

FOREWORD

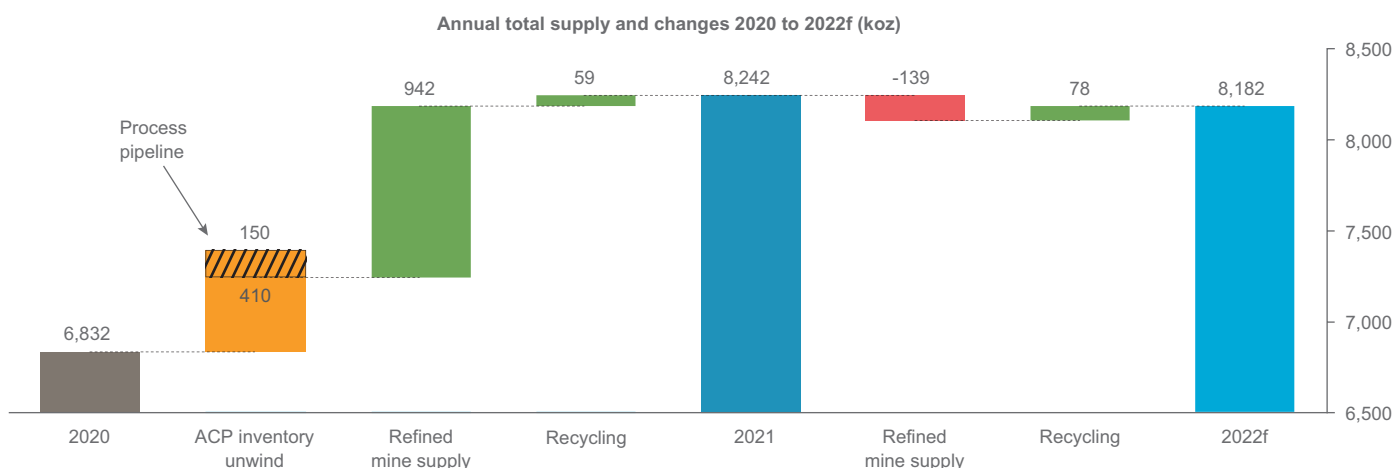
This edition of *Platinum Quarterly* presents fourth quarter and annual platinum supply and demand developments for 2021 as well as an updated forecast for 2022. It also includes the WPIC's views on issues and trends relevant to those investors considering exposure to platinum as an investment asset, including a high level overview of the potential impacts from the Russian invasion of Ukraine, plus an update on how our product partnerships continue to meet investors' needs. The *Platinum Quarterly* report and data (starting on page 6) are prepared independently for the WPIC by Metals Focus.

Platinum supply and demand – updating 2021 estimates and 2022 forecasts

Total platinum demand rose 21% (+283 koz) quarter-on-quarter in Q4'21, with ongoing strong demand from the industrial and jewellery segments supplemented by improving automotive demand, despite ongoing semiconductor shortages. This was helped by improved but still negative investment demand, with ongoing strength in bar and coin demand offset by continued reductions in ETF holdings and stocks held by exchanges (primarily NYMEX), albeit at lower rates than in Q3'21. In the platinum market a further sign of the positive sentiment towards the metal emerged, as seen in North America, where rising prices attracted renewed buying interest, rather than triggering any material profit taking. However, Q4'21 total supply increased by 5% (+108 koz), exceeding total demand, with strong refined production in South Africa which was supplemented by the accelerated unwinding of Anglo American Platinum's ACP semi-finished inventory, more than making up for flat quarter-on-quarter recycling rates. The net impact was a fourth quarter platinum surplus of 475 koz.

The changes in supply and demand seen in Q4'21 highlight that 2021 was a year of two very different halves, with a modest surplus over the first two quarters (a net H1'21 surplus of 107 koz), escalating dramatically over quarters three and four (a H2'21 surplus of 1,125 koz) for an annual surplus of 1,232 koz. The big escalation over the second half was caused by the accelerated processing of Anglo American Platinum's ACP semi-finished inventory driving up refined metal supply (up 219 koz half-on-half), semiconductor shortages reducing vehicle production and automotive platinum demand (down 144 koz half-on-half), and the large reduction in ETF holdings and NYMEX stocks (a half-on-half fall of 814 koz). The investment outflows seen in the second half of the year resulted in full-year 2021 investment demand being net negative (-43 koz), versus the exceptional record demand in 2020 (+1,546 koz). In 2021 total platinum supply increased by 21% and total demand decreased by 9%, resulting in the estimated platinum surplus for 2021 we reported in November 2021 of 769 koz increasing to 1,232 koz.

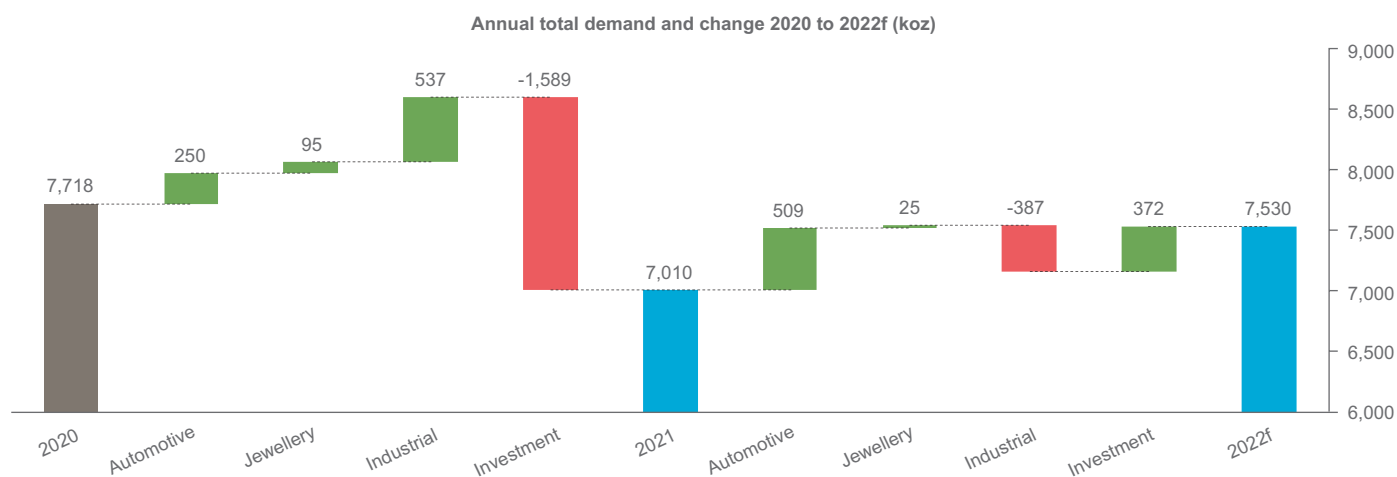
However, despite the massive surplus in 2021, the spot platinum market remained tight, increasingly so in the latter part of the year with physical platinum in the London and Zurich spot markets reported as being hard to procure at times. This market tightness reflects ongoing strong speculative and quasi-speculative demand for platinum from China, which reported exceptionally strong imports during 2021, far in excess of its estimated demand (which is factored into our supply/demand balance). At the macro level, the scale of China's imports versus its import demand requirements was such that they completely absorbed last year's estimated surplus.



Source: Metals Focus, WPIC Research. Note: 150 koz of the 2021 ACP unwind to only be refined in 2022.

The outlook for 2022 is influenced by the continuation of many of the same themes that dominated the second half of 2021, with the additional overlay of inflation concerns and without the significant additional refined platinum flows from the unwinding of Anglo American's semi-finished ACP inventory. Demand is projected to increase 7% (+520 koz) while supply will decline by a modest 1% (-61 koz). Automotive demand is expected to continue to grow, by 19% (+509 koz), but with growth still limited by the ongoing semiconductor shortage, which is expected to abate towards the end of the year. Jewellery demand is forecast to remain broadly flat year-on-year (+25 koz) on continued consumer preferences for new gold jewellery designs. Coming down from record strength in 2021, total industrial demand is forecast to contract 15% (-387 koz) as glass and chemical plant expansions slow. And finally, after a year of net negative investment (-43 koz), investment demand is expected to increase to 329 koz in 2022, with ongoing strong demand for bar and coin (+429 koz) and modest ETF demand (+50 koz) offsetting the expected further reduction in stocks held by exchanges (mainly NYMEX, -150 koz versus -139 koz in 2021). In aggregate, these supply and demand expectations result in a projected surplus of 652 koz in 2022, significantly down from the 1,232 koz surplus in 2021.

While the forecast surplus in 2022 is material, the year has begun with a continuation of the physical market tightness experienced in 2021 as shown by ongoing backwardation, negative EFP rates and sustained lease rates. Although January 2022 China import data was not available when this report was finalised, these market tightness indications in 2022 suggest that China imports continue to exceed identified demand.



The platinum investment case – China imports absorbing the surplus

Updated estimates for 2021 and 2022 are dominated by increases in platinum surpluses for both years, but it is imperative to consider the exceptionally strong imports of platinum into China. The portion of these imports greater than identified demand, which do not show in the supply/demand analysis, were substantial enough to absorb the whole of the 2021 surplus. Although it is too early to expect the same in 2022, we note that the spot physical market remains tight, likely due to ongoing strong demand into China, for the time being at least, supplemented by Russia concerns.

The tight market conditions are illustrated by the relative strength of the platinum price in H2'21 despite significantly higher than planned supply of material from the ACP semi-finished inventory that was almost completely processed during the year. Indeed, the relative price strength in the spot market moved the forward curve into backwardation, deep enough to create an arbitrage incentive for market participants to access platinum from NYMEX stocks and deliver physical metal into the spot market.

Putting some figures on the strength in demand from China: The estimated global supply/demand surplus for 2021 of 1,232 koz resulted from higher refined mine supply (largely the ACP inventory unwind), the reduction in NYMEX stocks and net negative ETF demand. At the same time, we estimate that China's identified platinum demand totalled around 2.2 moz, but according to data from Bloomberg it imported around 3.5 moz up to 1.3 moz more than its visible needs in 2021, and absorbing all of the global surplus. The drivers behind these excess imports is not completely clear at this point in time, and it could be that with loosening travel restrictions and more on the ground research, allocation of the excess imports to specific uses may be increasingly possible. However, it is

unlikely that any single aspect of demand alone could explain such a significant jump. Indeed, reports from on the ground in China suggest that a portion of the additional imports are due to market players within the platinum supply chain building speculative positions in physical metal, as seen in other commodities in the past.

Importantly, the definition of 'demand' in our projections does not include speculative positions outside of bar and coin, ETFs and NYMEX stocks, therefore this demand from China is not captured in our published demand, hence the headline surplus.

Looking into 2022, it is clear that the year is starting as 2021 finished with ongoing reductions in NYMEX stocks and continued backwardation pointing to continued physical market tightness. Although it is clearly too early to state that ongoing strength in China's imports is the reason, should this be the case, it could put a very different perspective on the headline estimated surplus of 652 koz platinum in 2022. As noted above, it is also quite possible that as the year goes on and access to China improves, additional or increased sources of demand could become apparent and change the supply/demand balance for 2022 and beyond, although speculation is likely to remain a material portion.

Some of the other points to highlight from the 2022 outlook:

While Anglo American Platinum announced that nearly all of the semi-finished inventory ahead of the ACP converter plant was processed in 2021, their published data does not reflect that the full platinum content of that processed inventory was either sold or increased their refined metal inventory. It is possible that the disruption associated with the outages and significantly higher processing rate in 2021 has resulted in approximately 150 koz of platinum remaining locked up in their process pipeline. While this 150 koz is included in our published 2022 forecast for refined production, this flow of material may influence stock management decisions necessary in 2022 to support planned furnace rebuilds. Refined mine supply is projected to be stable given the additional work the producers have put into preventative maintenance and stope development. Although wage negotiations start mid-year, and employees will certainly be conscious of the massive dividend pay-outs from the PGM miners and gold producer agreements recently reached, which have historically influenced PGM outcomes; either way, associated strike disruptions would likely fall into 2023. There is a possibility of mine supply disruptions from delays to downstream processing maintenance, with some rebuilds planned during the year, worsening power supply instability in Southern Africa, or a reduction of Russian PGM supplies associated with the invasion of Ukraine.

Addressing the potential for reduced PGM supply from Russia, both security of supply concerns and sanctions could impact short- and long-term metal flows. Historically, sanctions applied to other commodities such as aluminium, resulted in a short period of interruption until metal flows adjusted into countries not applying sanctions, which can then free up flows from elsewhere. While so far, Russian producers have not been subject to sanctions that would prevent them selling platinum or palladium to Western customers, restrictions already imposed on the international SWIFT payment notification system appear more likely to interrupt short term metal flows. For platinum, this would compound an already tight physical market and add to price volatility.

However, security of supply and certificate of origin concerns could push automakers to reduce their reliance on Russia, which given Russia accounts for almost forty percent of global palladium supply but only eleven percent of global mined platinum supply, could naturally result in additional platinum for palladium substitution longer-term. Furthermore, it could be argued that a strategic push to accelerate production of green or pink hydrogen would help reduce Europe's imports of natural gas from Russia. Although it would take an almost herculean infrastructure push, blending in 20% of hydrogen into Europe's natural gas networks, which is technically achievable, could halve Russian gas imports. One noteworthy additional consideration is a potential impact on Battery Electric Vehicles (BEVs) is that Russia accounts for c.20% of class 1 nickel production globally, an essential input into lithium ion batteries. While China could easily absorb any of this material diverted from the west (most of it probably goes to China already), there is the question of whether Western automakers will be happy to use batteries that contain Russian origin nickel, which could potentially distort the market, hindering the pace of growth in BEVs. This principle could indeed also enhance platinum for palladium substitution.

We don't expect Russian sanctions to have a material impact on recycling, which is expected to be up 4% year-on-year (+78 koz). Capacity constraints seem to be easing, but raw material supply remains inversely linked to automotive production rates as the semiconductor shortage has forced consumers to run older vehicles for longer.

In terms of demand, the ongoing semiconductor shortage is continuing to impact vehicle production rates, but this is expected to ease as 2022 unfolds. Positively, automakers are prioritising higher margin vehicles which is generally good for platinum demand. But there is also an ongoing push for BEVs particularly in Europe where automakers need to minimise fleet emissions, although

emerging battery material supply constraints could prove a limiting factor, which could benefit ICE. Longer term, it is also interesting to note that a number of automakers have announced they are developing Euro 7 compliant diesel engines, indicating that they have some reservations that the pace of electrification is sustainable or possible.

Jewellery demand remains muted versus historical levels but flat on 2021. China looks likely to remain subdued in the near-term, but there is the potential for upside in Japan, historically a strong market for platinum jewellery, as COVID restrictions ease. It is also encouraging to see good growth in India where Q4'21 platinum demand leapt 88% year-on-year to 38 koz and could continue to surprise to the upside.

Industrial demand reached record levels in 2021, being the second most significant sector of consumption of platinum for the third year in a row. We are expecting a cyclical easing of industrial demand in 2022 due to fewer capacity additions, particularly in glass, but it will be interesting to see if Russian sanctions have any impact on demand from the petroleum sector. The UK, for example, has banned the export of oil refinery equipment to Russia, which is likely to include platinum containing catalysts.

Investment demand will probably be the most keenly watched part of the platinum landscape as it can provide an indicator of real demand for platinum in the spot market. We're expecting another strong year for bar and coin demand, but only modest ETF demand, although this is an area within which we could see upside depending upon the outlook for the PGM mining equities (see below). The main focus is likely to remain on NYMEX stocks as an indicator of the level of demand for metal in the spot market. As seen in the second half of 2021, tight market conditions can support the spot price relative to the forwards, creating an arbitrage that draws stocks away from NYMEX to satisfy demand for metal in the physical market, which as in 2021 will likely be demand into China.

The platinum investment case – ETF outflows flows could reverse in 2022

After ETF inflows of 991 koz in 2019 and 509 koz in 2020, platinum ETF outflows totalled -237 koz in 2021, which appears to have been the result of one ETF being closed down in Q3'21 (admittedly only ~25 koz) and more significantly a rotation out of the South African ETFs into the South African listed PGM mining equities. The big attraction the equities offered over the ETFs was exposure to the huge cash generation the miners enjoyed in 2021, with revenues bolstered by the high prices of rhodium, palladium and the minor PGMs. Indeed, after its year end, Anglo American Platinum announced a record final dividend of R80B (US\$5.3B), completely validating the investor attention.

The WPIC outlook includes 50 koz of positive ETF demand in 2022, but there could be a more significant investor rotation back to ETFs depending upon the outlook for the PGM miners. Whilst PGM prices currently remain at healthy levels, cash generating ability could be impacted by inflationary pressures and higher expenditure on capital programmes (plus some unsanctioned projects are not yet in official company guidance estimates). Depending upon the outlooks for individual investors, these factors could divert some attention back to the platinum ETFs after the equities trade ex-dividend. Anglo American Platinum was the first to go ex-dividend on 3 March 2022.

WPIC initiatives highlights

Last quarter, we started this section with the following words, "Heightened global risk, related to the severity of the ongoing impacts of the COVID-19 pandemic, continues to drive increased retail and institutional investor interest in hard assets, including commodities and platinum." Sadly, given the events in Ukraine, this is even more true now than it was then. Throughout 2021 we saw this play out with our partners reporting increased interest in platinum from investors, enhanced by the growing visibility of platinum's role in global decarbonisation. We expect this trend to continue into 2022.

Increasing the number and impact of our product partnerships in our four target markets, China, Japan, North America and Europe remains a key focus for us. We are working closely with our partners to strengthen their focus on platinum and to increase investor awareness of platinum.

Our partnerships have a dual benefit; not only do they continue to have a positive impact on investor choice and access by growing the number and type of platinum investment products available globally, they also increase our reach, providing us with the opportunity of presenting the investment case for platinum to our partners' clients and investor audiences.

Furthermore, an ongoing close interaction with our partners helps us better understand the key drivers of investment demand globally, and the type of products that investors are looking for.

2021 was yet another record-breaking year for WPIC product partnerships in North America and Europe. The increased global risk brought on by the pandemic in 2020 continued to lead to unprecedented demand for platinum bars and coins, aided by the release of various new platinum bullion products by our partners. We continued to work closely with them to develop specific promotional campaigns for when the market seemed to be cooling off. Those campaigns, alongside the provision of our increased research as well as collaborative videos and interviews, assisted their distribution and attracted more investors to platinum, including many gold investors. While the increased platinum price naturally resulted in some profit taking, demand for platinum bars and coins remained strong.

In China, the weakening price of platinum strongly fuelled the sales of our Chinese partners in platinum bars in Q4'21, supplemented by the debut of Platinum panda coins launched by China Gold Coin in October. As the physical-backed bank trading accounts are under regulatory suspension, physical bars and coins remain the only vehicles for domestic investors looking for exposure to platinum. Interestingly we also observed that platinum kilo bars were attracting considerable attention as serious investors sought lower-premium products, with sales volumes growing faster than those of smaller bars across our partnerships.

The strong demand for platinum kilo bars also stoked the interest of fabricators. Our China team was approached by several precious metal fabricators planning to diversify into platinum refining and looking to partner with WPIC for marketing platinum investment bars. This gives us confidence that we are building a strong production pipeline for 2022, with an expectation that we will continue to expand our sales network within China.

Our product partners in Japan recorded rebounding platinum sales, especially in December during which platinum accumulation plans realised their strongest net inflows of 2021. We are continuing to work with Japan Bullion Market Association (JBMA), including on initiating more investor development activities for our retail partners, deepening our footprint in Japan and identifying new partners for market development.

In summary, we believe that our efforts to increase platinum investment product availability and attractiveness to more investors around the world are yielding results. We are well positioned to support future investment demand growth.

Paul Wilson, CEO

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PLATINUM QUARTERLY Q4 2021

Table 1: Supply, demand and above ground stocks summary

	2019	2020	2021	2022f	2021/2020 Growth %	2022f/2021 Growth %	Q3 2021	Q4 2021
Platinum Supply-demand Balance (koz)								
SUPPLY								
Refined Production	6,075	4,989	6,317	6,119	27%	-3%	1,592	1,695
South Africa	4,374	3,298	4,711	4,431	43%	-6%	1,228	1,280
Zimbabwe	458	448	475	465	6%	-2%	111	121
North America	356	337	271	358	-20%	32%	50	63
Russia	716	704	652	661	-7%	1%	153	178
Other	170	202	208	205	3%	-1%	51	52
Increase (-)/Decrease (+) in Producer Inventory	+2	-84	-59	+0	N/A	N/A	-28	-21
Total Mining Supply	6,077	4,906	6,258	6,119	28%	-2%	1,565	1,674
Recycling	2,129	1,926	1,984	2,063	3%	4%	463	461
Autocatalyst	1,584	1,438	1,495	1,559	4%	4%	341	341
Jewellery	476	422	422	434	0%	3%	104	103
Industrial	69	66	67	69	1%	3%	17	17
Total Supply	8,206	6,832	8,242	8,182	21%	-1%	2,027	2,135
DEMAND								
Automotive	2,831	2,370	2,621	3,129	11%	19%	582	656
Autocatalyst	2,831	2,370	2,621	3,129	11%	19%	582	656
Non-road	†	†	†	†	†	†	†	†
Jewellery	2,099	1,820	1,915	1,940	5%	1%	481	497
Industrial	2,127	1,982	2,519	2,132	27%	-15%	596	615
Chemical	694	596	684	632	15%	-8%	156	199
Petroleum	219	109	182	194	68%	6%	46	54
Electrical	144	130	135	135	4%	0%	35	32
Glass	236	407	715	331	75%	-54%	164	121
Medical and Biomedical	249	239	247	251	4%	1%	64	61
Other	584	500	555	588	11%	6%	132	147
Investment	1,237	1,546	-43	329	N/A	N/A	-282	-108
Change in Bars, Coins	266	578	332	429	-43%	29%	110	95
Change in ETF Holdings	991	509	-237	50	N/A	N/A	-219	-155
Change in Stocks Held by Exchanges	-20	458	-139	-150	N/A	N/A	-173	-48
Total Demand	8,294	7,718	7,010	7,530	-9%	7%	1,377	1,660
Balance	-87	-886	1,232	652	N/A	-47%	650	475
Above Ground Stocks	3,563**	2,677	3,908	4,560	46%	17%		

Source: Metals Focus 2019 - 2022.

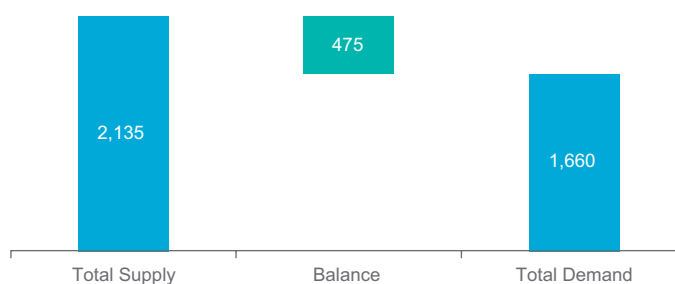
Notes:

- **Above Ground Stocks 3,650 koz as of 31 December 2018 (Metals Focus).
- † Non-road automotive demand is included in autocatalyst demand.
- All estimates are based on the latest available information, but they are subject to revision in subsequent quarterly reports.
- The WPIC did not publish quarterly estimates for 2013 or the first two quarters of 2014. However, quarterly estimates from Q3 2014, to Q4 2017 are contained in previously published PQs which are freely available on the WPIC website. Quarterly estimates from Q2 2018 and half-yearly estimates from H1 2018 are included in Tables 3 and 4 respectively, on pages 24 and 25 (supply, demand and above ground stocks). Details of regional recycling supply in Table 6 on page 27 are only published from 2019.

2021 FOURTH QUARTER PLATINUM MARKET REVIEW

The key factors that defined the platinum market during the previous quarter persisted during Q4'21. While supply chain bottlenecks eased slightly, the provision of semiconductor chips to the automotive industry remained below pre-pandemic levels. This continued to weigh on platinum demand from the automotive sector, which was down by 8% (-56 koz) year-on-year. Industrial demand was up 17% (+90 koz) registering healthy gains versus a COVID impacted Q4'20. The detection of the highly contagious Omicron variant clouded economic activity, as did rising inflation. Talk of tapering and hawkish Fed signals in addition to switching to platinum mining and other equities saw further liquidations in ETF holdings of -155 koz. Outflows from NYMEX slowed to -48 koz, and bar and coin demand grew 58% (+35 koz), supported by a swing to net purchasing in Japan. Mine supply enjoyed a further improvement against a COVID- and operationally-impaired Q4'20, as production stability accelerated the processing of semi-finished inventory. With supply recovery outpacing demand in the quarter, the market remained in a surplus of 475 koz. This was lower than the surplus seen in Q3'21 but marked a swing from the deficit recorded in Q4'20.

Chart 1: Supply-demand balance, koz, Q4 2021



Source: Metals Focus

Supply

Refined production jumped 30% (+392 koz) year-on-year to 1,695 koz, as South Africa recovered from disruptions and output was also boosted by the processing of semi-finished inventory. South African production rose 407 koz to 1,280 koz, up 47%, largely reflecting a low base in Q4'20, when the Anglo Convertor Plant (ACP) shutdown severely curtailed domestic output. Additionally, volumes in Q4'21 were boosted by the unexpectedly faster refining of around 140 koz of semi-finished inventory, built-up as a result of the shutdown.

A decline in safety performances, attributed to the disruption of work practices caused by the pandemic, continued to impact operations, with the suspension of two shafts towards the end of the quarter, while COVID-19 infections forced the suspension of production at an additional shaft. The impact of these disruptions on refined volumes will however only emerge in Q1'22.

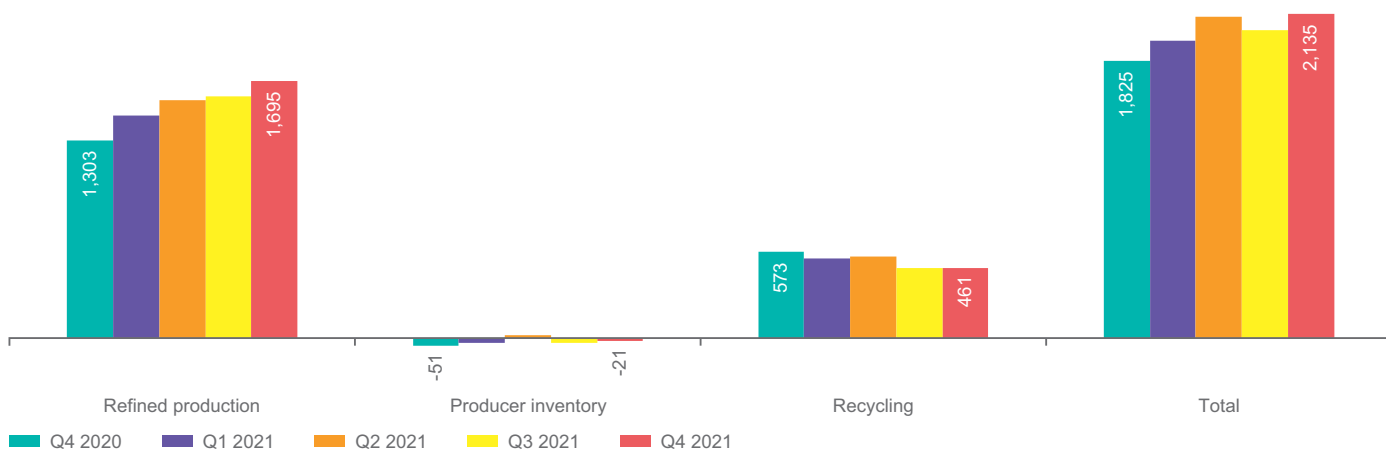
Zimbabwe production increased 6% (+6 koz) to 121 koz as additional volumes from the concentrator debottlenecking project at Unki offset a modest decline from Zimplats, where lower grades and decreased concentrator recoveries limited output. Russian output for the quarter was virtually unchanged year-on-year as the disruption from the mine flooding and concentrator stoppage earlier in the year normalised. North American production declined 23% (-19 koz) to 63 koz, primarily due to the deferred impact of the strike at Vale's Sudbury operations in addition to safety related production restrictions at Sibanye-Stillwater's US operations.

Recycling

Global platinum recycling fell well short of Q4'20 which had benefited from higher volumes, as stocks which had been built up following the severe lockdown-constraints of the previous pandemic-affected quarters were processed. Total recycling declined 20% (-112 koz) to 461 koz. Autocatalyst recycling fell by 19% (-81 koz) year-on-year in Q4'21 to 341 koz. This reflected the impact of older vehicles being run for longer due to constrained new vehicle production, which reduced the supply of end-of-life vehicles. In addition, weaker palladium and rhodium prices, which encouraged some yards to stockpile spent cannisters, meant there was much less pressure on the smelting and refining sectors, and so processing lead times returned to more "normal" levels. Platinum jewellery recycling declined 23% (-31 koz) driven mostly by China where recycling fell by 33% in Q4'21 following lower platinum

jewellery sales and the price correction in November/December. In addition, de-stocking of platinum inventory by some showrooms and retailers, reported earlier in the year, came to an end, weakening scrap collection to some extent. Platinum recovered from electronic waste was unchanged on Q4'20.

Chart 2: Platinum supply, koz

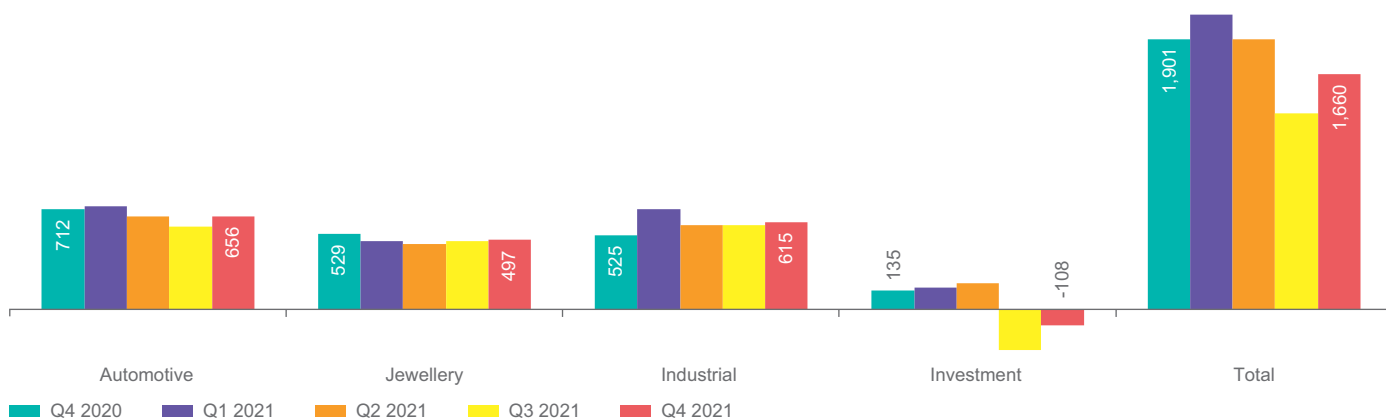


Source: Metals Focus

Demand

Total demand in Q4'21 was 13% (-242 koz) lower than in Q4'20, but up by 21% (+283 koz) on Q3'21. The bulk of the decline compared to Q4'20 can be attributed to the investment segment and specifically ETF outflows of -155 koz along with exchange stock movements of -48 koz. The impact was cushioned somewhat by a recovery in bar and coin demand, mostly from Japan. Total bar and coin demand increased by 58% (+35 koz) year-on-year, although it was 14% (-15 koz) below Q3'21. Growth in most industrial segments, which in total rose by 17% (+90 koz), offset the decline in the autocatalyst segment, which was down by 8% (-56 koz), due to the continuance of semiconductor shortages. In addition, jewellery demand fell by 6% (-33 koz) due to softer consumer demand in Japan and China, reflecting the continued drag from the pandemic and competition from gold jewellery.

Chart 3: Platinum demand, koz



Source: Metals Focus

Automotive demand

Light vehicle production recovered noticeably from the deep cuts seen in Q3'21. Production in Q4'21 improved 22% compared with the previous quarter but, as the sector continued to be marred by semiconductor shortages, it fell 14% short of the 23.6M vehicles produced in Q4'20. Platinum autocatalyst demand improved by 13% (+74 koz) compared to Q3'21, but fell 8% (-56 koz) short of Q4'20.

In Europe, passenger vehicle production declined by 25% while heavy-duty production contracted only modestly by 1%. As a result, compared to Q4'20, platinum demand declined by 23% (-76 koz). While North American passenger car output also dropped 13%, the focus on proactively managing semiconductor supplies to maximise production of higher-margin products saw production of pickup trucks grow by 6% year-on-year. Given higher PGM loadings in these larger vehicles, combined with growing substitution of palladium with platinum, this resulted in a 6% (+5 koz) lift in platinum demand from the region.

In China, passenger vehicle production declined by 6%, however, internal combustion engine (ICE) vehicle production was more deeply cut in favour of battery electric vehicles (BEVs), which still enjoy healthy subsidies. Heavy-duty vehicle production also suffered, falling sharply by 56%, reflecting a high base, as output had been boosted by pre-emptive buying of China V heavy-duty vehicles before the rules change. Despite these lower unit numbers, platinum demand grew 31% (+27 koz), on the back of the more stringent legislation. By way of illustration, in Q4'21 81% of heavy-duty vehicles produced in the country were China VI compliant, compared to 17% in Q4'20. Field research further indicates that substitution of palladium with platinum has also seen higher adoption in China.

In the Rest of the World, platinum demand contracted by a modest 2% (-3 koz), as the effect of vehicle production cuts outweighed that of tighter emissions legislation.

Jewellery demand

Global platinum jewellery demand contracted 6% (-33 koz) year-on-year to 497 koz, due to lower sales volumes from the Asian regions, which was not offset by growth in western markets.

Europe saw another solid quarter of gains, up 21% (+12 koz) year-on-year, attributed to strong wedding demand and surging sales for high-end jewellery and watches. Ongoing COVID-related diversion of consumer expenditure towards durable goods instead of travel, entertainment and social events, combined with retailers' enthusiasm for platinum enabled North American offtake to grow further, up 14% (+13 koz), even if Omicron meant some weddings were postponed.

In China however, platinum jewellery demand suffered due to ongoing competition from a robust gold jewellery market, declining 29% (-69 koz) year-on-year compared to a 19% increase in gold jewellery fabrication. Due to aggressive gold sales campaigns by major retail brands in December, as well as inventory building for the Chinese New Year, capital and other resources were channelled towards gold, partly at the expense of platinum.

Japanese demand was also disappointing, both in isolation and compared to gold's performance. While marking an improvement from the 20% drop seen in the previous quarter, Q4'21 volumes were still down by 10% (-9 koz) year-on-year. This compares to a 20% rise in gold jewellery fabrication. The continued health of consumer appetite for kihei chains, which account for a far bigger share of gold than of platinum jewellery was a key factor driving this discrepancy. We also understand that there was a shift to higher value-added products, meaning that for a given budget jewellery pieces would contain less platinum and instead more margin to cover labour/design costs.

Indian platinum jewellery fabrication jumped by 88% (+18 koz) in Q4'21 vs Q4'20 to a high of 38 koz. The spurt in demand resulted from the record number of weddings and positive consumer sentiment as COVID cases remained subdued throughout the country. Additionally, the increase in appetite for diamond jewellery further supported platinum demand.

Industrial demand

Industrial demand grew by 17% (+90 koz) against Q4'20 and 3% (+19 koz) quarter-on-quarter, as most sectors navigated pandemic-induced supply challenges and stronger than expected consumer demand.

Petroleum

Platinum demand rose by 18% (+8 koz) quarter-on-quarter to 54 koz in Q4'21. In spite of virus flare-ups and the emergence of the Omicron variant, the impact on economic activity in Q4'21 proved to be more muted than expected, with global refining output posting further, albeit modest, gains in Q4'21. In Uzbekistan, state-owned oil and gas producer Uzbekneftegaz commissioned a gas-to-liquid plant in December 2021. The construction of the plant had been postponed by almost 18 months as a result of COVID-related restrictions and equipment supply challenges. In Europe and North America, volumes posted sharp gains year-on-year, though this was largely due to a low base effect when refinery closures and cuts to refining output curtailed platinum demand in Q4'20. On a quarter-on-quarter basis, volumes remained steady, as refining activity returned to more normal levels. Meanwhile in China, platinum demand continued to benefit from refining and downstream petrochemical capacity expansions.

Chemical

Platinum chemical offtake grew by 27% (+43 koz) quarter-on-quarter and 12% (+21 koz) year-on-year to 199 koz in Q4'21. Most of these gains were accounted for by new capacity expansion in China. In December, China's Shenghong Petrochemical announced that construction of its 16m tonnes/year integrated crude-to-petrochemical plant was complete (including a 2.8m tonnes/year paraxylene unit), with a test run scheduled for Q1'22.

On the other hand, platinum use in silicone faced growing challenges in Q4'21 due to the surge in energy prices, supply chain disruptions and significantly higher input costs, though volumes were still higher year-on-year. The nitric acid industry also suffered in Q4'21, posting weaker demand for platinum on both a year-on-year and quarter-on-quarter basis. In essence, this was down to weaker fertilizer production (nitric acid is the key chemical in the manufacture of fertilizers), due to surging gas prices. The impact was particularly pronounced in Europe where heavy reliance on natural gas forced some fertilizer manufactures to halt or reduce operations in late 2021.

Medical

Staff shortages with large numbers of medical workers in quarantine, particularly in the US, coupled with increased demand for hospital beds, resulted in numerous elective surgeries being cancelled. Despite a moderate increase in the number of cancer treatments, platinum demand was down 4% (-2 koz) in the final quarter of 2021 compared to Q3'21.

Glass

New additions to LCD tank and fiberglass capacity in China resulted in a 66% (+48 koz) growth in platinum demand year-on-year to 121 koz in Q4'21. The increase was partly due to pandemic-related constraints in 2020 where most investments and start-ups of new plants were delayed. NEG and TungHsu had the largest new LCD tank installations during the quarter and are anticipated to add new capacity in Q1 this year. Investment activity in the glass industry is expected to remain focused in China.

Electrical

In Q4'21, with falling sales and year-end inventory adjustments in consumer electronics, demand from the electrical segment decreased by 11% (-4 koz) year-on-year. In comparison to Q3'21, where hard disk drive (HDD) shipments surprised to the upside, Q4'21 disappointed with key industry players citing continued supply chain issues hampering shipments for the quarter.

Other

Demand from the Other industrial segment in Q4'21 increased by 3% (+5 koz) year-on-year. Spark plugs and sensors demand recovered in line with the improvement in vehicle production, coupled with inventory building activities and growing adoption of thermal platinum sensors in BEVs.

Investment demand

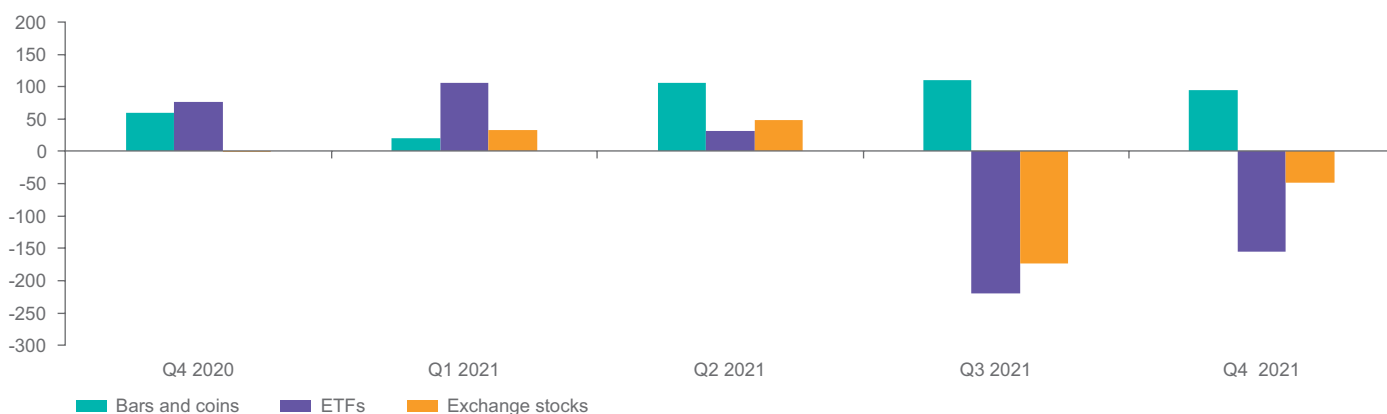
Overall investment demand for Q4'21 declined 243 koz year-on-year, as ETF holdings declined 237 koz year on year and exchange stocks registered a 48 koz outflow. Retail investor interest in bar and coins was healthy overall and saw a 58% (+35 koz) increase in Q4'21.

Starting with bar and coin demand, in North America, while sales eased by 4% (-2 koz) year-on-year to 53 koz, they were still up sharply quarter-on-quarter. Overall, demand for physical precious metals remained strong in Q4'21, reflected in a lack of selling back by investors and elevated premiums. In the platinum market specifically, a further sign of the positive sentiment towards the metal emerged when rising prices attracted renewed buying interest, rather than triggering any material profit taking. European bar and coin investment picked up in Q4'21 following a summer lull. Volumes were also up by 14% (+2 koz) on a year-on-year basis, as macroeconomic uncertainties and surging inflationary fears in particular, underpinned demand for hard assets. In Japan, a weakening yen drove the local platinum price sharply higher during parts of October and November, resulting in investor liquidations. While this was more than offset by buying at other times during the quarter, overall net investment in bars and coins of 18 koz in Japan was modest. Still, it marked a year-on-year swing from the net disinvestment seen in Q4'20.

While the decline in ETF holdings in 2021 were mostly led by outflows from holdings in South Africa in Q3'21, we saw negative demand in most regions during Q4'21, with higher liquidations from Europe (-63 koz) as some investors' interest shifted, albeit perhaps temporarily, to platinum mining equities (attracted by strong corporate profits). Crucially, the global macro backdrop was challenging for precious metals in general during the quarter, as consensus expectations increasingly called for higher interest rates due to earlier and faster normalisation of US monetary policy.

Turning to stocks held by exchanges, the outflow from NYMEX continued at a slower pace and was partly offset by gains in Japanese exchange stocks. Similar to Q3'21, the factors that kept NYMEX deposits high (namely high EFPs) have dissipated. In addition, strong imports to China resulted in a flow of physical platinum from Western vaults to that country.

Chart 4: Platinum Investment, koz

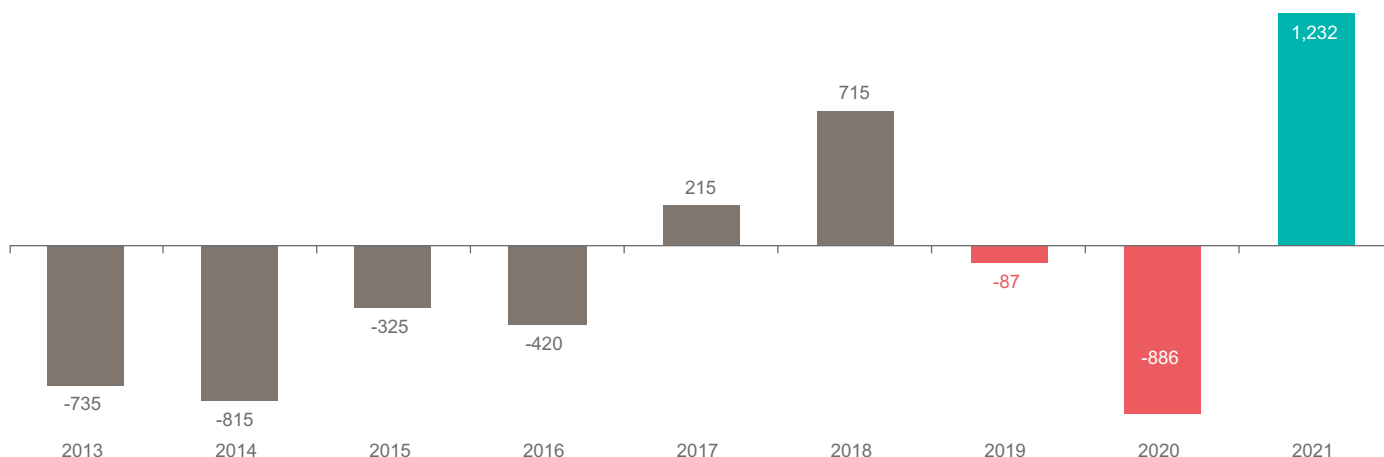


Source: Metals Focus

2021 REVIEW

In many ways 2021 was a year of contradictions. Global growth is estimated to have reached 5.5%, recording the strongest post-recession pace in 80 years according to the World Bank, yet many sectors struggled to recover or respond to improving consumer demand. Vehicle production was severely curtailed as the automotive industry, which in 2020 typically reduced orders for semiconductor chips to match lower production, was consequently relegated to a lower priority by semiconductor producers, which not only faced natural and man-made disasters combined with pandemic induced challenges, but also strong demand from more lucrative communication and electronics markets. Total platinum demand contracted by 9% (-707 koz) as the spectacular investment demand seen in 2020 declined heavily including ETF demand reversing. Automotive demand grew 11% (+250 koz), lifted by stringent emission legislation and substitution of palladium with platinum, while overall industrial demand increased 27% (+537 koz). Jewellery recovered by 5% (+95 koz) as western markets and a strong performance from India countered the downward shift in China and Japan. Total supply grew 21% (+1,411 koz) thanks to the stable operational performance from South Africa, which enabled the acceleration of semi-finished inventory drawdown, while recycling lifted modestly by 3% (+59 koz). Strong supply and falling demand pushed the surplus to 1,232 koz, contrasting sharply with the deep deficit of -886 koz in 2020.

Chart 5: Supply-demand balance, koz, 2013-2021



Source: Metals Focus

This brings us to another contradiction we saw in 2021. While our estimates point to a surplus exceeding 1 Moz, a number of bullion market indicators, as well as anecdotal evidence from our field research, are pointing to tightening conditions in the platinum bullion market. Platinum OTC forwards were in backwardation for most of the year and EFPs were negative for much of the second half. Feedback from our contacts also suggests that during periods in the second half of 2021 securing physical platinum in the London/Zurich markets was not always easy. Indeed, in our view this dynamic explains the draw-downs from NYMEX inventories seen last year.

We believe, this conundrum can be explained by strong speculative and quasi-speculative demand for platinum from China. The resulting imports into the country were exceptionally strong in 2021. Focusing on Chinese reported imports of unwrought platinum, at 2.75 Moz these were up 45% from already elevated levels seen in 2020 and more than twice the average annual total over 2016-2019. While physical demand in the country did increase significantly, the roughly 400 koz overall rise in local demand accounts for only a fraction of the growth in imports.

Our field research in China suggests that this discrepancy is due to strong speculative and quasi-speculative local demand. The presence of speculative activity is also consistent with patterns seen on the Shanghai Gold Exchange – on a number of occasions price weakness coincided with sharp increases in trading volumes, likely reflecting bargain-hunting by investors. This is not unprecedented – there have been numerous occasions in the past when we have seen such behaviour in China. Nor has it been exclusive to platinum. Our estimates and field research pointed to a build-up of palladium stocks in China a few years ago, again fuelled by quasi-speculative buying. We have also seen similar activity in rhodium in the past.

We cannot of course rule out the possibility that we have underestimated local physical automotive, industrial or jewellery demand. However, given the resources we dedicate to researching the Chinese market and the overlap of local and Western platinum consumers, we believe it is extremely unlikely that this could explain a gap of such magnitude.

Given its sheer volume, this activity has had a profound effect on international platinum bullion market conditions. At the macro level, this build-up of Chinese inventories would have completely absorbed last year's surplus and saw inventories move from London, Switzerland and New York into the country. As these stocks are not available to the global bullion market, this shift has been driving tightening market conditions for platinum, kept it in a backwardation and supported the spot price relative to the forward curve.

The flip side of all of this, is that there is now a build-up of above ground stocks within China. Whether held by pure speculators or local traders, industrial users and other market participants, this will eventually be released into the local market, either being sold off within China or consumed instead of procuring fresh imports. However, given Chinese investors' past behaviour, unless there is a dramatic change in platinum's fundamentals that unnerves them, we do not believe this is likely to happen any time soon. For example, it took a long time and very strong price gains for palladium and rhodium inventories that were accumulated in China during previous cycles to be released.

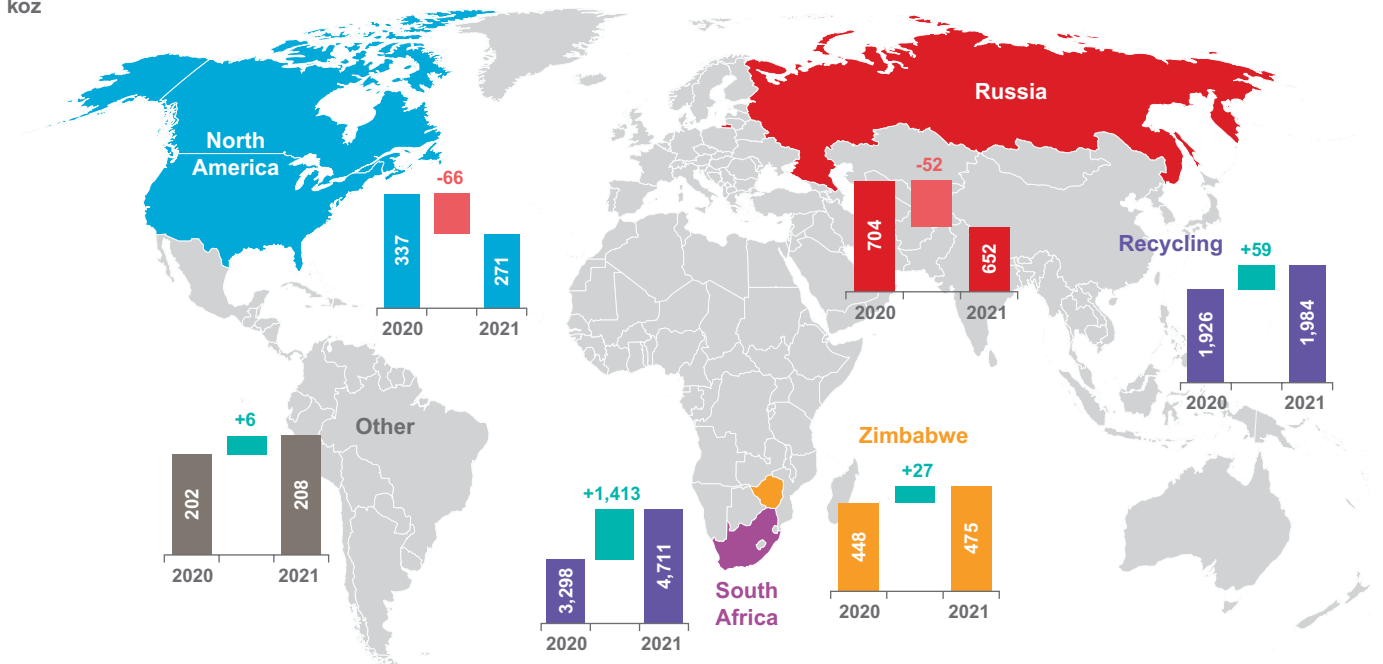
Supply

Global refined production rose 27% year-on-year (+1,328 koz) to 6,317 koz, as operations recovered from the pandemic disruption and ACP shutdown of 2020. In addition, refined volumes were boosted by the release of around 410 koz of semi-finished inventory accumulated in 2020, also because of the ACP shutdown.

South Africa accounted for the bulk of this change adding 1,413 koz (+43%). The semi-finished inventory built up as a result of the ACP shutdown was expected to take 2 years to process, however, the outperformance of the Anglo American Platinum processing infrastructure accelerated the release, boosting 2021 production. Sibanye-Stillwater and Northam made more modest contributions to growth, as their operations recovered from COVID restrictions and Northam's growth projects advanced.

Zimbabwe production increased 6% (+27 koz) to 475 koz as the backlog of semi-finished inventory was processed through South African smelters and refineries. Russian output fell 7% (-52 koz) to 652 koz due the impact of mine flooding and the concentrator stoppage in early 2021. North American production declined 20% (-66 koz) to 271 koz primarily due to the impact of the 70-day strike at Vale's Sudbury operations in addition to safety related production restrictions at Sibanye-Stillwater's US operations.

Chart 6: Changes in supply, 2020 vs. 2021
koz



Source: Metals Focus

Recycling

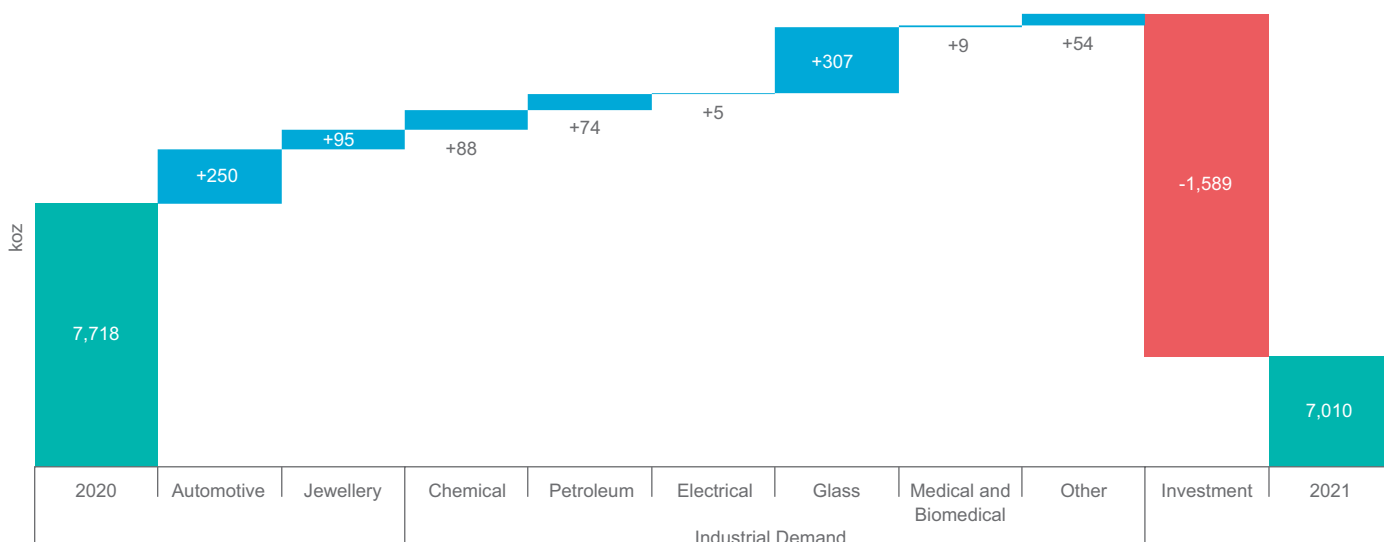
Total recycling of platinum rose 3% (+59 koz) in 2021 to 1,984 koz. The recovery of platinum from spent autocatalysts rose by 4% (+ 57 koz) last year to 1,495 koz. Although this fell short of 2019's record high of 1,584 koz, it still remained a historically elevated total. The two most important drivers were the normalisation of the industry in most locations, as COVID-related restrictions were eased, and the historical trend in the use of platinum in after-treatment systems, principally in the mid-2000s. At this time, platinum automotive demand had surged, mainly in diesel vehicles and most notably in Europe, in response to tighter emissions legislation. One partial offset, especially during the first half of last year, was a lack of smelting capacity, which contributed to extended processing lead times.

Jewellery recycling for the year equalled that of 2020 as the two most active markets for platinum jewellery recycling, namely China and Japan, were subjected to continued severe COVID curtailment measures combined with consumer interest leaning towards gold. China's platinum jewellery scrap increased by 1% (+2 koz) year-on-year in 2021 mainly driven by the significant post-virus rebound in Q1'21. Electronic recycling also registered a small increase of 1% (+1 koz).

Demand

Total demand in 2021 declined 9% (-707 koz) to 7,010 koz. Despite weak car production, autocatalyst demand grew 11% (+250 koz), and jewellery demand rose by 5% (+95 koz). Industrial demand buoyed by expansions in the glass, chemical and petroleum sectors grew 27% (+537 koz). In the investment segment, after two years of significant growth, ETF demand as well as bar and coin investment declined by 745 koz and 247 koz (43%) respectively. In addition, with some of the risk requirements no longer as prevalent, along with historically high physical imports into China, the change in stocks held by exchanges, primarily on NYMEX, declined by 597 koz.

Chart 7: Changes in demand by category, 2020 vs. 2021



Source: Metals Focus

Automotive demand

Severely impaired by supply chain challenges, specifically the semiconductor shortage, light vehicle production for 2021 was only 2% higher than 2020 while heavy-duty vehicle production contracted by 3%. Notwithstanding these challenges, platinum demand grew 11% (+250 koz), lifted by higher loadings to address tightening emissions legislation as well as an increase in the substitution of palladium with platinum.

In Europe, autocatalyst demand fell by 6% (-61 koz). The continued decline of diesel's share of car sales played a key part. Diesel's overall share came to 21.7%, falling 6% compared to 2020. Chip shortages were another key factor, as they suppressed overall car sales/production and the continued penetration of BEVs also weighed on platinum demand.

In contrast, North American platinum demand increased by 28% (+83 koz) despite passenger car production remaining flat year-on-year. There were three key drivers contributing to this. First, the sale and production of larger body types requiring higher loadings, secondly a modest increase in diesel vehicle production and finally a growing adoption of tri-metal catalyst technology, which on average contains a higher ratio of platinum.

In China, despite heavy-duty vehicle production being under pressure, due to significant pre-buying of China V trucks (with lower PGM loadings) in 2020, and a 4% decline in ICE passenger car production, platinum demand jumped 37% (+104 koz). This can be ascribed to the first full year of nationwide light vehicle China 6a and a half year of heavy-duty China VIa emissions legislation implementation. In addition, substitution of palladium with platinum added to the growth. In other regions, the improvement in economic activity, along with tighter emission standards, saw platinum demand grow by 26% (+117 koz).

Jewellery demand

Global jewellery consumption grew 5% (+95 koz) to 1,915 koz after tumbling to 1,820 koz at the height of the pandemic. Despite western markets now outstripping pre-pandemic demand, the drag from lower demand in China and Japan has seen platinum jewellery struggle to recover to pre-pandemic levels.

European demand growth has been raised again, up 32% (+64 koz) to 260 koz and even 10% higher than 2019. Gains due to re-stocking, record results for the high-end, weddings re-starting and economies re-opening have all contributed to this result.

North American demand, too, has been raised again, up 48% year-on-year (+133 koz) and 20% on 2019, as drivers such as diversion of consumer expenditure and re-stocking proved more enduring than expected. The disappointing result for Japanese demand in Q4'21, meanwhile, has left the full-year total somewhat short of already depressed 2020 levels.

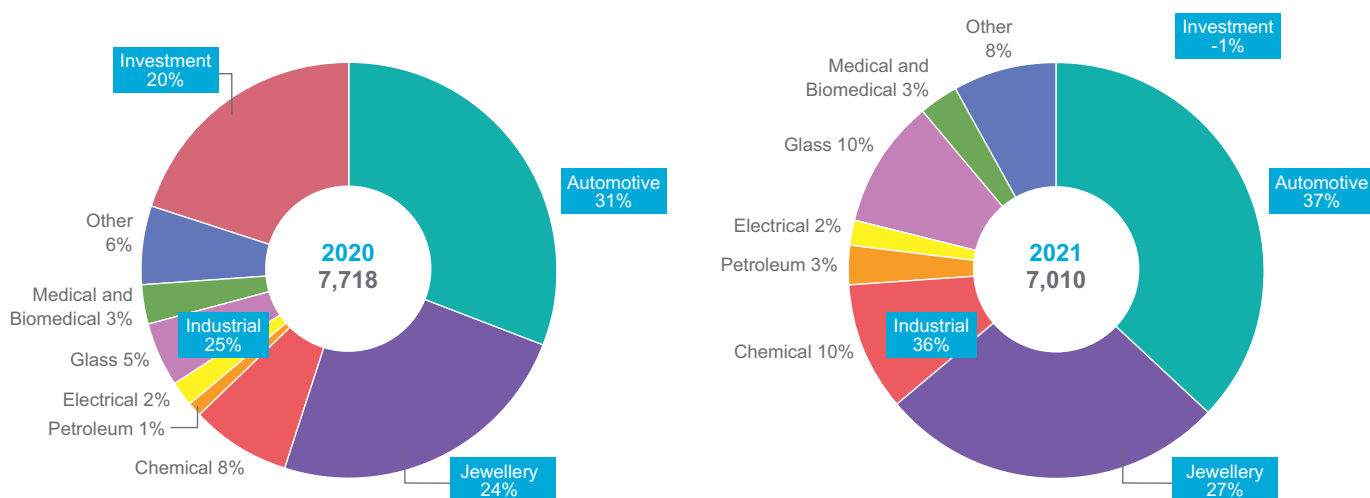
China's platinum jewellery fabrication in 2021 declined 15% (-128 koz), with the annual output at 703 koz posting a record low in this series. In 2021, the robust gold market presented a challenge for platinum, driven by trade support in the form of large-scale gold jewellery promotions as well as a favourable correction in the gold price.

In India, the return to a "new normal" resulted in a full-year growth of 77% (+ 37 koz) year-on-year to 85 koz in 2021. The spurt in demand resulted from the record number of weddings while positive consumer sentiment as COVID cases remained subdued. Additionally, the increase in demand for diamond jewellery also boosted demand for platinum, which is favoured in diamond settings.

Industrial demand

Industrial demand for platinum registered a record high for the past decade and was up 27% (+537 koz) on 2020. Plant expansions in the glass, chemical and petroleum sectors boosted demand with these segments accounting for 87% of the 537 koz growth last year. Other Industrial Demand, which includes non-automotive fuel cell applications, automotive sensors and spark plugs, grew by 11% (+54 koz).

Chart 8: Demand end-use shares, 2020 vs. 2021



Source: Metals Focus

Petroleum

Platinum demand grew by 68% (+74 koz) year-on-year to 182 koz in 2021, though the total was still some 17% below the pre-COVID 2019 figure. To a large degree, this growth reflects a gradual recovery in global oil refining on the back of vaccine rollouts and improving economic activity and mobility. Platinum also benefited from the ongoing expansion of refining and petrochemical capacity in China. Elsewhere, 2021 also witnessed new plants come on-stream after construction was temporarily disrupted by COVID.

Chemical

Platinum demand rose by 15% (+88 koz) year-on-year in 2021, recouping almost all of its losses in 2020. Sizeable additions of paraxylene (PX) and propane dehydrogenation (PDH) units in China remained the key growth driver last year, a reflection of the country's efforts to cut reliance to imported petrochemicals in the medium term. The economic recovery from the COVID pandemic also led to a major rebound in demand for silicone products, though the pace of this recovery slowed notably in late 2021. Still, for the full year, increased silicone volumes contributed to higher platinum demand. The nitric acid industry was the only major area that recorded lower platinum use last year, due to sharply higher gas prices, which reduced operating rates among fertilizer manufacturers.

Glass

In 2021, platinum demand from the glass industry rose by 75% (+307 koz) year-on-year. This was mostly a result of the delay in investments and start-ups of new plants in 2020 due to the constraints of the pandemic. New investment decisions were limited, reflecting the size of the earlier planned expansions as well as rising operating expenses in the production of display glass. NEG and AGC achieved the largest new LCD tank installations during the year.

Medical

Global measures to control the pandemic, led by higher vaccination rates, enabled non-COVID-related hospital admissions to rise in 2021, allowing platinum-using elective procedures and cancer treatments to resume. Demand for the year was up 4% (+9 koz) year-on-year, although still down 1% (-1 koz) against pre-pandemic levels.

Electrical

With remote and hybrid work styles continuing through 2021, electronics demand for platinum, mainly from HDDs, increased by 4% (+5 koz) last year.

Other

Other industrial demand recovered 11% (+54 koz) in 2021. Several factors boosted platinum offtake despite weakness in the automotive sector overall. First the growth in second-hand car sales supported demand for after-market parts such as sensors and sparkplugs, second new communication technologies such as 5G and a growing number of low-orbiting satellites, and finally the modest growth in the hydrogen economy, where electrolyser capacity doubled to reach a total installed capacity of 341MW in the year.

Investment demand

Following a year of exceptionally high demand, bar and coin investment saw a 43% decline (-247 koz) in 2021. Last year, demand in North America rose 9% year-on-year (+22 koz) to a decade high of 264 koz. This was part of the broader, positive climate favouring precious metals which had started during early 2020. This reflected growing fears about the inflationary outlook and concerns that the economic revival might be derailed, should interest rate increases start or a new wave of COVID emerge. As a result, 2021 was characterised by strong buying interest, historically high premiums and only isolated pockets of selling back by retail investors. Product availability was stronger than in 2020, although product delivery lead times remained extended. European bar and coin investment slipped by 19% (-14 koz) in 2021, though volumes remained high by historical standards and were the second highest on record. Multi-decade high inflation, negative real interest rates and doubts about the economic recovery continued to favour purchases of physical precious metals as a means of wealth preservation. This also explain why selling back was subdued despite notable price gains.

After two years of impressive inflows, ETF holdings, generally preferred by institutional investors rather than bar and coin, suffered liquidations in 2021. The drivers of this selling varied regionally, with some investors for example rotating in favour of platinum mining and other equities. More generally, the changing outlook for US interest rates negatively affected investor appetite for precious metals which impacted platinum. Net holdings declined by 237 koz compared to 509 koz of inflows in 2020.

After stocks held in exchange-approved vaults reached unprecedented high levels by July 2021, especially in New York, outflows emerged in the second half of the year. As previously indicated, EFPs moving from a premium to a discount resulted in withdrawals from NYMEX-approved warehouse inventories. In part, some of these outflows were fuelled by the EFP discount driven by a shortage of metal in the spot market due to the exceptionally high imports into China, with net imports into China and Hong Kong amounting to 3.2 Moz, an increase of 46% on 2020 and the highest since 2013.

ABOVE GROUND STOCKS

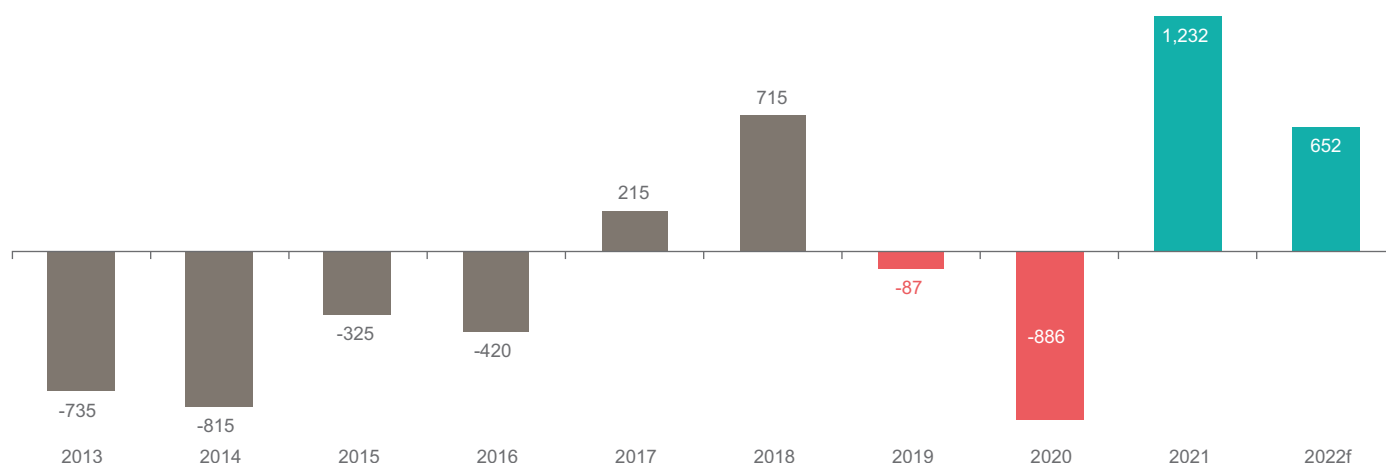
The significant decline in investment demand combined with substantially higher refined mine supply, boosted by ACP inventory unwind, more than offset considerable growth in industrial demand and recovering automotive and jewellery demand. This resulted in the market balance in 2021 swinging from the supply shortfall of 886 koz seen in 2020 to a surplus of 1,232 koz and pushing above-ground stocks up to 3,908 koz, equivalent to 6.6 months of demand cover.

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.

2022 OUTLOOK

With rising energy costs and continued supply disruptions anticipated for 2022, global economic growth is expected to slow to around 4.4%. This remains healthy by historical standards and crucially we expect it will be accompanied by robust gains in industrial production. At the end of February, Russia's full-scale invasion of the Ukraine has generated heightened volatility across all precious metals. While platinum supply is less exposed to Russia, the pronounced impact on gold and palladium will also impact platinum although the extent of this beyond greater price volatility is unclear at this stage. Pandemic-related risks have of course not fully evaporated. Should a new wave of the virus require new restrictions, this could weigh on economic growth and in turn weigh on expectations. Against this backdrop, we anticipate demand to increase 7% (+520 koz) while supply will decline by a modest 1% (-61 koz). Automotive demand is expected to breach 3 Moz, as the semiconductor shortage unwinds, and tighter emissions limits support higher loadings. Jewellery demand is forecast to grow by 1%, remaining below the 2 Moz mark for a third consecutive year, as key consuming markets continue to favour gold ahead of platinum this year. Overall, Industrial demand will contract 15% (-387 koz) as glass and chemical plant expansions slow. Following a year of net outflows in investment demand, we expect investment demand to increase by 372 koz this year. As a result of the changes in both supply and demand, we forecast the market surplus to decline from 1,232 koz in 2021 to 652 koz this year. However, the ongoing tightness in the physical market and NYMEX stock drawdowns suggests that the trends that dominated 2021 is set to continue in 2022.

Chart 9: Supply-demand balance, koz, 2013-2022f



Source: Metals Focus

Supply

In 2022, mine supply is forecast to decline 3% (-198 koz) year-on-year to 6,199 koz as the refining of semi-finished inventory declines, while planned furnace maintenance in South Africa and Russia reduces processing availability. The accelerated processing of the Anglo-American Platinum semi-finished inventory in 2021 has largely depleted the remaining semi-finished stocks available for refining in 2022. While some release from inventory is expected by Anglo American Platinum and other producers, this will be much lower than 2021. Planned smelter maintenance presents some downside risk to production as the scheduled reduction in processing capacity may be extended.

Zimbabwean production capacity is forecast to increase through the concentrator debottlenecking project at Unki and mine development at Zimplats. However, the normalisation of semi-finished material going through South African smelters and refineries is expected to result in a slight decline in Zimbabwean refined production to 465 koz.

Although Russian output has recovered from the mine flooding and concentrator building disruptions of 2021, volumes will be limited by planned smelter maintenance and are forecast to remain virtually flat year-on-year.

North America is expected to add 86 koz (+32%) as disruption from the Sudbury strike and safety incidents of 2021 normalises, while project development progresses. However, the ramp-up of new production areas brings inherent risks and regional labour shortages may hamper growth.

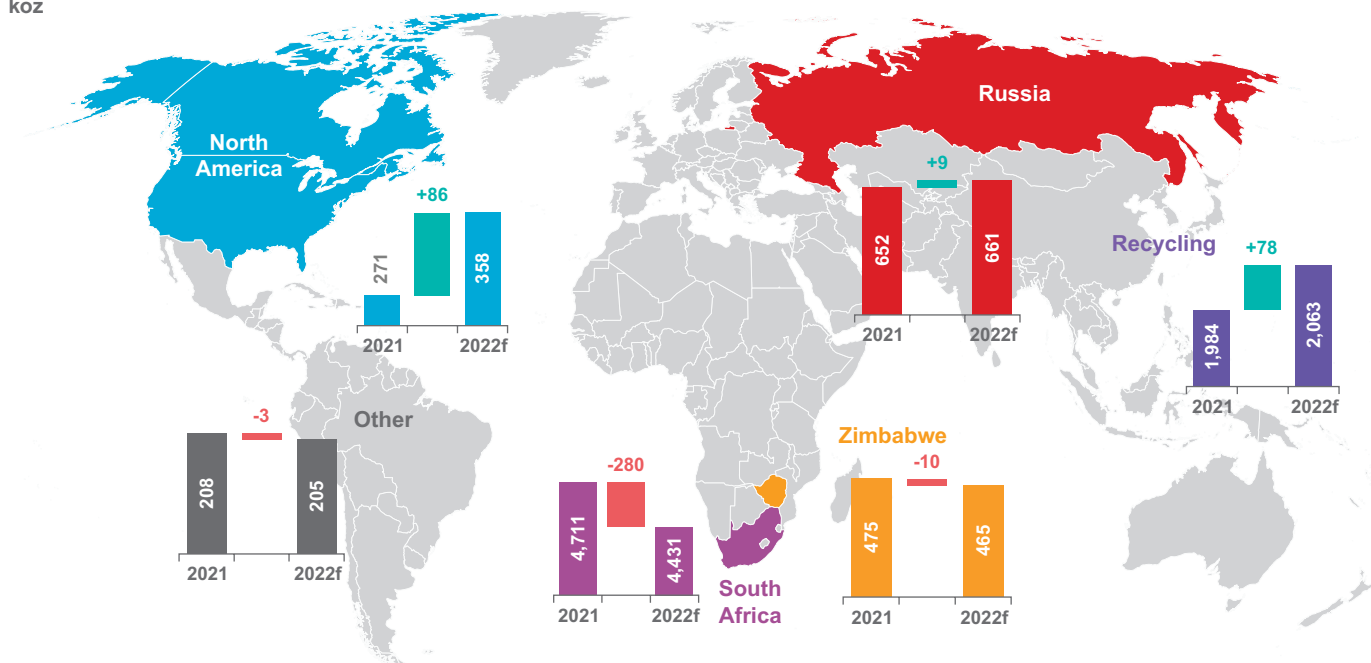
Recycling

Global platinum recycling is forecast to reach 2,063 koz, up 4% (+78 koz). This is driven by a forecast 4% (+64 koz) rise from autocatalyst recycling to 1,559 koz, which we expect will be the second highest on record. This reflects a continuation of those themes which underpinned last year's gains. Most important will be the historical trend in platinum automotive demand. The second key development will be the gradual easing of the chip shortage, which will support higher vehicle production and, in turn, increased supplies of end-of-life vehicles.

Jewellery recycling volumes in 2022 are forecast to grow 3% (+12 koz) as a sharp recovery in Japan more than offsets the 5% decline expected in jewellery recycling from China.

Chart 10: Changes in supply, 2021 vs. 2022f

koz

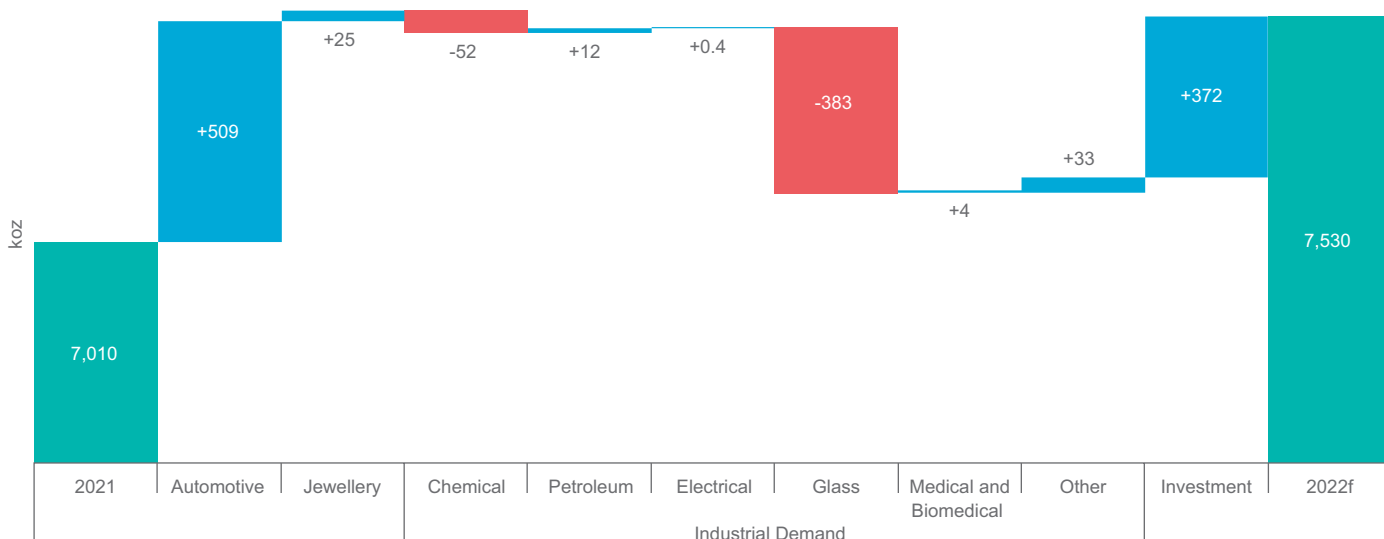


Source: Metals Focus

Demand

While the Omicron COVID-19 variant dampened the start of the year, the lifting of restrictions around the globe supports demand recovery across most industries. We forecast a 7% (+520 koz) rise in overall demand to 7,530 koz, as growth in automotive demand and investment demand offsets a sharp decline in glass demand, following two years of significant capacity expansion.

Chart 11: Changes in demand by category, 2021 vs. 2022f



Source: Metals Focus

Automotive demand

Light-duty vehicle production is expected to increase by almost 10 million units in 2022 to 86M, while heavy-duty production is set to be unchanged year-on-year at 3.3M units, a reflection of the slow easing of the semiconductor constraints over the course of the year. The rise in units produced, a bigger share of heavy-duty vehicles being fitted with platinum-loaded aftertreatment systems and a substitution of palladium with platinum increasing from 200 koz in 2021 to 340 koz, will see platinum demand increase by 19% (+509 koz).

In Europe, demand is expected to improve by 12% (+125 koz) as vehicle production gradually recovers. Higher vehicle production in North America will also support platinum demand. As in 2021, the weighting of production towards larger vehicles with higher loadings, combined with growing deployment of tri-metal catalyst technology, will see platinum demand increase 14% (+55 koz) this year.

In China, the overall 50% (+190 koz) increase in platinum demand will be driven by a more than twofold increase in heavy-duty catalysis usage, combined with healthy growth in light-duty demand, aided by growing substitution.

In other regions, we forecast demand to grow by 17% (+99 koz) as the effects of the pandemic unwind, the impact of semiconductor shortage recedes, and tighter emission legislation takes effect.

Jewellery demand

Jewellery demand in 2022 is forecast to increase by 1% (+25 koz), as strong growth in India and a healthy recovery in Japan offset the modest decline from western markets and a further contraction in Chinese demand.

European fabrication may dip a fraction due to the end of re-stocking and consumer expenditure switching to services, especially travel. However, still solid output for the luxury brands and an anticipated increase in wedding demand should limit losses, with output still 7% up on a pre-pandemic 2019.

North American offtake is also expected to dip in 2022 as consumer expenditure normalises and re-stocking ends. However, bridal demand should prove stronger than earlier projected (as Omicron meant more weddings were postponed in late 2021). With still firm support from retailers and wide price differentials to gold, this should confine the drop to just 2% (-9 koz) year-on-year.

In Japan we forecast a healthy recovery in platinum jewellery demand. However, due to the persistence of COVID-related restrictions in the first few months of the year and a higher platinum price, we do not envisage a return to pre-pandemic levels.

In China, the preference for gold jewellery is expected to persist in 2022 driven by strong trade and marketing support along with our higher price outlook for gold. A possible softening of the overall Chinese economy may also bring headwinds for demand. However, several leading brands continue to see platinum as a core component of their offering with campaigns planned for the year. As a result, we anticipate only a slight decrease of 2% (-14 koz) for platinum jewellery.

This year, we expect a 30% (+26 koz) growth in platinum jewellery demand in India, as the economy recovers and discretionary spending increases in step with the withdrawal of COVID restrictions.

Industrial demand

Petroleum

In spite of the ongoing Omicron wave, the recovery in global oil demand has continued so far in 2022. As restrictions to contain the spread of COVID are expected to gradually ease, oil refining output is on track to surpass pre-pandemic levels later this year. This recovery, along with the ongoing capacity expansion in China, should bode well for platinum-bearing catalysts. However, some of these gains are expected to be offset by refinery closures, as oil companies face increasing pressure to shift away from fossil fuel to low or zero carbon products. Even so, for the full year, platinum demand is expected to grow by 6% (+12 koz) year-on-year to 194 koz.

Chemical

Demand is expected to fall by 8% (-52 koz) year-on-year to 632 koz in 2022, but it is worth stressing that absolute volumes remain high by historical standards. This fall is largely due to China where current project pipelines suggest lower capacity additions this year. Elsewhere, platinum offtake is expected to benefit from easing supply chain bottlenecks and ongoing improvements in the global economy, both of which will propel demand for silicone products higher in 2022. Finally, after a challenging 2021, the fertilizer industry is expected to face less disruptions this year, which will also help platinum offtake.

Electrical

In the electrical segment, the adoption of energy-assisted magnetic recording drives, which contain higher metal loadings per disk will result in increased platinum consumption. However, competition from solid-state drives (SSDs) in mass-storage applications, will counter the growth, leaving platinum demand flat year-on-year.

Medical

We expect higher vaccination rates to allow hospitals to continue operating at more normalised levels. Elective procedures face a significant backlog, due to the pandemic forcing cancellations. Despite strong demand for these procedures, potential growth in platinum demand is limited by hospital capacity. Platinum medical demand is therefore forecast to grow just 1% (+4 koz) in 2022 to 251 koz, which will also be up 1% (+2 koz) versus pre-pandemic levels.

Glass

We forecast a sharp decline in platinum demand from the glass industry for 2022. This follows exceptionally strong demand last year and is consistent with past cycles of capacity investment. As we noted in the previous edition of the Platinum Quarterly, capacity expansions/investments are concentrated to take advantage of economies of scale and are often followed by a sustained period of lower investment. In addition, the high cost of producing display glass at present is eroding margins and should discourage new investment decisions, as demonstrated by the extended display glass shortage. We therefore forecast that platinum demand from the glass industry will halve to 331 koz in 2022.

Other

As availability of semiconductor chips improve quarter-by-quarter this year, so will the fate of the automotive industry and the requirement for platinum loaded sensors and spark plugs. In addition, the increased need for sensors in BEVs will also help the segment. Platinum will also benefit from a growing space industry and hydrogen economy, with the latter seeing a 56% increase in platinum demand in 2022 alone. Overall, we forecast 6% (+33 koz) growth in 2022.

Investment demand

In 2022, global platinum bar and coin demand is expected to increase by 29% (+97 koz). This year, after continued year-on-year growth, North American bar and coin investment is forecast to strengthen further, by 7% (+18 koz) to 282 koz. Many of the themes that played out in 2021 will underpin this year's gains, namely rising inflation and consumer concerns about the economic outlook brought about by rising interest rates, or the potential for widespread restrictions should a new variant of COVID-19 emerge. European bar and coin investment is forecast to remain steady in 2022, as inflationary and economic uncertainty that drove volumes in 2021 are likely to persist.

Following unprecedented ETF demand in 2019 and 2020, and despite the liquidations seen in 2021, ETF holdings remain elevated. ETFs are preferred by institutional investors, whose investment criteria can diverge from retail investors, who tend to prefer bars and coins. Bearing this in mind, the already high level of ETF holdings, coupled with challenges posed by the looming rise in US interest rates, means that net ETF investment in 2022 is expected to be modest, at 50 koz this year. In addition, given that exchange stocks remain historically high, and with the ongoing healthy appetite for physical metal from China maintaining market tightness and negative EFP rates, further depletion in stocks held at exchanges during 2022 seems likely.

ABOVE GROUND STOCKS

With the total supply remaining largely flat and demand set to increase by 7% the market while remaining in a surplus of 652 koz in 2022, will contract compared to 2021, which will result in above-ground stocks increasing to 4,560 koz, providing over 7 months of demand cover.

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

PLATINUM QUARTERLY Q4 2021

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f	2021/2020 Growth %	2022f/2021 Growth %
Platinum Supply-demand Balance (koz)												
SUPPLY												
Refined Production	6,070	4,875	6,160	6,045	6,130	6,125	6,075	4,989	6,317	6,119	27%	-3%
South Africa	4,355	3,135	4,480	4,265	4,385	4,470	4,374	3,298	4,711	4,431	43%	-6%
Zimbabwe	405	405	405	490	480	465	458	448	475	465	6%	-2%
North America	355	395	365	390	360	345	356	337	271	358	-20%	32%
Russia	740	740	710	715	720	665	716	704	652	661	-7%	1%
Other	215	200	200	185	185	180	170	202	208	205	3%	-1%
Increase (-)/Decrease (+) in Producer Inventory	-215	+350	+30	+30	+30	+10	+2	-84	-59	+0	N/A	N/A
Total Mining Supply	5,855	5,225	6,190	6,075	6,160	6,135	6,077	4,906	6,258	6,119	28%	-2%
Recycling	2,000	2,055	1,720	1,860	1,915	1,955	2,129	1,926	1,984	2,063	3%	4%
Autocatalyst	1,120	1,255	1,185	1,210	1,325	1,420	1,584	1,438	1,495	1,559	4%	4%
Jewellery	855	775	515	625	560	505	476	422	422	434	0%	3%
Industrial	25	25	20	25	30	30	69	66	67	69	1%	3%
Total Supply	7,855	7,280	7,910	7,935	8,075	8,090	8,206	6,832	8,242	8,182	21%	-1%
DEMAND												
Automotive	3,130	3,245	3,245	3,360	3,300	3,100	2,831	2,370	2,621	3,129	11%	19%
Autocatalyst	2,990	3,095	3,105	3,225	3,160	2,955	2,831	2,370	2,621	3,129	11%	19%
Non-road	140	150	140	135	140	145	†	†	†	†	†	†
Jewellery	2,945	3,000	2,840	2,505	2,460	2,245	2,099	1,820	1,915	1,940	5%	1%
Industrial	1,580	1,700	1,845	1,955	1,825	2,015	2,127	1,982	2,519	2,132	27%	-15%
Chemical	535	540	515	560	570	565	694	596	684	632	15%	-8%
Petroleum	50	60	205	220	100	235	219	109	182	194	68%	6%
Electrical	195	215	205	195	210	205	144	130	135	135	4%	0%
Glass	145	205	235	255	205	250	236	407	715	331	75%	-54%
Medical and Biomedical	220	225	240	235	235	235	249	239	247	251	4%	1%
Other	435	455	445	490	505	525	584	500	555	588	11%	6%
Investment	935	150	305	535	275	15	1,237	1,546	-43	329	N/A	N/A
Change in Bars, Coins	-5	50	525	460	215	280	266	578	332	429	-43%	29%
Change in ETF Holdings	905	215	-240	-10	105	-245	991	509	-237	50	N/A	N/A
Change in Stocks Held by Exchanges	35	-115	20	85	-45	-20	-20	458	-139	-150	N/A	N/A
Total Demand	8,590	8,095	8,235	8,355	7,860	7,375	8,294	7,718	7,010	7,530	-9%	7%
Balance	-735	-815	-325	-420	215	715	-87	-886	1,232	652	N/A	-47%
Above Ground Stocks	3405*	2,590	2,265	1,845	2,060	2,775	3,563**	2,677	3,908	4,560	46%	17%

Source: Metals Focus 2019 - 2022, SFA (Oxford) 2013 - 2018.

Notes:

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

PLATINUM QUARTERLY Q4 2021

Table 3: Supply and demand summary – quarterly comparison

	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q4'21/Q4'20 Growth %	Q4'21/Q3'21 Growth %
Platinum Supply-demand Balance (koz)											
SUPPLY											
Refined Production	1,575	1,248	942	1,496	1,303	1,465	1,566	1,592	1,695	30%	6%
South Africa	1,180	843	521	1,062	873	1,028	1,175	1,228	1,280	47%	4%
Zimbabwe	108	108	110	115	115	118	125	111	121	6%	9%
North America	94	98	87	71	82	83	75	50	63	-23%	27%
Russia	149	150	175	196	182	184	137	153	178	-2%	17%
Other	42	50	49	52	51	52	53	51	52	1%	1%
Increase (-)/Decrease (+) in Producer Inventory	+45	+54	+25	-112	-51	-29	+18	-28	-21	N/A	N/A
Total Mining Supply	1,620	1,302	967	1,384	1,252	1,435	1,584	1,565	1,674	34%	7%
Recycling	525	447	375	531	573	526	535	463	461	-20%	0%
Autocatalyst	387	361	263	393	422	392	421	341	341	-19%	0%
Jewellery	121	70	97	121	134	118	98	104	103	-23%	-2%
Industrial	18	17	15	17	17	16	17	17	17	0%	1%
Total Supply	2,145	1,749	1,342	1,916	1,825	1,961	2,119	2,027	2,135	17%	5%
DEMAND											
Automotive	678	635	384	639	712	724	658	582	656	-8%	13%
Autocatalyst	678	635	384	639	712	724	658	582	656	-8%	13%
Non-road	†	†	†	†	†	†	†	†	†	N/A	N/A
Jewellery	496	393	388	510	529	479	459	481	497	-6%	3%
Industrial	502	568	387	503	525	709	598	596	615	17%	3%
Chemical	190	179	113	126	178	119	210	156	199	12%	27%
Petroleum	55	33	18	21	36	36	46	46	54	51%	18%
Electrical	36	32	29	33	36	33	35	35	32	-11%	-9%
Glass	13	146	62	127	73	318	112	164	121	66%	-26%
Medical and Biomedical	62	60	60	60	60	60	63	64	61	3%	-4%
Other	146	118	104	136	143	143	132	132	147	3%	12%
Investment	78	67	383	961	135	160	187	-282	-108	N/A	N/A
Change in Bars, Coins	24	300	122	97	60	21	107	110	95	58%	-14%
Change in ETF Holdings	47	-213	123	523	76	106	31	-219	-155	N/A	N/A
Change in Stocks Held by Exchanges	6	-20	138	342	-1	33	49	-173	-48	N/A	N/A
Total Demand	1,753	1,662	1,542	2,613	1,901	2,072	1,902	1,377	1,660	-13%	21%
Balance	393	87	-200	-697	-76	-111	217	650	475	N/A	-27%

Source: Metals Focus 2019 - 2022.

Notes:

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

PLATINUM QUARTERLY Q4 2021

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

	H2 2019	H1 2020	H2 2020	H1 2021	H2 2021	H2'21/H2'20 Growth %	H2'21/H1'21 Growth %
Platinum Supply-demand Balance (koz)							
SUPPLY							
Refined Production	3,100	2,191	2,799	3,030	3,287	17%	8%
South Africa	2,293	1,364	1,934	2,203	2,508	30%	14%
Zimbabwe	228	218	230	243	232	1%	-4%
North America	173	185	153	159	113	-26%	-29%
Russia	324	325	379	321	331	-13%	3%
Other	83	99	103	105	103	0%	-1%
Increase (-)/Decrease (+) in Producer Inventory	+16	+79	-162	-11	-48	N/A	N/A
Total Mining Supply	3,116	2,269	2,637	3,019	3,239	23%	7%
Recycling	1,044	822	1,104	1,061	923	-16%	-13%
Autocatalyst	772	623	815	813	682	-16%	-16%
Jewellery	237	167	255	216	207	-19%	-4%
Industrial	35	32	34	33	34	0%	5%
Total Supply	4,160	3,091	3,741	4,080	4,162	11%	2%
DEMAND							
Automotive	1,344	1,020	1,351	1,382	1,238	-8%	-10%
Autocatalyst	1,344	1,020	1,351	1,382	1,238	-8%	-10%
Non-road	†	†	†	†	†	N/A	N/A
Jewellery	1,025	780	1,039	937	977	-6%	4%
Industrial	1,034	954	1,028	1,307	1,212	18%	-7%
Chemical	351	293	304	330	355	17%	8%
Petroleum	109	51	57	82	101	75%	23%
Electrical	73	61	68	68	67	-2%	-2%
Glass	84	208	200	429	285	43%	-34%
Medical and Biomedical	124	119	119	123	125	5%	2%
Other	292	222	279	275	279	0%	1%
Investment	324	449	1,096	347	-390	N/A	N/A
Change in Bars, Coins	74	422	156	127	205	31%	61%
Change in ETF Holdings	254	-90	599	137	-374	N/A	N/A
Change in Stocks Held by Exchanges	-4	118	341	82	-221	N/A	N/A
Total Demand	3,728	3,204	4,514	3,974	3,037	-33%	-24%
Balance	433	-113	-773	107	1,125	N/A	>±300%

Source: Metals Focus 2019 - 2022.

Notes:

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

PLATINUM QUARTERLY Q4 2021

Table 5: Regional demand – annual and quarterly comparison

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f	2021/2020 Growth %	2022f/2021 Growth %	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	
Platinum gross demand (koz)																		
Automotive	3,130	3,240	3,250	3,350	3,290	3,090	2,831	2,370	2,621	3,129	11%	19%	712	724	658	582	656	
North America	425	465	480	410	390	390	343	301	384									
Western Europe	1,350	1,395	1,450	1,630	1,545	1,325	1,447	1,087	1,026									
Japan	585	585	510	450	435	425	305	245	253									
China	130	125	145	195	230	220	185	280	384									
India	165	170	180	170	175	195	††	††	††									
Rest of the World	475	500	485	495	515	535	550	457	574									
Jewellery	2,945	3,000	2,840	2,505	2,460	2,245	2,099	1,820	1,915	1,940	5%	1%	529	479	459	481	497	
North America	200	230	250	265	280	280	341	277	409									
Western Europe	220	220	235	240	250	255	237	196	260									
Japan	335	335	340	335	340	345	372	316	298									
China	1,990	1,975	1,765	1,450	1,340	1,095	871	832	703									
India	140	175	180	145	175	195	102	48	85									
Rest of the World	60	65	70	70	75	75	176	151	159									
Chemical	535	540	515	560	570	565	694	596	684	632	15%	-8%	178	119	210	156	199	
North America	55	55	55	50	50	50	77	91	98									
Western Europe	110	105	75	110	115	105	125	115	120									
Japan	10	10	10	15	15	15	66	62	65									
China	195	215	230	225	220	215	236	185	251									
Rest of the World	165	155	145	160	170	180	190	144	151									
Petroleum	50	60	205	220	100	235	219	109	182	194	68%	6%	36	36	46	46	54	
North America	40	25	-25	90	55	55	30	5	26									
Western Europe	-45	-20	70	10	5	20	14	11	15									
Japan	10	-35	5	0	-40	5	7	6	7									
China	80	-5	45	80	45	10	66	35	26									
Rest of the World	-35	95	110	40	35	145	103	52	109									
Electrical	195	215	205	195	210	205	144	130	135	135	4%	0%	36	33	35	35	32	
North America	10	15	15	10	15	15	38	35	35									
Western Europe	5	10	10	10	10	10	27	23	25									
Japan	15	15	15	15	15	15	20	16	17									
China	75	70	70	80	90	85	28	31	31									
Rest of the World	90	105	95	80	80	80	31	25	26									
Glass	145	205	235	255	205	250	236	407	715	331	75%	-54%	73	318	112	164	121	
North America	5	10	0	20	5	5	7	-37	17									
Western Europe	-10	15	10	5	5	35	59	25	5									
Japan	0	-25	-5	-10	-10	0	-40	-66	-22									
China	90	115	130	150	110	80	180	360	713									
Rest of the World	60	90	100	90	95	130	30	126	3									
Medical	220	225	240	235	235	235	249	239	247	251	4%	1%	60	60	63	64	61	
Other industrial	435	455	445	490	505	525	584	500	555	588	11%	6%	143	143	132	132	147	
Bar & Coin Investment	-5	50	525	460	215	280	266	578	332	429	-43%	29%	60	21	107	110	95	
North America							159	242	264									
Western Europe							52	75	61									
Japan							46	240	-26									
Rest of the World							9	21	33									
ETF Investment	905	215	-240	-10	105	-245	991	509	-237	50	N/A	N/A	76	106	31	-219	-155	
North America							125	526	-4									
Western Europe							509	237	59									
Japan							-13	58	-23									
Rest of the World							370	-312	-268									
Change in Stocks Held by Exchanges	35	-115	20	85	-45	-20	-20	458	-139	-150	N/A	N/A	-1	33	49	-173	-48	
Investment	935	150	305	535	275	15	1,237	1,546	-43	329	N/A	N/A	135	160	187	-282	-108	
Total Demand	8,590	8,090	8,240	8,345	7,850	7,365	8,294	7,718	7,010	7,530	-9%	7%	1,901	2,072	1,902	1,377	1,660	

Source:Metals Focus 2019 - 2022, SFA (Oxford) 2013 - 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.

PLATINUM QUARTERLY Q4 2021

Table 6: Regional recycling – annual and quarterly comparison

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f	2021/2020 Growth %	2022f/2021 Growth %	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	
Platinum recycling supply (koz)																		
Automotive	1,120	1,255	1,185	1,210	1,325	1,420	1,584	1,438	1,495	1,559	4%	4%	422	392	421	341	341	
North America							520	458	460									
Western Europe							802	738	792									
Japan							116	110	108									
China							36	36	37									
Rest of the World							110	96	99									
Jewellery	855	775	515	625	560	505	476	422	422	434	0%	3%	134	118	98	104	103	
North America							3	3	3									
Western Europe							4	4	4									
Japan							187	162	160									
China							276	248	250									
Rest of the World							5	5	5									
Industrial	25	25	20	25	30	30	69	66	67	69	1%	3%	17	16	17	17	17	
North America							15	12	12									
Western Europe							11	10	11									
Japan							34	34	34									
China							7	7	8									
Rest of the World							2	2	2									

Source: Metals Focus 2019 - 2022, SFA (Oxford) 2013 – 2018.

GLOSSARY OF TERMS

Above ground stocks

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

ADH

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

BDH

Butane dehydrogenation; catalytic conversion of isobutane to isobutylene.

Bharat

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

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

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

China Vehicle Emission Standards

China's vehicle emission standards are set nationally by the Ministry of Environmental Protection and are regionally and locally enforced by Environmental Protection Bureaus. A number of cities and provinces in China continue the historic practice of early introduction of new standards.

China 6

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

China VI

In June 2018, China finalized China VI standards that will apply to new heavy-duty diesel vehicles nationwide in two stages. The first stage, China VI-a, originally targeted to have become applicable by July 2020 for new models but has been delayed by 6 months to January 2021, and all new HDVs targeted for compliance in July 2021. The second stage, China VI-b will apply to gas engines nationwide starting in January 2021 and all new HDVs in July 2023.

Compounds (Platinum based)

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

Diesel oxidation catalyst (DOC)

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

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

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

Electrolysis of water

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

Emissions Legislation

Regulations that necessitate the fitment of autocatalyst systems dealing with the treatment of vehicle tailpipe emissions such as carbon monoxide (CO), particulate matter, hydrocarbons and oxides of nitrogen (NO_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 CO₂, 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 beam.

HDD

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

HDV

Heavy-duty vehicle.

Hydrogen Production Methods

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

white – naturally occurring or produced as industrial by-product

black or brown – coal gasification

grey – steam methane reforming

turquoise – methane pyrolysis

blue – steam methane reforming plus carbon capture

green – water electrolysis using 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.

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.

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