

## FOREWORD

This edition of *Platinum Quarterly* presents platinum supply and demand developments for the third quarter of 2022, an updated outlook for 2022 and an initial forecast for 2023. It also includes the WPIC's views on issues and trends relevant to those investors considering exposure to platinum as an investment asset, plus an update on how our product partnerships continue to meet investors' needs. The *Platinum Quarterly* data and commentary (starting on page 7) are prepared independently for the WPIC by Metals Focus.

After two years of significant surpluses, the platinum market is forecast to move from surplus into deficit in 2023, a swing of over 1.1 Moz. The surplus in 2021 and the one forecast for 2022 are largely due to constrained automotive production subduing platinum automotive demand growth, significant exchange stock outflows and ETF disinvestment and, in 2021, a significant producer work-in-progress inventory unwind boosting supply. In contrast, mine supply is expected to remain constrained in 2023, whilst automotive, industrial, jewellery and investment demand are all up year-on-year, the latter due to strong bar and coin demand more than offsetting ongoing, yet much reduced, exchange stock outflows and ETF disinvestment. The net impact is for a projected deficit of 303 koz in 2023. For full year 2022, lower mine and recycling supply expectations result in a reduced surplus of 804 koz, down 17% (-170 koz) from the forecast surplus in our last *Platinum Quarterly*. The significant surplus in 2021 and the surplus forecast in 2022 reflect as an increase in above ground stocks. However, according to Bloomberg data, in 2021 and to date in 2022, China has imported 2.5 Moz of platinum in excess of its identified demand, not only absorbing both surpluses but also removing metal availability to non-China demand and only likely to be available to meet demand in China after a significant increase in the platinum price. Thus, we think that a tight physical market will continue in 2023.

### 2022 supply/demand surplus reduced on supply challenges:

- The forecast 2022 platinum surplus has reduced since our last forecast, as weaker mine and recycling supply expectations have more than offset slight downward revisions to automotive, jewellery and industrial demand, supplemented by an improved outlook for bar and coin demand, principally in Japan.
- In terms of supply, key features of 2022 have been continued downward revisions to mining company production guidance due to ongoing operational and power availability challenges, as well as reduced forecasts for recycling supply, mostly a result of reduced scrappage of old vehicles in response to the constrained availability of new vehicles.
- The major demand themes in 2022 include slower automotive demand growth as supply chain challenges and the zero-COVID policy in China constrain new vehicle production, stronger than expected jewellery demand (particularly in the US and China), continued robust industrial demand and negative investment demand.
- Demand in 2022 will be negatively impacted by the continuation of the significant ETF disinvestment and exchange stock outflows that commenced in mid-2021. This will be partially offset by strong bar and coin demand in most geographies, aside from Japan.

### 2023 platinum market expected to move into deficit:

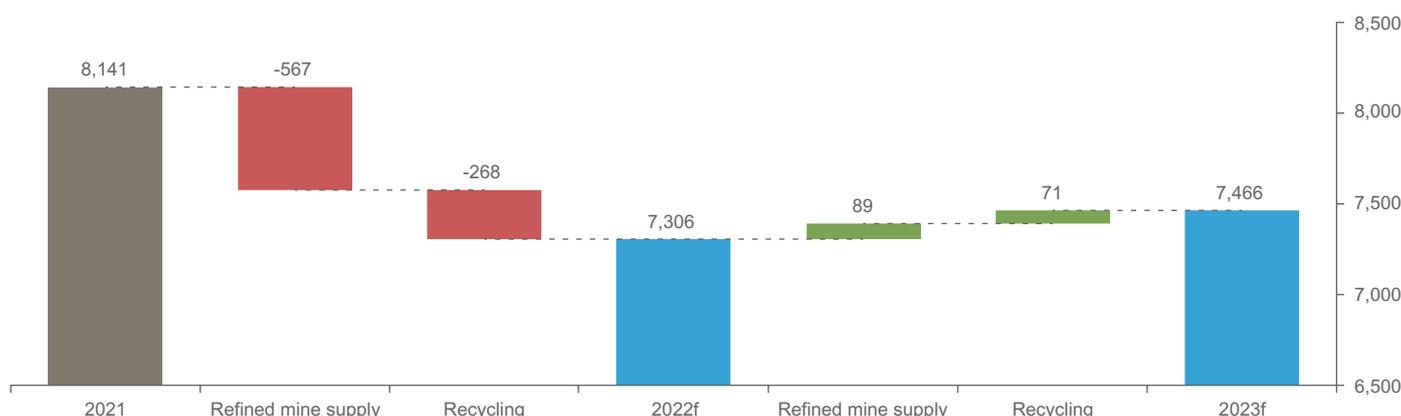
- The platinum supply/demand balance is expected to be in deficit in 2023, a swing of over 1.1 Moz. This is principally due to constrained supply and strong demand growth in automotive and industrial applications, and a significant reversal from negative to positive investment demand, a change of over 700 koz.
- Mine production is forecast to be mainly flat versus 2022 due to a continuation of the constraints that have limited production this year. Recycling supply is expected to continue to be hampered by the limited availability of automotive scrap.
- Automotive demand is expected to improve 11% year-on-year, supported by both increased production volumes and increased platinum for palladium substitution and a greater market penetration of platinum-containing exhaust treatment systems in heavy-duty vehicles (HD). Jewellery demand is forecast to be flat on 2022. Industrial demand is projected to increase 10% year-on-year, almost reaching the record levels seen in 2021. Whilst the world may be facing a recessionary environment, much of the capital for industrial capacity additions has already been committed.
- Investment demand is expected to shift radically from negative investment demand to positive investment demand supported by strong demand for bar and coin offsetting continued ETF disinvestment and exchange stock outflows, albeit at reduced rates versus 2021 and 2022.

## Platinum supply and demand – quarter three, updating 2022 forecasts and initial 2023 outlook

### Q3 2022 and full-year 2022 dominated by negative investment demand

Total Q3 supply was down 12% (-232 koz) year-on-year at 1,748 koz, with mine supply remaining constrained by operational challenges including power shortages in South Africa and recycling supply limited by scrap availability. Total mine supply was down 11% year-on-year (-171 koz) with Anglo American Platinum’s output negatively impacted by the rebuild of the Polokwane smelter, and Sibanye Stillwater’s Stillwater mine in Montana continuing to face operational challenges, in part due to the flooding earlier in the year. Recycling was down 13% (-61 koz) year-on-year due to a continued shortage of scrapped autocatalysts, as well as less jewellery being sold back in China. Both the mining and recycling constraints are themes that are expected to continue through the end of the year and into 2023, with total supply for 2022 expected to be down 10% on 2021 at 7,306 koz.

Annual total supply and changes 2021 to 2023f (koz)



Source: Metals Focus

Automotive demand for platinum was flat quarter-on-quarter, but up 25% year-on-year as supply chain challenges began to ease. This momentum is expected to continue through the fourth quarter, resulting in projected 2022 automotive demand for platinum of 2,964 koz being up 12% year-on-year. The projections for platinum for palladium substitution in 2022 remain unchanged at 340 koz. Jewellery demand was down 3% quarter-on-quarter with continued weakness in China offsetting continued strength in demand from North America, Europe and India; but it is expected to remain flat year-on-year for 2022 as a whole, albeit still well below historical levels. Industrial demand improved 10% year-on-year in Q3'22 to 553 koz. Industrial demand for 2022 as a whole is expected to total 2,110 koz, down 14% from 2021, which was a record year; the forecast is for 2022 to still be the third strongest year for industrial demand since 2013.

For the fifth quarter in a row, the dominant demand driver in Q3'22 was continued negative ETF demand and exchange stock outflows, which combined totalled -369 koz, partially offset by positive bar and coin demand of 97 koz. In a rising interest rate environment there is an opportunity cost associated with ETFs as holders must pay the annual ETF management fee and are also forgoing the interest receivable on a comparable cash deposit. As a result, investors looking for yield may choose to rotate out of ETFs into owning physical metal that they can lease out to increase their return. This may be a factor behind some of the ETF disinvestment seen since the middle of 2021. Turning to exchange stocks, the outflows have been driven by tight physical market conditions, but with stocks having now fallen to historically normal levels, limited further outflows are expected. Bar and coin demand for 2022 is forecast to total 340 koz. This includes 45 koz of net disinvestment in Japan; although Japanese demand did turn modestly net positive in Q3'22 and is expected to remain positive into 2023. Total investment demand in 2022 is expected to come to negative 525 koz including 865 koz of ETF and exchange stock outflows, partially offset by net positive bar and coin demand.

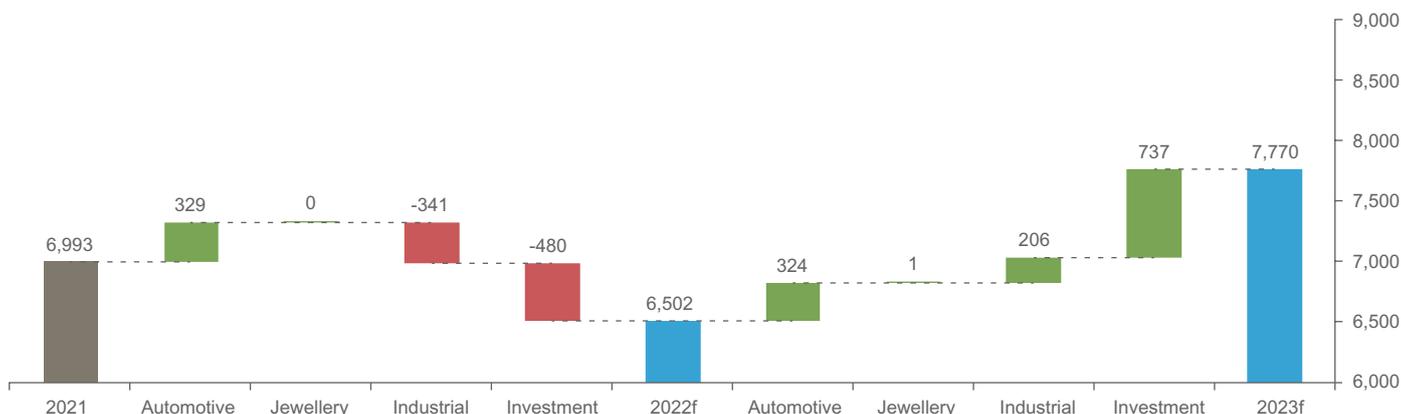
In terms of the platinum market's supply/demand balance, the net result is a Q3'22 platinum surplus of 263 koz and a forecast full-year 2022 surplus of 804 koz. This implies Q4'22 excess supply of 67 koz, which would be the smallest quarterly surplus of 2022 and potentially indicating a change in market direction. In Q3'22, as was seen in H1'22 and in 2021 as a whole, continued strong China platinum imports in excess of identified demand appear to have continued to attract metal away from Western vaults and into China.

## Initial 2023 forecasts – platinum market in deficit, a significant turnaround

Some of the themes that have characterised 2021 and 2022 are expected to continue into 2023, but dramatic changes are expected to manifest in other areas that result in the platinum market pivoting from surplus to deficit. Both mining and recycling supply are expected to continue to face headwinds, whilst demand is forecast to grow strongly from increasing platinum for palladium substitution in gasoline vehicles, jewellery demand staying largely flat, industrial demand remaining strong despite the challenging economic environment and investment demand turning positive. The swing from negative to positive bar and coin demand in Japan is forecast to push total bar and coin demand to its third strongest year in our time series, ETF disinvestment is anticipated to slow significantly, and only very limited exchange stock outflows are projected.

Mining supply has been beset by operational challenges in 2022, which are expected to remain a feature through 2023. South Africa's struggles with load shedding, which increased significantly quarter-on-quarter, are expected to continue to negatively impact refined metal output for the foreseeable future. Whilst output from Russia is currently forecast to remain flat year-on-year in 2023, Nornickel has cautioned of risks to future production levels as it struggles with sanctions and it has consequently withdrawn guidance. Recycling supply's challenges with scrap availability are expected to ease somewhat in 2023, but recycling supply is still expected to remain 11% below pre-COVID levels. Mine supply for 2023 is projected to total 5,726 koz (+1% year-on-year) and recycling supply to come to 1,740 koz (+4% year-on-year) for total supply of 7,466 koz (+2% year-on-year).

Annual total demand and changes 2021 to 2023f (koz)



Source: Metals Focus

The big risk to platinum demand in 2023 is the weak economic outlook eroding consumer demand for goods that contain platinum or are reliant upon platinum for their manufacture. Addressing this, it is worth noting that automotive production remains constrained below levels that would be normal for prevailing economic activity, jewellery demand is expected to be supported by fewer COVID lockdowns in China than in 2022, and industrial demand is characterised by capacity additions that have already been financially and physically committed to.

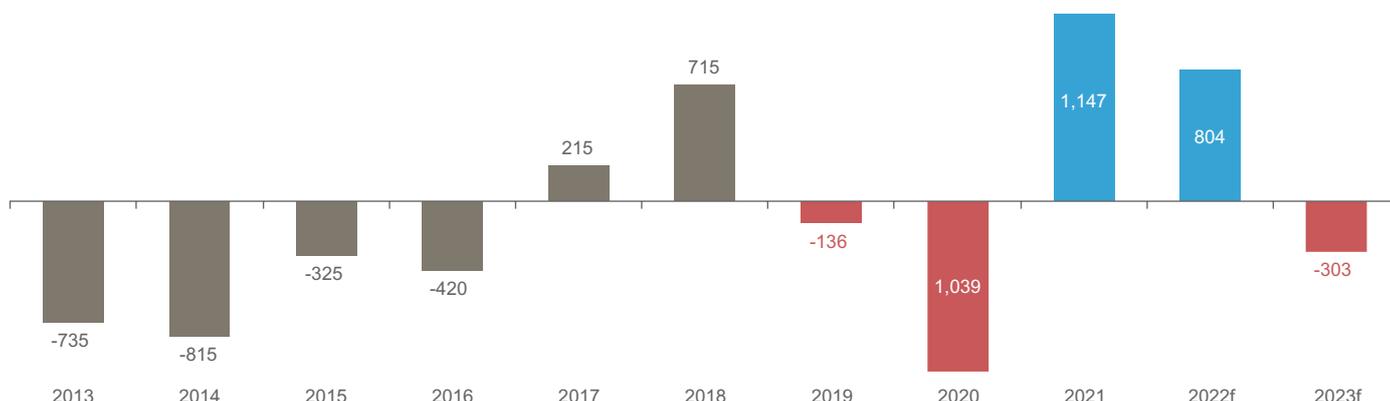
Although the production of pure internal combustion vehicles (ICE) is expected to contract by 5% in 2023, production of hybrid vehicles and heavy-duty vehicles, which are more platinum intensive vehicle categories, is forecast to increase by 15% and 11%, respectively. Total automotive demand is expected to increase 11% year-on-year to 3,288 koz in 2023, including 500 koz of platinum substitution for palladium. Jewellery demand for platinum is expected to be flat at 1,954 koz (+1 koz year-on-year) in 2023 as fewer COVID lockdowns in China and the price differential to gold support demand. Forecast industrial demand of 2,316 koz in 2023

(+10% year-on-year) is projected to be one of the strongest years in our time series, second only to, and only 5% below, the record year of 2021. Industrial demand is to be led by glass capacity additions in China and Egypt, with total glass demand of 481 koz (+52% year-on-year), coupled with continued strong chemical, medical and other demand, more than offsetting weaker outlooks for the petroleum and electrical sub-sectors.

In terms of investment demand, bar and coin is expected to increase by 49% to 507 koz, primarily due to a swing from negative to positive investment demand in Japan, but also due to improved product availability in North America and Europe. ETF disinvestment is expected to continue, but at a much lower rate than in 2022, while further significant exchange stock outflows are not expected to occur. In aggregate, investment demand is expected to total 212 koz, a 737 koz positive increase in demand from 2022.

The net impact is for the platinum market to move into a deficit of 303 koz in 2023, a change of more than 1.1 Moz from the projected 2022 surplus.

Annual platinum supply/demand balances



Source: Metals Focus

## The platinum investment case – a compelling investment opportunity in the current climate

Since the last *Platinum Quarterly* in September, we have seen continued moves by central banks trying to dampen inflation by raising interest rates; so far with little effect. Employment remains high, and although the growth of the rate of inflation has generally slowed, this is more to do with oil and gas prices pulling back from recent highs, which will likely be temporary. The economic outlook remains highly uncertain, with significant regional variations. Europe continues to look particularly vulnerable to economic shocks, especially on the energy front, despite successes in filling natural gas storage facilities, and China’s dogmatic zero-COVID strategy may leave it increasingly vulnerable to economic headwinds if not eased soon.

The outlook for many investable assets is therefore dominated by the challenging economic outlook, high inflation, and rising interest rates. Platinum is by no means immune to these challenges, but it is in a relatively unique position in the commodity space in that supply is both highly concentrated and constrained, and platinum demand is either already below recessionary levels, and unlikely to fall further (automotive demand), or is relatively well protected from recessionary downside risks (bar and coin and industrial demand). Given this, the swing from two years of significant surpluses into a deficit appears to be relatively defensible despite the prevailing economic environment.

In terms of risking the outlook, supply is only likely to be more challenged by inflationary and economic headwinds, whilst automotive production remains capped below recessionary demand levels, and industrial demand is influenced more by multi-year capacity addition decisions rather than short-term demand fluctuations. The areas with the greatest downside risks are jewellery and investment demand. With an erosion of consumer purchasing power, it is difficult to argue for anything other than an asymmetric risk to the downside for jewellery demand if the global economic outlook worsens from the one already baked into the forecasts. Investment demand is more nuanced; bar and coin demand is likely to prove relatively recession proof as investors look to platinum as a hard asset and a store of value, and exchange stocks are really at, or close to, minimum levels. On the other hand, rising real rates due to central bank efforts to suppress inflation could maintain downward pressure on ETF holdings over and above the 275 koz of disinvestment in the 2023 outlook.

A likely question is whether the platinum price will respond to the market moving into a deficit, or whether the significant surpluses of 2021 and 2022 will quench market expectations by offsetting any deficits that emerge over the next few years. Addressing this point, it is important to remember that the recent platinum surpluses were heavily influenced by investment flows with material being drawn from visible inventories (ETFs and exchange stocks), and, according to customs data, flowing to China. Or at least, China's imports in excess of identified demand broadly match, or even exceed, the platinum market surpluses estimated for 2021 and forecast in 2022. And, without the flows of this metal, which reflect as negative investment demand, the market would be broadly balanced. The second thing to highlight is that regulations in China make it challenging and expensive to export platinum once it is in country, effectively meaning that any inventories accumulated in China are captive there and are no longer available to satisfy demand in excess of supply in the rest of the world. Whilst inventories in China may well be released to meet domestic demand requirements, a similar situation with palladium occurred in the 2010's and the quasi-speculative inventories in China were only released after a significant increase – more than a doubling – in the price of palladium. Thus, it seems likely that only a massive increase in the platinum price would release any quasi-speculative inventories being accumulated in China today.

Summarising this, the near-term investment case for platinum being a market moving quickly from surpluses into deficit appears compelling and relatively recession proof, especially as it would appear that above ground inventories outside of ETFs now appear to be relatively unavailable to the broader market and geographically constrained to China.

The longer term prospects for platinum also appear to be attractive. Mine supply may grow slightly in the medium to longer term, and recycling supply should improve as automotive production capacity normalises. On the demand side, automotive platinum for palladium substitution looks set to continue beyond 2023, which is likely to offset the gradual decline in ICE market share going forwards. Added to which, industrial demand appears set to continue to deliver the 4% CAGR increase seen since 2013. The only areas of demand that may be more challenged longer-term are jewellery, which has declined by 4% per annum since 2013, and investment if ETF outflows continue. At the same time, there are not many established commodities that offer the prospect of significant growth in demand from a new end-segment; in platinum's case the hydrogen economy. The need to decarbonise the world is more acute than ever and hydrogen produced in platinum-containing electrolyzers and used to displace natural gas, or as an energy source in fuel cell electric vehicles, should have a significant role to play in the energy transition. Whilst hydrogen related demand for platinum is relatively small in 2022 and 2023, it is expected to grow substantially through the 2020's and beyond, and could reach as much as 35% of total platinum demand by 2040.

In conclusion, the supply/demand dynamics for platinum are quickly moving into positive territory as we move into 2023. Based upon currently available information, it seems probable that many of the trends that are expected to push the platinum market into deficit in 2023 could well continue into the medium and longer-term.

### WPIC initiatives highlights

Writing this during COP 27, it is apparent that the importance of green hydrogen for decarbonising the world, and platinum's role in the production and use of green hydrogen, have never been of greater importance. Although hydrogen-linked demand for platinum is relatively small at this point in time, is expected to grow meaningfully through the rest of the 2020's. Added to which, small changes in demand from a new end source of demand, could have a meaningful impact on market dynamics as platinum moves into a deficit despite the challenging economic environment, which is unusual in and of itself. We expect both the platinum market deficit and platinum's role as a lone proxy for exposure to hydrogen (outside of the equity markets) to continue to attract investor interest, and we remain committed to working with our partners to support both the availability and awareness of platinum investment products worldwide.

The continued investor interest in platinum bar and coin experienced during these last two years has given additional impetus to our partnership initiatives and we are pleased with their progress in 2022. For example, in Q3 in North America, APMEX, launched its own branded platinum bars as an addition to its precious metals offering. We were also pleased to be able to continue supporting SD Bullion with its platinum "Tree of Life" and "Roaring Lion" coins, as well as The East India Company platinum Victory coins, distributed by A-Mark Precious Metals. Despite lower volumes in Q3, demand for physical bars and coins continues to show signs of good health and we remain optimistic for Q4.

In China, our product partners, Jin Zheng Long and Bai De Jin, picked up momentum in Q3, recording their highest single quarterly sales since 2017. This was helped in particular by attractive platinum prices in July, as well as other investment assets performing poorly, and also by the improving outlook for the platinum market. Similarly, Japanese partners also performed well in Q3, turning our Japanese product partnership portfolio into a net inflow, as investors took advantage of the platinum price dip. We also made good progress in both ASEAN and Korean market development by leveraging local partners to distribute our research insights to local investors.

We published our last *Platinum Quarterly* as Shanghai Platinum Week 2022 had just got underway, which continued the great success from last year, and included the China PGMs Market Summit as well as two satellite events. Although COVID controls in China made attending the conference challenging, even for those based in China, the attendance numbers were exceptionally strong. The event received strong support from many world-renowned organizations in the PGMs value chain and attracted more than 250 in-person delegates plus tens of thousands of attendees online. Whilst the huge interest in Shanghai Platinum Week was rather breath-taking, perhaps it should not be a great surprise in the context of the ongoing significant imports of platinum into China, well in excess of identified demand.

Announced just before Shanghai Platinum Week, WPIC was delighted to join the Lin-Gang PGMs Centre project, led by the Shanghai Lin-Gang Group. The aims are to promote PGM applications in technology, improve the Chinese platinum market infrastructure, and to strengthen the investment case for platinum.

**Trevor Raymond, CEO**

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# PLATINUM QUARTERLY Q3 2022

**Table 1: Supply, demand and above ground stocks summary**

	2019	2020	2021	2022f	2023f	2022f/2021 Growth %	2023f/2022f Growth %	Q2 2022	Q3 2022
<b>Platinum Supply-demand Balance (koz)</b>									
<b>SUPPLY</b>									
<b>Refined Production</b>	<b>6,075</b>	<b>4,989</b>	<b>6,297</b>	<b>5,643</b>	<b>5,726</b>	<b>-10%</b>	<b>1%</b>	<b>1,530</b>	<b>1,401</b>
South Africa	4,374	3,298	4,678	4,012	4,047	-14%	1%	1,128	986
Zimbabwe	458	448	485	478	502	-1%	5%	124	118
North America	356	337	273	269	319	-2%	19%	65	66
Russia	716	704	652	678	654	4%	-4%	161	179
Other	170	202	208	205	205	-1%	0%	52	52
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+2</b>	<b>-84</b>	<b>-93</b>	<b>-5</b>	<b>+0</b>	<b>N/A</b>	<b>N/A</b>	<b>-2</b>	<b>-43</b>
<b>Total Mining Supply</b>	<b>6,077</b>	<b>4,906</b>	<b>6,204</b>	<b>5,637</b>	<b>5,726</b>	<b>-9%</b>	<b>2%</b>	<b>1,528</b>	<b>1,357</b>
<b>Recycling</b>	<b>2,134</b>	<b>1,930</b>	<b>1,937</b>	<b>1,669</b>	<b>1,740</b>	<b>-14%</b>	<b>4%</b>	<b>439</b>	<b>391</b>
Autocatalyst	1,589	1,442	1,448	1,228	1,289	-15%	5%	330	285
Jewellery	476	422	422	372	382	-12%	3%	92	90
Industrial	69	66	67	68	69	3%	2%	17	17
<b>Total Supply</b>	<b>8,211</b>	<b>6,835</b>	<b>8,141</b>	<b>7,306</b>	<b>7,466</b>	<b>-10%</b>	<b>2%</b>	<b>1,967</b>	<b>1,748</b>
<b>DEMAND</b>									
<b>Automotive</b>	<b>2,867</b>	<b>2,402</b>	<b>2,635</b>	<b>2,964</b>	<b>3,288</b>	<b>12%</b>	<b>11%</b>	<b>712</b>	<b>723</b>
Autocatalyst	2,867	2,402	2,635	2,964	3,288	12%	11%	712	723
Non-road	†	†	†	†	†	†	†	†	†
<b>Jewellery</b>	<b>2,106</b>	<b>1,830</b>	<b>1,953</b>	<b>1,953</b>	<b>1,954</b>	<b>0%</b>	<b>0%</b>	<b>496</b>	<b>482</b>
<b>Industrial</b>	<b>2,137</b>	<b>2,098</b>	<b>2,450</b>	<b>2,110</b>	<b>2,316</b>	<b>-14%</b>	<b>10%</b>	<b>565</b>	<b>553</b>
Chemical	679	693	658	627	666	-5%	6%	167	174
Petroleum	219	109	172	200	180	17%	-10%	50	51
Electrical	144	130	135	110	107	-19%	-3%	27	26
Glass	236	407	697	316	481	-55%	52%	101	92
Medical and Biomedical	277	256	267	276	283	3%	3%	70	69
Other	582	502	522	581	599	11%	3%	150	141
<b>Investment</b>	<b>1,237</b>	<b>1,544</b>	<b>-45</b>	<b>-525</b>	<b>212</b>	<b>N/A</b>	<b>N/A</b>	<b>-137</b>	<b>-272</b>
Change in Bars, Coins	266	578	332	340	507	2%	49%	75	97
Change in ETF Holdings	991	507	-238	-550	-275	N/A	N/A	-89	-235
Change in Stocks Held by Exchanges	-20	458	-139	-315	-20	N/A	N/A	-123	-134
<b>Total Demand</b>	<b>8,347</b>	<b>7,874</b>	<b>6,993</b>	<b>6,502</b>	<b>7,770</b>	<b>-7%</b>	<b>19%</b>	<b>1,636</b>	<b>1,485</b>
<b>Balance</b>	<b>-136</b>	<b>-1,039</b>	<b>1,147</b>	<b>804</b>	<b>-303</b>	<b>-30%</b>	<b>N/A</b>	<b>331</b>	<b>263</b>
<b>Above Ground Stocks</b>	<b>3,514**</b>	<b>2,476</b>	<b>3,623</b>	<b>4,426</b>	<b>4,123</b>	<b>22%</b>	<b>-7%</b>		

Source: Metals Focus 2019 - 2023.

Notes:

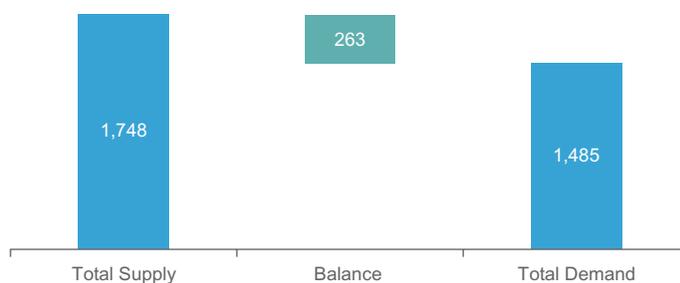
- \*\*Above Ground Stocks 3,650 koz as of 31 December 2018 (Metals Focus).
- † Non-road automotive demand is included in autocatalyst demand.
- All estimates are based on the latest available information, but they are subject to revision in subsequent quarterly reports.
- The WPIC did not publish quarterly estimates for 2013 or the first two quarters of 2014. However, quarterly estimates from Q3 2014, to Q4 2017 are contained in previously published PQs which are freely available on the WPIC website.
- Quarterly estimates from Q2 2018 and half-yearly estimates from H1 2018 are included in Tables 3 and 4 respectively, on pages 22 and 23 (supply, demand and above ground stocks). Details of regional recycling supply in Table 6 on page 25 are only published from 2019.

## 2022 THIRD QUARTER PLATINUM MARKET REVIEW

The macroeconomic backdrop and principal drivers of the global economy that dominated the first half of 2022 persisted throughout Q3'22. We are in the 10<sup>th</sup> month of the Russia-Ukraine conflict with no resolution, while the fight against inflation remains a priority for central banks. In spite of attempts to mitigate the war-inflicted energy crisis, oil and gas prices remain historically high (despite their recent easing). This continues to weigh on consumer spending as well as industrial output. In spite of these headwinds, platinum demand has been relatively resilient, aided by an ongoing post-pandemic recovery and, in the autocatalyst sector, higher platinum loadings. At 1,485 koz, total demand for the quarter saw a marked improvement on a severely impacted Q3'21, up 12% (+160 koz). Increased availability of semiconductor chips saw automotive demand grow 25% (+143 koz), industrial demand held firm, adding 10 koz (+2%), and jewellery demand edged slightly lower to 482 koz (down 1%, -3 koz). While bar and coin purchases improved against Q2'22 (+22 koz), they were 12% (-13 koz) weaker than Q3'21. Further outflows from exchange warehouse stocks, combined with ETF liquidations of -235 koz, resulted in net disinvestment for Q3 of 272 koz.

It is worth commenting on Chinese imports during the period again, as these remained strong and in excess of our estimates of local physical demand. Once again, we believe that stock-building, particularly in July to take advantage of attractive prices, is taking place. This is likely attracting metal away from Western vaults, including those in London, Switzerland and New York. Turning to supply, both mine production and recycling struggled in the quarter. Mine supply declined 171 koz to 1,357koz, due mostly to maintenance and power supply challenges in South Africa, which could not be offset by improvements elsewhere. Recycling also struggled as scrap yard inventories of spent autocatalysts remained low, while the softer price disincentivised jewellery recycling. As a result, the market surplus contracted by 60% against Q3'21 to 263 koz and was 21% lower than in Q2'22.

**Chart 1: Supply-demand balance, koz, Q3 2022**



Source: Metals Focus

### Supply

Refined platinum production declined 11% (-171 koz) year-on-year to 1,401 koz as weaker South African production offset increases elsewhere. Production from the world's number-one producer, South Africa, fell 18% (-215 koz) year-on-year to 986 koz. A decline was expected due to planned maintenance at Anglo-American Platinum's Polokwane smelter. The volumes in Q3'21 were also boosted by the release of semi-finished inventory (accumulated due to the Anglo Converter Plant outage). However, the magnitude of the drop exceeded expectations, primarily due to the impact of power outages. Eskom, the national electricity provider, experienced an all-time low during the quarter, with power curtailment during the period exceeding Q2'22, the previous worst quarter, by 140%. While output from the entire production chain (mining, concentrating, smelting and refining) was affected, smelter availability was most impacted, with mining companies reporting some build-up of semi-processed inventory.

Russian production rose 17% year-on-year (+26 koz) for the quarter, due to the processing of semi-finished inventory and as output recovered from the mine flooding at Nor Nickel last year. Zimbabwe production edged up 2% as increased output from the Unki concentrator debottlenecking project offset lower volumes from Zimplats, resulting from a scheduled furnace relining.

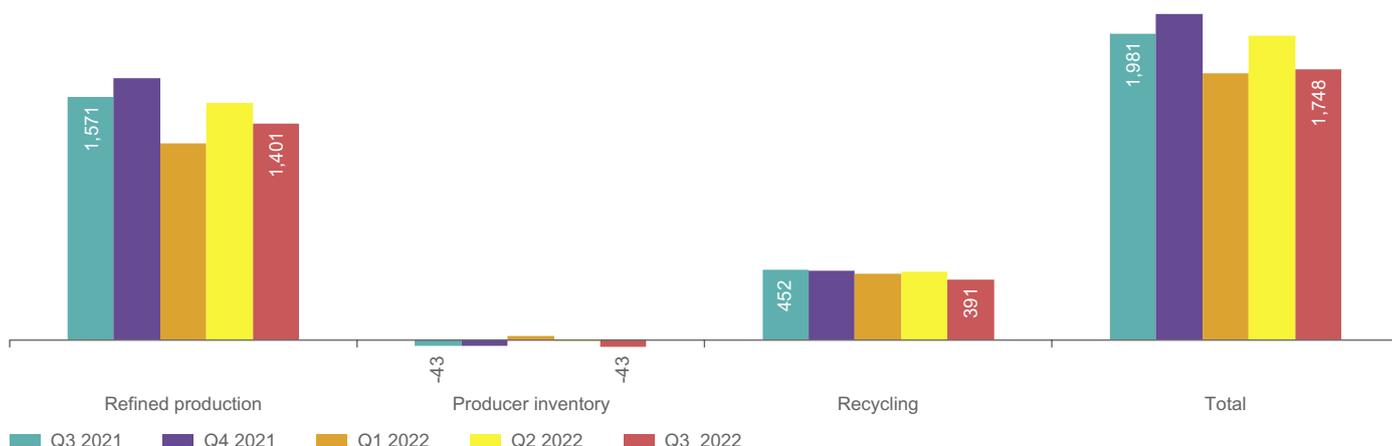
North American output increased 31% (+16 koz) year-on-year as declines from the US were offset by increased output from Canada. US production declined as a result of the continued effects of the flooding in June, which impacted the Stillwater mine. A strike at Glencore’s nickel operations affected the quarter, but this was offset by increased output from Vale’s Sudbury operations which recovered from last year’s strike.

## Recycling

Global recycling struggled, declining to 391 koz (-61 koz year-on-year), its lowest since a pandemic-affected Q2’20. The recovery of platinum from spent autocatalysts was down 14% (-47 koz) compared with the previous quarter. The lack of semiconductor chips has reduced the availability of new vehicles resulting in existing cars being driven for longer. Although the shortage is no longer acute, this impact on light vehicle production continues to affect the availability of end-of-life vehicles. Meanwhile, COVID-induced constraints on travel have seen annual mileage drop between 15–25% in some countries. This has led to consumers delaying new model purchases, resulting in a rise in the average age of the vehicle parc.

Platinum jewellery recycling declined by 14% year-on-year in Q3’22 to 90 koz. The weakness is a consequence of shrinking platinum jewellery appetite in the Chinese market, the primary source of jewellery recycling, and a weaker price during the quarter. Recovery of platinum from electronic waste during Q3’22 remained steady.

Chart 2: Platinum supply, koz

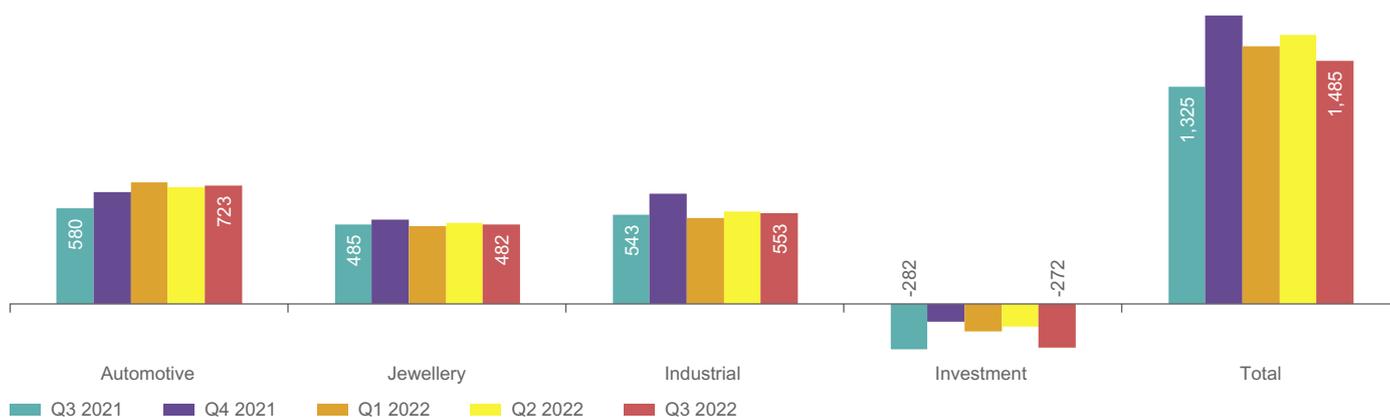


Source: Metals Focus

## Demand

Total demand in Q3’22, flattered by the weakness in Q3’21, improved 12% (+160 koz) but was still down 9% on Q2’22. The automotive industry recorded a healthy recovery from the chip-impaired lows of Q3’21, rising by 143 koz year-on-year, while industrial demand remained broadly steady, improving by 2% on Q3’21. Jewellery demand registered a modest decline in Q3’22 as western markets and Japan could not offset further losses in China. Meanwhile, ETF liquidations and exchange stock outflows persisted during the quarter. Finally, while bar and coin investment improved 29% on Q2’22, limitations in available production capacity saw demand decline 12% (-13 koz) against Q3’21.

Chart 3: Platinum demand, koz



Source: Metals Focus

### Automotive demand

Total automotive platinum demand in Q3'22 increased by 25% (+143 koz) as light-duty vehicle (LDV) production increased by 27% on a very weak Q3'21 and heavy-duty vehicle (HDV) manufacturing improved modestly, growing by 3%. Regionally, while the effect of the Russian invasion of Ukraine continued to restrict European production, resulting in a 12% decline against Q2'22, output there improved by 27% year-on-year. In all other regions, LDV production rose, both year-on-year and quarter-on-quarter. Improved production resulted from easing supply chain challenges, healthy order books (despite looming cost of living challenges) and inventory replenishment.

In China, the purchase tax cut on new vehicle incentives and fewer COVID-induced lockdowns further boosted Q3'22 production. In addition to growth in vehicle numbers boosting platinum demand during the quarter, the 50% year-on-year increase in hybrid vehicle production, often with heavier PGM loadings than standard internal combustion engines (ICE) to address the low exhaust temperatures during stop-start cycles, further supported platinum demand. In the HDV segment, weak production in China overshadowed healthy growth in other regions. Despite the overall modest increase in production, platinum demand in on-road HDV catalysts rose by 29% year-on-year, as newly produced HDVs in China and India now boast stringent China VI and Bharat 6 emission-compliant after-treatment systems respectively, with significantly higher platinum loadings.

### Jewellery demand

The 1% decline in global jewellery demand reflected a weak Chinese performance that was almost offset by widespread gains elsewhere.

European fabrication rose strongly year-on-year, but results were mixed. Those producing for the mainstream and bridal markets saw growth essentially stop, while those producing for the top-end of the market still enjoyed strength (as a guide, Swiss platinum watch hallmarking was up 36% year-on-year). North American demand dipped marginally, which primarily reflects particularly strong demand in the comparable Q3'21 quarter. Even so, North American jewellery demand in Q3'22 was still up by close to a third on Q3'19 thanks to drivers such as price differentials and retailer support. Postponed weddings and behavioural shifts have also seen seasonal patterns shift as September has become more popular for weddings (as opposed to the traditional May/June period).

Platinum jewellery demand in China posted another hefty decline. While the easing of lockdowns and pent-up demand benefited jewellery demand as a whole, consumers continued to prefer gold ahead of platinum jewellery. In large part this relates to gold's stronger acceptance as a quasi-investment jewellery metal in China, which is in turn mainly due to the smaller losses incurred when one is selling back old pieces. (Effectively, a tighter buy:sell spread, to bring the concept closer to a traditional investment asset.) Fashion trends are also benefitting gold, both generally and due to the popularity of traditional Chinese culturally-influenced designs, which are deemed to appeal more in yellow, and are particularly popular among consumers these days. In late August, a resurgence of COVID cases resulted in a general slump in the jewellery market as pandemic controls tightened and impaired consumer sentiment.

Japan also achieved a healthy quarterly increase in jewellery demand, comfortably exceeding our expectations. After having struggled to recover to pre-pandemic levels, demand has sprung back to life. Local retail sales and inventory replenishment are the key drivers of this acceleration, although we also saw very strong gains in exports during the quarter, across most of Japan's key trading partners for platinum jewellery. Our contacts suggest that TV channel sales remain healthy, although bricks and mortar sales are also starting to pick up. Clearly the continued transition towards post-pandemic normality has underpinned demand and it is likely that a resumption of weddings has also helped.

Indian platinum jewellery fabrication jumped 60% year-on-year. Fabrication is now 70% above pre-pandemic (or Q3'19) levels, helped by the growing penetration of platinum jewellery. Furthermore, growing awareness and popularity of men's platinum jewellery, which is relatively heavier in weight, has helped fabrication.

### **Industrial demand**

Industrial demand improved only 2% year-on-year (+10 koz) as this year there are fewer capacity expansions in glass, and demand for electronic goods have fallen sharply.

### **Chemical**

Platinum chemical offtake rose by 4% (+7 koz) quarter-on-quarter to 174 koz in Q3'22; it also grew 8% year-on-year. Strong paraxylene (PX) capacity additions in China represent the bulk of the overall increase. Inter Pipeline's on-streaming of a new propane dehydrogenation (PDH) plant in Canada also added to the quarter-on-quarter increase. Conversely, platinum demand in the silicone industry began to slip in Q3'22 as high input costs and planned maintenance lifted silicone prices and weighed on demand. The nitric acid industry (a component of fertiliser demand) is under pressure from high gas prices, as well as reduced Russian gas supply, despite the latter not being directly sanctioned. These high prices, although somewhat limiting production, are now having a significant impact on demand for fertiliser, driving farmers to be more sparing with its use.

### **Petroleum**

Platinum demand remained flat against Q2'22, but rose 29% (+11 koz) year-on-year to 51 koz in Q3'22. While higher prices weighed on oil demand, growing use in power generation, on the back of high gas prices, has supported platinum demand in this sector.

### **Medical**

Platinum demand from medical devices remained strong in Q3'22 as the industry continued to tackle the COVID-induced backlog. As such, platinum demand rose by 4% (+3 koz) in Q3'22 compared to Q3'21.

### **Glass**

The 18% year-on-year decline in platinum demand from the glass industry was mainly the result of fewer notable additions to fiberglass capacity during the quarter. The general picture of demand remaining low through 2022 remains in place, following last year's substantial investments. At 92 koz, Q3'22 demand was almost half of last year's quarterly average.

### **Electrical**

Electrical demand slumped by 26% (-9 koz) year-on-year, affected by hard disk drive (HDD) shipments falling to historically low levels. In the context of high inflation and interest rate hikes, the sharp reduction in disposable income has hit consumer electronics sales. In addition, the gloomy economic outlook has affected capital expenditure budgets resulting in lower demand for nearline storage and data center construction. In addition, the current over-supply of NAND flash memory used in solid state drive (SSD) solutions have seen prices topple, which has seen non-PGM based SSDs gain market share from platinum consuming HDDs.

## Other

Other industrial demand rose by 9% (+12 koz) year-on-year in Q3'22. The improvement reflects increased vehicle production leading to firmer spark plug and sensor demand. Growth in the hydrogen electrolyser and stationary fuel cell markets, as countries seek to improve low-carbon energy self-sufficiency, also supported platinum demand growth, albeit from a very small base.

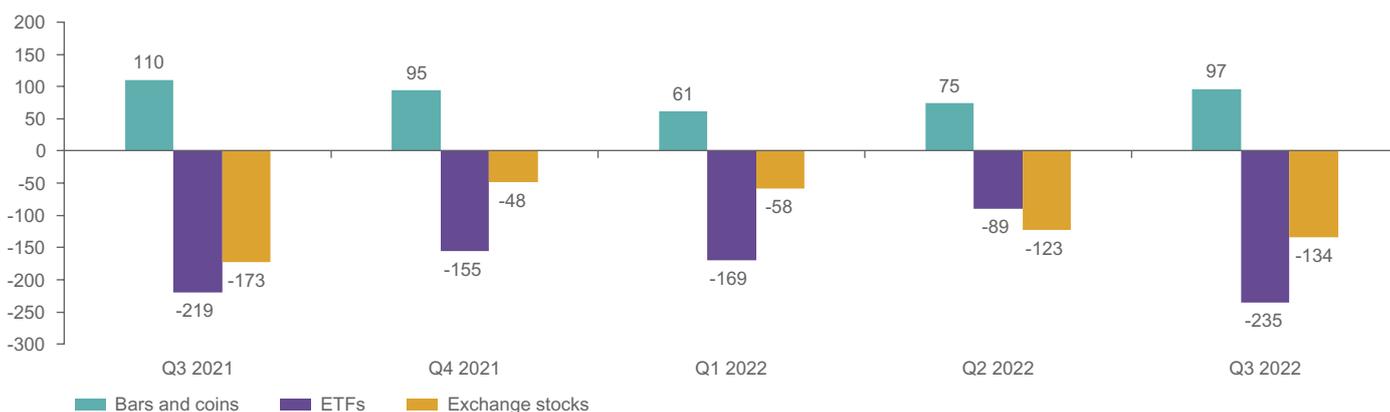
## Investment demand

Global bar and coin demand in Q3'22 fell 12% year-on-year (-13 koz) to 97 koz. That said, the total was still 29% (+22 koz) up on the previous quarter. From a regional standpoint, precious metals bar and coin demand in both North America and Europe remained strong, especially towards end-quarter, which in turn meant that product delivery lead times remained extended, as they have for much of this year. A continued headwind for satisfying demand is that investment products' manufacturing capacity continues to be focused on the much higher volume gold and silver markets, at the expense of platinum. After seeing disinvestment for the first six months of the year, Japanese retail investment once again turned positive in Q3'22, although at a net 15 koz the absolute volume was modest. The relative stability of the local platinum price over the quarter, and its failure to return to earlier highs when it did rally, capped sales and there were some spurts of bargain hunting following price corrections. All this helped the overall total move into positive territory again.

ETFs over the last quarter registered the second largest quarterly outflow in the series, totalling 235 koz, around half of which were declines in North American funds.

NYMEX and TOCOM warehouse stocks also continued to see outflows, incentivised by a degree of tightness in the physical market and exchange of futures for physical (EFP) discounts, which have led to 134 koz leaving the exchanges over the last quarter. As of end-September, NYMEX warehouse inventories totalled 184 koz, similar to pre-pandemic levels (where, due to a pandemic-induced dislocation of material, NYMEX stocks reached a peak of 718 koz in July 2021).

**Chart 4: Platinum Investment, koz**

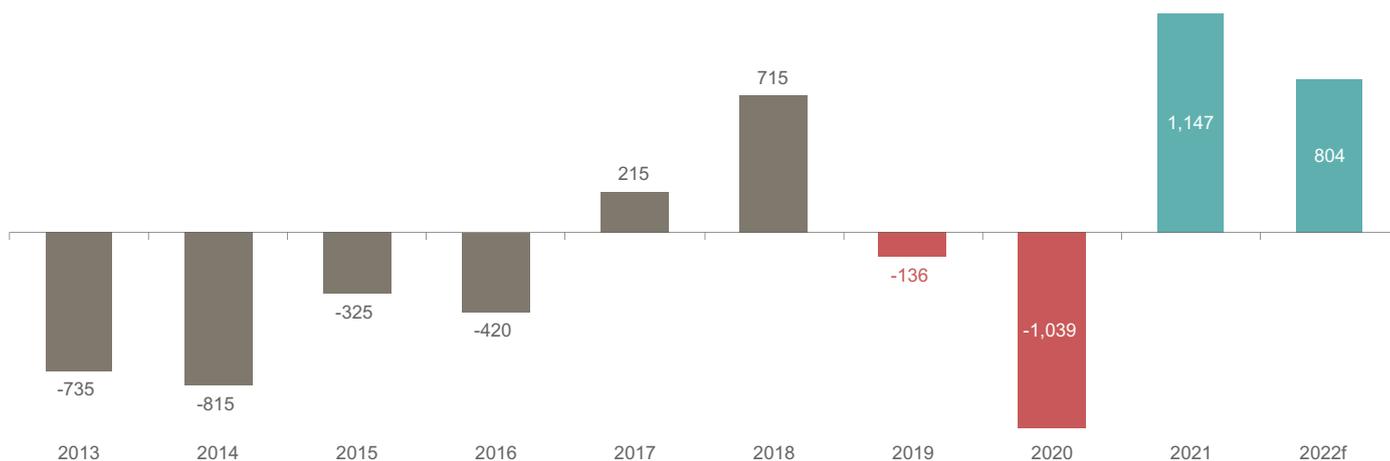


Source: Metals Focus

## 2022 OUTLOOK

While the International Monetary Fund has not revised its forecast global economic growth rate for 2022 down further since the previous *Platinum Quarterly* (remaining at 3.2%), inflation increases and the slowdown in economic activity have been sharper than expected. Even so, automotive platinum demand is expected to maintain current projections increasing by 12% to reach 2,964 koz, although this is still well below pre-COVID levels. Conversely, due to fewer capacity expansions expected in glass, industrial demand is set to decline by 14% to 2,110 koz, albeit remaining at historically elevated levels after the record demand seen in 2021. Jewellery demand is forecast to remain unchanged at 1,953 koz, with growth in Europe, North America, India and Japan countering weakness in jewellery’s mainstay market – China. For the full-year, we forecast disinvestment of around 525 koz comprising of 550 koz of net outflows from ETFs and 315 koz of outflows from exchange warehouse stocks. Bar and coin investment is forecast to increase by 2% in 2022 to 340 koz. With operating environments beyond miners control becoming increasingly challenging, mine supply is forecast to decline 9% (-567 koz). Similarly, the shortage of end-of-life vehicles weighs on the outlook for recycled ounces which is expected to decline by 14% (-268 koz). Despite weaker supply, and largely flat industrial demand, the impact of investment behaviour will see the market remain in a surplus of 804 koz this year.

Chart 5: Supply-demand balance, koz, 2013-2022f



Source: Metals Focus

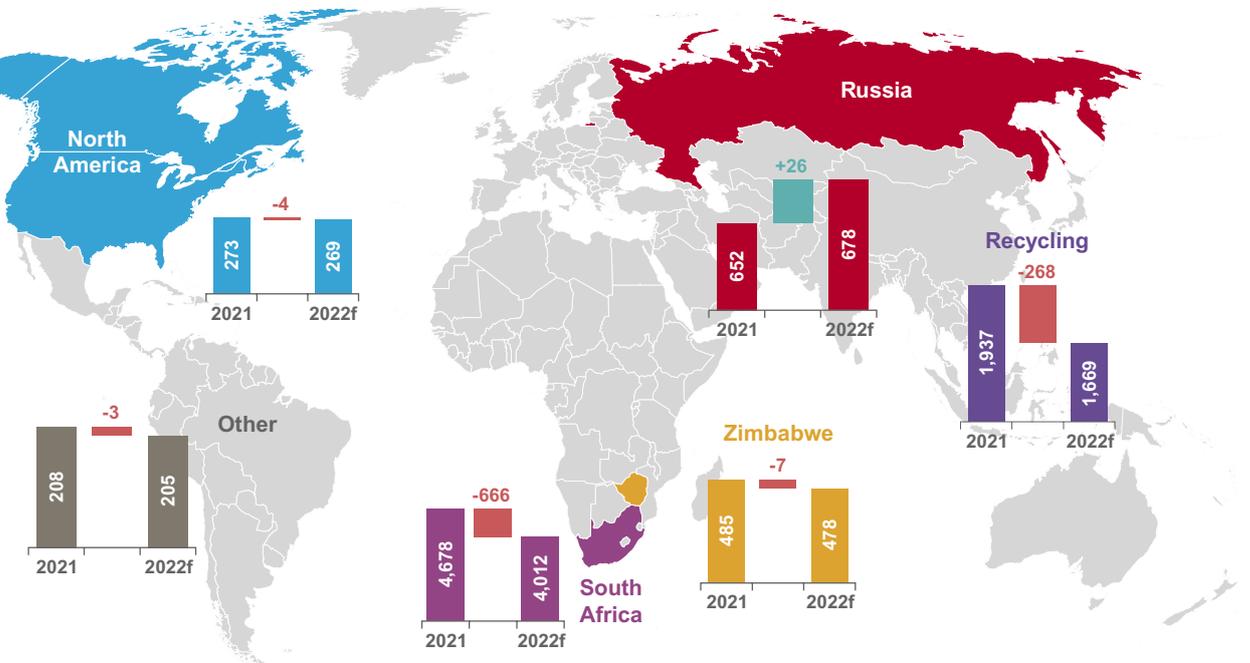
## Supply

This edition of *Platinum Quarterly* represents the third consecutive downward revision to the 2022 supply outlook, as a challenging operating environment and procurement constraints continue to weigh on South African output. Two producers lowered their guided production outlook during the quarter. Most significantly, Anglo American Platinum reduced its 2022 outlook by an additional 190 koz, a result of the delivery of sub-standard materials from the Polokwane smelter rebuild, which will, as a consequence, be delayed by two months. The smelter represents around half of Anglo American Platinum’s smelting capacity which in turn processes around 40% of total South African platinum mine supply. The final 2022 mine production total will be dictated by the exact timing of the smelter restart. The latest downward revision indicates an expected cumulative 280 koz shortfall against initial guidance at the start of the year.

Eskom load shedding continues to present a significant headwind, with the frequency and severity of power outages reaching unprecedented levels. Year-to-date outages have increased by 189% against 2021 which was the previous worst year. In addition, poor safety performances continue to impact production with two major stoppages reported in the period. Mining companies report increasing socio-economic pressures in the country contributing to increased community protests. While unprotected industrial action by contractors at Implala Rustenburg disrupted operations, the signing of a five-year wage agreement between AMCU and Sibanye-Stillwater finalised the last remaining outstanding deal in the current round of negotiations and should bring stability to permanent workforce labour relations.

Global platinum mine supply in 2022 is forecast to decline by 9% (-567 koz) year-on-year to 5,637 koz. South Africa represents the bulk of the decline, and is forecast to fall 14% year-on-year to 4,012 koz, due to the depletion of Anglo American Platinum semi-finished inventory that boosted refined volumes in 2021, in addition to constrained smelter availability and mine site disruption. While underlying mine capacity has increased in Zimbabwe the processing of a backlog of semi-finished inventory through South African refineries last year means refined output is expected to remain essentially unchanged. Despite logistical constraints and procurement challenges Russian production continues to achieve planned volumes, with full-year production expected to increase 4% (+26 koz) year-on-year to 678 koz. North America has experienced a turbulent year, with labour constraints, a strike at Glencore’s operations and a flood at the Stillwater mine weighing on output. However, volumes are expected to remain near flat year-on-year, at 269 koz, as 2021 output was also disrupted by a strike at Vale’s Sudbury operations.

**Chart 6: Changes in supply, 2021 vs. 2022f**  
koz



Source: Metals Focus

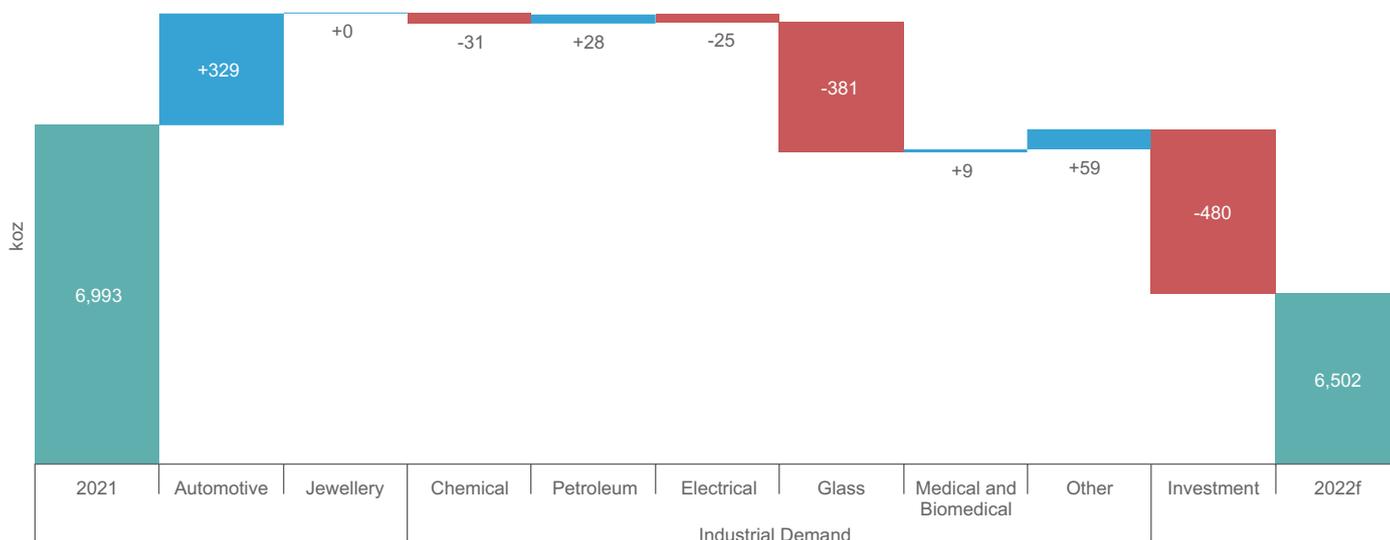
**Recycling**

Global recycling will decline by 14% this year. Automotive recycling in 2022 is expected to fall by 15% (-220 koz) to a six-year low of 1,228 koz. The losses will be concentrated in North America and Europe. Even though automotive demand is gradually improving, weaker production volumes over the past two years have weighed on the availability of end-of-life vehicles this year. In addition, the cost-of-living crisis and its impact on disposable incomes is encouraging consumers to delay purchasing a new vehicle with older models at the end of their ownership chain remaining in use for longer than they otherwise would. Jewellery recycling will be down 12% (-50 koz) as the 22% decline in China offsets increases elsewhere. Recycling from electronic waste is expected to remain steady, growing by 3% (2 koz).

**Demand**

Expected outflows in ETFs and warehouse stocks of 865 koz will be partially offset by 340 koz of bar and coin demand to bring net disinvestment to 525 koz for the year. Automotive demand is expected to increase by 12% (+329 koz) to 2,964 koz while industrial demand will decline by 14% (-341 koz) off the back of fewer capacity expansions and weaker electronics demand. Jewellery demand is expected to be flat year-on-year at 1,953 koz.

Chart 7: Changes in demand by category, 2021 vs. 2022f



Source: Metals Focus

## Automotive demand

Despite rising cost of living concerns and expectations that the global energy crisis will weigh on automotive growth prospects, production remains relatively healthy as low inventories and full order books support the potential for even higher output than is currently seen. LMC Automotive, a GlobalData Company, forecast light-duty vehicle (LDV) production to increase to 82.3M units in 2022, up 7% on 2021. In contrast, heavy-duty vehicle (HDV) production will contract by 15% this year, falling just below 3M units. A combination of higher passenger vehicle numbers, tighter emissions legislation for HDVs in China and India, as well as growing substitution of palladium with platinum compared to last year, support the 12% (+329 koz) increase expected for platinum demand this year. Platinum demand in all regions, excluding Japan, is expected to increase in 2022, as the impact of the chip shortage gradually and partially eases. Even European demand, despite the weakness in automotive production caused by the Russian invasion of Ukraine and supply chain challenges, will see modest gains in platinum demand, as the production of hybrid vehicles jumps 27% year-on-year, and even though diesel LDV production has continued to slip lower.

In North America, demand will increase by 18% as production of LDV ICE vehicles improves by 9% and HDV production, while off a small base, increases by 6%. In China, while LDV production will benefit from the tax incentive introduced in June, HDV production will be down by as much as 43%. Despite the decline in units, platinum demand will grow 35% due the tighter emissions legislation in the form of China VIa, combined with higher platinum to palladium ratios in aftertreatment systems. For 2022, we expect that substitution of palladium with platinum will reach around 360 koz, almost double our estimate for 2021.

## Jewellery demand

Global jewellery demand is expected to remain broadly unchanged at 1,953 koz in 2022. Stronger demand in western markets, as well as India and Japan, will fail to compensate for weaker interest in platinum jewellery in China.

We forecast Chinese platinum jewellery will fall by 24% to a historical low of 535 koz in 2022. Our field research revealed that sales during the National Day Holiday (1<sup>st</sup> – 7<sup>th</sup> October) were worse than expected. Moreover, stricter pandemic prevention measures and impaired consumer sentiment are likely to remain unchanged in the short-term. Meanwhile, the fourth quarter is traditionally a peak season for gold jewellery.

European fabrication's full-year is estimated to slow from Q1 – Q3's +21% to +15% as the temporary uplift from postponed weddings dwindles and the cost-of-living crisis undermines demand for bridal and mainstream jewellery. Current feedback, however, points to the high-end continuing to "defy gravity", with ongoing gains expected in Q4.

North American demand is expected to slow from H1's +25% to +11% for the full year as Q4'22 suffers from ongoing expenditure shifts to services plus high inflation despite dollar strength, which will result in lower demand in the quarter, dampening the full-year performance.

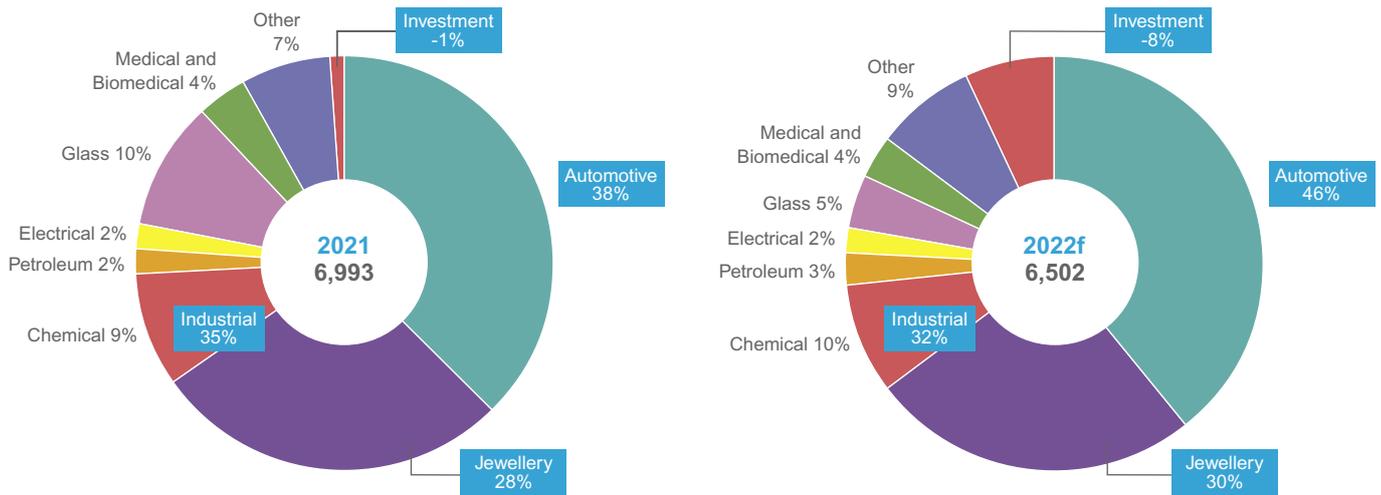
The healthy gains seen during the first half of 2022 and optimism among our contacts within the local jewellery industry have given us confidence to revise our 2022 forecast for Japanese jewellery demand. In addition to decent sales at the retail end, strong exports and, to a lesser extent, an increase in the average platinum purity, are also offering some support. Demand would have been even higher, in our view, if borders had opened to tourists earlier, something that points to further gains in the foreseeable future.

In India, full year demand is expected to grow by almost one-third as positive consumer sentiment, rising disposal incomes and interest in bi-metal jewellery products grow.

**Industrial demand**

Industrial demand in 2022 is forecast to decline by 14% (-341 koz) as fewer glass plant capacity expansions and lower demand for consumer electronics offset growth in other areas.

**Chart 8: Demand end-use shares, 2021 vs. 2022f**



Source: Metals Focus

**Petroleum**

Petroleum demand is expected to rise 17% (+28 koz) year-on-year in 2022 to 200 koz. This growth is largely on the back of a low base and will bring demand back closer to pre-pandemic levels. The IEA warns of continued deceleration due to demand weakness, although some switching from gas to oil, due to higher gas prices, will offset some of the slowdown.

**Chemical**

Platinum demand is expected to decline by 5% (-31 koz) year-on-year in 2022 to 627 koz, its lowest level since 2018. Except for China, all regions will see year-on-year growth, highlighting how vital China is for platinum chemicals demand – making up one-third of the market in 2021. Most losses are due to slowing Chinese capacity expansions in the paraxylene (PX) and, to a lesser extent, propane dehydrogenation markets. This development is quite natural, after several years of double-digit growth, and a shift of economic focus with the Chinese government's latest five-year plan. Platinum demand in silicone products is expected to grow year-on-year in 2022 as the world recovers from the pandemic and standards of living gradually improve, despite starting to come under pressure again in the latter half of 2022 as the slowdown in economic activity will impact silicone demand segments. Nitric acid remains one of the few industries performing worse than under a COVID-impacted 2020 and 2021. As a key component of fertiliser used in food production, the industry comes under pressure this year as elevated gas prices weigh on demand. With Russia, Ukraine and Belarus being large fertiliser suppliers the conflict there has also impacted platinum offtake.

### **Glass**

We have adjusted our forecast for glass demand in 2022 slightly downwards compared to the previous *Platinum Quarterly* to reflect the withdrawal of some fibreglass operations in India. Following the exceptionally high levels of capacity investment last year, a slowdown has been inevitable and with it a decline in platinum demand in 2022. We now forecast global demand in 2022 will halve to 316 koz. A positive development in recent months are indications that the pandemic has had little impact on global capacity installations. Given also that the worst of it seems to be behind us, we no longer feel this is a material risk to 2022 offtake.

### **Medical**

Overall platinum demand in 2022 is much improved on 2021. As well as direct impacts from the pandemic on early 2021 in the West, higher vaccination rates, improved hospital management dealing with the disease and normalisation of living with the virus has increased the number of elective procedures taking place this year. This brings platinum medical demand in 2022 to 276 koz, up 3% (+9 koz), remaining just shy of 2019's 277 koz.

### **Electrical**

We forecast a decline of 19% (-25 koz) as HDD manufacturers are expected to take a more aggressive stance towards reducing capacity output and drawing down high inventories due to weaker-than-expected demand during the peak season. Furthermore, the increase in SSDs' market share, at the expense of HDDs, will continue to weigh on metal offtake.

### **Other**

In 2022, growth in vehicle production, the still strong vehicle aftermarket, increased deployment of PEM electrolyser capacity and the growth in stationary fuel cells containing platinum will see demand increase by 11% (+59 koz).

### **Investment demand**

Global platinum bar and coin demand is forecast to rise by 2% (+8 koz) this year to 340 koz. Even so, the total still remains well below 2020's recent high of 578 koz. The 2022 performance reflects further gains in North America, which offsets losses in Europe and Japan.

Looking first at North America, the expected gains are all the more impressive given the challenges facing a lack of production capacity, which has seen many bar and coin manufacturers often focussing on far higher volume gold and silver investment products. However, the impact on platinum has been more apparent in Europe. Even though the Russia-Ukraine war and high inflation have driven gold and silver retail investment higher, this has not been the case for platinum. The sales tax that applies to platinum coins and bars remains an important headwind, although a similar regime has not impeded silver demand. Furthermore, the removal of the margin tax in Germany, which means that non-EU silver bullion coins now face 19% VAT, is not expected to benefit platinum or gold demand this year. In Japan, signs that local investors are becoming used to higher local price levels point to another quarter of small, but positive, net investment, reflected in our full year forecast of net disinvestment of only 45 koz.

Following peak ETF holdings in July last year of 4.04 Moz, ETFs have seen outflows totalling 493 koz so far this year to bring total holdings to 3.15 Moz as of end-September. Dollar strength and the protracted chip shortage, limiting automotive production, have weighed on platinum's investment appeal so far this year. Additionally, rising interest rates increase the opportunity cost for holding non-yielding assets. While lending physical platinum has been possible at a premium for much of the year, it is not possible to capitalise on this by holding ETFs which, by their nature, are allocated metal.

### **ABOVE GROUND STOCKS**

While lower than 2021 this year's surplus of 804 koz will see above ground stocks increase to 4,426 koz, the highest in the series and exceeding annual South African output.

The WPIC definition of above ground stocks is the year-end estimate of the cumulative platinum holdings not associated with exchange-traded funds, metal held by exchanges or working inventories of mining producers, refiners, fabricators, or end-users.

2023 OUTLOOK

Moving into 2023, the platinum market is forecast to swing from a significant surplus to a deficit. In volume terms, the swing amounts to more than 1.1 Moz, more than 700 koz of which is due to an improved outlook for investment demand, with the balance related to increased automotive and industrial demand.

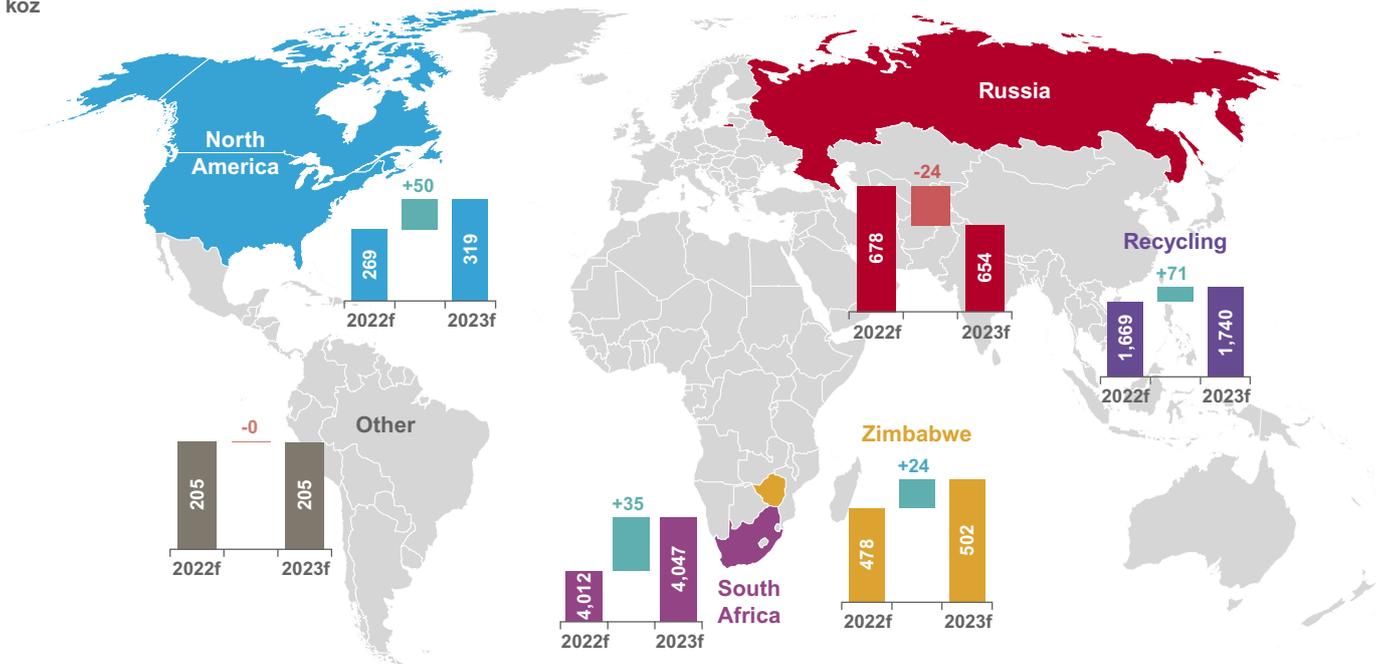
Supply

Platinum mining companies were effective in navigating the initial operational constraints caused by the pandemic, with mined output rapidly recovering after the lockdowns of early 2020. The longer-term impacts of the pandemic and macroeconomic environment continue to present significant headwinds to platinum mine supply. In South Africa, unreliable power supply, increased socioeconomic challenges and supply chain constraints all continue to disrupt mine supply. In the last three years, producers have deviated from planned production at a level greater than any other year since the widespread strikes in 2014. In addition, the Russia-Ukraine conflict continues to introduce significant uncertainty to the Russian supply outlook. In response to capital constraints, logistical challenges and some critical Western suppliers withdrawing from Russia, Nornickel has withdrawn its production guidance, with development plans under review. In North America, labour constraints continue to hamper the producers' ability to deliver on operational plans.

The upshot of this is a more uncertain outlook for platinum mine supply. However, this uncertainty occurs in a period of highly inflated PGM basket prices. While prices have softened somewhat from their recent highs, PGM mining profitability is still near record levels. These high-profit levels have allowed the ongoing increased stay-in-business capital levels on existing operations as well as producers' efforts to de-risk future production by investing in asset reliability and building excess capacity in processing infrastructure. While this process supports the medium-term outlook and stability of platinum supply, disruption is likely to remain a feature in 2023. Even so, global platinum mine supply in 2023 is forecast to edge higher, by 2% (+89 koz) year-on-year to 5,726 koz.

Platinum recycling is forecast to expand by 4% (+71 koz) to 1,740 koz in 2023 as vehicle production strengthens, and with it rising automotive sales, which in turn result in the increased supply of end-of-life vehicles entering the recycling supply chain.

Chart 9: Changes in supply, 2022f vs. 2023f koz

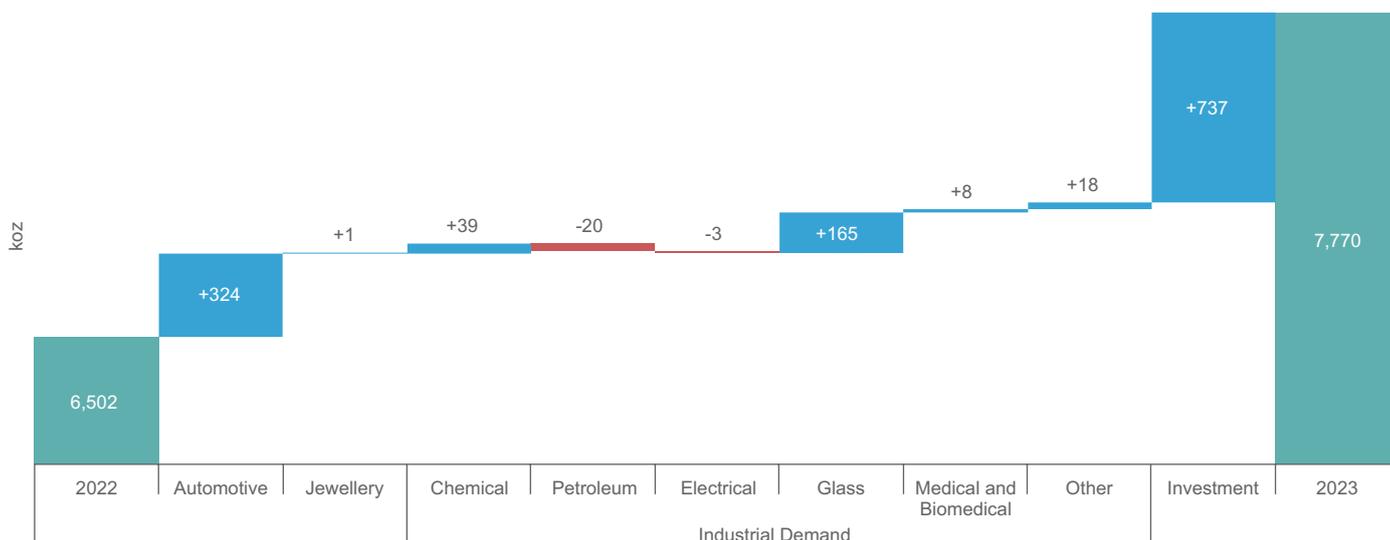


Source: Metals Focus

## Demand

With global economic growth forecast to fall to 2.7% next year, there are several risks to platinum demand in 2023. However, LDV production is expected to grow by 3% to 85M, while HDV production recovers as supply chains debottleneck and COVID control measures ease. Growth seems counterintuitive in the current weak economic environment, but vehicle production is still well below production levels typically supported by prevailing economic activity and, in fact, car production will fall short by more than 15 million vehicles, when compared with automotive production forecasts for 2023 released pre-pandemic (Q4'19). That said, the cost-of-living crisis will weigh on consumer sentiment and behaviour, curtailing growth in some sectors. After two years of disinvestment, we forecast net investment of 212 koz in 2023, or a swing of 737 koz year-on-year. While we expect further outflows in ETFs and exchange stocks, bar and coin investment is expected to surpass 500 koz, a three-year high. We expect platinum demand in 2023 to grow by 19% to 7,770 koz, edging closer to pre-pandemic levels, but hampered by the current war-induced energy crisis.

**Chart 10: Changes in demand by category, 2022f vs. 2023f**



Source: Metals Focus

We forecast an 11% (+324 koz) increase to 3,288 koz for automotive demand in 2023. Despite expectations that pure ICE vehicle production will contract by 5% next year, hybrid vehicle production is set to increase by 15%, with the latter typically having higher PGM loadings in their exhaust treatment systems (to improve emissions control in stop-start conditions). We also expect HDV demand to rise further in 2023 as production is anticipated to recover by 11%. Moreover, full implementation of China VIb emissions legislation is targeted for July 2023, in which strict onboard diagnostics (OBD) will also apply to all diesel engines. As a result, automotive demand in China will continue to increase by close to a third next year, despite expectations that LDV production will be marginally lower than 2022 as the tax incentive comes to an end. Annual platinum demand from the automotive sector in China will reach almost 700 koz, 2.7 times higher than pre-pandemic levels. While demand in Europe and North America are expected to rise modestly, both Japan and rest of world will record double digit growth in demand. Japan's increase will be the result of an improvement in vehicle production, while in the Rest of the World category, both vehicle production and higher loadings will support the 12% increase. Included within the regional figures quoted, platinum substitution for palladium is estimated to fall just short of 500 koz in 2023, up from around 340 koz in 2022.

For the third year, jewellery demand is expected to remain broadly flat at 1,954 koz. We forecast platinum jewellery demand from China to recover in 2023, driven mainly by fewer lockdowns and COVID-related disruptions. The level is still 18% lower than in 2021 as ongoing competition from gold jewellery hampers interest in platinum jewellery. Furthermore, local suppliers have indicated that their R&D efforts and capital investment will continue to be more gold-focused next year. Europe is forecast to see a dip in jewellery demand, due to an economic slowdown, the normalisation of wedding numbers after the post-COVID surge and a shift of consumer expenditure towards services such as vacations. It is also difficult to see the high-end continuing to register much growth.

Overall European demand should still exceed 2021 due to healthy gold price differentials. North American demand is forecast to drop in 2023, chiefly through a lower number of weddings and an end to retailer restocking. That would still leave offtake similar to 2021, and so up on 2019, thanks to high gold price differentials and a still robust jobs market. We expect Japanese demand will continue to recover, helped by a continued post-pandemic recovery (one should not forget that the country was slower to open up than most), the return of tourists and stronger exports, underpinned by the expected re-start of the Hong Kong jewellery shows – a key offset event for Japanese product. In India, the improvement in economic activity and disposable incomes will see a further healthy rise in platinum jewellery demand.

In the chemical sector, demand is forecast to increase by 6% (+39 koz) year-on-year to 666 koz in 2023. Following a turbulent three-year period from 2020 to 2022, the nitric acid industry is expected to recover, becoming the largest contributor to overall growth in chemical platinum offtake. Elsewhere, faster development of Chinese propane dehydrogenation capacity, following a slow 2022, and expanded capacity in North America, Poland and Kazakhstan, will add to platinum demand. Offtake from the paraxylene and silicone markets will remain broadly level year-on-year. The slowing economic outlook and elevated gas prices are expected to weigh on European silicone demand, offsetting improvements in China and other emerging markets.

Platinum offtake from the oil industry is projected to decline in 2023 by 10% (-20 koz) to 180 koz. A slowing world economy in the near term has seen the International Energy Agency downgrade expectations for oil demand next year. While we account for some capacity additions during 2023, we do expect some metal to return to the market, as sizeable plant maintenance is scheduled for 2023, with new improved catalyst technology requiring lower platinum loadings.

Following the substantial recalibration of capacity and inventory in the electrical segment, we forecast the decline to slow. Platinum demand from this sector is expected to drop by 3% (-3 koz).

Platinum demand in the glass industry is expected to rise next year, most of which will come from the anticipated growth in capacity expansions/investments in China and the construction of some new fibreglass plant projects in Egypt. We therefore forecast that platinum demand from the glass industry will jump by 52% to 481 koz in 2023.

We expect to see platinum medical demand normalise and resume its general trend higher unincumbered by the pandemic. Emerging markets, notably China and India, will see the highest growth rate due to their high-growth medical industries, while industrialised markets too should see improved access to medical care. We forecast a 3% (+8 koz) rise year-on-year to 283 koz in 2023, its first year surpassing 2019's pre-pandemic level.

Other industrial demand is expected to rise by 3% (+18 koz) in 2023. While the improvement in demand for spark plugs and sensors are the main drivers for the growth here, the contribution from the hydrogen economy, albeit from a low base, is also growing. In 2023 we expect demand from stationary fuel cells will increase 24% and PEM electrolyser demand by as much as 129%.

Next year, platinum coin and bar demand is forecast to jump by 49% (+167 koz) to 507 koz, a three-year high. In North America and Europe, modestly lower gold and silver demand (albeit remaining elevated) should allow manufacturers to allocate more capacity to platinum. Separately, Japan is expected to generate net investment for the first time on an annual basis since 2020. This will reflect the impact of positive price expectations as investors respond to a firmer price trend.

As inflation recedes and real rates climb throughout 2023, we expect further liquidations of ETF holdings. However, as the chip shortage improves and the hydrogen economy continues to show promising signs of development (both lifting investor sentiment towards platinum), we do not expect to see the same level of liquidations, and so forecast 275 koz will be divested in 2023. In addition, as only 203 koz were held in NYMEX and TOCOM warehouses combined as at 30<sup>th</sup> September, now closer to historical normal levels, we do not expect to see significant further outflows from exchange warehouses.

### ABOVE GROUND STOCKS

With a projected deficit of 303 koz in 2023, we expect above-ground stocks to decline to 4,123 koz by year-end.

The WPIC definition of above ground stock is the year-end estimate of the cumulative platinum holdings not associated with exchange-traded funds, metal held by exchanges or working inventories of mining producers, refiners, fabricators or end-users.

# PLATINUM QUARTERLY Q3 2022

**Table 2: Supply, demand and above ground stocks summary – annual comparison**

	2014	2015	2016	2017	2018	2019	2020	2021	2022f	2023f	2022f/2021 Growth %	2023f/2022f Growth %
<b>Platinum Supply-demand Balance (koz)</b>												
<b>SUPPLY</b>												
<b>Refined Production</b>	<b>4,875</b>	<b>6,160</b>	<b>6,045</b>	<b>6,130</b>	<b>6,125</b>	<b>6,075</b>	<b>4,989</b>	<b>6,297</b>	<b>5,643</b>	<b>5,726</b>	<b>-10%</b>	<b>1%</b>
South Africa	3,135	4,480	4,265	4,385	4,470	4,374	3,298	4,678	4,012	4,047	-14%	1%
Zimbabwe	405	405	490	480	465	458	448	485	478	502	-1%	5%
North America	395	365	390	360	345	356	337	273	269	319	-2%	19%
Russia	740	710	715	720	665	716	704	652	678	654	4%	-4%
Other	200	200	185	185	180	170	202	208	205	205	-1%	0%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+350</b>	<b>+30</b>	<b>+30</b>	<b>+30</b>	<b>+10</b>	<b>+2</b>	<b>-84</b>	<b>-93</b>	<b>-5</b>	<b>+0</b>	<b>N/A</b>	<b>N/A</b>
<b>Total Mining Supply</b>	<b>5,225</b>	<b>6,190</b>	<b>6,075</b>	<b>6,160</b>	<b>6,135</b>	<b>6,077</b>	<b>4,906</b>	<b>6,204</b>	<b>5,637</b>	<b>5,726</b>	<b>-9%</b>	<b>2%</b>
<b>Recycling</b>	<b>2,055</b>	<b>1,720</b>	<b>1,860</b>	<b>1,915</b>	<b>1,955</b>	<b>2,134</b>	<b>1,930</b>	<b>1,937</b>	<b>1,669</b>	<b>1,740</b>	<b>-14%</b>	<b>4%</b>
Autocatalyst	1,255	1,185	1,210	1,325	1,420	1,589	1,442	1,448	1,228	1,289	-15%	5%
Jewellery	775	515	625	560	505	476	422	422	372	382	-12%	3%
Industrial	25	20	25	30	30	69	66	67	68	69	3%	2%
<b>Total Supply</b>	<b>7,280</b>	<b>7,910</b>	<b>7,935</b>	<b>8,075</b>	<b>8,090</b>	<b>8,211</b>	<b>6,835</b>	<b>8,141</b>	<b>7,306</b>	<b>7,466</b>	<b>-10%</b>	<b>2%</b>
<b>DEMAND</b>												
<b>Automotive</b>	<b>3,245</b>	<b>3,245</b>	<b>3,360</b>	<b>3,300</b>	<b>3,100</b>	<b>2,867</b>	<b>2,402</b>	<b>2,635</b>	<b>2,964</b>	<b>3,288</b>	<b>12%</b>	<b>11%</b>
Autocatalyst	3,095	3,105	3,225	3,160	2,955	2,867	2,402	2,635	2,964	3,288	12%	11%
Non-road	150	140	135	140	145	†	†	†	†	†	†	†
<b>Jewellery</b>	<b>3,000</b>	<b>2,840</b>	<b>2,505</b>	<b>2,460</b>	<b>2,245</b>	<b>2,106</b>	<b>1,830</b>	<b>1,953</b>	<b>1,953</b>	<b>1,954</b>	<b>0%</b>	<b>0%</b>
<b>Industrial</b>	<b>1,700</b>	<b>1,845</b>	<b>1,955</b>	<b>1,825</b>	<b>2,015</b>	<b>2,137</b>	<b>2,098</b>	<b>2,450</b>	<b>2,110</b>	<b>2,316</b>	<b>-14%</b>	<b>10%</b>
Chemical	540	515	560	570	565	679	693	658	627	666	-5%	6%
Petroleum	60	205	220	100	235	219	109	172	200	180	17%	-10%
Electrical	215	205	195	210	205	144	130	135	110	107	-19%	-3%
Glass	205	235	255	205	250	236	407	697	316	481	-55%	52%
Medical and Biomedical	225	240	235	235	235	277	256	267	276	283	3%	3%
Other	455	445	490	505	525	582	502	522	581	599	11%	3%
<b>Investment</b>	<b>150</b>	<b>305</b>	<b>535</b>	<b>275</b>	<b>15</b>	<b>1,237</b>	<b>1,544</b>	<b>-45</b>	<b>-525</b>	<b>212</b>	<b>N/A</b>	<b>N/A</b>
Change in Bars, Coins	50	525	460	215	280	266	578	332	340	507	2%	49%
Change in ETF Holdings	215	-240	-10	105	-245	991	507	-238	-550	-275	N/A	N/A
Change in Stocks Held by Exchanges	-115	20	85	-45	-20	-20	458	-139	-315	-20	N/A	N/A
<b>Total Demand</b>	<b>8,095</b>	<b>8,235</b>	<b>8,355</b>	<b>7,860</b>	<b>7,375</b>	<b>8,347</b>	<b>7,874</b>	<b>6,993</b>	<b>6,502</b>	<b>7,770</b>	<b>-7%</b>	<b>19%</b>
<b>Balance</b>	<b>-815</b>	<b>-325</b>	<b>-420</b>	<b>215</b>	<b>715</b>	<b>-136</b>	<b>-1,039</b>	<b>1,147</b>	<b>804</b>	<b>-303</b>	<b>-30%</b>	<b>N/A</b>
<b>Above Ground Stocks</b>	<b>2,590*</b>	<b>2,265</b>	<b>1,845</b>	<b>2,060</b>	<b>2,775</b>	<b>3,514**</b>	<b>2,476</b>	<b>3,623</b>	<b>4,426</b>	<b>4,123</b>	<b>22%</b>	<b>-7%</b>

Source: Metals Focus 2019 - 2023, SFA (Oxford) 2014 - 2018.

Notes:

1. Above Ground Stocks: \*4,140 koz as of 31st December 2012 (SFA (Oxford)). \*\*3,650 koz as of 31 December 2018 (Metals Focus).
2. † Non-road automotive demand is included in autocatalyst demand.
3. Data from Metals Focus and SFA (Oxford) may not have been prepared on the same or directly comparable basis.
4. Prior to 2019 SFA data is independently rounded to the nearest 5 koz.

# PLATINUM QUARTERLY Q3 2022

Table 3: Supply and demand summary – quarterly comparison

	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q3'22/Q3'21 Growth %	Q3'22/Q2'22 Growth %
<b>Platinum Supply-demand Balance (koz)</b>											
<b>SUPPLY</b>											
<b>Refined Production</b>	<b>1,496</b>	<b>1,303</b>	<b>1,465</b>	<b>1,566</b>	<b>1,571</b>	<b>1,695</b>	<b>1,273</b>	<b>1,530</b>	<b>1,401</b>	<b>-11%</b>	<b>-8%</b>
South Africa	1,062	873	1,028	1,175	1,201	1,274	878	1,128	986	-18%	-13%
Zimbabwe	115	115	118	125	116	127	117	124	118	2%	-5%
North America	71	82	83	75	51	64	66	65	66	31%	2%
Russia	196	182	184	137	153	178	163	161	179	17%	11%
Other	52	51	52	53	51	52	49	52	52	1%	0%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>-112</b>	<b>-51</b>	<b>-29</b>	<b>+18</b>	<b>-43</b>	<b>-39</b>	<b>+24</b>	<b>-2</b>	<b>-43</b>	<b>N/A</b>	<b>N/A</b>
<b>Total Mining Supply</b>	<b>1,384</b>	<b>1,252</b>	<b>1,435</b>	<b>1,584</b>	<b>1,529</b>	<b>1,656</b>	<b>1,298</b>	<b>1,528</b>	<b>1,357</b>	<b>-11%</b>	<b>-11%</b>
<b>Recycling</b>	<b>541</b>	<b>578</b>	<b>514</b>	<b>521</b>	<b>452</b>	<b>449</b>	<b>424</b>	<b>439</b>	<b>391</b>	<b>-13%</b>	<b>-11%</b>
Autocatalyst	403	418	380	407	331	330	308	330	285	-14%	-14%
Jewellery	121	134	118	98	104	102	98	92	90	-14%	-3%
Industrial	17	26	16	16	17	17	17	17	17	1%	1%
<b>Total Supply</b>	<b>1,925</b>	<b>1,830</b>	<b>1,950</b>	<b>2,105</b>	<b>1,981</b>	<b>2,105</b>	<b>1,721</b>	<b>1,967</b>	<b>1,748</b>	<b>-12%</b>	<b>-11%</b>
<b>DEMAND</b>											
<b>Automotive</b>	<b>648</b>	<b>720</b>	<b>723</b>	<b>657</b>	<b>580</b>	<b>678</b>	<b>745</b>	<b>712</b>	<b>723</b>	<b>25%</b>	<b>2%</b>
Autocatalyst	648	720	723	657	580	678	745	712	723	25%	2%
Non-road	†	†	†	†	†	†	†	†	†	N/A	N/A
<b>Jewellery</b>	<b>511</b>	<b>534</b>	<b>487</b>	<b>470</b>	<b>485</b>	<b>511</b>	<b>469</b>	<b>496</b>	<b>482</b>	<b>-1%</b>	<b>-3%</b>
<b>Industrial</b>	<b>573</b>	<b>567</b>	<b>467</b>	<b>787</b>	<b>543</b>	<b>676</b>	<b>519</b>	<b>565</b>	<b>553</b>	<b>2%</b>	<b>-2%</b>
Chemical	140	213	119	193	161	184	127	167	174	8%	4%
Petroleum	21	36	37	39	39	57	46	50	51	29%	1%
Electrical	33	36	33	35	35	32	30	27	26	-26%	-4%
Glass	180	73	75	325	112	186	101	101	92	-18%	-9%
Medical and Biomedical	64	64	63	65	66	73	70	70	69	4%	-1%
Other	136	145	141	130	130	145	145	150	141	9%	-6%
<b>Investment</b>	<b>960</b>	<b>135</b>	<b>159</b>	<b>187</b>	<b>-282</b>	<b>-108</b>	<b>-165</b>	<b>-137</b>	<b>-272</b>	<b>N/A</b>	<b>N/A</b>
Change in Bars, Coins	97	60	21	107	110	95	61	75	97	-12%	29%
Change in ETF Holdings	522	76	105	31	-219	-155	-169	-89	-235	N/A	N/A
Change in Stocks Held by Exchanges	342	-1	33	49	-173	-48	-58	-123	-134	N/A	N/A
<b>Total Demand</b>	<b>2,692</b>	<b>1,956</b>	<b>1,836</b>	<b>2,101</b>	<b>1,325</b>	<b>1,757</b>	<b>1,568</b>	<b>1,636</b>	<b>1,485</b>	<b>12%</b>	<b>-9%</b>
<b>Balance</b>	<b>-767</b>	<b>-126</b>	<b>113</b>	<b>4</b>	<b>656</b>	<b>348</b>	<b>153</b>	<b>331</b>	<b>263</b>	<b>-60%</b>	<b>-21%</b>

Source: Metals Focus 2020 - 2023.

Notes:

1. † Non-road automotive demand is included in autocatalyst demand.

# PLATINUM QUARTERLY Q3 2022

Table 4: Supply and demand summary – half-yearly comparison

	H1 2020	H2 2020	H1 2021	H2 2021	H1 2022	H1'22/H1'21 Growth %	H1'22/H2'21 Growth %
<b>Platinum Supply-demand Balance (koz)</b>							
<b>SUPPLY</b>							
<b>Refined Production</b>	<b>2,191</b>	<b>2,799</b>	<b>3,030</b>	<b>3,266</b>	<b>2,803</b>	<b>-7%</b>	<b>-14%</b>
South Africa	1,364	1,934	2,203	2,475	2,006	-9%	-19%
Zimbabwe	218	230	243	242	241	-1%	-1%
North America	185	153	159	115	131	-17%	15%
Russia	325	379	321	331	324	1%	-2%
Other	99	103	105	103	101	-3%	-2%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+79</b>	<b>-162</b>	<b>-11</b>	<b>-82</b>	<b>22</b>	<b>N/A</b>	<b>N/A</b>
<b>Total Mining Supply</b>	<b>2,269</b>	<b>2,637</b>	<b>3,019</b>	<b>3,184</b>	<b>2,825</b>	<b>-6%</b>	<b>-11%</b>
<b>Recycling</b>	<b>819</b>	<b>1,119</b>	<b>1,035</b>	<b>902</b>	<b>863</b>	<b>-17%</b>	<b>-4%</b>
Autocatalyst	621	821	787	661	639	-19%	-3%
Jewellery	167	255	215	206	191	-11%	-8%
Industrial	32	43	33	34	34	4%	0%
<b>Total Supply</b>	<b>3,088</b>	<b>3,755</b>	<b>4,055</b>	<b>4,086</b>	<b>3,689</b>	<b>-9%</b>	<b>-10%</b>
<b>DEMAND</b>							
<b>Automotive</b>	<b>1,035</b>	<b>1,368</b>	<b>1,379</b>	<b>1,258</b>	<b>1,457</b>	<b>6%</b>	<b>16%</b>
Autocatalyst	1,035	1,368	1,379	1,258	1,457	6%	16%
Non-road	†	†	†	†	†	N/A	N/A
<b>Jewellery</b>	<b>785</b>	<b>1,045</b>	<b>957</b>	<b>995</b>	<b>965</b>	<b>1%</b>	<b>-3%</b>
<b>Industrial</b>	<b>957</b>	<b>1,140</b>	<b>1,255</b>	<b>1,219</b>	<b>1,084</b>	<b>-14%</b>	<b>-11%</b>
Chemical	340	353	313	346	293	-6%	-15%
Petroleum	51	57	76	96	96	27%	0%
Electrical	61	68	68	67	57	-17%	-15%
Glass	155	253	400	297	203	-49%	-32%
Medical and Biomedical	128	128	128	139	140	10%	1%
Other	221	281	271	275	295	9%	8%
<b>Investment</b>	<b>449</b>	<b>1,094</b>	<b>345</b>	<b>-390</b>	<b>-303</b>	<b>N/A</b>	<b>N/A</b>
Change in Bars, Coins	422	156	127	205	136	7%	-34%
Change in ETF Holdings	-90	597	136	-374	-258	N/A	N/A
Change in Stocks Held by Exchanges	118	341	82	-221	-181	N/A	N/A
<b>Total Demand</b>	<b>3,226</b>	<b>4,648</b>	<b>3,937</b>	<b>3,082</b>	<b>3,204</b>	<b>-19%</b>	<b>4%</b>
<b>Balance</b>	<b>-138</b>	<b>-893</b>	<b>118</b>	<b>1,004</b>	<b>485</b>	<b>&gt;±300%</b>	<b>-52%</b>

Source: Metals Focus 2019 - 2022.

Notes:

1. † Non-road automotive demand is included in autocatalyst demand.

# PLATINUM QUARTERLY Q3 2022

Table 5: Regional demand – annual and quarterly comparison

	2014	2015	2016	2017	2018	2019	2020	2021	2022f	2023f	2022f/2021 Growth %	2023f/2022f Growth %	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	
<b>Platinum gross demand (koz)</b>																		
<b>Automotive</b>	3,240	3,250	3,350	3,290	3,090	2,867	2,402	2,635	2,964	3,288	12%	11%	580	678	745	712	723	
North America	465	480	410	390	390	341	298	379										
Western Europe	1,395	1,450	1,630	1,545	1,325	1,459	1,102	1,002										
Japan	585	510	450	435	425	308	247	262										
China	125	145	195	230	220	184	280	384										
India	170	180	170	175	195	††	††	††										
Rest of the World	500	485	495	515	535	575	475	608										
<b>Jewellery</b>	3,000	2,840	2,505	2,460	2,245	2,106	1,830	1,953	1,953	1,954	0%	0%	485	511	469	496	482	
North America	230	250	265	280	280	341	277	409										
Western Europe	220	235	240	250	255	237	196	260										
Japan	335	340	335	340	345	372	316	298										
China	1,975	1,765	1,450	1,340	1,095	871	832	703										
India	175	180	145	175	195	109	59	123										
Rest of the World	65	70	70	75	75	176	151	159										
<b>Chemical</b>	540	515	560	570	565	679	693	658	627	666	-5%	6%	161	184	127	167	174	
North America	55	55	50	50	50	90	95	98										
Western Europe	105	75	110	115	105	125	115	121										
Japan	10	10	15	15	15	66	62	65										
China	215	230	225	220	215	207	254	218										
Rest of the World	155	145	160	170	180	192	167	157										
<b>Petroleum</b>	60	205	220	100	235	219	109	172	200	180	17%	-10%	39	57	46	50	51	
North America	25	-25	90	55	55	30	5	32										
Western Europe	-20	70	10	5	20	14	11	18										
Japan	-35	5	0	-40	5	7	6	12										
China	-5	45	80	45	10	66	35	42										
Rest of the World	95	110	40	35	145	103	52	67										
<b>Electrical</b>	215	205	195	210	205	144	130	135	110	107	-19%	-3%	35	32	30	27	26	
North America	15	15	10	15	15	38	35	35										
Western Europe	10	10	10	10	10	27	23	25										
Japan	15	15	15	15	15	20	16	17										
China	70	70	80	90	85	28	31	31										
Rest of the World	105	95	80	80	80	31	25	26										
<b>Glass</b>	205	235	255	205	250	236	407	697	316	481	-55%	52%	112	186	101	101	92	
North America	10	0	20	5	5	7	-37	17										
Western Europe	15	10	5	5	35	59	25	5										
Japan	-25	-5	-10	-10	0	-40	-66	7										
China	115	130	150	110	80	180	360	666										
Rest of the World	90	100	90	95	130	30	126	3										
<b>Medical</b>	225	240	235	235	235	277	256	267	276	283	3%	3%	66	73	70	70	69	
<b>Other industrial</b>	455	445	490	505	525	582	502	522	581	599	11%	3%	130	145	145	150	141	
<b>Bar &amp; Coin Investment</b>	50	525	460	215	280	266	578	332	340	507	2%	49%	110	95	61	75	97	
North America						159	242	264										
Western Europe						52	75	61										
Japan						46	240	-26										
Rest of the World						9	21	33										
<b>ETF Investment</b>	215	-240	-10	105	-245	991	507	-238	-550	-275	N/A	N/A	-219	-155	-169	-89	-235	
North America						125	524	-6										
Western Europe						509	237	59										
Japan						-13	58	-23										
Rest of the World						370	-312	-268										
<b>Change in Stocks Held by Exchanges</b>	-115	20	85	-45	-20	-20	458	-139	-315	-20	N/A	N/A	-173	-48	-58	-123	-134	
<b>Investment</b>	150	305	535	275	15	1,237	1,544	-45	-525	212	N/A	N/A	-282	-108	-165	-137	-272	
<b>Total Demand</b>	8,090	8,240	8,345	7,850	7,365	8,347	7,874	6,993	6,502	7,770	-7%	19%	1,325	1,757	1,568	1,636	1,485	

Source: Metals Focus 2019 - 2023, SFA (Oxford) 2013 - 2018.

Notes:

- † Non-road automotive demand is included in autocatalyst demand.
- †† India automotive demand is included in Rest of the World.
- Data from Metals Focus and SFA (Oxford) may not have been prepared on the same or directly comparable basis.
- Prior to 2019 SFA data is independently rounded to the nearest 5 koz.

**Table 6: Regional recycling – annual and quarterly comparison**

	2014	2015	2016	2017	2018	2019	2020	2021	2022f	2023f	2022f/2021 Growth %	2023f/2022f Growth %	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022
<b>Platinum recycling supply (koz)</b>																	
<b>Automotive</b>	1,255	1,185	1,210	1,325	1,420	1,589	1,442	1,448	1,228	1,289	-15%	5%	331	330	308	330	285
North America						520	458	459									
Western Europe						807	747	768									
Japan						116	110	108									
China						36	36	33									
Rest of the World						110	90	81									
<b>Jewellery</b>	775	515	625	560	505	476	422	422	372	382	-12%	3%	104	102	98	92	90
North America						3	3	3									
Western Europe						4	4	3									
Japan						187	162	160									
China						276	248	250									
Rest of the World						5	5	5									
<b>Industrial</b>	25	20	25	30	30	69	66	67	68	68	3%	-1%	17	17	17	17	17
North America						15	12	12									
Western Europe						11	10	11									
Japan						34	34	34									
China						7	7	8									
Rest of the World						2	2	2									

Source: Metals Focus 2019 - 2023, SFA (Oxford) 2014 - 2018.

## GLOSSARY OF TERMS

### Above ground stocks

The year-end estimate of the cumulative platinum holdings not associated with exchange-traded funds; metal held by exchanges or working inventories of mining producers, refiners, fabricators, or end-users. Typically, unpublished vaulted metal holdings from which a supply-demand shortfall can be readily supplied or to which a supply-demand surplus can readily flow.

### ADH

Alkane dehydrogenation: catalytic conversion of alkanes to alkenes. Broad term encompassing BDH and PDH.

### BDH

Butane dehydrogenation; catalytic conversion of isobutane to isobutylene.

### Bharat

The Government of India introduced Bharat emission standards (BSES) to reduce and regulate the output of air pollutants from internal combustion and spark-ignition engine equipment, including motor vehicles.

### Bharat Stage V/VI standards (BS-V, BS-VI)

Early in 2016 the Indian government announced the intention to 'leapfrog' Bharat Stage V and move directly to Bharat Stage VI, equivalent to Euro 6, in 2020. This intention, despite lockdown, has not been altered.

### China Vehicle Emission Standards

China's vehicle emission standards are set nationally by the Ministry of Environmental Protection and are regionally and locally enforced by Environmental Protection Bureaus.

A number of cities and provinces in China continue the historic practice of early introduction of new standards.

### China 6

As of December 2016, China adopted China 6 standards that apply nationwide to light-duty passenger vehicles from July 2020 (China 6a) and July 2023 (China 6b). These standards incorporate elements of Euro 6 and U.S. Tier 2 regulations for tailpipe and evaporative emissions. China 6b includes mandatory on-road emissions testing modelled after the EU RDE regulation (also known as Euro 6d TEMP) with a few enhancements and modifications. A number of cities and provinces adopted China 6b in July 2019 and many automakers have proceeded to adopt China 6b early for all their production.

### China VI

In June 2018, China finalized China VI standards that will apply to new heavy-duty diesel vehicles nationwide in two stages.

The first stage, China VI-a, originally targeted to have become applicable by July 2020 for new models but has been delayed by 6 months to January 2021, and all new HDVs targeted for compliance in July 2021. The second stage, China VI-b will apply to gas engines nationwide starting in January 2021 and all new HDVs in July 2023.

### Compounds (Platinum based)

Platinum combines with other elements to form chemical mixtures that are used as catalysts in chemical processes as well as in plating, metal deposition and other industrial processes.

### Diesel oxidation catalyst (DOC)

A DOC oxidises harmful carbon monoxide and unburnt hydrocarbons, produced by incomplete combustion of diesel fuel, to non-toxic carbon dioxide and water.

### Diesel particulate filter (DPF) and catalysed diesel particulate filter (CDPF)

A DPF physically filters particulates (soot) from diesel exhaust. A CDPF adds a PGM catalyst coating to facilitate oxidation and removal of the soot. The terms are often used interchangeably.

### Electrolysis of water

Water electrolyzers are electrochemical devices used to split water molecules into hydrogen and oxygen. An electrical current is applied to the electrolyser cell, and water is split into oxygen and hydrogen. The electrolysis system comprises of the system, the stack, and the cell.

### Emissions Legislation

Regulations that necessitate the fitment of autocatalyst systems dealing with the treatment of vehicle tailpipe emissions such as carbon monoxide (CO), particulate matter, hydrocarbons, and oxides of nitrogen (NO<sub>x</sub>). There are a range of standards specific to various regions and countries with varying minimum emissions targets and deadlines for compliance.

### EPA

Environmental Protection Agency regulating the US vehicle and engine emission standards for pollutants.

### ETF

Exchange-traded fund. A security that tracks an index, commodity, or basket of assets. Platinum ETFs included in demand are backed by physical metal (LPPM good delivery bars stored in a secure vault approved by the listing exchange).

### Euro V/VI emission standards

EU emission standards for heavy-duty vehicles. Euro V legislation was introduced in 2008-09 and Euro VI in 2013/2014; similar standards have later been adopted in some other countries.

### Euro 5/6 emission standards

EU emission standards for light-duty vehicles. Euro 5 legislation was introduced in 2009-11 and Euro 6 in 2014/2015. The limits set in Euro 6 have remained unchanged, but the measuring methods have become more stringent progressively including Euro 6 a, b, c, d, and Euro 6d-Temp, now in place. For CO<sub>2</sub>, the laboratory based WLTP and for NO<sub>x</sub> RDE.

### FCM

Fuel Consumption Monitoring describes the recording of actual consumption during the life of the vehicle. Applicable under Euro 6d to all new vehicles from 1/01/2020 and all new registrations from 1/01/2021.

### Forward prices

The price of a commodity at a future point in time. Typically comprises of the spot price as well as the risk-free interest rate and cost of carry.

### GTL

Gas-to-liquids is a process that converts natural gas to liquid hydrocarbons such as gasoline or diesel fuel.

### HAMR

Heat-Assisted Magnetic Recording. A magnetic recording technology which involves spot-heating the drive platters with laser beam.

### HDD

Hard disk drive. Data storage device that stores digital data by magnetic platters.

### HDV

Heavy-duty vehicle.

### Hydrogen Production Methods

In recent years, colours have been used to refer to different hydrogen production routes. There is no international agreement on the use of these terms as yet, nor have their meanings in this context been clearly defined but the following colour key provides a guideline of most widely use reference to the various production methods

white – naturally occurring or produced as industrial by-product

black or brown – coal gasification

grey – steam methane reforming

turquoise – methane pyrolysis

blue – steam methane reforming plus carbon capture

green – water electrolysis with renewable energy sources

pink – nuclear power

yellow – solar power or mix of multiple sources.

### ICE

Internal combustion engine.

### IoT

Internet of Things. Networking system that allows data to be sent to and received from objects and devices through internet.

### ISC

In Service Conformity which requires vehicles to not only conform with exhaust emission standards when they are new but also while in use.

### Jewellery alloys

The purity of platinum jewellery is invariably expressed in parts per 1,000. For example, the most common variant, pt950, is 95% fine platinum, with the rest of the jewellery alloy made up of other metals such as cobalt or copper. Different markets would typically prescribe the purity levels for qualification and hallmarking of the jewellery as platinum jewellery.

### Jewellery demand

Captures the first transformation of unwrought platinum into a semi-finished or finished jewellery product.

### Koz

Thousand ounces.

### LCD

Liquid-crystal display used for video display.

### LCV

Light commercial vehicle.

### Lean NO<sub>x</sub> traps (LNT)

Platinum/rhodium-based, catalyses the chemical reduction of NO<sub>x</sub> in diesel engine exhaust to harmless nitrogen.

### Lease rates

The lease rate is defined as the rate at which the owner of the commodity lends or sells it and buys it back from the borrower in the market. LPPM.

### The London Platinum and Palladium Market (LPPM)

It is a trade association representing the interests of the platinum and palladium market. It provides guidance and benchmarks on the form and governance of platinum and palladium delivered to the market and publishes a list of the companies that comply with the guidelines and purity. This list is known as the Good Delivery List. As at May 2020 the Good Delivery Lists consists of 31 platinum refiners, 28 palladium refiners, 15 full members, 41 associate members, 45 affiliate members and 2 affiliated exchange members.

### MAMR

Microwave-Assisted Magnetic Recording. A magnetic recording technology by writing in the drive platters with a microwave field.

### Metal-in-concentrate

PGMs contained in the concentrate produced after the crushing, milling and froth flotation processes in the concentrator. It is a measure of a mine's output before the smelting and refining stages.

### MLCC

Multi-layer ceramic capacitors. A number of individual thin film capacitors stacked as a whole.

### moz

Million ounces.

### NAND flash Memory

NAND flash memory is a type of non-volatile storage technology that does not require power in order to retain data. It uses floating-gate transistors that are connected in a way that the resulting connection resembles a NAND gate, where several transistors are series connected and a bit line is pulled low only when all word lines are at a high state.

### NEDC

New European Driving Cycle vehicle emissions test set out in United Nations Vehicle Regulation 101 maintained by the United Nations Economic Commission for Europe and updated and reviewed from time to time. The WLTP is aimed to significantly enhance and replace this regulation.

### Net demand

A measure of the requirement for new metal, i.e., net of recycling.

### Non-road engines

Non-road engines are diesel engines used, for example, in construction, agricultural and mining equipment, often using engine and emissions technology similar to on-road heavy-duty diesel vehicles.

### Ounce conversion

One metric tonne = 1,000 kilogrammes (kg) or 32,151 troy ounces.

### oz

A unit of weight commonly used for precious metals.  
1 troy oz = 31.103 grams.

### PDH

Propane dehydrogenation, where propane is converted to propylene.

### PEM Electrolyser Technology

One of four key water electrolyser technologies. The electrode on oxygen side (anode) contains iridium oxide while the electrode on hydrogen side (cathode) typically contains platinum. Transport layers are platinum-coated sintered porous titanium, and the bipolar plates would typically have platinum on with other metals.

### PGMs

Platinum group metals.

### PMR

Precious metals refinery.

### Pricing benchmarks

A price for a commodity that is traded on a liquid market that is used as a reference for buyers and sellers. In the case of platinum, the most commonly referenced benchmark is the LBMA Platinum Price, which is administered and distributed by the London Metals Exchange. The LBMA Platinum Price is discovered through an auction process.

### Producer inventory

As used in the supply-demand balance, the change in producer inventory is the difference between reported refined production and metal sales.

### PX

Paraxylene is a chemical produced from petroleum naphtha extracted from crude oil using a platinum catalyst. This is used in the production of terephthalic acid which is used to manufacture polyester.

### Refined production

Processed platinum output from refineries typically of a minimum 99.95% purity in the form of ingot, sponge, or grain.

### RDE

The Real Driving Emissions (RDE) test measures the pollutants such as NO<sub>x</sub>, emitted by cars while driven on the road. It is in addition to laboratory tests. RDE testing was implemented in September 2017 for new types of cars and has applied to all registrations from September 2019.

### Secondary supply

Covers the recovery of platinum from fabricated products, including unused trade stocks. Excludes scrap generated during manufacturing (known as production or process scrap). Autocatalyst and jewellery recycling are shown in the country where the scrap is generated, which may differ from where it is refined.

### Selective catalytic reduction (SCR)

Selective Catalytic Reduction (SCR) is an emissions control technology system that injects a liquid-reductant agent (urea) into the outlet stream of a diesel engine. The automotive-grade urea, known by the trade name AdBlue. The system typically requires a platinum bearing DOC ahead of the SCR unit.

### SGE

Shanghai Gold Exchange.

### SSD

Solid-state drive. Data storage device that uses memory chips to store data, typically using flash memory.

### Stage 4 regulations

Non-road mobile machinery (NRMM) is regulated by increasingly stringent regulations set out in tiers from Stage 1 to 5. This was last reviewed in May 2018 with deadlines set for 2020 and 2021. A submission by industry bodies requesting a delay in implementation as yet to be ruled on.

### Three-way catalyst

Used in gasoline cars to remove hydrocarbons, carbon monoxide and NO<sub>x</sub>. Largely palladium-based now, they also include some rhodium.

### US Vehicle Emission Standards

US vehicle and engine emission standards for pollutants, are established by the US Environmental Protection Agency (EPA) based on the Clean Air Act (CAA). The State of California has the right to introduce its own emission regulations. Engine and vehicle emission regulations are adopted by the California Air Resources Board (CARB), a regulatory body within the California EPA. Vehicles can in every year be certified in different emission classes, called "bins." The fleet average emissions over all "bins" are then regulated and reduced from year to year. To achieve the required fleet average, every year more vehicles have to be registered in the lower bins.

### Tier 3

Emission regulation issued by EPA. The regulation defines common targets until 2025 in the USA.

### Tier 4 stage

Non-road mobile machinery (NRMM) is regulated by increasingly stringent regulations set out in tiers from Stage 1 to 5. This was last reviewed in May 2018 with deadlines set for 2020 and 2021. A submission by industry bodies requesting a delay in implementation yet to be ruled on.

### Washcoat

The layer that contains the active catalytic materials, such as PGMs, that is applied on the inactive, often ceramic, substrate within an autocatalyst block or component.

### WIP

Work in progress.

### WLTP

Worldwide Harmonised Light Vehicle Test Procedure is a laboratory test to measure pollutant emissions and fuel consumption. WLTP replaces the New European Driving Cycle (NEDC). It became applicable to new car types from September 2017 and new registrations from September 2018.

### WPIC

The World Platinum Investment Council.

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