spur replacement demand, leading to a 2% rebound in PC shipments in 2026.

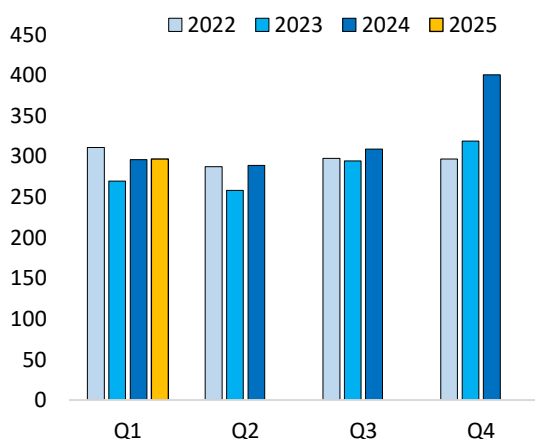
Global PC shipments, million units



Source: Canalys

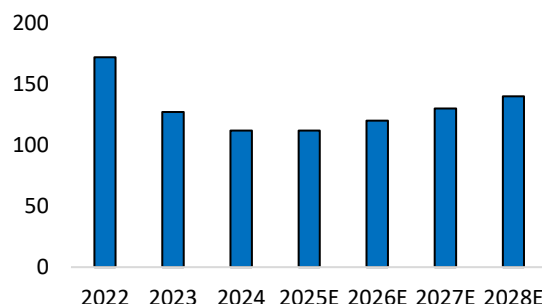
In the smartphone segment, global production is expected to plateau at 1.3 billion units in 2025, largely due to trade-related bottlenecks and component shortages linked to the US tariffs. Nevertheless, a shift toward 5G-enabled devices continues to drive complexity and PGM use per unit. The share of 5G smartphones is anticipated to reach 76% by the end of 2026, with total shipments growing to 1.4 billion units. This trend is being supported by the proliferation of AI applications and aggressive marketing strategies urging consumers to replace legacy devices.

Global smartphone shipments, million units



Source: Canalys

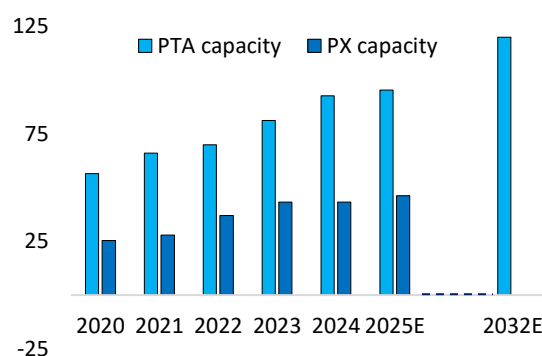
Global HDD shipments, million units



Source: NN analysis, Gardner

As for HDDs, shipments containing platinum remained stable at 112 million units in 2024 and 2025. However, demand is projected to rise to 120 million units in 2026, propelled by increasing data centre expansion, cloud storage growth, and the AI boom, all of which require high-capacity and reliable storage solutions.

PTA and PX capacities in China, million tonnes



Source: NN analysis

Chemical Industry. Industrial demand for palladium and platinum in the chemical sector is expected to expand further, reaching 0.7 million ounces each in 2025, which is a 5% growth for palladium and 2% for platinum. This is driven by the increasing deployment of metal-based catalysts in the production of high-demand materials. For palladium, the main use is as catalysts for purified terephthalic acid (PTA), a precursor for PET plastics. With capacity additions across multiple chemical plants in China, demand for PTA, and, by extension, palladium, is increasing. In the case of platinum, its primary role in the chemical sector involves pyroxene production, where it acts as an effective oxidation catalyst. Growth in the consumer goods and construction industries in Asia continues to underpin demand.

In 2026, both palladium and platinum demand in the chemical sector is expected to grow by another 5%, as new plants come online and existing capacity is ramped up. The broader industrialisation trends in Southeast Asia and India are expected to play a growing role in supporting this trajectory.

Petrochemicals. Platinum demand by the petrochemical sector is set to rise significantly — by 17% in 2025 — to approximately 0.2 million ounces. This increase is largely tied to global refining capacity expansions, particularly in China, Mexico, and Iran. Together, these countries are contributing more than 1 million barrels per day (bpd) of new refining capacity. Platinum-based catalysts are essential for key processes such as reforming and isomerisation in oil refining.

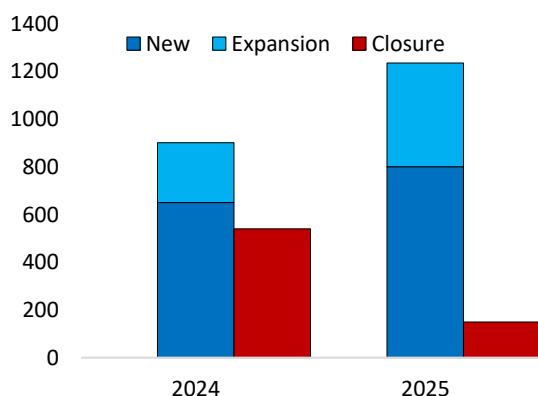
New Oil Refinery projects, B/D

2025		
China	Yulong	400
	Ningbo Daxie	120
Mexico	Pemex Olmeca Refinery	340
Iran	National Iranian Oil Refining Company	180
Bahrain	Bahrain Petroleum	110
2026		
China	Sinopec Zhenhai	290
	Huajin Aramco	300
India	Hindustan	180
Saudi Arabia	SATORP	40
2027		
India	Indian Oil	200
	Numaligarh Refinery LTD	120
	Chennai Petroleum	180
Jordan	Jordan Petroleum Refinery Company	50

Source: US Energy Information Administration

In 2026, although new capacity additions are expected to slow to 810 bpd, platinum demand in this segment is projected to grow by a further 5%. This deceleration reflects not only a high base effect but also a structural shift in the global refining landscape, as European refiners face declining output amid stricter environmental standards and the ongoing transition to cleaner energy sources.

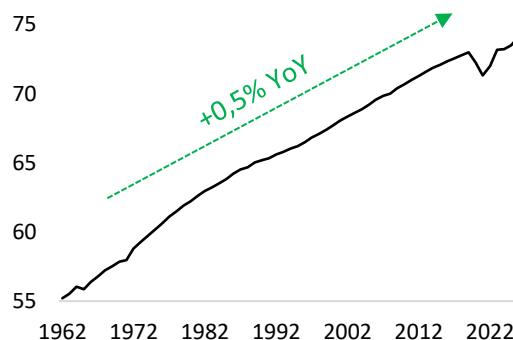
Change in global oil refining capacity, thousand barrels per day



Source: NN analysis

Healthcare and Dentistry. Palladium demand in the medical sector is expected to decline by 10% year-on-year in 2025, falling to around 135 koz. This drop is largely attributed to a continued shift away from metal-ceramic dental crowns, where palladium has traditionally been used as a core material. The popularity of all-ceramic and zirconia crowns, driven by aesthetics, biocompatibility, and cost, has displaced palladium in many dental labs. Nevertheless, technological advancements in 2025-2026 are expected to enable the production of more natural-looking, enamel-coloured crowns based on palladium alloys. Combined with price stabilisation, these improvements may help drive a 5% rebound in palladium demand by dentistry next year.

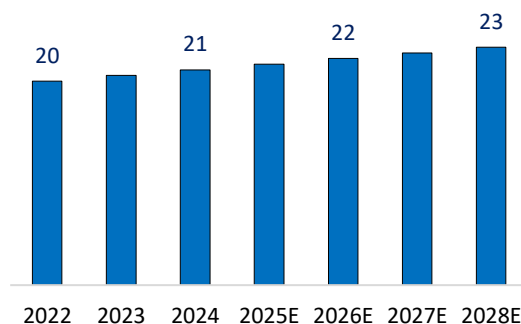
Global life expectancy, years



Source: World Health Organization

Platinum demand in the healthcare sector is expected to grow by 4% in 2025, reaching 0.3 Moz. This increase is underpinned by demographic trends, notably the rising life expectancy and the growing global incidence of cancer. According to the World Health Organisation, by 2028, cancer cases are expected to rise by 3% annually, necessitating greater use of platinum-based chemotherapy agents such as cisplatin and carboplatin. Additionally, platinum is used in various medical implants and diagnostic devices, further supporting demand.

Cancer Incidence in the World, Millions of people, +3% YoY



Source: IQVIA Institute for Human Data Science

Glass Industry. Platinum consumption in the glass industry is expected to grow by 3% in 2025, reaching 0.5 million ounces. However, the pace of growth is likely to moderate as the substitution phase, where platinum replaced rhodium in many glass-manufacturing applications, approaches saturation. Rhodium's extreme price volatility had previously driven manufacturers to favour platinum-based alternatives, but this trend is now stabilising.

In 2026, we expect the total industrial demand for palladium (excluding automotive and jewellery) to rise by 5% to 1.6 Moz. Platinum demand is also forecast to increase by 5% to 2.7 Moz. This steady expansion reflects continued technological innovation, infrastructure investment, and demographic shifts, with China remaining the core growth engine across multiple sectors. However, macroeconomic conditions, metal prices, and geopolitical shifts, particularly related to the regionalisation trend, will remain key variables influencing the trajectory of industrial demand for the PGMs in the medium term.

NORNICHEL PALLADIUM CENTRE R&D UPDATE ON NEW PD APPLICATIONS

The Palladium Centre, established to enhance the global palladium market, is expanding by growing its international team and launching an advanced laboratory in Moscow. This is part of a global initiative to develop infrastructure that can create new opportunities for palladium.

Existing markets. Palladium has significant potential in existing markets, both for traditional PGM applications and for base metal PGM doping, where there is a clear demand from end users for efficiency improvements.

Traditional PGM applications. For fibreglass manufacturing, substituting platinum and rhodium with palladium in bushings provides significant cost savings for customers. Palladium weighs 50% less than platinum but maintains a similar smelting temperature and recycling.

Extensive promotion of current leads made of palladium on the Chinese market in Q1 resulted in several industrial testing launches by the top five Chinese fibreglass producers. The testing programme will include current leads and full-body Pd-Pt alloy bushings later this year.

Palladium Centre bushing prototype with all-Pd lead



In electrochemical processes, the Centre has started commercialising electrodes that have been successfully tested for water disinfection. Pd-Ir-Ru anodes (which are cheaper than traditional Ir-Ru) for water treatment have been installed at a large municipal water treatment facility and are demonstrating an average of 18% less energy consumption and competitive corrosion resistance, which supports further scaling. Additionally, the team has developed low-iridium anodes for water treatment and ballast water treatment, which are scheduled to be tested in China in Q2–3 2025.

In addition, the Centre is working on the development of palladium-containing catalytic layers for anodes, targeting both copper foil and chlor-alkali production. The anode prototype for copper foil production aims to reduce energy consumption by 5% and lower CapEx for anode coating by 3–5%, while also extending the service life of anodes in copper foil production by up to 20%. Laboratory testing is scheduled for late 2025, and industrial trials are planned for H1 2026.

Base metal PGM doping. The field of large-scale chemical production represents a promising market for new PGM applications. The Palladium Centre has recently initiated projects focused on this sector and is currently planning their expansion by the end of the year.

For steam reforming and autothermal reforming hydrogen production processes, a Pd-doped Ni catalyst has successfully completed its laboratory testing phase, demonstrating a significant (10 p.p.) increase in the methane conversion rate compared to conventional Ni-based catalysts. Pilot testing with a leading Russian ammonia producer is scheduled for H2 2025. Scaling operations in Russia and China are planned for 2026–2027.

According to the Centre's estimates, the new long-term demand for palladium in existing markets could reach 0.5–0.6 Moz, in addition to 1.7 Moz of demand for one-off installations in the short term.

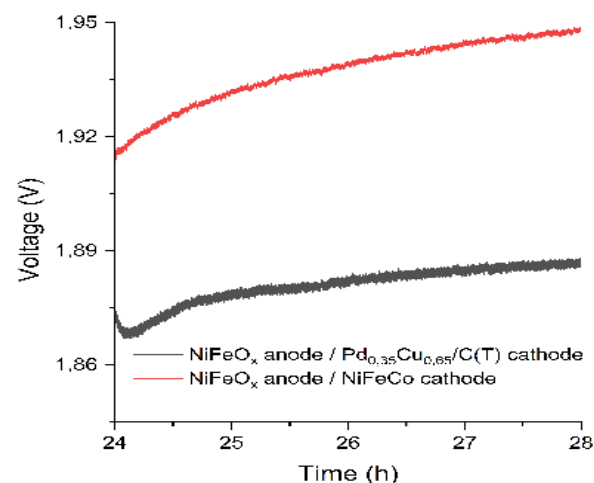
New markets – Greentech. With palladium now priced 4.5 times lower than iridium, a transition to palladium could be critical in advancing the hydrogen economy sustainably. Thanks to its strong catalytic performance and superior hydrogen permeability, palladium is well-suited for all hydrogen applications, including its production, utilisation and storage.

The Palladium Centre's Pd-Ir catalyst for PEM electrolyzers has successfully passed the 1000-hour membrane electrode assembly (MEA) durability test with low degradation of less than 1%. Semi-industrial testing of the Pd30Ir70 prototype has showed results of 1.73V@2A/cm², which beats the pure Ir benchmark of 1.78V@2 A/cm².

In the case of fuel cell catalysts, the prototype's support was upgraded after lab tests in China in 2024. The target for prototype Pt75Pd25/C is 0.67V@2A/cm², which is higher than the market benchmark 0.65V@2A/cm². The results of the second stage of testing by the top five Chinese MEA and fuel cell stack producers are expected to be ready no later than Q3 2025.

For alkaline electrolyzers, laboratory tests of the Palladium Centre's palladium-coated copper-toed cathode prototype confirm the potential for 5–10% lower electricity consumption while maintaining stable voltage performance. Following successful 2024 lab tests, the prototype's optimisation continues in 2025, with pilot testing scheduled for later this year. Commercial scaling is planned for 2026–2027.

Lab test results



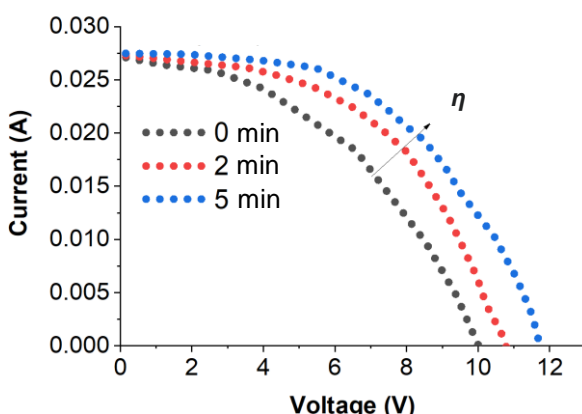
Decreasing the voltage across the cell relative to the benchmark at the same current means that the cell releases hydrogen more efficiently

The Palladium Centre has pushed the limits of perovskite photovoltaics by implementing Pd. After the successful laboratory testing of our prototype in 2024, industrial testing was completed with a leading Russian PV manufacturer, which showed (under the same conditions) an increase in efficiency for perovskites using a PdSe₂ layer of 3+ p.p.

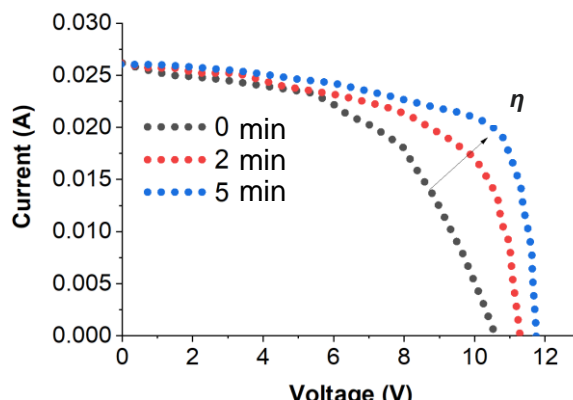
As for the next steps, the Centre is collaborating with leading manufacturers in Asia to integrate the developments, with long-term industrial testing planned for the second half of 2025. Scaling in China & Japan is expected in 2026–2027.

Semi-industrial test results: I–V curve with Energy conversion efficiency (η) of the reference perovskite module and perovskite with PdSe₂

A. Benchmark



B. Palladium Centre Prototype



High-tech industries

The AI boom is driving the demand for effective but cheap substitutes for gold in microelectronics, in printed circuit boards, bonding wires and connectors.

The Palladium Centre is actively promoting palladium as a durable, cost-effective coating for base metals (Cu, Ni), offering a viable alternative to gold in these applications. The Centre is focusing on both existing and emerging opportunities, leveraging palladium's unique properties to address industry needs.

For OLED technologies, the Centre has initiated the development of a palladium-based metal–organic complex as a light-emitting layer in OLED display diodes. The project aims to provide a palladium-based complex that is cheaper than traditional Ir complexes in red and green emitters. Industrial testing of the palladium complex is scheduled for 2026.

According to the Centre's estimates, the use of palladium in New markets will add up to 0.9–1.0 Moz to the longer-term annual demand.

GLOBAL PGM SUPPLY

In 2025, global refined palladium, platinum production is expected to decline by 2% to 9.2 Moz and 7.1 Moz, respectively.

In 2025, global mine production of palladium and platinum is expected to total approximately 6.2 million ounces (Moz) and 5.6 Moz, respectively, representing a slight decline compared to the previous year. This contraction primarily results from the reduced output in North America, driven by operational curtailments at the Stillwater mine in the US. Production in South Africa is expected to decrease marginally due to persistent "project optimisation" amid challenging market conditions, although significant reductions are mitigated by cross-subsidisation and low corporate debt levels from prior profitable years. Russian palladium and platinum production is expected to remain relatively flat in 2025.

As for the secondary production, it is expected to improve slightly this year (+4% for palladium and 3% for platinum), but it still significantly behind both the expectations and the-COVID levels. We see that previous projections remain unmet because of extended vehicle usage lifetimes, reduced profitability from processing automotive catalysts, and processors' reluctance to dispose metal containing materials amid weak PGM prices.

RUSSIA

Primary production in 2025 of palladium and platinum in Russia is expected to be relatively flat at 2.7 Moz and 0.7 Moz, respectively.

Nornickel, Russia's largest (and effectively the only operating) PGM producer, will maintain stable operations this year. The planned major smelter repair at the Nadezhda metallurgical plant was successfully finalised in 2024 and the company doesn't expect to review its current production guidance, which is 2.7 Moz Pd and 0.7 Moz Pt.

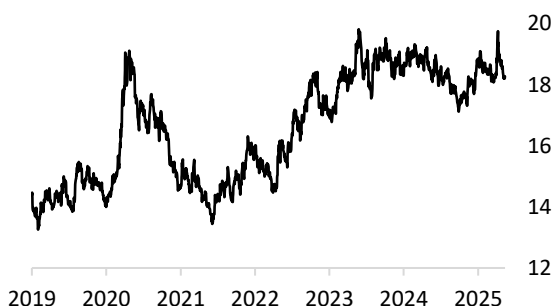
From 2026 onwards, the Chernogorskye deposit, owned by Russian Platinum, is scheduled to commence operations, supplying concentrates containing PGMs to Nornickel pursuant to an off-take agreement. It is anticipated that achieving the planned production levels will take between one and two years. At full capacity, this project could add around 0.5 Moz palladium and 0.2 Moz platinum annually, significantly bolstering Russia's long-term PGM production.

SOUTH AFRICA AND ZIMBABWE

In 2025, South African palladium production is expected to decline by 4% year-on-year to 2.2 million ounces, while their platinum production is expected to reach 3.8 million ounces. Local producers continue to face challenging market conditions due to persistently low PGM basket prices, prompting intensified cost optimisation efforts and cross-subsidisation between profitable and marginal operations. Meanwhile, in Zimbabwe, primary PGM production is expected to increase by 4% for palladium to 0.4 million ounces and by 2% for platinum to 0.5 million ounces.

During the high-price environment of 2021–2022, South African PGM producers were able to reduce their debt burdens significantly, gaining a more resilient financial position. As a result, most companies now maintain low levels of leverage, enabling them to weather the ongoing weak price cycle without major revisions to production strategies. This financial strength has helped sustain operations and allowed strategic support of underperforming assets. In early 2025, South African producers also benefited from a temporarily weakened rand, which depreciated to nearly 20 rand per US dollar in April. This provided a cost advantage, as most operating costs are rand-denominated while revenues are in US dollars. However, by the end of 1H 2025, the currency had strengthened again at about 18 rand per dollar, which is reminiscent of the 2024 FX rates, dampening some of the earlier gains in profitability.

USD/ZAR exchange rate



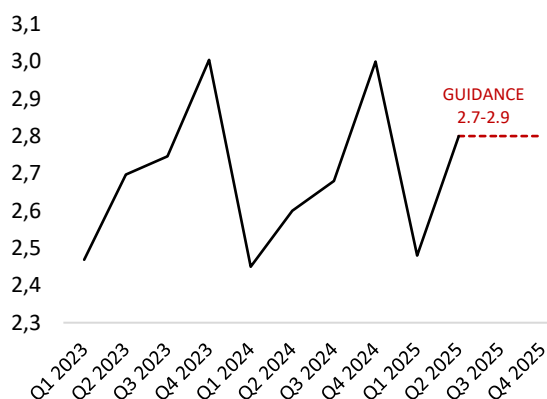
Source: TradingView

Valterra Platinum Limited (formerly Anglo American Platinum), one of the largest producers in the region, closed 2024 with 1.3 Moz of palladium and 1.9 Moz of platinum. While the company maintains unrevised production guidance for 2025, Q1 2025 results showed an 8% year-on-year decline, producing only 170 koz of palladium and 200 koz of platinum. The fall was due to the severe flooding at the Tumela mine, which disrupted operations for six months following the inundation of the main pumping station. Despite this setback, Valtterra remains committed to its full-year targets.

Valterra's open-pit Mogalakwena mine recorded a 3% year-on-year increase in Q1 2025, producing 107 koz of palladium and 98 koz of platinum. This growth was driven by a higher concentrator throughput and improved ore grades. The average head grade stood at 2.48 g/t, in line with full-year expectations of 2.7–2.9 g/t.

Historically, the output has always been lower in the first quarter of the year compared to subsequent quarters. Therefore, we expect a modest increase in output from the Mototolo and Modikwa projects by the end of 2025, even though the grades at the current mining areas are low. The company is also mindful that, despite Eskom's uninterrupted electricity supply throughout the year, there is still a risk of disruptions, which could lead to adjustments in projections.

Mogalakwena 4E grade, g/t



Source: Valtterra

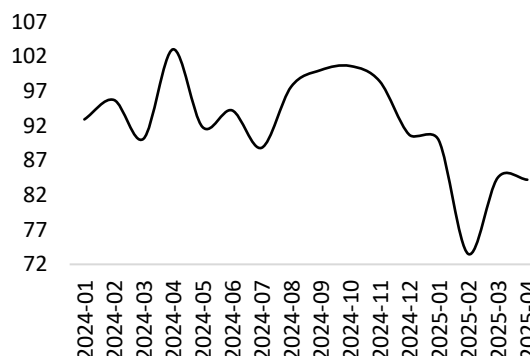
In Zimbabwe, Valtterra's Unki mine was initially projected to grow by 6% in 2025. However, following a 15% drop in platinum output in Q1 to 54 koz, forecasts were revised downwards. This decline was attributed to reduced ore grades, lower metal recoveries, and planned maintenance, all of which impacted milling volumes. Rising costs have also placed the mine under pressure.

According to **Impala Platinum's (Implats)** guidance, the company expects to maintain its 2024 production levels in 2025, with 600 koz of palladium and 1.2 Moz of platinum. Nevertheless, Q1 2025 results showed a 6% year-on-year dip in the South African output, with only 128 koz of palladium and 249 koz of platinum produced. Their challenges included limited labour availability, safety-related stoppages, severe weather conditions, and supply chain disruptions. Impala Rustenburg posted a 6% drop, while the Mimosa and Two Rivers joint ventures declined by 9%. Nonetheless, the company expects that in FY2026, its PGM production will remain at the FY2025 level due to the successful resolution of the workforce issues and improvement of logistics inefficiencies.

Zimplats, Implats' Zimbabwean subsidiary, forecasts 2025 output of 300 koz of both palladium (+8%) and platinum (+5%). However, in Q1 2025, their production fell by 11% quarter-on-quarter due to equipment constraints, leading to a 6% annual decline in 6E concentrate volumes despite a partial rebound in open-pit mining.

The Mimosa mine, a 50/50 joint venture between Implats and Sibanye-Stillwater, is projected to produce 93 koz of palladium (-3%) and 118 koz of platinum (-4%) in 2025. Power outages and scheduled maintenance in Q1 2025 led to a 6% drop in 6E concentrate production to 60 koz.

Seasonally adjusted index of the volume of mining production - PGM (Base: 2019=100), %



Source: SA Statistics Bureau

Sibanye-Stillwater's African operations delivered 600 koz of palladium and 1.1 Moz of platinum in 2024. They are expected to maintain similar levels in 2025. Nonetheless, Q1 2025 saw a 3% year-on-year decline, with 111 koz of palladium and 225 koz of platinum. This was primarily due to the closure of Shaft 4B at the Marikana mine in late Q1 2024. Production at Rustenburg edged up by 1%, despite adverse weather. While surface mining fell 17% due to rainfall, underground output increased by 2%. Refined output at Platinum Mile and Marikana fell 33% and 10%, respectively, largely because of weather-related disruptions.

Northam Platinum reported 2024 production of 274 koz palladium and 534 koz platinum and plans to maintain these levels through 2025. Zondereinde mine is expected to decline slightly by 2% year-on-year, while Booyssendal remains steady, and Eland is targeting a 15% increase in output.

Among future projects, the **Platreef** mine is set to begin Phase 1 operations in late 2025, with Phase 2 expansion scheduled for 2027. As Phase 1 and Phase 2 come into effect from late 2025 through to 2027, the production volume of PGM will gradually rise from 100 thousand ounces up to 450 thousand ounces of 4E. Meanwhile, the **Waterberg** project continues to face funding challenges, though a strategic sale of a 26% stake in Hosken Consolidated Investments Limited is being pursued to raise \$1.8 billion. In Zimbabwe, the **Karo** mine startup has been officially postponed to the second half of 2026. Given current market conditions and subdued palladium prices, we have not included production from this project in our short-term models. Its commissioning remains dependent on the improved financials and price dynamics.

NORTH AMERICA

In 2025, we expect primary PGM production in North America to decline sharply by 17% and 7% YoY to 0.7Moz and 0.3Moz of palladium and platinum, respectively, due to the Stillwater mine restructuring.

Falling palladium prices have made PGM mines in North America unprofitable due to palladium-rich ore and high production costs. Stillwater's mined production in Q1 2025 of 2E PGMs amounted to 72 koz, reflecting a 41% YoY decline and for 2025-2026, we are expecting flat 2E production of 245 koz (which is 42% lower than in 2024), due to the suspension of the Stillwater West mine, which has been placed on maintenance.

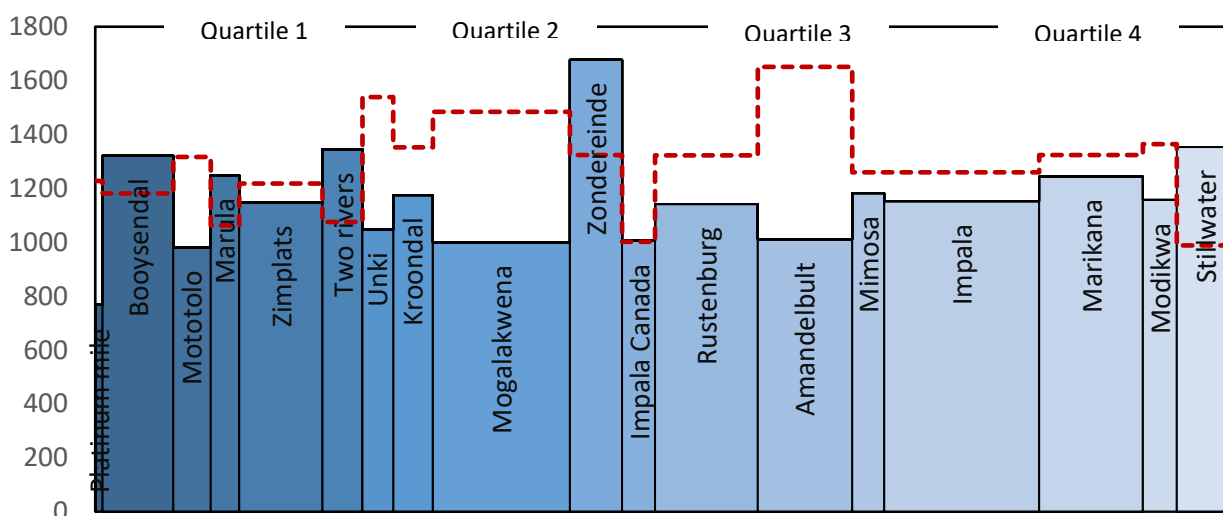
In March 2025, the CEO of Impala Platinum stated that the company is considering the possibility of an early closure of its Canadian palladium mine due to a 43% drop in profits. According to the CEO, if the current trend continues, the company may decide to accelerate the mine's wind-down, potentially concluding operations before the initially planned 2-year timeline. If Impala Canada does not close earlier than planned in 2027, we expect its 2026 production to be 0.2 Moz Pd and 0.02 Moz Pt.

As for the non-ferrous metal producers in the region, Vale's PGM output in Q1 2025 decreased by 70% to 27 koz of palladium and 24 koz of platinum. Conversely, Glencore reported a 40% increase in their palladium production compared to the previous quarter, reaching 21 koz in Q1 2025. This rise does not reflect a capacity expansion but rather a recovery from the lower volumes in 2023-2024, while their platinum production remained stable at 6 Koz.

In total, we expect the 2026 global primary supply to decrease slightly by 2% to 6.1 Moz palladium and by 1% to 5.5 Moz platinum, primarily due to the conservation of the Stillwater's and, potentially, Impala Canada's mines as well as depletion of nickel reserves at Vale's and Glencore's operations in North America. In South Africa, we observe a relatively stable production with a minor downward trend owing to cross-subsidisation among companies and low debt burden. In Russia, we expect the launch of the Chernogorskiye deposit, which is expected to raise the PGM output

Major African and North American PGM mines All-in Sustaining Cost and Current PGM Basket Price in 2024, USD/6E oz

AISC in 2024, USD per 6E oz



Source: NN analysis

In 2024, about a quarter of PGM primary production outside Russia was loss-making at the then spot prices despite the cost-saving measures implemented across the African and North American PGM mines.

RECYCLING

Recycling has been under pressure across the post-COVID period, and 2024 was the next in this series of tough years, with the recycling going further down to 2.9 Moz of Pd, and 1.5 Moz of Pt. In 2025, despite the rising car prices, trade flow difficulties during trade wars and an increase in the average car lifetime to 14 years, we expect recycling to grow by +9% YoY for both Pd to 3 Moz and Pt to 1.5 Moz, due to extended recycling programs in China, modest sales growth in Europe and NA, and a recovery in Japan's light vehicle sales. Potential downside risks, such as the US tariffs, will remain, though.

Recycling remains one of the most opaque segments of the PGM supply chain, largely due to the inherent complexity of material flows and the reluctance of key market participants to disclose data. The process involves a multi-layered and fragmented network of collectors, aggregators, and processors, making it difficult to trace volumes accurately from the collection source to refinement. At the final stages, fabricators, who ultimately accumulate and process the bulk of secondary PGMs, often treat throughput data as commercially sensitive and do not report them publicly. As a result, even among the most knowledgeable analytical agencies and major fabricators, estimates and forecasts of recycled PGMs vary significantly. For example, for palladium in 2025, the estimates vary widely between 2.7 and 3.4 Moz.

This ambiguity complicates the analysis of the recycling sector's performance. Nevertheless, it is evident that current recycling volumes are falling well short of their theoretical potential. Based on metrics such as average vehicle fleet age, expected vehicle lifespan, and PGM loadings in end-of-life vehicles, secondary supply should be much higher than what is currently observed in the market. The shortfall is estimated at around 300 koz for platinum and roughly 600 koz for palladium, indicating significant underutilisation of available resources.

One of the main reasons for this discrepancy is the shifting behaviour of vehicle owners in key markets. In response to higher interest rates and vehicle financing costs, consumers in Western economies are holding on to their cars longer. The average vehicle lifetime has increased from 12 to 14 years in recent years, and in some countries, it is already approaching 20 years. This trend delays the entry of catalytic converters into the recycling stream, suppressing the flow of recoverable PGMs.

At the same time, scrapyards – key nodes in the recycling chain – are showing increased reluctance to release material into the market under the current low-price environment. After benefiting from strong margins during the 2020–2022 price spike, many are now holding collected catalysts in anticipation of a future price rebound, effectively creating a bottleneck in the supply of secondary PGMs.

Compounding these challenges is the impact of high interest rates on fabricators, who are the primary entities responsible for the final processing of recycled PGMs. Since the acquisition of secondary material typically involves cash-in-advance transactions, tighter credit conditions are making it more difficult for fabricators to finance and accelerate the collection of material. Even well-capitalised players are finding it challenging to scale operations or incentivise upstream partners.

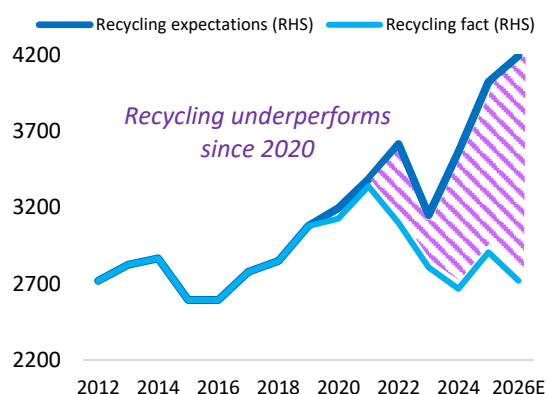
In China, government trade-in programs have provided a modest boost to recycling, but the significant growth that many industry participants anticipated several years ago has yet to materialise. This underperformance has caused some to delay or reconsider investments in local

secondary processing facilities, dampening expectations for China's short-term impact on global recycled supply.

Our analysis of financial reports of major players across the recycling value chain, combined with direct communication with processors and intermediaries, suggests that the total recycled PGM output in 2025 will only experience slight increases compared to 2024.

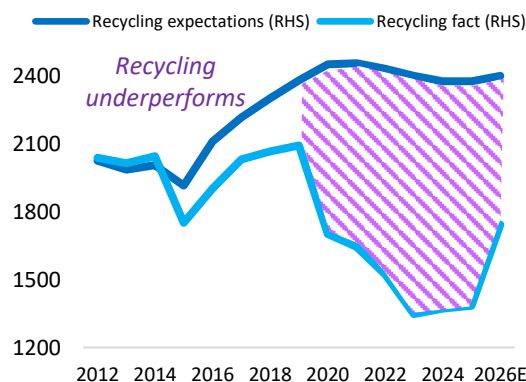
A meaningful acceleration in recycling numbers is anticipated in 2026, driven by lower interest rates and potentially higher PGM prices. However, a full recovery to the pre-COVID recycling levels is unlikely before 2027–2028. In the meantime, secondary supply will continue to lag behind both the market potential and the industry expectations, contributing to the ongoing tightness and volatility in the global PGM balance.

World Pd Recycling Volumes, koz



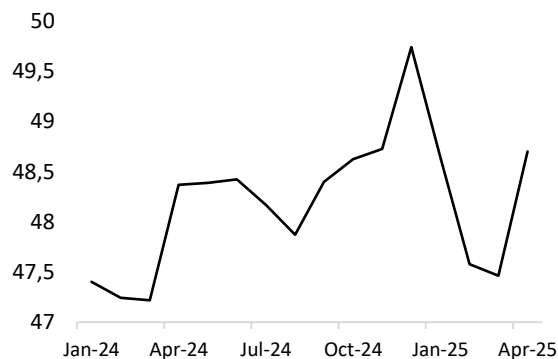
Source: NN analysis

World Pt Recycling Volumes, koz



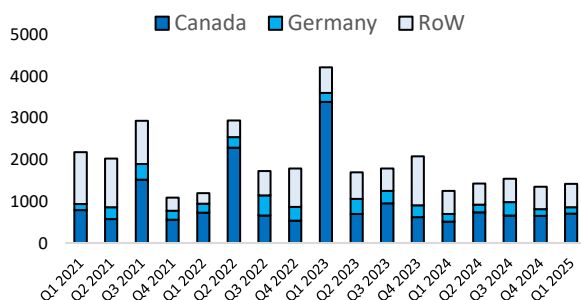
Source: NN analysis

Global Prices of New Vehicles, USD



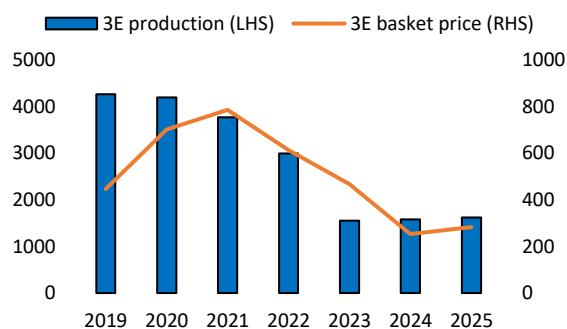
Source: Kelley Blue Book

US: import of spent autocatalyst (ceramic), tonnes



Source: Trade statistics

Sibanye-Stillwater's recycled production, koz



Source: Sibanye-Stillwater

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GLOSSARY OF TERMS

Abbreviation	Term
(t)oz	Troy ounce
(P)HEV	(Plug-in) hybrid electric vehicle
2E	Platinum, palladium
4E	Platinum, palladium, rhodium and gold
6E	Platinum, palladium, rhodium, iridium,
BEV	Battery electric vehicle
CFTC	Commodity Futures Trading Commission
COVID-19 (COVID)	Coronavirus Disease 2019
ETF	Exchange-traded fund
EU	European Union
EV	Electric vehicle
FCEV	Fuel cell electric vehicle
ICE	Internal combustion engine
HDD	Hard disk drive
koz	Thousand troy ounces
LBMA	London Bullion Market Association
LPPM	London Platinum and Palladium Market
MMC	Mining metallurgical company
Moz	Million troy ounces
NEV	New energy vehicle
NYMEX	New York Mercantile Exchange
OEM(s)	Original equipment manufacturers
PC	Personal computer
PGM(s)	Platinum group metals
PTA	Purified terephthalic acid
PX	Paraxylene
R&D	Research and development
YoY	Year-on-year
YTD	Year to date