PLATINUM QUARTERLY

Q4 2022

8th March 2023

World Platinum Investment Council

FOREWORD

This edition of *Platinum Quarterly* presents fourth quarter and annual platinum supply and demand developments for 2022 as well as an updated outlook 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 5) are prepared independently for the WPIC by Metals Focus.

2023 forecast deficit of 556 koz as supply remains weak with strong demand growth

- After two years of significant surpluses the platinum market is forecast to move to a material deficit in 2023. The change from the 776 koz surplus in 2022 to the forecast deficit of 556 koz in 2023 is over 1.3 Moz which reflects mining and recycling supply remaining close to the weak levels in 2022, up only 3% (201 koz) and strong demand growth of 24% (1,534 koz).
- Although power supply risks and operational challenges have been factored into the mining supply forecast for 2023, a worsening of electricity supply shortages in major producer South Africa and a gradual erosion of operational stability in Russia, linked to ongoing sanctions, present downside risks to supply.
- In contrast, although demand forecasts include the negative impact of inflation and lower global economic growth, downside risks are well protected as the strong demand growth results mainly from ongoing platinum for palladium substitution in automotive applications, already committed glass capacity additions, with construction to be completed in 2023, and robust bar and coin demand, while the significant outflows from ETFs and exchange stocks have largely run their course.

Platinum supply and demand – quarter four trends, full year 2022 and updated 2023 outlook

Reduced 2022 surplus – robust automotive and industrial offset by negative investment demand

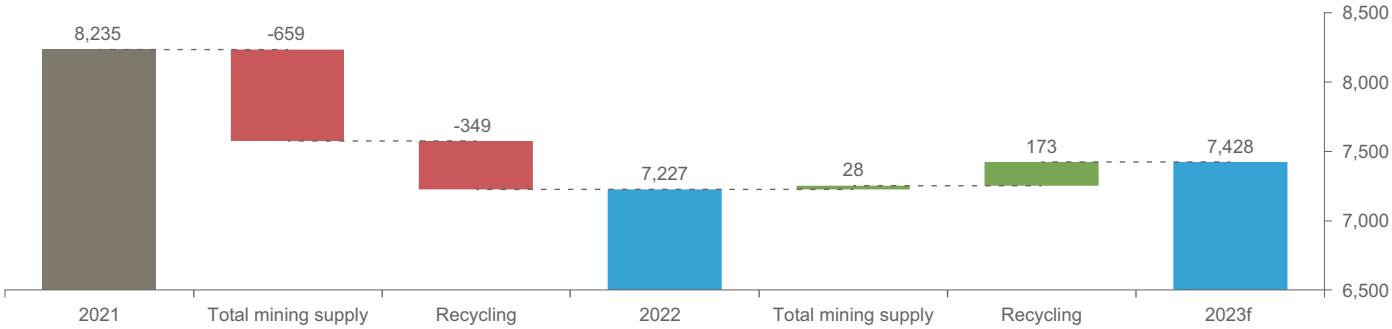
Total supply was down 18% year-on-year in Q4, at 1,739 koz (-389 koz) due to electricity and infrastructure challenges in South Africa impacting refined mine production, and supply chain provenance concerns limiting recycling in North America. For the full year 2022, total mining supply was down 11% year-on-year at 5,545 koz (-659 koz), recycling was down 17% at 1,682 koz (-349 koz) and total supply was down 12% at 7,227 koz (-1,008 koz).

Total demand was down 5% year-on-year in Q4, at 1,634 koz (-78 koz) and 9% year-on-year for the full year 2022, 6,451 koz (-626 koz).

Automotive demand for 2022 was up 12% year-on-year at 2,957 koz (+311 koz) with platinum demand supported by increased production of higher platinum carrying hybrid vehicles, a 7% increase in China VIb compliant heavy-duty vehicles, and continued platinum for palladium substitution in gasoline vehicles. Jewellery demand in 2022 was down 3% year-on-year in 2022, at 1,894 koz (-59 koz). Whilst industrial demand was down 11% year-on-year (-288 koz), it is off an historic peak in 2021, with 2022 still the second strongest year on record, at 2,243 koz. The most significant change in industrial demand was significantly fewer glass capacity additions in 2022. Although 2022 was heavily impacted by net negative investment demand (-643 koz), Q4 showed significant improvement as the heavy out flows from ETF and exchange stock holdings in the first three quarters (-808 koz) almost ceased (-60 koz). However, the reverse was true for bar and coin demand as the still robust first three quarters (+223 koz) fell to almost zero in Q4 (1 koz), as stronger platinum prices and inflation concerns reduced retail investor purchasing.

The net impact on supply demand balance for 2022 is a platinum surplus of 776 koz.

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



Source: Metals Focus

Updated 2023 outlook – platinum market deficit of -556 koz on stronger industrial demand

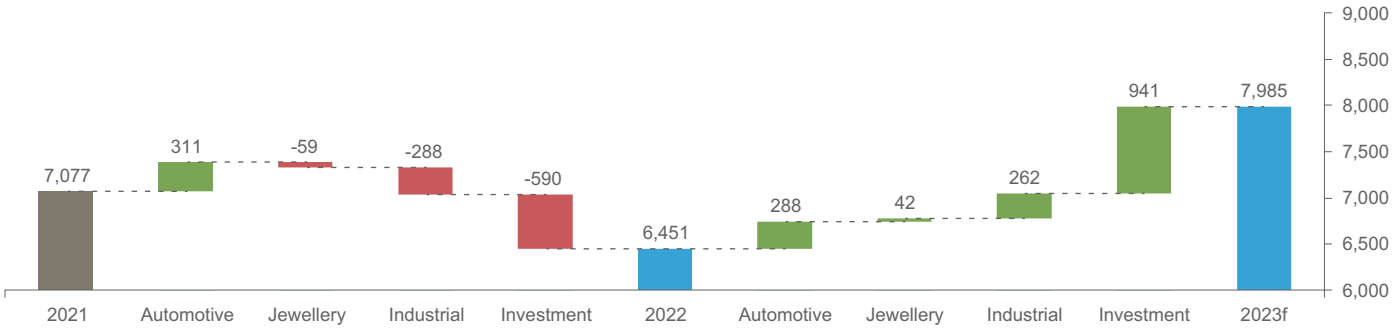
The forecast deficit for 2023 (-556 koz) is deeper than projected in our *Q3'22 Platinum Quarterly*, primarily on the identification of additional planned glass capacity expansions in China during 2023.

Mining supply is expected to continue to be restricted by electricity shortages in South Africa and sanctions-related operational challenges in Russia. A significant challenge facing the South African mining industry is the ongoing electricity crisis. Whilst the miners have been able to flex operations to accommodate power shortages without significantly impacting output to date, it creates uncertainty regarding the release of semi-finished inventory built up during smelter maintenance. Recycling supply chain constraints experienced in 2022 are expected to abate in 2023 although the macro-driven reduced availability of end-of-life vehicles will keep recycling supply well below pre-COVID levels.

Strong demand growth is still expected as automotive demand is driven by rising platinum substitution for palladium, which offsets reductions from growing EV penetration and still muted new vehicle production. Whilst jewellery demand is anticipated to remain weak, industrial demand strength, led by glass capacity expansions, is forecast to continue. This strong growth in industrial demand is driven by significant glass capacity additions in China, with global platinum demand from the glass sector expected to grow by 55% year-on-year to 737 koz. It is worth noting the high variability in growth of industrial demand for platinum is strongly linked to capacity additions rather than annual replacement for wear. Similarly, investment demand is expected to improve significantly in 2023. Despite the muted start to 2023, platinum bar and coin demand is projected to increase by 100% year-on-year to 450 koz. ETF demand is expected to improve from net outflows of -560 koz in 2022 to -132 koz in 2023. Exchange stock outflows are also expected to moderate from -307 koz in 2022 to -20 koz in 2023. The net impact is for investment demand to move -643 koz in 2022 to +298 koz in 2023 a change of over 900 koz versus 2022.

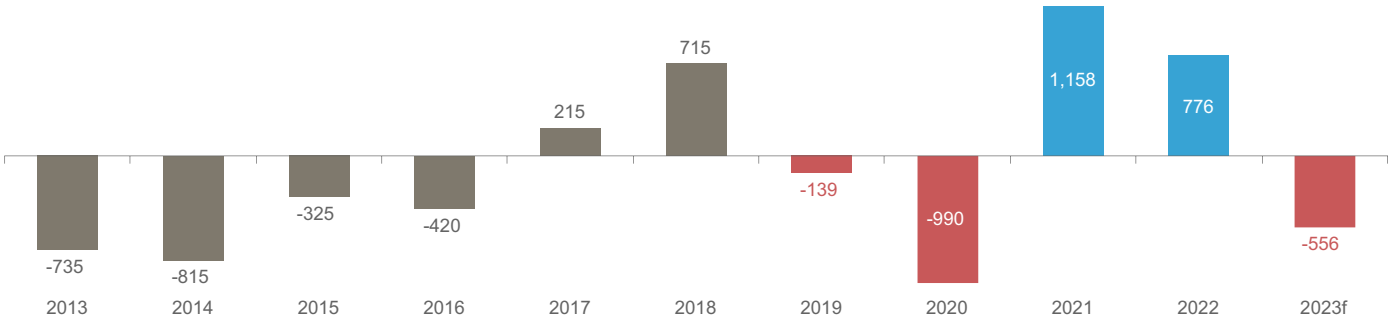
Total platinum demand in 2023 is forecast to increase year-on-year by 24% (1,534 koz) to 7,985 koz. In combination with the muted supply outlook, the net impact is for a project platinum market deficit of 556 koz in 2023, a change of more than 1.3 Moz from the surplus in 2022.

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



Source: Metals Focus

Annual platinum supply/demand balances



Source: Metals Focus

The platinum investment case – supply challenges underline risk of metal shortages

Since the last *Platinum Quarterly* in November, we have seen some significant changes in the underlying economic outlook. In general, there has been an overall improvement here, with the risks of a deep and prolonged global recession having abated. If a recession does materialise, it is likely to be shallower and shorter than previously feared. However, despite the improving economic outlook and easing inflationary risks – primarily due to falling energy costs – central bank rhetoric, particularly from the Fed, is currently pointing to future rate increases during the year. This is in contrast to early 2023 expectations which anticipated that, due to falling inflation, central banks would begin to taper rate increases, possibly even reversing them, as the year progressed.

Nevertheless, we believe that, despite the likelihood of rate rises, the associated risk to consumer spending has lessened. In any event, current estimates already take into account how continued rate rises might impact spending on non-essential items and the effect of higher financing costs for larger purchases, such as new vehicles. That said, whilst demand might be looking better protected than before, the signalling of continued rate increases by the Fed does have a bearing on the dollar, which is likely to remain stronger for longer, which generally results in lower commodity prices in US dollar terms; a factor that impacts all commodities priced in US dollars, not just platinum. With the risks to consumer spending having eased somewhat, we have even greater confidence in the projected year-on-year growth in platinum demand, whilst at the same time the challenges facing primary mine supply, as well as recycling, mean that the risks to supply are biased to the downside. In addition to the growth in automotive, industrial and jewellery platinum demand, the largest contributor to the supply/demand outlook moving from surplus to deficit is investment demand. Rising real interest rates and platinum lease rates have had a major bearing on platinum investment demand since the middle of 2021. Increasing interest rates have pushed investors into a hunt for yield, which has penalised non-yielding assets, resulting in significant disinvestment from precious metal ETFs. Between January 2021 and December 2022, global ETF holdings have declined by 3.8 Moz for gold, 137 Moz for silver, and 560 koz for platinum. Platinum ETF disinvestment may not have all been a macro-asset allocation decision to move away from non-yielding assets; in contrast to gold and silver, the platinum forward and futures markets were in backwardation from mid-2021 until late 2022. This means that asset class agnostic investors could be paid to hold platinum positions by moving their exposure from an ETF into the forward or futures markets, or potentially even towards buying the metal and leasing it out to capitalise on the high lease rates for much of the period. Indeed, since the platinum market moved back into contango, ETF disposals, which first slowed, have now begun to reverse. This gives us confidence that the risks to ETF investment demand are biased to the upside from current net disinvestment projections for 2023.

The change in exchange stocks has also contributed materially to the change in investment demand. The elevated lease rates seen since mid-2021 have resulted in negative EFP rates, which have incentivised holders to move stocks off-exchange to lend into the prompt, or near-term trading, market. This has resulted in over 400 koz of platinum coming out of exchange stocks, which together with the 800 koz that came from ETFs, significantly contributed to the substantial surpluses we have reported for 2021 and 2022. Exchange stocks fell to below long-run levels, but recent additions have moved them back to historical averages. We think the risk of further exchange stock outflows are extremely low in 2023 as current stock levels are adequate to back futures positions for the smooth functioning of the platinum futures markets.

Platinum bar and coin demand is projected to be extremely robust for 2023, up 100% year-on-year. This outlook remains highly dependent upon investor demand, which was very weak in Q4'22 and has had a muted start to 2023. In aggregate, we think the upside risks to ETF demand are likely to more than offset the downside risks to bar and coin demand.

In conclusion, we have a high degree of confidence in the projected deficit of 556 koz for 2023. The risks to supply are unlikely to be solved in the near-term, and demand looks set to continue to grow, and we believe it is likely that the deficit projected for this year will be the first of several, supported in-part by the expansion in demand for platinum from the growth of the hydrogen economy over the longer-term, albeit off a small base.

Commodity markets tend to self-solve for imbalances. In the case of deficits this would normally mean increasing prices until a supply response is incentivised, or there is demand destruction. The platinum market is characterised by extremely limited elasticity of supply, which means that prices would normally be expected to increase to the point where there is demand destruction (for example palladium substitution for platinum in automotive applications). However, this is typically somewhat softened for platinum by the existence of above ground stocks, the release of which would effectively act as an additional source of supply. However, we have observed that the bulk of above ground stocks appear to have migrated to China, which has been importing platinum at a rate well in excess of its identified needs. China has strict controls that limited platinum and palladium from being re-exported, which means that the majority of the inventories in China are geographically captive and unavailable to satisfy shortages in the rest of the world. At the same time, China's platinum import volumes have proven to be extremely price sensitive, increasing at low prices and falling away

when the platinum price increases. Thus, demand into China may be a limiting factor on platinum price appreciation, even if the rest of the world is seeing a shortage of metal. At the same time, it is worth observing that a similar situation occurred in palladium in the mid-2010's, with China accumulating significant above ground inventories ahead of the market moving into deficit. Whilst these inventories were eventually released to the domestic market, it required the palladium price to more than double to fully release them.

WPIC initiatives highlights

During 2022 we continued our efforts to increase the number and impact of our product partnerships in our four key target markets, China, Japan North America and Europe. We continue to work closely with our partners and support a wide range of initiatives to increase the awareness of platinum as an investment asset, its value credentials, and investment products available to investors worldwide.

The strong demand for alternative hard assets, including precious metals, continued unabated for most of 2022. The extremely high demand for gold and silver investment products placed some pressure on the availability of platinum bars and coins which was exacerbated by the cost of holding stock due to the elevated platinum lease rates. We worked closely with our product partners to maintain product availability and in Q4'22 included several initiatives to offset the decline in investor demand as inflation and the deteriorating economic outlook softened demand for all precious metals.

In favour of investment demand for platinum is the increasing awareness amongst retail investors of platinum's role in global decarbonisation. Whilst platinum already plays a critical role in reducing harmful automotive emissions, it also contributes to moderating greenhouse emissions by significantly lowering the energy requirements for many industrial processes, thanks to its unique catalytic properties. Adding to platinum's green credentials is the key role it plays in the production and use of green hydrogen. This is underlined by the forecast that electrolyser and stationary fuel cell demand for platinum will triple in 2023. We also note a significant increase in hydrogen related projects around the world, with the number of metals and mining related hydrogen projects alone doubling in 2022. Indeed, the longer-term outlook for hydrogen-linked demand for platinum will, on some projections, equal current automotive demand for platinum in the 2030's. We expect both the platinum market deficit and platinum's growing role as a proxy for exposure to green hydrogen 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.

WPIC product partnerships in North America and Europe experienced a good year overall in 2022. The strong demand for platinum bars and coins for most of the year was aided by the launching of various new platinum bullion products by our partners and supported in Q4 by campaigns that included an increased provision of our research content as well as collaborative videos and interviews. Early indications are of softer demand in 2023 however we will continue to increase platinum awareness and to work alongside our partners to launch new products.

In China, the increased level of platinum bar and coin sales in 2022 was held back by the COVID-related restrictions. Most pleasing was that based on encouraging sales of the first launch of the platinum panda coin in 17 years in 2022, China Gold Coins confirmed the continuity of platinum panda coins for 2023 and more importantly an addition of a platinum dragon coin for the year of dragon in 2024. The platinum dragon coin is planned to be first of a zodiac series, which will run for 12 years. WPIC will work to help China Gold Coin further reach its target customers in China via value-added marketing campaigns in 2023.

In Japan, we are delighted to announce the addition of two new partners in Q4, Japan Exchange and Nihon Material. Both have platinum investment products and believe that WPIC market insights are invaluable to their customer development. We continue to make good progress with our entry into the ASEAN and Korean markets as we leverage local partners to distribute our research insights to local investors.

Trevor Raymond, CEO

Contents

Table 1: Supply, demand and above ground stocks summary

	2019	2020	2021	2022	2023f	2022/2021 Growth %	2023f/2022 Growth %	Q3 2022	Q4 2022
Platinum Supply-demand Balance (koz)									
SUPPLY									
Refined Production	**6,075**	**4,989**	**6,297**	**5,579**	**5,573**	**-11%**	**0%**	**1,407**	**1,369**
South Africa	4,374	3,298	4,678	3,975	3,920	-15%	-1%	994	974
Zimbabwe	458	448	485	480	502	-1%	5%	116	123
North America	356	337	273	260	302	-5%	16%	66	63
Russia	716	704	652	663	644	2%	-3%	179	160
Other	170	202	208	201	205	-3%	2%	52	49
Increase (-)/Decrease (+) in Producer Inventory	+2	-84	-93	-35	+0	N/A	N/A	-43	-13
Total Mining Supply	**6,077**	**4,906**	**6,204**	**5,545**	**5,573**	**-11%**	**1%**	**1,363**	**1,356**
Recycling	**2,134**	**1,970**	**2,032**	**1,682**	**1,856**	**-17%**	**10%**	**408**	**383**
Autocatalyst	1,589	1,482	1,543	1,242	1,391	-20%	12%	301	274
Jewellery	476	422	422	372	395	-12%	6%	90	92
Industrial	69	66	67	68	69	3%	2%	17	17
Total Supply	**8,211**	**6,876**	**8,235**	**7,227**	**7,428**	**-12%**	**3%**	**1,772**	**1,739**
DEMAND									
Automotive	**2,870**	**2,403**	**2,647**	**2,957**	**3,246**	**12%**	**10%**	**727**	**763**
Autocatalyst	2,870	2,403	2,647	2,957	3,246	12%	10%	727	763
Non-road	†	†	†	†	†	N/A	N/A	†	†
Jewellery	**2,106**	**1,830**	**1,953**	**1,894**	**1,936**	**-3%**	**2%**	**481**	**452**
Industrial	**2,142**	**2,096**	**2,530**	**2,243**	**2,505**	**-11%**	**12%**	**586**	**477**
Chemical	679	693	682	629	619	-8%	-2%	174	157
Petroleum	219	109	171	188	180	10%	-4%	48	51
Electrical	144	130	135	106	100	-21%	-6%	26	24
Glass	236	407	728	474	737	-35%	55%	128	42
Medical and Biomedical	277	256	269	275	283	2%	3%	70	69
Other	586	501	546	570	587	5%	3%	141	134
Investment	**1,233**	**1,536**	**-53**	**-643**	**298**	**N/A**	**N/A**	**-277**	**-59**
Change in Bars, Coins	263	571	324	225	450	-31%	100%	92	1
Change in ETF Holdings	991	507	-238	-560	-132	N/A	N/A	-235	-67
Change in Stocks Held by Exchanges	-20	458	-139	-307	-20	N/A	N/A	-134	7
Total Demand	**8,350**	**7,866**	**7,077**	**6,451**	**7,985**	**-9%**	**24%**	**1,517**	**1,634**
Balance	**-139**	**-990**	**1,158**	**776**	**-556**	**-33%**	**N/A**	**255**	**105**
Above Ground Stocks	**3,511****	**2,521**	**3,679**	**4,455**	**3,899**	**21%**	**-12%**		

Source: Metals Focus 2019 - 2023.

Notes:

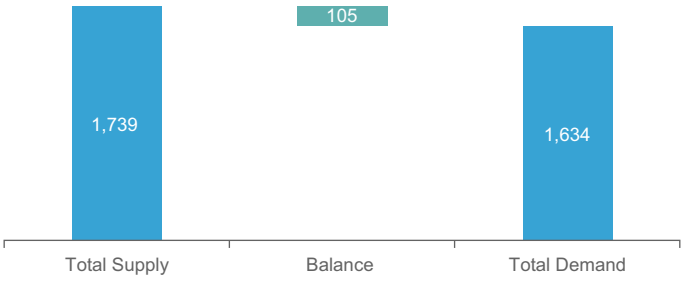
1. **Above Ground Stocks 3,650 koz as of 31 December 2018 (Metals Focus).
2. † Non-road automotive demand is included in autocatalyst demand.
3. All estimates are based on the latest available information, but they are subject to revision in subsequent quarterly reports.
4. The WPIC did not publish quarterly 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.
5. 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 FOURTH QUARTER PLATINUM MARKET REVIEW

During the fourth quarter, the global economy surprised to the upside, remaining stronger than expected. Growth rates for the quarter in both the United States and Eurozone exceeded expectations, inflation appeared to decelerate in both markets, while labour markets remained tighter than anticipated. In addition, China's abandonment of its zero-COVID policy has generated some optimism. Despite these improvements, lingering constraints still weighed on the quarter – the semiconductor shortage, while steadily improving, curbed vehicle production growth in North America and Europe. Meanwhile, the income squeeze faced by households contributed to slowing vehicle sales rates. At 1,634 koz, total demand for the quarter was 5% (-78 koz) lower than Q4'21, mainly due to the 24% decline in the industrial sector where the decommissioning of glass plants in Japan in 2022 and the effect of higher chemical plant expansions in China in Q4'21 relative to Q4'22 impacted this segment. A further decline in the jewellery sector (-59 koz, -12% year-on-year) offset growth in automotive demand (+82 koz, +12%), which benefitted from the easing chip shortage. While the outflows in ETFs and warehouse stocks slowed markedly this past quarter, bar and coin sales, which disappointed when compared to Q4'21 due to weaker sales in North America and Europe, were compounded by net disinvestment in Japan as the high yen price enticed investors to sell.

Refined mine production declined sharply by -326 koz year-on-year to 1,369 koz. This was mainly due to a drop in South African supply owing to smelter maintenance in Q4'22, as well as Q4'21 being boosted by the release of semi-finished inventory. Recycling continued to struggle, declining 19% year-on-year (-89 koz), which was attributable to lower inventories and some minor impact (specifically in North America) following the law-enforcement activities aimed at curbing high autocatalyst thefts. Jewellery recycling, too, was down due to slower jewellery sales in China, with correspondingly fewer sellbacks. The impact of the lower supply, which totalled 1,739 koz, aided a further contraction in the market surplus, which fell by 75% against Q4'21 to 105 koz; it was also 59% lower than in Q3'22.

Chart 1: Supply-demand balance, koz, Q4 2022



Source: Metals Focus

Supply

Refined mine supply declined 18% (-300 koz) year-on-year to 1,356 koz, primarily due to lower output from South Africa, with Russia also experiencing a modest decline.

Output from South Africa declined 24% (-300 koz) year-on-year due to the combined impact of smelter maintenance and the release of semi-finished inventory that boosted refined volumes in Q4'21. Lower output from Anglo American Platinum represented most of the year-on-year decline due to the Polokwane smelter rebuild. Implats' output also declined as the company embarked on a rebuild of the Number 4 furnace. As the country's power crisis deepened, the constrained processing capacity during the quarter was exacerbated by the increasing frequency and magnitude of load curtailment.

Russian production declined 10% (-18 koz) year-on-year as the transport of platinum-containing products processed in Finland was impacted by geopolitical tensions resulting from the Russian-Ukraine conflict. The decline was further compounded as the prior year's output was buoyed by a release of semi-finished inventory.

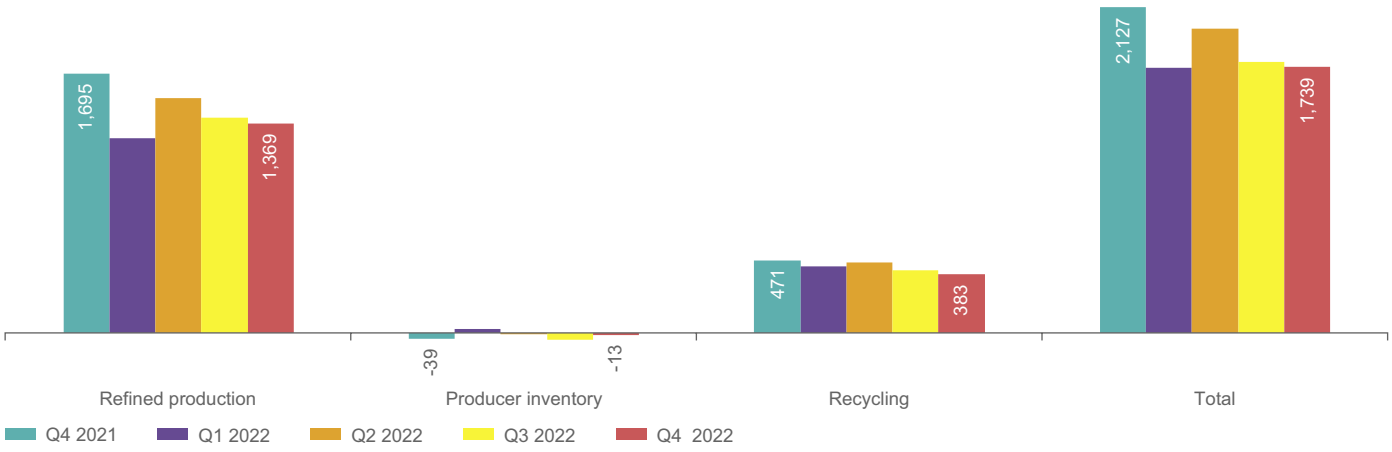
Zimbabwe's refined production remained unchanged year-on-year with growth in underlying mine production matching output in 2021, which was boosted by the release of semi-finished inventory. Gains from the commissioning of a new concentrator at Zimplats were partly offset by maintenance at Unki. Output from North America remained flat as modest growth from Canada was offset by a decline in the US.

Recycling

A combination of factors saw global recycling fall further in Q4'22 to 383 koz, down 19% (-89 koz) on Q4'21. The bulk of the decline was the result of a reduction in autocatalyst recycling, which weakened by 22% year-on-year (-78 koz). Low availability of new vehicles and changing consumer behaviour have resulted in cars being driven for longer. Although the availability of new cars is improving, there was still a slowdown in the supply of end-of-life vehicles. Meanwhile, the shift towards working remotely and online shopping, accelerated by the pandemic, has resulted in the number of miles being driven in 2022 falling by an estimated 10% in cities and even more so in urban areas. Furthermore, the income squeeze has seen some consumers delay new vehicle purchases. Finally, in the North American market, the quarter was also impacted (more in sentiment than in volumes) by federal law enforcement activity clamping down on autocatalyst theft. This resulted in some suppliers across the value chain reassessing their processes, which delayed throughput. That said, we expect this to only have a temporary impact as the industry (which already has very robust processes in place) looks to introduce further mechanisms to improve confidence in the provenance of purchased spent catalysts.

Platinum jewellery scrap was down by 10% year-on-year in Q4'22. With 55% of the jewellery recycling market share, China's weak jewellery sales, despite better platinum prices in the quarter, constrained selling-back activity. Electronic recycling was essentially unchanged compared to the prior year.

Chart 2: Platinum supply, koz

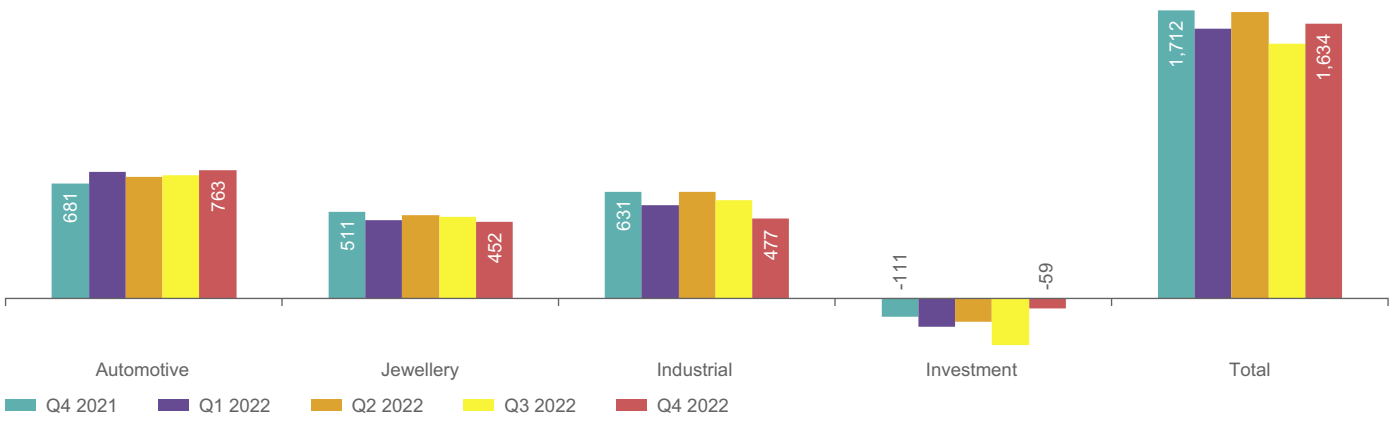


Source: Metals Focus

Demand

Total demand in Q4'22 was down 5% year-on-year (-78 koz) as industrial demand fell due to a combination of a higher Q4'21 base, as well as some LCD glass plant decommissioning seen in Japan (as platinum recovered from recycled equipment offsets new demand). Meanwhile despite lower production of internal combustion engine vehicles in the quarter, a combination of higher loadings (especially in heavy-duty diesel), increased hybrid vehicle production and further platinum for palladium substitution, saw automotive demand increase 12% year-on-year (+82 koz). Outflows in the investment segment slowed compared to prior quarters in 2022. ETF holdings shed -67 koz while exchange stocks gained 7 koz. Bar and coin investment weakened in the quarter as North American and European sales slowed and Japanese investor profited from exceptionally high Yen platinum prices.

Chart 3: Platinum demand, koz



Source: Metals Focus

Automotive demand

Total automotive platinum demand in Q4'22 increased by 12% year-on-year (+82 koz). This occurred despite a 7% decline in the production of internal combustion engine (ICE) cars and a 6% decline in heavy-duty vehicle output. There were several factors that offset the lower ICE and heavy-duty vehicle production. First, the manufacture of hybrid vehicles rose by 28%. The higher variability in engine temperatures (compared to ICE cars) in these powertrains generally requires higher catalyst loadings. Second, production volumes of heavy-duty vehicles with a China VIb compliant PGM-based catalyst improved by 7%. Third, with increasing production of models now fitted with a trimetal catalyst, the associated platinum for palladium substitution has helped to limit the impact of accelerating powertrain electrification.

Taking a closer look at regional performances, each jurisdiction registered improved platinum demand compared to last year. It is worth noting that light-vehicle production in India jumped 22% year-on-year which supported the 21% increase in platinum demand in our Rest of World segment. In North America and China, the two regions where we have noted the greatest activity in substitution of platinum for palladium, demand increased 15% (+14 koz) and 8% year-on-year (+9 koz) respectively. That said, European demand also improved as both diesel and gasoline light duty production were higher than Q4'21, despite the chip shortage in the region persisting. Demand in Japan also increased as vehicle production recovered in response to the cautious emergence out of lockdown there. For example, fuel cell electric vehicle production in Japan, while still low numbers, improved by 33% year-on-year.

Jewellery demand

The 12% year-on-year (-59 koz) decline in global jewellery demand was the result of weaker Chinese and North American demand which was not offset by growth in other regions.

Chinese platinum jewellery demand in Q4'22 slumped by 40% year-on-year (-68 koz). This reflected the severe impact of COVID prevention measures in October and November, combined with lower mobility across the country after the shift away from a zero-COVID policy in early December due to the surge in outbreaks directly following the emergence from lockdown. Furthermore, although most retailers' operations returned to normal by end-December after the peak of infections, rising footfall to shopping malls and gradually improved consumer sentiment mostly benefitted gold jewellery. In contrast, platinum jewellery continued to experience headwinds from gold jewellery due to seasonal festival demand for the forthcoming Chinese New Year and gold jewellery having more attractive buy and sell spreads (i.e. the sellback price for gold jewellery is trading closer to the cost of purchasing new jewellery than was the case for platinum).

North American platinum jewellery demand fell 13% year-on-year in Q4'22 due to a mix of factors such as consumer expenditure swinging back to services (especially travel) and the peak for postponed weddings having passed. However, retailer caution towards stock levels also impacted demand, with fabrication volumes below sales to run down inventory.

Demand for platinum jewellery in Europe saw a 7% year-on-year rise but, as before, there were marked differences between sectors; the top end remained strong (as indicated by the 30% rise for Swiss platinum watch hallmarking), whereas bridal/mainstream sales were soft (UK hallmarking for instance fell 19%) on recession fears and the cost of living crisis.

Meanwhile, demand in Japan was slightly softer than Q3'22 but still up on Q4'21 (7%, +5 koz year-on-year). Export sales remained strong and, although online and TV sales were slightly softer, bricks and mortar sales have started to benefit from improved Japanese consumer activity and mobility, following a very cautious approach towards COVID restrictions.

In India, continuing the growth trend of the earlier quarters, platinum jewellery fabrication jumped by 20% year-on-year (+10 koz) in Q4'22 to 63 koz, a record high in our series. During the quarter, activity was supported by the wedding and festival season as demand typically sees a seasonal pickup during this period.

Industrial demand

Industrial demand weakened 24% year-on-year (-154 koz), albeit that the comparable quarter was the second strongest on record, as glass plant decommissioning and chemical plant expansions in Q4'21 resulted in lower year-on-year demand.

Chemical

Platinum chemical offtake declined by 9% (-16 koz) quarter-on-quarter to 157 koz in Q4'22. The majority of the change came from the on-streaming of a new propane dehydrogenation (PDH) plant in Canada, which benefited Q3'22 demand, but not Q4'22. In addition, silicone demand was down significantly on a quarterly basis, led by lower demand for packaging, coatings, industrial, and construction silicones as global economic activity slowed. Compared to Q4'21, chemical demand was down 16% (-30 koz), although this was more due to standout paraxylene capacity additions in Q4'21, particularly in China .

Petroleum

Platinum demand contracted by 11% (-6 koz) year-on-year in Q4'22 compared to Q4'21. Mounting economic headwinds continued to weigh on consumption, which were exacerbated by China's COVID lockdowns and ongoing outbreaks, Europe's energy crisis and a strong dollar. In addition, production cuts were made by OPEC+ in November to meet agreed output levels.

Medical

Platinum demand from medical devices fell marginally quarter-on-quarter in Q4'22, as seasonal staff shortages, exacerbated by COVID, increased the number of elective procedures that were postponed or cancelled. Even so, platinum demand improved year-on-year rising by 2% (+2 koz) in Q4'22, as vaccinations and better COVID management meant the virus had less of an impact on the sector.

Glass

The 70% year-on-year decline to 42 koz in platinum demand from the glass industry in Q4'22, reflected the further decommissioning of remaining Japanese LCD tanks as a result of high power costs, as well as a slowdown in fiberglass capacity investments in China as the zero-COVID policy was maintained throughout H2.

Electrical

Demand from the electrical segment in Q4'22 fell by 26% (-8 koz) year-on-year, reflecting a decline in all mainstream electronic applications. In the data storage segment, HDD shipments fell to an all-time low. In light of the uncertain economic sentiment many companies significantly reduced capital expenditure. In many cases, purchases of sizeable capex items, such as nearline storage and the further construction of data centres, were placed on hold.

Other

Global other industrial demand declined by 8% (-11 koz) to 134 koz in Q4'22. In the automotive segment, we saw a decline in demand for spark plugs and sensors. In contrast, demand improved in both stationary fuel cells and the aerospace industry. Electrolyser demand in the quarter also reflected the marked increase in electrolyser manufacturing last year.

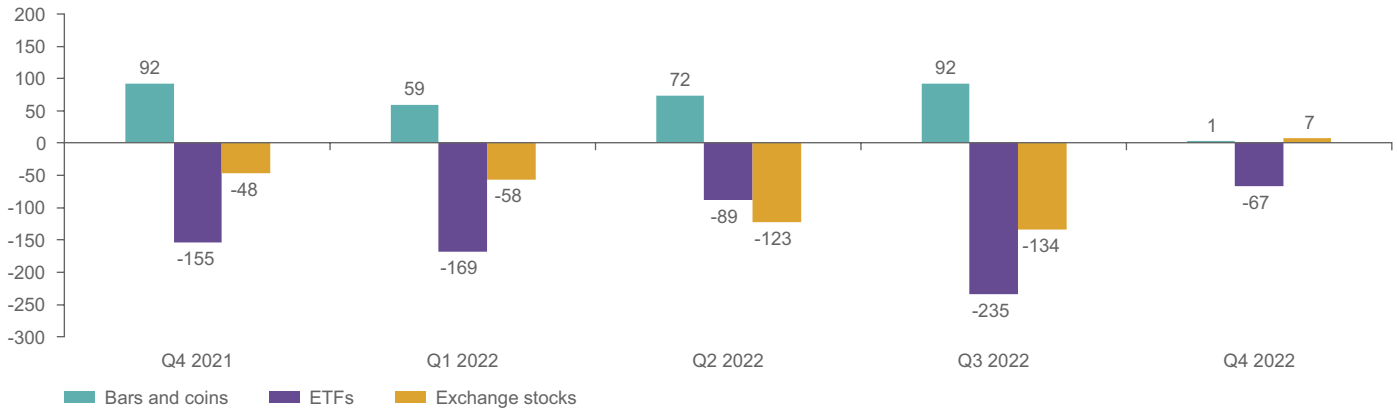
Investment demand

Retail investment fell almost to zero during Q4'22, reaching just 1 koz on a net basis (-90 koz year-on-year). This largely reflected the increased platinum prices which resulted in weaker sales in all key regions. Most stark however, was the return to net disinvestment in Japan as the slide in the yen accentuated the platinum price strength in local terms. Retail purchases in Europe and North America remained in positive territory (on a net basis), but also suffered from a lack of product availability, as manufacturers continued to focus on strongly performing gold and silver.

ETF outflows slowed in the quarter to -67 koz. The slower pace of liquidations can be ascribed to investors adapting to the current economic conditions. While interest hikes prevailed, liquidations out of North American funds slowed most notably, suggesting that investors have adjusted to the new conditions.

NYMEX and TOCOM warehouse stocks edged higher by 7 koz. This coincides with a slowdown in Chinese imports easing the physical tightness seen throughout 2022.

Chart 4: Platinum Investment, koz



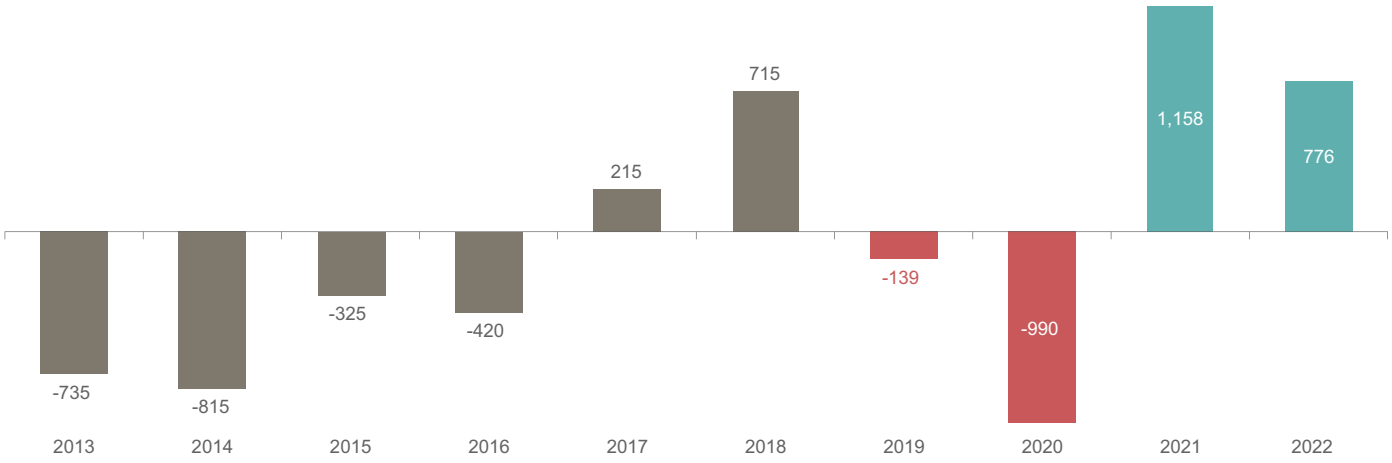
Source: Metals Focus

2022 REVIEW

Following greater-than-expected resilience, the International Monetary Fund slightly increased its estimate of global economic growth for 2022. Since the release of the previous *Platinum Quarterly*, 2022 growth is now pegged at 3.4% compared to 3.2% previously. Despite some resilience in platinum demand, slowing economic conditions, higher inflation and interest rates, tighter cost of living conditions and the residual impact of the pandemic weighed on some demand segments. Total platinum demand declined 9% year-on-year (-626 koz) to 6,451 koz, the lowest level in this series. While we saw a healthy 12% (+311 koz) year-on-year increase in automotive demand, it was insufficient to abate the outflow of -560 koz in ETF holdings and -307 koz of exchange warehouse stocks. While bar and coin investment was positive at 225 koz, it was almost 100 koz lower than in 2021. Industrial demand also weakened, by 11% (-288 koz), although this mostly reflected record demand in 2021, which was boosted by capacity expansions in the glass and chemical sectors.

On the supply side, the platinum market also struggled. Total mining supply declined 11% year-on-year (-659 koz) as operational challenges prevailed amid ever worsening power shortages in South Africa. In addition, 2021 saw a significant drawdown of a COVID-related inventory build-up. Secondary supply also declined as both spent autocatalyst and jewellery markets struggled due to residual COVID lockdown damage. Despite this, the market recorded a surplus, adding 776 koz to above-ground stocks last year.

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



Source: Metals Focus

Supply

Refined mine production in 2022 fell 11% (-717 koz) year-on-year to 5,579 koz. While the release of around 400 koz of semi-finished inventory, accumulated as a result of the 2020 Anglo Convertor Plant (ACP) shutdown, boosted output in 2021, production in 2022 faced significant headwinds, falling below 6,000 koz for only the third time in the past decade. South Africa accounted for most of the decline falling 15% (-704 koz) to 3,975 koz, with several disruption events through the year resulting in production falling short of planned volumes. Output from North America also fell short of expectations due to a flood and reduced mine plan at Sibanye-Stillwater's US operation, in addition to a strike at Glencore's nickel operations in Canada.

Refined production from South Africa was expected to decline last year, although the extent of these losses exceeded expectations. Several factors accounted for this, with producers subject to individual disruption events, although common themes emerged of constrained supply chains, safety stoppages, community disruption and an unstable power supply. Extended smelter maintenance was, however, responsible for by far the largest share of lost production. Accelerated wear at Implats' Number 3 furnace necessitated an unplanned full rebuild, while the delivery of substandard materials required for Anglo American Platinum's Polokwane smelter rebuild resulted in an extended shutdown. Mine production continued unabated through smelter maintenance and thus constrained processing capacity resulted in a short-term build-up of semi-processed inventory which can be caught-up. The timing of the Polokwane rebuild towards the end of the year and the subsequent rebuild of Implats' Number 4 furnace has meant significant volumes were not caught-up in 2022 contributing to the year-on-year drop in mine supply.

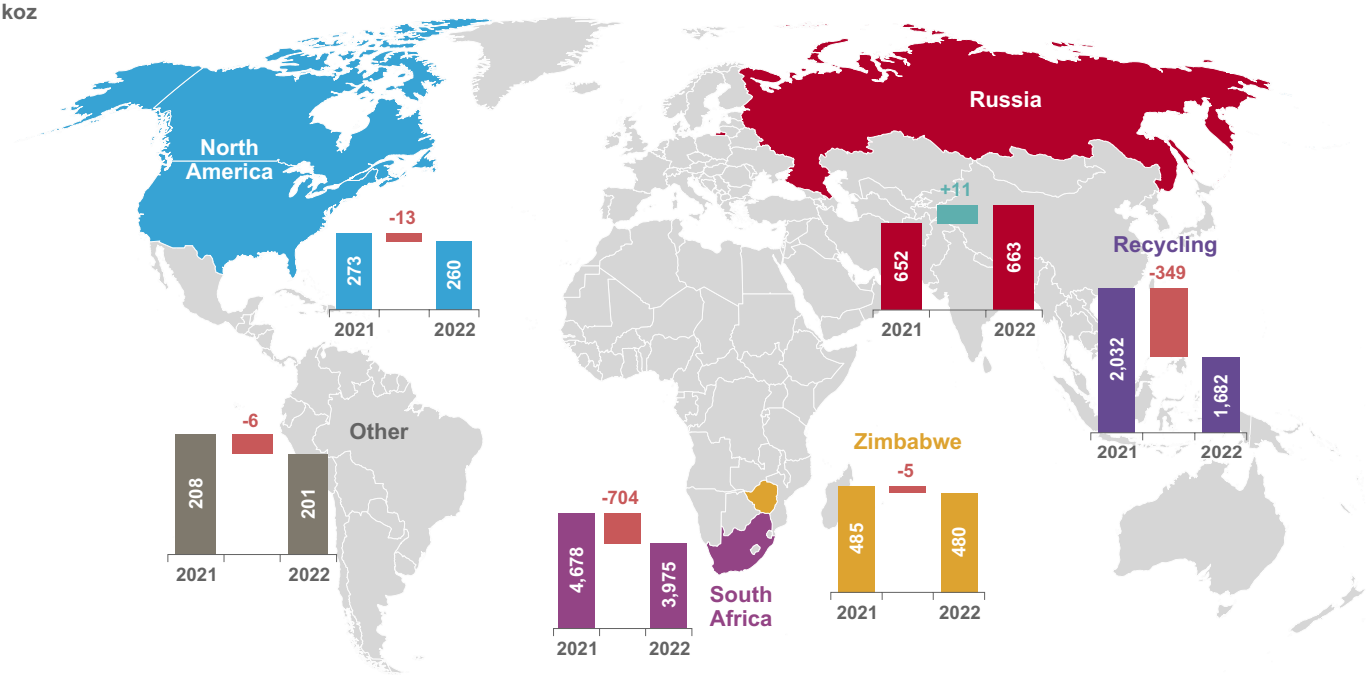
The Russian-Ukraine conflict and changing geopolitical dynamics introduced downside risk to Russian output. Nornickel, the country's major PGM producer, experienced significant challenges in procurement and sales logistics. The impact on production was however offset by the deferral of smelter maintenance which was originally planned for 2022, with the result that Russian production increased 2% (+11 koz) to 663 koz, in the process achieving planned volumes. Logistical constraints and the reorientation of sales to new markets impacted sales through 2022. We await the company's full year report for confirmation, but expect this will confirm that not all of Nornickel's platinum production reached the market last year.

In Zimbabwe, despite underlying mine production increasing due to project development, refined output remained unchanged year-on-year due to the release of semi-processed inventory in 2021. The completion of the Unki debottlenecking project and the commissioning of the Ngezi third concentrator at Zimplats increased capacity, which will result in higher refined volumes in 2023.

Against expectations of growth coming into 2022, North American output fell 5% (-13 koz) to 260 koz. The decline was driven by lower output from Sibanye-Stillwater's US operations, the result of Mine Safety and Health Administration-mandated operational constraints in response to safety incidents. A seven-week suspension of some mining areas, due to regional flooding, also created significant disruption. As a result of these challenges and Sibanye-Stillwater gearing up for a weaker palladium market, a revised mine plan, significantly lowering output, was implemented. More broadly, regional labour shortages and supply chain issues pressured operational stability. While a strike at Glencore's nickel operations constrained growth, Canada's output recovered from the 2021 strike at Vale's Sudbury operations.

Chart 6: Changes in supply, 2021 vs. 2022

koz



Source: Metals Focus

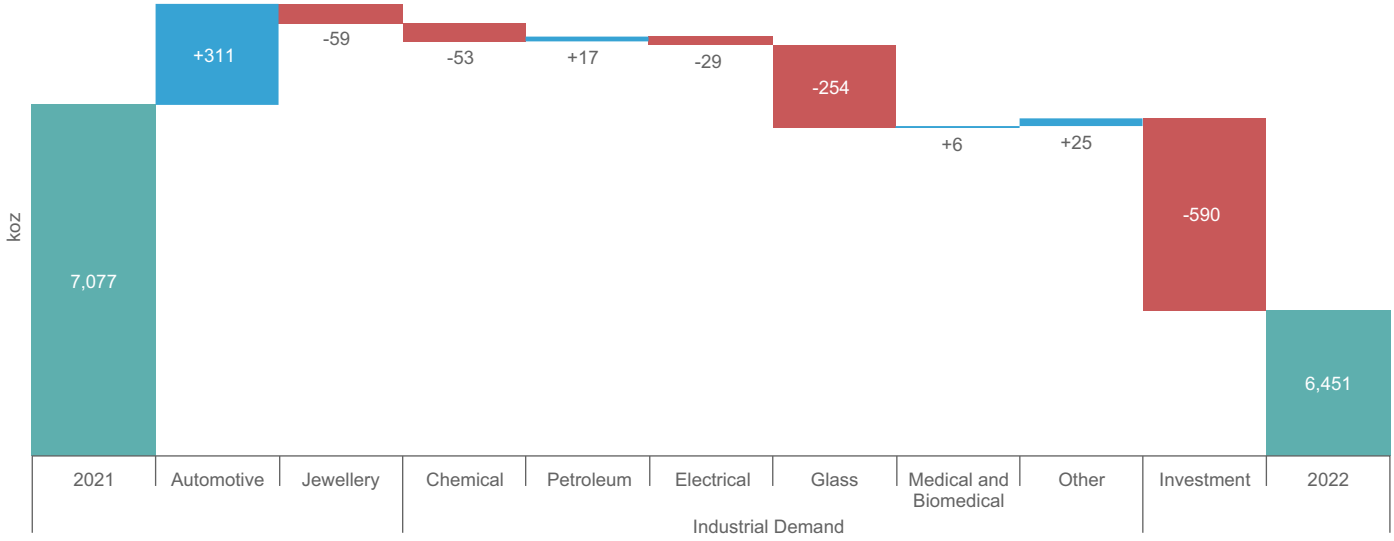
Recycling

Global recycling declined 17% year-on-year in 2022 to 1,682 koz. Automotive recycling in 2022 fell by 20% (-301 koz) to 1,242 koz. Despite improvements in new car availability, inventory levels were low and delivery lead times still long. This is resulting in consumers driving their cars for longer. Cost-of-living concerns, as well as changes in driving behaviour, further limited the availability of end-of-life vehicles. Jewellery recycling fell by 12% year-on-year (-50 koz) due to a 22% decline in China linked to the weak demand for new platinum jewellery there. Recycling from electronic waste improved by 3% (+2 koz).

Demand

Platinum demand declined year-on-year to 6,451 koz (-9%) driven by net retail disinvestment and fewer plant capacity expansions compared to 2021. Automotive demand increased by 12% year-on-year (+311 koz) to 2,957 koz, while industrial demand declined by 11% (-288 koz). Weakness in the consumer electronics market in 2022 resulted in platinum demand in this segment falling by 21% year-on-year (-29 koz). With the largest jewellery market in lockdown for much of 2022, jewellery unsurprisingly declined by 3% (-59 koz). During 2022, we continued to see ETF liquidations (-560 koz), as well as a decline in warehouse stocks (-307 koz). While bar and coin investment reached 225 koz this was 31% down on 2021, mostly reflecting net liquidations in Japan as the yen platinum price strengthened.

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



Source: Metals Focus

Automotive demand

The global automotive market remained on an improving path throughout last year, reaching 2,957 koz, up 12% year-on-year (+311 koz), despite headwinds brought about by the lingering chip shortage, the Russia-Ukraine war, cost-of-living concerns and the severe lockdown in China, the world's biggest car market. LMC Automotive, a GlobalData Company, estimate that light-duty vehicle (LDV) production increased by 6% to 82M versus 2021. Heavy-duty vehicle (HDV) production, on the other hand, contracted by 16% last year, falling below 3M units.

Despite vehicle production falling well short of the 89M units seen in 2019, platinum demand was more than 100 koz higher than in 2019 on the back of three key factors. First, the number of hybrid vehicles produced jumped by almost one-third. Due to the combined use of battery and fuel power a hybrid vehicle has higher temperature variability, which often requires higher loadings on the after-treatment system to ensure effective abatement. Second, the introduction of China VI in heavy-duty vehicles saw platinum demand in this category surge by 36% in 2022. Finally, the substitution of platinum for palladium gained traction last year.

Aside from Europe and Japan, we have seen double-digit increases in platinum automotive demand in most geographies in 2022. While both of these markets registered growth in vehicle production, ongoing thrifting in Japan and aggressive electrification in Europe weighed on their platinum demand. In China, a combination of tighter emissions legislation and more trimetal catalysts being installed, offset the decline in internal combustion engine (ICE) production. While North American ICE production was up by 6% last year, platinum demand grew 17% as the phase-in of tighter emissions legislation and platinum for palladium substitution boosted demand.

Jewellery demand

The damage caused to the Chinese jewellery market due to COVID lockdowns saw global jewellery demand contract 3% in 2022 to 1,894 koz. Despite strong growth from Western markets and India, the weakness in the all-important Chinese market saw demand fall to its lowest level in the past decade.

Chinese platinum jewellery fabrication fell for the ninth consecutive year in 2022, sliding 31% to a recent low of 484 koz. The main factors were COVID-related disruptions across the country, impaired consumer sentiment and accelerated competition from the gold jewellery market.

European fabrication rose 16% (+27% on 2019), primarily due to a boom for top-end watches and jewellery (Swiss watch hallmarking shot up by 79%), as well as strong first half gains in bridal demand due to wedding postponements from 2021, enabling modest full year growth (2022 UK hallmarking was up 13% year-on-year).

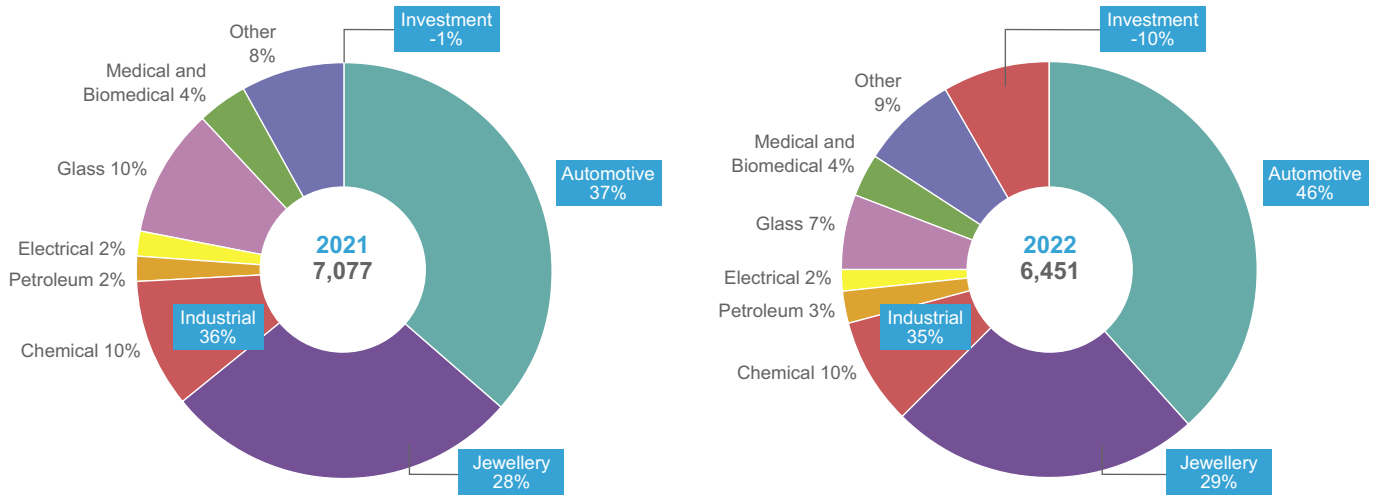
Demand in North America grew 9% year-on-year in 2022 thanks to such drivers as wedding postponements from 2021 and a strong economy. North American appetite for platinum jewellery was also up 31% on 2019 due to drivers such as attractive price differentials versus white gold and a wider spread of retailers now showcasing the metal.

In India, the increase in the number of organised retailers offering platinum, along with growing consumer interest, has seen platinum demand increase by 35% in 2022 to 167 koz. In Japan too, the improvement in demand was seen across various mediums (online as well as instore) resulting in a 12% (+35 koz) increase.

Industrial demand

Industrial demand in 2022 declined by 11% year-on-year (-288 koz) due to fewer glass and chemical plant capacity expansions and lower demand for consumer electronics which offset growth in other areas. It is worth noting that 2021 was a record year for Industrial demand, and 2022 is still the second strongest year for industrial demand on record.

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



Source: Metals Focus

Petroleum

Petroleum demand grew 10% (+17 koz) year-on-year in 2022 to 188 koz, as oil production continued its post-COVID recovery. Most of the growth was due to new capacity in the Middle East following a year of consolidation in 2021, which offset a slowdown in reforming and isomerisation capacity growth in Japan and China. Russian capacity was unchanged in 2022, although some of its refineries operated below capacity given lower export demand, culminating in December with the EU banning seaborne imports of crude oil from Russia (which makes up around half of Russian exports). Despite the growth, 2022 platinum demand in the petroleum industry is still 18% down on 2019 levels.

Chemical

Platinum demand for the chemicals industry totalled 629 koz in 2022, a fall of 8% (-53 koz) compared to 2021. Most of the decline came from a slowdown in paraxylene (PX) capacity expansions. Platinum's use as a catalyst in PX manufacturing is dominated by China. The country's recent bid for petrochemical self-sufficiency has led to substantial growth since 2019. However, Chinese PX capacity expansions in 2022 did not keep pace with the growth seen in 2019-21, leading to lower demand, albeit still at an elevated level. Similarly, propane dehydrogenation (PDH) capacity expansions were down on 2021, again led by a slowdown in Chinese growth, the full effects were offset by new capacity on-streaming in Canada, the United States and Kazakhstan.

Silicone demand was also marginally down in 2022, owing mostly to weaker demand from Europe. Offtake for nitric acid, a key component of fertiliser manufacturing, was also down, driven by lower output in China, Russia, Belarus and Europe. Due to the war, trade barriers exist that hampered the flow of fertiliser, resulting in lower output from Russia and Belarus. Elevated energy prices made the energy-intensive fertiliser manufacturing process uneconomic, particularly in Europe for large parts of last year.

Glass

Compared to the previous *Platinum Quarterly,* we have adjusted our estimate for glass demand upwards for 2022, as new data indicated that more fibreglass capacity was installed in China last year than previously estimated. Despite this upward revision, the expansions in 2022 were not at the same level as seen in 2021, which was the strongest year on record, and resulted in a year-on-year decline in platinum demand in 2022. We now estimate global demand in 2022 to have decreased by 35% year-on-year to 474 koz.

Medical

Platinum demand improved by 2% (+6 koz) in 2022 compared to 2021. Higher vaccination rates, better hospital management in dealing with the virus and a build-up of elective procedure backlogs throughout 2020–21 helped platinum medical demand improve year-on-year. Total medical demand for 2022 will be 275 koz, 1% short of 2019's pre-COVID level of 277 koz. Lockdowns and the recent outbreak of COVID in China had less of an impact on platinum medical demand than the rest of the world in 2020-21, as China only makes up 12% of global medical demand for platinum.

Electrical

Reduced capex spend, as well as oversupply of semiconductors for phones, PCs and other consumer electronics, weighed on the electronics sector in 2022. For the full year, demand fell by 21% to 106 koz. HDD shipments declined as data centre construction plans were placed on hold amid the pessimistic economic outlook. In addition, an oversupply of SSDs resulted in aggressive price cuts, further taking market share away from the HDD PC and gaming console markets.

Other

Platinum demand in the other industrial segment grew 5% year-on-year (+25 koz) in 2022, as higher vehicle production resulted in increased demand for spark plugs and sensors. In addition, total installed electrolyser capacity surpassed 1GW in 2022, resulting in firmer demand for platinum from PEM electrolysers.

Investment demand

In 2022, global bar and coin demand fell by 31% year-on-year (-99 koz) to an eight-year low of 225 koz. Key to this was another year of net liquidations in Japan, which were much more pronounced than in 2021. European demand also weakened, dropping to a four-year low. This all contrasted with a slight improvement in North America, where retail investment edged up by 1% to a new record high.

ETFs saw outflows totalling -560 koz to close the year with total holdings at just over 3,000 koz. This is 1,000 koz lower than their July 2021 peak of 4,036,413 koz,. Several macro factors tarnished platinum's investment appeal during 2022, including a stronger dollar and the ongoing chip shortage, which curbed vehicle production. Rising interest rates were another factor as this resulted in an increase in the opportunity cost for holding non-yielding assets. Warehouse stock outflows exceeded 300 koz by year-end, seeing stock levels return to historic norms.

ABOVE GROUND STOCKS

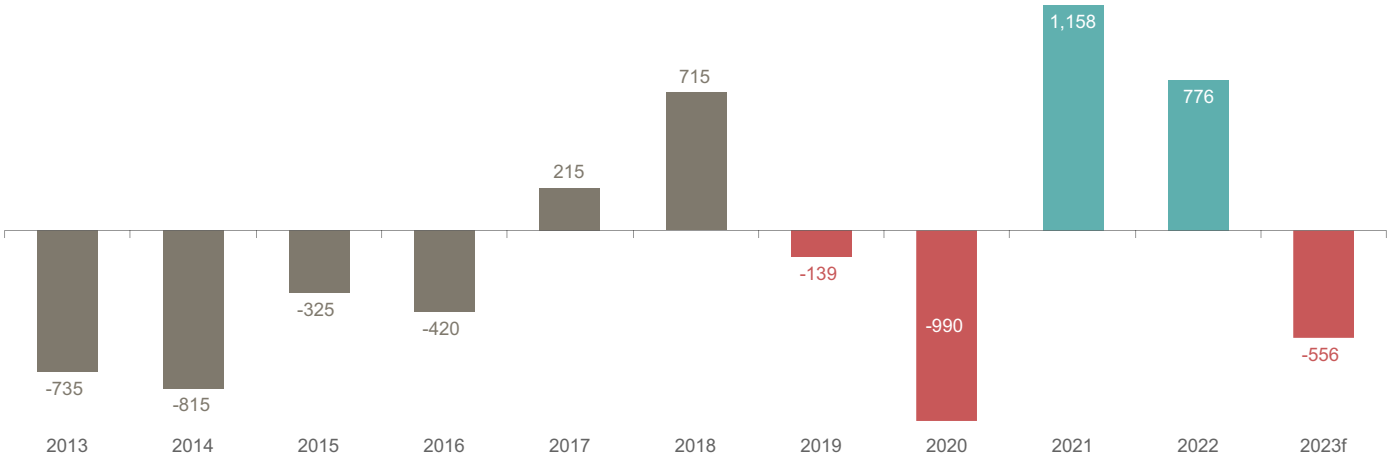
The surplus of 776 koz for 2022 saw above-ground stocks increase to 4,455 koz, surpassing annual South African mine supply.

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

From a macro perspective 2023 is expected to be a difficult year. Despite some green shoots in the form of China's reopening, Europe's better than expected navigation of the energy crisis and improving inflation expectations, global growth, according to the IMF, is expected to slow to 2.9%. Notwithstanding this more subdued outlook, we expect the platinum market to swing from a significant surplus to a meaningful deficit. There are two key drivers for this. Investment demand will swing by close to 1,000 koz as coin and bar demand improves and ETF liquidations slow. In addition, we expect both mine supply and secondary supply to face further headwinds this year, which will curtail normal growth and recovery in global supply.

Chart 9: Supply-demand balance, koz, 2013-2023f



Source: Metals Focus

Supply

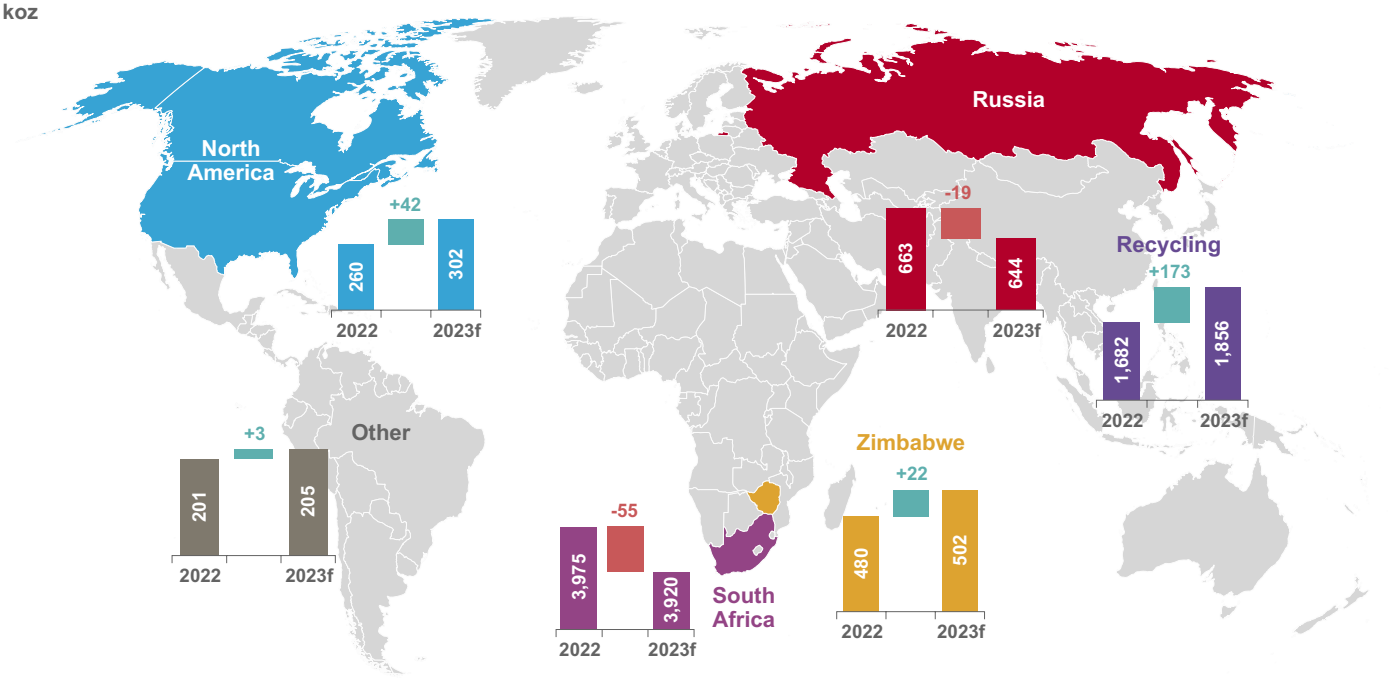
Post-pandemic platinum mine supply has increased in volatility. Following the 2014 strikes and until the advent of COVID, global annual platinum supply remained in a narrow range between 6,100-6,300 koz. More recently, despite underlying mine production remaining relatively consistent, processing constraints have impacted refined production.

As discussed above, significant headwinds in South Africa constrained output in 2022 and many of these drivers are expected to persist this year. Disruption has been most acute at smelting facilities where the concentration of supply through a small number of assets results in the outsized impact on global supply. While the completion of major smelter rebuilds should bring more stability to South African supply, the country's deepening energy crisis presents significant uncertainty in the timing of the release of semi-finished inventory built as a consequence of smelter downtime. Additionally, miners report an increasingly challenging operating environment, community disruption and security incidents which will continue to impact South African output, while inflationary pressure will increasingly impact margins. In light of this, we expect the country's mine supply to remain largely unchanged year-on-year as the easing of constrained smelter capacity is offset by lower grades at key mines and some infrastructure closures.

In Russia, Nornickel guidance indicates lower output due to the impact of deferred smelter maintenance. Challenges in transporting product internationally for processing could present a logistical bottleneck, but due to the reorientation of sales it is likely that movement of refined inventory will continue. On balance we estimate the refined Russian production will decline slightly, but remain robust. Production from Zimbabwe is expected to reach a new high this year of around 500 koz as ongoing project development brings new volumes online. North America is forecast to deliver the greatest regional growth, with increases both from Canadian nickel mining and the normalisation of output after disruptions at Sibanye-Stillwater's US operations. However, should constraints at the Stillwater mine continue, this will put the regional growth at risk.

Chart 10: Changes in supply, 2022 vs. 2023f

koz



Source: Metals Focus

Recycling

Global recycling is expected to recover by 10% in 2023 to 1,856 (+173 koz), largely reflecting our expectations that the growth in new vehicle production will lead to a normalisation of end of life scrappage rates and thus the spent autocatalyst market, which is forecast to recover by 12% year-on-year to 1,391 koz, but still remain below pre-pandemic levels. With remote work and online shopping now entrenched behaviour we can expect to see cars driven for longer. Turning to platinum jewellery scrap, global recycling is expected to increase 6% (+23 koz) as declines elsewhere offset an anticipated recovery in China, mostly driven by fewer COVID-related disruptions and our expected recovery in the platinum price. Finally, we expect modest growth in electronic recycling.

Demand

Automotive demand

Global automotive demand is expected to increase by 10% in 2023 to 3,246 koz (+288 koz year-on-year). While global vehicle production is forecast to increase by just 5% to 86M units, the production of internal combustion engine vehicles is set to decline by 5%. However, hybrid vehicles will grow by 33% making up 19% of global light-duty production in 2023. With China emerging from lockdown heavy-duty vehicle (HDV) production is expected to recover, growing by 6% to 3.1M units. The drivers that supported the growth in automotive platinum demand in 2022 will also be prevalent in 2023. In China, emissions regulation China VIa required all new urban HDVs to comply by July 2020 and all other HDVs by July 2021. China VIb, with far stricter onboard diagnostic requirements, was implemented from January 2021 for all gasoline and natural gas engines, and from July this year, China VIb regulations will also extend to all diesel engines. As a consequence, HDV platinum requirements will grow by 15% this year. As legislation has expanded to capture a broader spectrum of non-road vehicles, this segment will see an even higher growth rate (+24%). Finally, the installation of trimetal catalysts is set to steadily increase. With reports of more models being fitted with these higher platinum-loaded catalysts we have revised our substitution estimate upward by close to 100 koz to 540 koz for 2023.

Regionally, Chinese automotive demand will continue to outpace growth elsewhere. In the Rest of the World, growth in vehicle production and tighter legislation in countries such as India, Brazil and Mexico will also result double-digit growth in automotive demand for platinum. Japan will also boast healthy growth in demand on the back of the recovery in vehicle production, especially in the fuel cell electric vehicle category. Europe and North American growth will be more muted as battery electric vehicle production is favoured ahead of ICE vehicles. Light-vehicle diesel vehicle production will decline further in Europe, compared to the growth of the last two years; diesel output in North America is also expected to weaken this year.

Jewellery demand

Global jewellery demand is expected to improve by 2% (+42 koz), growing to 1,936 koz. In a reversal of 2022 trends, Western markets are forecast to decline while some optimism surrounding China's emergence from lockdown, which should result in a 15% year-on-year (+73 koz) improvement there, although this will still be 21% lower than in 2021, for two reasons. First, concerns about economic uncertainty and a lack of confidence will continue to weigh on Chinese consumer spending on discretionary items in the short to medium term. Second, we expect competition from gold jewellery to persist due to consumers' growing preferences for quasi-investment and value-preservation products.

Europe should see a 7% dip in platinum jewellery demand due to recession fears, fewer weddings and a shift in consumer expenditure towards travel. That leaves offtake at its second highest ever, in part through the solid gains made by top end watches and jewellery, which may only ease slightly this year.

North America could see a 10% retreat through such drivers as (partial) normalisation of wedding numbers and an expenditure shift to services. Volumes, however, remain 18% up on 2019 thanks to a wider retailer base and still healthy price differentials versus white gold, and despite a fashion swing to the yellow look.

In India this year, although growth is expected to continue (+8%), the momentum is likely to moderate compared to the 35% year-on-year growth seen during 2022. While this partly reflects 2022's high base, growth will be affected as discretionary spending is negatively impacted by rising interest rates and concerns about a slowing economy amid a challenging global macro-economic backdrop. Japanese demand will continue to recover with a forecast 8% gain. The market will benefit from the return of tourists and stronger exports, as well as being supported by the expected re-start of the Hong Kong jewellery shows – a key event for Japanese products.

Industrial demand

Industrial demand in 2023 is forecast to improve by 12% year-on-year (+262 koz) to 2,505 koz, driven by considerable glass capacity expansions in China which will offset declines forecast in the chemical, petroleum and electronics sectors.

Petroleum

Petroleum demand is forecast to decline 4% year-on-year (-8 koz) to 180 koz. This is mostly due to significant cyclical gas-to-liquid plant changeouts which benefited platinum offtake volumes in 2022, which will not be repeated in 2023. Partially offsetting this, reforming and isomerisation capacity is expected to rise, led by growth in the Middle East and China.

Chemical

Chemical demand is forecast to contract by 2% year-on-year (-10 koz) to 619 koz, driven by weaker paraxylene offtake, as capacity expansions continue to slow, following several years of significant expansion in China. Nitric acid offtake is expected to remain largely flat year-on-year. Nitric acid is a key component in fertiliser production and the energy-intensive fertiliser manufacturing process is expected to continue to struggle in 2023 due to elevated energy prices, making European production in particular uneconomic. Offsetting this headwind, and given the global focus on food security, the ability of Russia and Belarus to export to the global market may improve, following international sanctions imposed last year. Additionally, any logistical improvements may see a boost in Ukrainian output. Additional propane dehydrogenation (PDH) capacity expansions in China, North America and Poland are forecast to offset slowing growth from Kazakhstan, leading to greater overall offtake. Silicone demand will rise more modestly this year reflecting slower global growth.

Glass

Platinum demand in the glass industry is expected to significantly rise this year, the majority of which will come from the anticipated growth in capacity expansions/investments in China. Installations in LCD tanks will drive this growth resulting in platinum LCD demand more than doubling this year. This is broadly in line with past industry growth cycles where capacity expansions/investments are concentrated to take advantage of economies of scale. Meanwhile, the construction of new fiberglass plants from China's project pipeline will continue as the country's COVID-19 restrictions ease. We therefore forecast that platinum demand from the glass industry will increase by 55% to 737 koz in 2023, resulting in 2023 superseding 2022 as the second strongest year on record for glass demand for platinum after 2021.

Medical

Platinum medical demand is expected to grow 3% year-on-year (+8 koz) to 283 koz, its first year surpassing pre-pandemic levels. While there will still be a hangover effect from COVID, the industry will return to its pre-pandemic natural growth path, led by population growth, an aging population, and better access to healthcare. The bulk of COVID's lingering impact will be felt in the much smaller Other and China regions, which together make up 19% of global demand. In addition, COVID will only stunt the growth of these nascent markets, instead of causing them to contract as we saw with the more established markets in 2020, Europe, North America and Japan.

Electrical

Inventory levels have improved significantly across supply chains, although the industry remains uncertain, retaining a cautious stance for this year. In addition to growing penetration of SSDs, the introduction of emerging blockchain technologies in the nearline storage market is likely to further weigh on HDD shipments. Demand for semiconductors is projected to remain relatively stable, which will partially offset losses in the storage market. Overall, platinum offtake is expected to fall by around 6% this year.

Other

Platinum demand from the other industrial segment is forecast to grow by 3% year-on-year in 2023. There are diverging trends in the underlying categories. Despite the automotive aftermarket continuing to recover we expect that the popularity of electric vehicles and downsized engines will constrain metal usage this year in sensors and spark plugs. The fall in demand from other areas will offset significant growth in electrolyser and stationary fuel cell demand, which is estimated to increase threefold compared to 2022.

Investment demand

This year, retail investment is forecast to double to 450 koz, which will be the highest since 2020. The most important development behind this outcome will be a return to net positive investment in Japan for the first time since 2020 (on a full year basis). North American and European demand should also strengthen, helped in part by increased product availability.

Given the prospects of higher interest rates throughout 2023, further ETF liquidations are forecast this year. However, we do not expect to see the same level of disinvestment as in 2022, and so forecast -132 koz will be sold on a net basis in 2023. Regionally, we anticipate that ETF holders in Europe and North America will continue to reduce their exposure given tighter monetary policy, while in South Africa we may see a renewed, but modest, interest in the commodity due to a relative decline in the attractiveness of the mining equities. By the end of December, NYMEX and TOCOM warehouse stock levels amounted to 211 koz which is in line with pre-COVID levels and also reflects the slowing of imports into China. As such we have maintained our previous forecast of a nominal -20 koz outflow for this year.

ABOVE GROUND STOCKS

Given the shift to a deficit of 556 koz in 2023, above ground stocks are forecast to drop to 3,899 koz.

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.

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

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023f	2022/2021 Growth %	2023f/2022 Growth %
Platinum Supply-demand Balance (koz)												
SUPPLY												
Refined Production	**4,875**	**6,160**	**6,045**	**6,130**	**6,125**	**6,075**	**4,989**	**6,297**	**5,579**	**5,573**	**-11%**	**0%**
South Africa	3,135	4,480	4,265	4,385	4,470	4,374	3,298	4,678	3,975	3,920	-15%	-1%
Zimbabwe	405	405	490	480	465	458	448	485	480	502	-1%	5%
North America	395	365	390	360	345	356	337	273	260	302	-5%	16%
Russia	740	710	715	720	665	716	704	652	663	644	2%	-3%
Other	200	200	185	185	180	170	202	208	201	205	-3%	2%
Increase (-)/Decrease (+) in Producer Inventory	+350	+30	+30	+30	+10	+2	-84	-93	-35	+0	N/A	N/A
Total Mining Supply	**5,225**	**6,190**	**6,075**	**6,160**	**6,135**	**6,077**	**4,906**	**6,204**	**5,545**	**5,573**	**-11%**	**1%**
Recycling	**2,055**	**1,720**	**1,860**	**1,915**	**1,955**	**2,134**	**1,970**	**2,032**	**1,682**	**1,856**	**-17%**	**10%**
Autocatalyst	1,255	1,185	1,210	1,325	1,420	1,589	1,482	1,543	1,242	1,391	-20%	12%
Jewellery	775	515	625	560	505	476	422	422	372	395	-12%	6%
Industrial	25	20	25	30	30	69	66	67	68	69	3%	2%
Total Supply	**7,280**	**7,910**	**7,935**	**8,075**	**8,090**	**8,211**	**6,876**	**8,235**	**7,227**	**7,428**	**-12%**	**3%**
DEMAND												
Automotive	**3,245**	**3,245**	**3,360**	**3,300**	**3,100**	**2,870**	**2,403**	**2,647**	**2,957**	**3,246**	**12%**	**10%**
Autocatalyst	3,095	3,105	3,225	3,160	2,955	2,870	2,403	2,647	2,957	3,246	12%	10%
Non-road	150	140	135	140	145	†	†	†	†	†	N/A	N/A
Jewellery	**3,000**	**2,840**	**2,505**	**2,460**	**2,245**	**2,106**	**1,830**	**1,953**	**1,894**	**1,936**	**-3%**	**2%**
Industrial	**1,700**	**1,845**	**1,955**	**1,825**	**2,015**	**2,142**	**2,096**	**2,530**	**2,243**	**2,505**	**-11%**	**12%**
Chemical	540	515	560	570	565	679	693	682	629	619	-8%	-2%
Petroleum	60	205	220	100	235	219	109	171	188	180	10%	-4%
Electrical	215	205	195	210	205	144	130	135	106	100	-21%	-6%
Glass	205	235	255	205	250	236	407	728	474	737	-35%	55%
Medical and Biomedical	225	240	235	235	235	277	256	269	275	283	2%	3%
Other	455	445	490	505	525	586	501	546	570	587	5%	3%
Investment	**150**	**305**	**535**	**275**	**15**	**1,233**	**1,536**	**-53**	**-643**	**298**	**N/A**	**N/A**
Change in Bars, Coins	50	525	460	215	280	263	571	324	225	450	-31%	100%
Change in ETF Holdings	215	-240	-10	105	-245	991	507	-238	-560	-132	N/A	N/A
Change in Stocks Held by Exchanges	-115	20	85	-45	-20	-20	458	-139	-307	-20	N/A	N/A
Total Demand	**8,095**	**8,235**	**8,355**	**7,860**	**7,375**	**8,350**	**7,866**	**7,077**	**6,451**	**7,985**	**-9%**	**24%**
Balance	**-815**	**-325**	**-420**	**215**	**715**	**-139**	**-990**	**1,158**	**776**	**-556**	**-33%**	**N/A**
Above Ground Stocks	**2,590***	**2,265**	**1,845**	**2,060**	**2,775**	**3,511****	**2,521**	**3,679**	**4,455**	**3,899**	**21%**	**-12%**

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.

Table 3: Supply and demand summary – quarterly comparison

	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q4'22/Q4'21 Growth %	Q4'22/Q3'22 Growth %
Platinum Supply-demand Balance (koz)											
SUPPLY											
Refined Production	**1,303**	**1,465**	**1,566**	**1,571**	**1,695**	**1,273**	**1,530**	**1,407**	**1,369**	**-19%**	**-3%**
South Africa	873	1,028	1,175	1,201	1,274	878	1,129	994	974	-24%	-2%
Zimbabwe	115	118	125	116	127	117	124	116	123	-3%	6%
North America	82	83	75	51	64	66	64	66	63	-1%	-5%
Russia	182	184	137	153	178	163	161	179	160	-10%	-10%
Other	51	52	53	51	52	49	52	52	49	-6%	-5%
Increase (-)/Decrease (+) in Producer Inventory	-51	-29	+18	-43	-39	+24	-2	-43	-13	N/A	N/A
Total Mining Supply	**1,252**	**1,435**	**1,584**	**1,529**	**1,656**	**1,298**	**1,528**	**1,363**	**1,356**	**-18%**	**-1%**
Recycling	**581**	**539**	**547**	**474**	**471**	**431**	**460**	**408**	**383**	**-19%**	**-6%**
Autocatalyst	430	405	433	353	352	316	351	301	274	-22%	-9%
Jewellery	134	118	98	104	102	98	92	90	92	-10%	2%
Industrial	17	16	16	17	17	17	17	17	17	1%	0%
Total Supply	**1,833**	**1,974**	**2,131**	**2,003**	**2,127**	**1,729**	**1,988**	**1,772**	**1,739**	**-18%**	**-2%**
DEMAND											
Automotive	**723**	**724**	**661**	**581**	**681**	**750**	**717**	**727**	**763**	**12%**	**5%**
Autocatalyst	723	724	661	581	681	750	717	727	763	12%	5%
Non-road	†	†	†	†	†	†	†	†	†	N/A	N/A
Jewellery	**534**	**487**	**470**	**485**	**511**	**467**	**495**	**481**	**452**	**-12%**	**-6%**
Industrial	**565**	**485**	**834**	**580**	**631**	**551**	**628**	**586**	**477**	**-24%**	**-19%**
Chemical	213	119	195	180	188	129	169	174	157	-16%	-9%
Petroleum	36	36	39	39	57	43	47	48	51	-11%	7%
Electrical	36	33	35	35	32	30	27	26	24	-26%	-8%
Glass	73	90	369	127	142	137	166	128	42	-70%	-67%
Medical and Biomedical	64	66	67	69	67	67	69	70	69	2%	-2%
Other	143	141	130	130	145	145	150	141	134	-8%	-5%
Investment	**131**	**157**	**185**	**-283**	**-111**	**-167**	**-139**	**-277**	**-59**	**N/A**	**N/A**
Change in Bars, Coins	56	19	104	109	92	59	72	92	1	-98%	-98%
Change in ETF Holdings	76	105	31	-219	-155	-169	-89	-235	-67	N/A	N/A
Change in Stocks Held by Exchanges	-1	33	49	-173	-48	-58	-123	-134	7	N/A	N/A
Total Demand	**1,953**	**1,854**	**2,150**	**1,362**	**1,712**	**1,600**	**1,701**	**1,517**	**1,634**	**-5%**	**8%**
Balance	**-119**	**120**	**-19**	**641**	**416**	**129**	**287**	**255**	**105**	**-75%**	**-59%**

Source: Metals Focus 2020 - 2022.

Notes:

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

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

	H2 2020	H1 2021	H2 2021	H1 2022	H2 2022	H2'22/H2'21 Growth %	H2'22/H1'22 Growth %
Platinum Supply-demand Balance (koz)							
SUPPLY							
Refined Production	**2,799**	**3,030**	**3,266**	**2,803**	**2,776**	**-15%**	**-1%**
South Africa	1,934	2,203	2,475	2,007	1,968	-20%	-2%
Zimbabwe	230	243	242	241	239	-1%	-1%
North America	153	159	115	131	129	13%	-1%
Russia	379	321	331	324	339	2%	5%
Other	103	105	103	101	101	-3%	0%
Increase (-)/Decrease (+) in Producer Inventory	-162	-11	-82	22	-57	N/A	N/A
Total Mining Supply	**2,637**	**3,019**	**3,184**	**2,825**	**2,719**	**-15%**	**-4%**
Recycling	**1,134**	**1,086**	**945**	**892**	**791**	**-16%**	**-11%**
Autocatalyst	845	838	705	667	575	-18%	-14%
Jewellery	255	215	206	191	181	-12%	-5%
Industrial	34	33	34	34	34	1%	1%
Total Supply	**3,770**	**4,105**	**4,130**	**3,717**	**3,510**	**-15%**	**-6%**
DEMAND							
Automotive	**1,370**	**1,385**	**1,262**	**1,467**	**1,490**	**18%**	**2%**
Autocatalyst	1,370	1,385	1,262	1,467	1,490	18%	2%
Non-road	†	†	†	†	0	N/A	N/A
Jewellery	**1,045**	**957**	**995**	**961**	**932**	**-6%**	**-3%**
Industrial	**1,140**	**1,320**	**1,211**	**1,179**	**1,064**	**-12%**	**-10%**
Chemical	354	314	368	298	331	-10%	11%
Petroleum	57	75	96	90	98	3%	9%
Electrical	68	68	67	57	49	-26%	-13%
Glass	253	459	269	304	171	-37%	-44%
Medical and Biomedical	128	132	136	136	139	2%	2%
Other	279	271	275	295	275	0%	-7%
Investment	**1,089**	**342**	**-395**	**-307**	**-336**	**N/A**	**N/A**
Change in Bars, Coins	151	123	201	132	93	-54%	-29%
Change in ETF Holdings	597	136	-374	-258	-302	N/A	N/A
Change in Stocks Held by Exchanges	341	82	-221	-181	-127	N/A	N/A
Total Demand	**4,644**	**4,004**	**3,073**	**3,301**	**3,150**	**3%**	**-5%**
Balance	**-874**	**102**	**1,057**	**416**	**360**	**-66%**	**-13%**

Source: Metals Focus 2019 - 2022.

Notes:

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

Table 5: Regional demand – annual and quarterly comparison

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023f	2022/2021 Growth %	2023f/2022 Growth %	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022
Platinum gross demand (koz)																	
Automotive	**3,240**	**3,250**	**3,350**	**3,290**	**3,090**	**2,870**	**2,403**	**2,647**	**2,957**	**3,246**	**12%**	**10%**	**681**	**750**	**717**	**727**	**763**
North America	465	480	410	390	390	341	298	379	441								
Western Europe	1,395	1,450	1,630	1,545	1,325	1,461	1,104	1,005	1,041								
Japan	585	510	450	435	425	308	245	269	268								
China	125	145	195	230	220	184	280	384	493								
India	170	180	170	175	195	††	††	††	††								
Rest of the World	500	485	495	515	535	577	476	609	714								
Jewellery	**3,000**	**2,840**	**2,505**	**2,460**	**2,245**	**2,106**	**1,830**	**1,953**	**1,894**	**1,936**	**-3%**	**2%**	**511**	**467**	**495**	**481**	**452**
North America	230	250	265	280	280	341	277	409	445								
Western Europe	220	235	240	250	255	237	196	260	302								
Japan	335	340	335	340	345	372	316	298	333								
China	1,975	1,765	1,450	1,340	1,095	871	832	703	484								
India	175	180	145	175	195	109	59	123	167								
Rest of the World	65	70	70	75	75	176	151	159	163								
Chemical	**540**	**515**	**560**	**570**	**565**	**679**	**693**	**682**	**629**	**619**	**-8%**	**-2%**	**188**	**129**	**169**	**174**	**157**
North America	55	55	50	50	50	90	96	102	104								
Western Europe	105	75	110	115	105	126	118	127	125								
Japan	10	10	15	15	15	66	62	65	66								
China	215	230	225	220	215	206	247	222	169								
Rest of the World	155	145	160	170	180	192	171	166	166								
Petroleum	**60**	**205**	**220**	**100**	**235**	**219**	**109**	**171**	**188**	**180**	**10%**	**-4%**	**57**	**43**	**47**	**48**	**51**
North America	25	-25	90	55	55	30	5	32	37								
Western Europe	-20	70	10	5	20	14	11	18	30								
Japan	-35	5	0	-40	5	7	6	12	7								
China	-5	45	80	45	10	66	35	39	26								
Rest of the World	95	110	40	35	145	103	52	69	88								
Electrical	**215**	**205**	**195**	**210**	**205**	**144**	**130**	**135**	**106**	**100**	**-21%**	**-6%**	**32**	**30**	**27**	**26**	**24**
North America	15	15	10	15	15	38	35	35	28								
Western Europe	10	10	10	10	10	27	23	25	20								
Japan	15	15	15	15	15	20	16	17	14								
China	70	70	80	90	85	28	31	31	23								
Rest of the World	105	95	80	80	80	31	25	26	22								
Glass	**205**	**235**	**255**	**205**	**250**	**236**	**407**	**728**	**474**	**737**	**-35%**	**55%**	**142**	**137**	**166**	**128**	**42**
North America	10	0	20	5	5	7	-37	16	17								
Western Europe	15	10	5	5	35	59	25	5	9								
Japan	-25	-5	-10	-10	0	-40	-66	-22	-49								
China	115	130	150	110	80	180	360	726	475								
Rest of the World	90	100	90	95	130	30	126	3	23								
Medical	**225**	**240**	**235**	**235**	**235**	**277**	**256**	**269**	**275**	**283**	**2%**	**3%**	**67**	**67**	**69**	**70**	**69**
Other industrial	**455**	**445**	**490**	**505**	**525**	**586**	**501**	**546**	**570**	**587**	**5%**	**3%**	**145**	**145**	**150**	**141**	**134**
Bar & Coin Investment	**50**	**525**	**460**	**215**	**280**	**263**	**571**	**324**	**225**	**450**	**-31%**	**100%**	**92**	**59**	**72**	**92**	**1**
North America						155	234	256	258								
Western Europe						52	75	61	44								
Japan						46	240	-26	-114								
Rest of the World						9	21	33	36								
ETF Investment	**215**	**-240**	**-10**	**105**	**-245**	**991**	**507**	**-238**	**-560**	**-132**	**N/A**	**N/A**	**-155**	**-169**	**-89**	**-235**	**-67**
North America						125	524	-6	-102								
Western Europe						509	237	59	-315								
Japan						-13	58	-23	-28								
Rest of the World						370	-312	-268	-116								
Change in Stocks Held by Exchanges	**-115**	**20**	**85**	**-45**	**-20**	**-20**	**458**	**-139**	**-307**	**-20**	**N/A**	**N/A**	**-48**	**-58**	**-123**	**-134**	**7**
Investment	**150**	**305**	**535**	**275**	**15**	**1,233**	**1,536**	**-53**	**-643**	**298**	**N/A**	**N/A**	**-111**	**-167**	**-139**	**-277**	**-59**
Total Demand	**8,090**	**8,240**	**8,345**	**7,850**	**7,365**	**8,350**	**7,866**	**7,077**	**6,451**	**7,985**	**-9%**	**24%**	**1,712**	**1,600**	**1,701**	**1,517**	**1,634**

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

Notes:

1. † Non-road automotive demand is included in autocatalyst demand.
2. †† India automotive demand is included in Rest of the World.
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.

Table 6: Regional recycling – annual and quarterly comparison

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023f	2022/2021 Growth %	2023f/2022 Growth %	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022
Platinum recycling supply (koz)																	
Automotive	**1,255**	**1,185**	**1,210**	**1,325**	**1,420**	**1,589**	**1,482**	**1,543**	**1,242**	**1,391**	**-20%**	**12%**	**352**	**316**	**351**	**301**	**274**
North America						520	458	480	369								
Western Europe						807	788	811	652								
Japan						116	110	117	111								
China						36	36	41	34								
Rest of the World						110	90	93	76								
Jewellery	**775**	**515**	**625**	**560**	**505**	**476**	**422**	**422**	**372**	**395**	**-12%**	**6%**	**102**	**98**	**92**	**90**	**92**
North America						3	3	3	3								
Western Europe						4	4	3	4								
Japan						187	162	160	165								
China						276	248	250	195								
Rest of the World						5	5	5	6								
Industrial	**25**	**20**	**25**	**30**	**30**	**69**	**66**	**67**	**68**	**69**	**3%**	**2%**	**17**	**17**	**17**	**17**	**17**
North America						15	12	12	13								
Western Europe						11	10	11	11								
Japan						34	34	34	34								
China						7	7	8	9								
Rest of the World						2	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 electrolysers 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_x). 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_2, the laboratory based WLTP and for NO_x 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 be.

HDD

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

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_x traps (LNT)

Platinum/rhodium-based, catalyses the chemical reduction of NO_x 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_x, 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_x. 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.