

Africa managed to increase its output by 9% to 3.6 Mt, with DRC being the top producer through its Ivanhoe's Kamo-a-Kakula project.

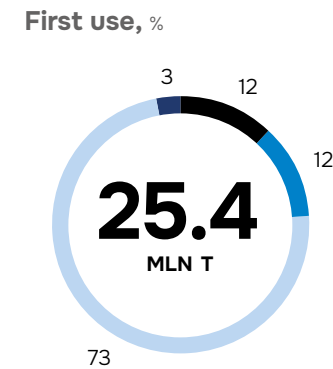
China ramped up its production by 2% to 1.9 Mt, while copper mine production in Indonesia declined 5% to 0.9 Mt.

Production in North America decreased, except for Canada where the output grew 4% to 0.4 Mt. In the US, the decline was 8% to 1.2 Mt, and in Mexico 2% to 0.7 Mt.

Refined copper production grew 4% y-o-y to 25.6 Mt amid new capacity launches in China. In South and Central America, production dropped 4% to 2.5 Mt due to the macroeconomic pressure throughout the year. Africa saw a 16% increase in production to 2.2 Mt, while Asia (including China) ramped up its output by 5% to 15.6 Mt. China's refined copper output increased by 9% to 11.5 Mt, while in Japan it decreased by 1% to 1.5 Mt. Copper output in Europe fell 2% to 3.5 Mt, in North America 4% to 1.5 Mt.



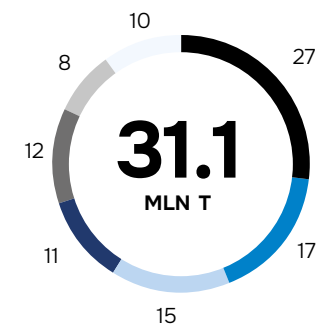
Refined copper consumption by industry



- Tubes
- Flat rolled products
- Wire rod
- Other

Source: Company data

End use by industry, %

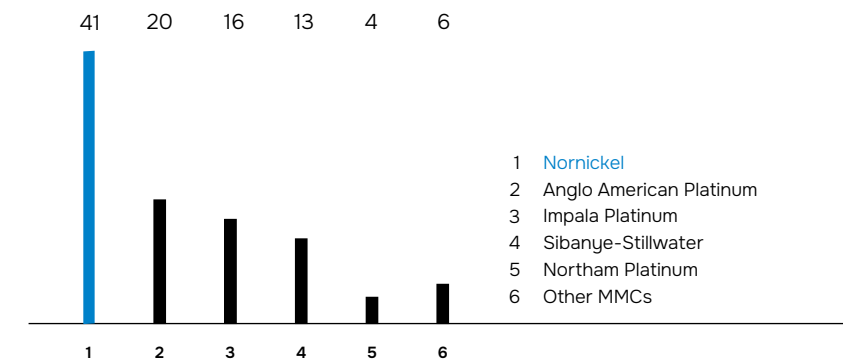


- Construction
- Utility
- Machinery
- Transport
- Consumer goods
- Air conditioning and refrigeration
- Other

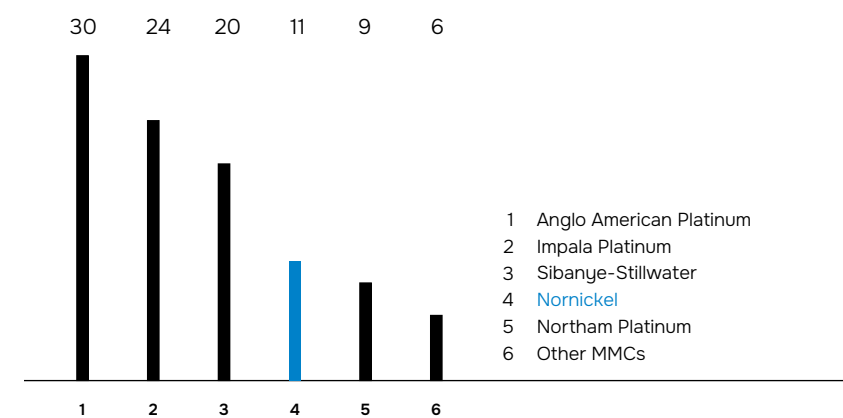
Source: Company data

PGM market

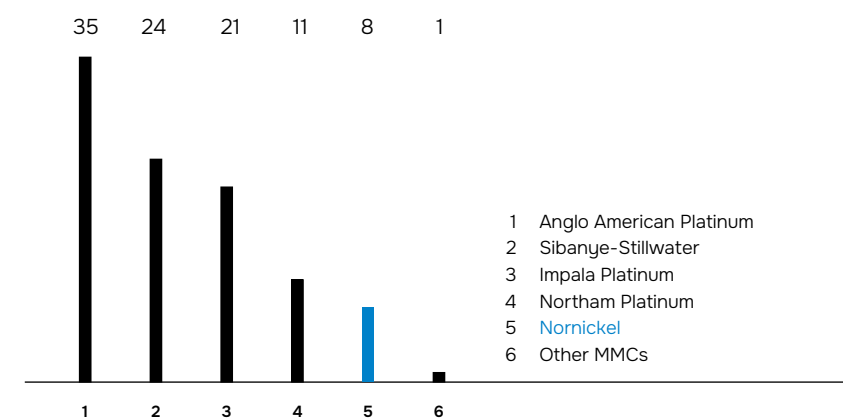
Nornickel – No. 1 in palladium production, %¹



Nornickel – No. 4 in platinum production, %¹



Nornickel – No. 5 in rhodium production, %¹



Sources: producer reports, Company analysis as of early March 2024

¹ Refined metal output including production from third-party feedstock and production from own feedstock by third parties under tolling agreements.

Key market trends

Palladium

Due to low ICE-powered vehicle sales in the first two months of 2023, the palladium price was declining, getting closer to the important USD 1,300/oz support level up until mid-March, when it entered into a horizontal trend, fluctuating between USD 1,300/oz and USD 1,600/oz levels. The trend change was triggered by the US banking crisis, which has supported prices for precious metals as the market lowered its expectations regarding the terminal rate level.

The price continued its downward movement in May to find the next support level at USD 1,225/oz by the end of June. Later, it started trading sideways, fluctuating between USD 1,225/oz and USD 1,300/oz as inflation expectations eased. The sideways trend continued until the beginning of October, when it made a stepdown to a lower price corridor, reaching its bottom at USD 1,125/oz. This occurred amid the Fed representatives' statements regarding the higher-for-longer interest rates environment.

The price plateaued at USD 1,125/oz up until 7 November, when it fell by 4% to USD 1,080/oz. Fed's hawkish statements yet again pressured all the precious metals. This led the palladium price to fall below the psychological level of USD 1,100/oz, which triggered a 3-year-record daily open interest increase on the NYMEX, dipping palladium down to USD 965/oz. Nevertheless, right after that, palladium bounced back and stabilised above the USD 1,050/oz level.

Late in the year, the palladium price showed increased volatility: the excessive volume of short positions resulted in a short squeeze in December, with prices soaring to USD 1,225/oz and then dropping again to USD 1,050/oz.

Platinum

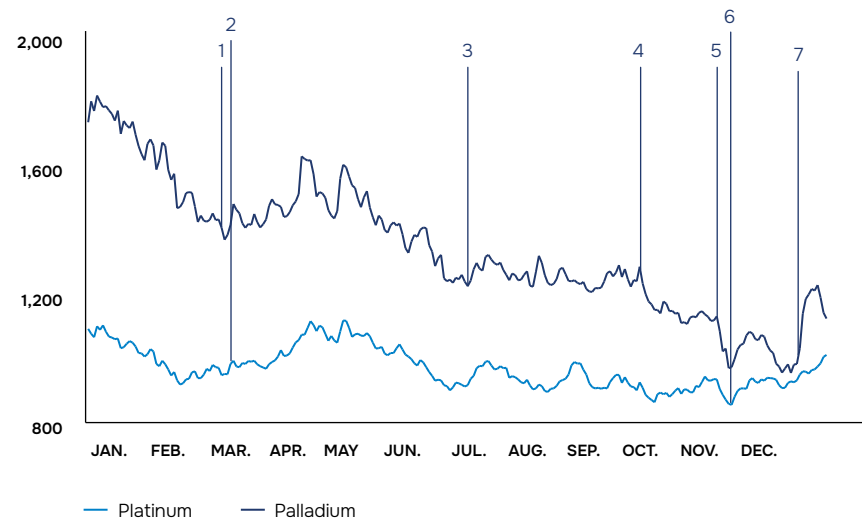
In early January, the platinum price rose slightly above USD 1,100/oz but began to decline by mid-January amid weak car sales. As the automotive market started to recover, the significance of macroeconomic factors in platinum pricing started to strengthen, which led to the platinum price following the upward trend of gold since the end of February.

The price rally continued as the next noticeable resistance level of USD 1,050/oz was broken on 13 April, when South African Eskom announced the return of Stage 6 load-shedding, which drove the price up above USD 1,100/oz level. However, in mid-May, the platinum price started to fall sharply, reaching its bottom at USD 900/oz by late June. This drop was caused, among other factors, by resilience of South African producers to electricity supply disruptions, weak macroeconomic data from China, and hawkish statements by the ECB, which put noticeable pressure on prices for precious metals.

Until the end of October, the price fluctuated between USD 900/oz and USD 1,000/oz, followed by an overall adjustment of prices for precious metals, which led the platinum price to a support level of USD 875/oz.

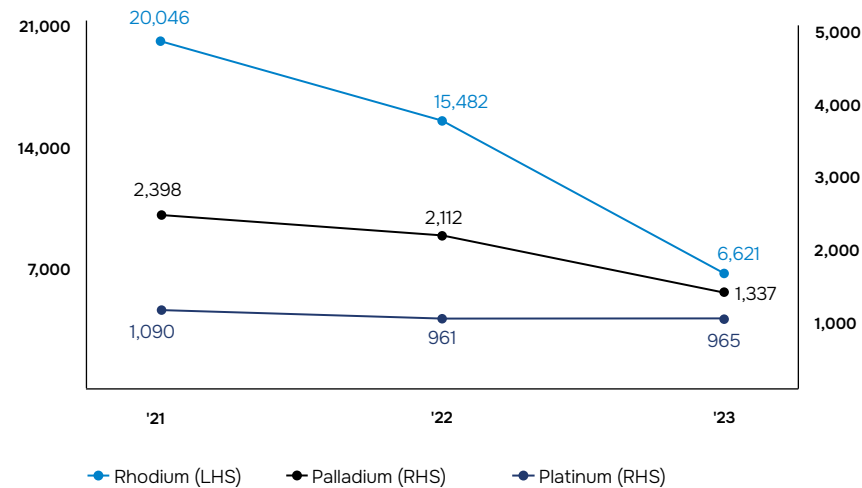
In December, the platinum price soared to above USD 1,000/oz amid statements by South American PGM producers about cutting their output given the depressed PGM basket prices.

Palladium and platinum prices in 2023, LPPM



1. The US and Europe's banking crisis reversed the pricing trend in the PGM market
2. Worsening of the power crunch in South Africa
3. Stabilisation of inflation expectations
4. Fed's hawkish statements
5. Fed representatives' statements regarding the higher-for-longer interest rates environment, and a surge in short speculative positions for palladium
6. Top foreign PGM producers announce production plan cuts amid cost optimisation efforts
7. Short squeeze in the palladium market

Average annual PGM prices, USD/OZ



Source: Company analysis

Market balance

In 2023, the palladium market remained in a significant deficit estimated at 30 tonnes, net of investment demand and consumer stock movement. Sales of stocks by automakers and autocatalyst producers provided additional liquidity to balance the market. Amid stable demand, the deficit increase was mainly driven by lower production. In 2023, palladium supply declined due to lower recycling and output in Russia amid the transition to new mining equipment and scheduled maintenance at Nadezhda Metallurgical Plant and Talnakh Concentrator of the Norilsk Division.

The platinum market moved into a deficit of 12 tonnes in 2023. During the year, global platinum consumption grew amid residual palladium-with-platinum substitution in autocatalytic converters and the launch of new capacities in China's glass industry. Meanwhile, global platinum production stagnated, as lower recycling was offset by the recovery of primary production in South Africa after the lack of smelting capacities and widespread power outages in 2022.

A moderate deficit of 3 tonnes remained in the rhodium market in 2023, which, as in the case of palladium, was balanced by stocks sold by market players. Rhodium production remained at the 2022 level: the recycling fall was offset by the recovery of primary production in South Africa while moderate consumption growth was driven by stronger demand from the chemical and automotive industries.

Consumption

Automotive industry. Exhaust treatment systems account for the bulk of total PGM consumption. In this sector, palladium, platinum, and rhodium are used in catalytic converters, which are mandatory for road transport and legally regulated in most countries. These solutions drastically reduce emissions of hazardous substances.

Due to their unique catalytic properties ensuring effective chemical reactions throughout the entire vehicle life cycle, there are almost no alternatives to PGMs in this sector.

Due to their catalytic properties, palladium and rhodium are the key choice for exhaust treatment systems in petrol vehicles, while platinum is used mostly in diesel vehicles. There has been a partial substitution of platinum for palladium in petrol vehicle catalysts in recent years due to a significant price spread between the metals. The peak level of substitution was reached in 2023, as the narrowed price spread between palladium and platinum leaves no incentives for a short-term substitution.

In 2023, Western regulators decided to adopt new environmental standards in the US and Europe, which will support PGM consumption in the automotive industry in the longer run. Moreover, in late 2023, global demand for EVs began to slow down to the benefit of HEVs (with PGM content even higher than in conventional ICE-powered vehicles), which makes automakers revisit their transport electrification strategies.

30 TONNES

Palladium market deficit in 2023

12 TONNES

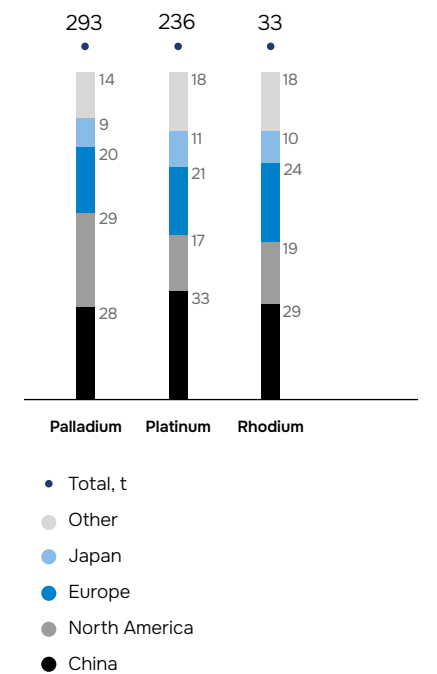
Platinum market deficit in 2023

3 TONNES

Rhodium market deficit in 2023

Source: PGM balance estimate as of March 2024

PGM consumption by region, %



- Total, t
- Other
- Japan
- Europe
- North America
- China

In 2023, palladium consumption in the automotive industry decreased by 1 tonne to 240 tonnes. The reason for sluggish demand for the metal in the automotive industry was that the minor increase in ICE-powered vehicle output was offset by residual palladium-with-platinum substitution in autocatalytic converters.

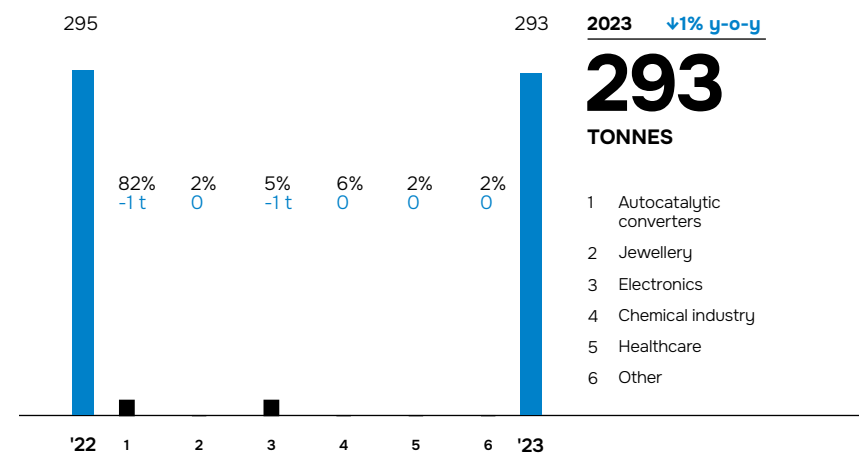
At the same time, palladium consumption in the automotive industry is supported by the declining share of diesel cars in the fleet mix as they are replaced with petrol cars and hybrids, which make greater use of palladium-based catalytic converters for exhaust fumes. The market share of diesel vehicles in Europe (27 EU countries + the UK + European Free Trade Association countries) dropped from 16% to 13% over the year. Despite the declining share of diesel vehicles, global demand for platinum from the automotive industry grew by 12 tonnes in 2023, driven by the recovery in production of trucks and residual substitution of platinum for palladium in petrol vehicles.

Rhodium consumption in this industry grew by 1 tonne amid a slight increase in vehicle production.

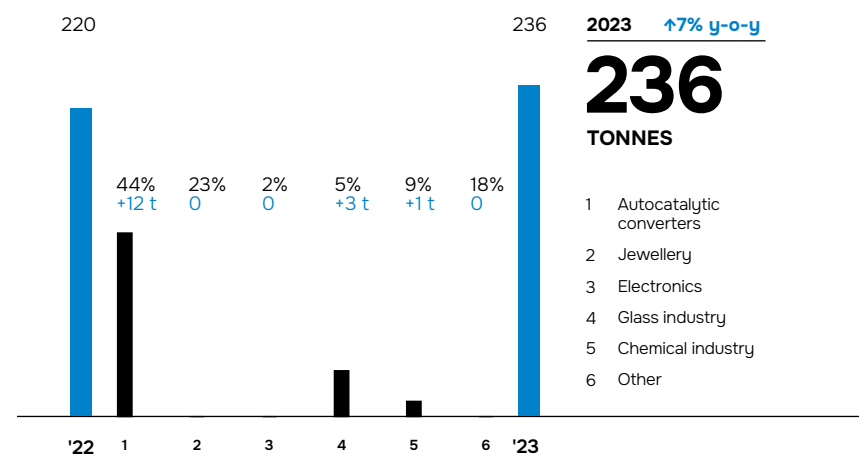
Electronics. Palladium has found its way into the electronics industry primarily as a material for capacitors and motherboards, while platinum is used in hard drives. In 2023, palladium consumption in the electronics industry decreased by 1 tonne to 16 tonnes on the back of weaker sales of household appliances. Platinum demand from the industry stayed flat at 5 tonnes.

Chemical industry. In 2023, the use of platinum in catalysts grew by 1 tonne to 21 tonnes amid the expansion of production capacities in China. Palladium demand in this industry remained at 19 tonnes.

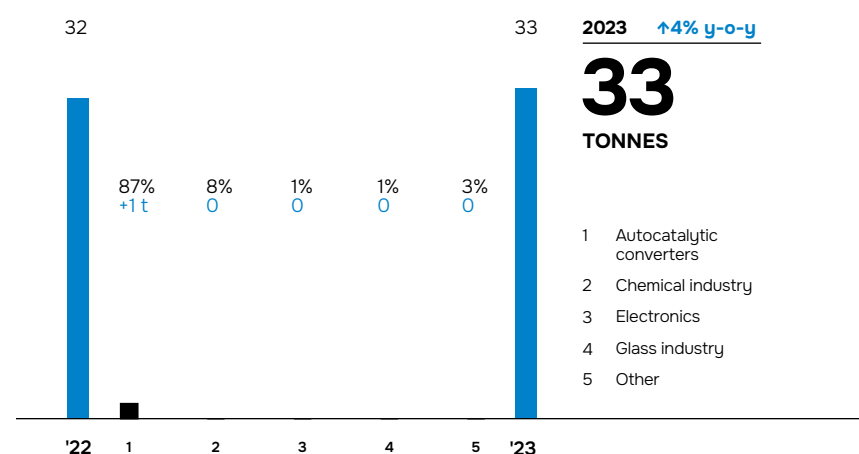
Palladium: consumption by industry, % and by application, T in 2023



Platinum: consumption by industry, % and by application, T in 2023



Rhodium: consumption by industry, % and by application, T in 2023



Healthcare. Palladium consumption in this industry decreased slightly, by 0.2 tonnes to 6 tonnes, driven by the long-term substitution trend, while demand for platinum stagnated at 8 tonnes.

Jewellery. The use of palladium and platinum in jewellery stayed flat at 5 tonnes and 54 tonnes, respectively. Although the macroeconomic uncertainty continues to put pressure on the demand for luxury goods in Europe and the US, jewellery sales growth in India offset the demand fall in developed economies.

Glass industry. Platinum containing products are needed to produce glass fibre and optical glass. Demand for the metal in this industry grew by 3 tonnes in 2023 as China expanded its production capacities.

Investments. Palladium and platinum are widely used as an investment instrument. Physical investments may vary from coins and smaller bars to investments in ETFs. Palladium stocks in ETFs increased by 2.1 tonnes to 16.0 tonnes in 2023, while platinum stocks decreased by 2.4 tonnes to 91.7 tonnes.

Supply

In 2023, primary refined palladium production decreased 1% y-o-y to 198 tonnes, while platinum and rhodium production grew 3% and 4% to 184 tonnes and 24 tonnes, respectively.

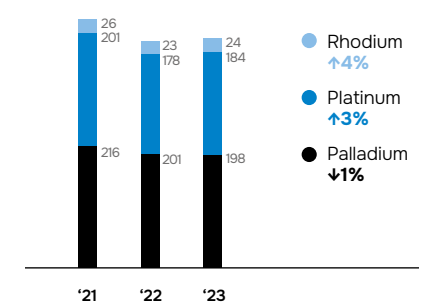
In Russia, the key palladium producer, palladium supply declined (by 3 tonnes) due to the transition to new mining equipment and scheduled maintenance at Nadezhda Metallurgical Plant and Talnakh Concentrator of the Norilsk Division. Platinum production stayed flat at 20.5 tonnes.

In 2023, South Africa, a key platinum and rhodium producer, saw its palladium, platinum, and rhodium output grow by 1 tonne, 5 tonnes, and 1 tonne to 75 tonnes, 133 tonnes, and 20 tonnes, respectively, – primarily because the shortage of smelting capacities was addressed.

Primary palladium and platinum production in Zimbabwe rose by 1 tonne to 14 tonnes and 17 tonnes, respectively, while rhodium output remained flat at 1.5 tonnes. Palladium production in the North America decreased by 1 tonne to 25 tonnes, while platinum production remained at 9 tonnes.

The main sources of recycled PGM supply are scrapped autocatalytic converters. In 2023, recycled palladium, platinum, and rhodium production decreased by 11 tonnes, 7 tonnes, and 1 tonne to 65 tonnes, 40 tonnes, and 7 tonnes, respectively. Such a noticeable decline in recycled supply was due to lower prices for PGMs, a tough monetary policy, stricter KYC policies in the US, and tightening of state regulation of the industry in China.

Primary PGM production, T



Source: Company data

2.1 TONNES

Increase in palladium inventories held by ETFs over 2023

2.4 TONNES

Reduction in platinum inventories held by ETFs over 2023