PLATINUM ESSENTIALS

Updating WPIC's two- to five-year platinum supply/demand outlook: Multi-year deficits expected

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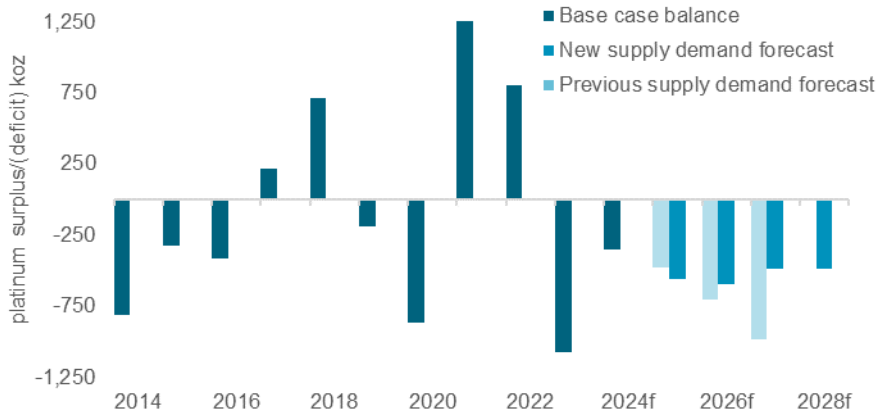
With our Platinum Quarterly outlook now running through 2024, this Platinum Essentials contains revised estimates for platinum supply/demand balances in the years 2025 to 2027 and our first estimate for 2028. As well as expecting consecutive deficits in 2023 and 2024, we forecast the platinum market to remain undersupplied throughout 2025 to 2028, with deficits averaging around 550 koz per annum, or approximately 7% of demand.

Downside risks remain a key theme for platinum supply. Primary mine supply risks have transitioned from operational (processing, electricity curtailments and extreme weather) to economic. Our mine supply forecast method utilises the mid-point of aggregate published company guidance. Primary supply forecasts have only been reduced by ~2% since our previous reports to reflect public announcements from PGM miners. However, we simultaneously estimate that 25% of PGM mined production is loss making at depressed spot prices (*link*) while noting that most production guidance does not reflect financial reporting to December 2023. This suggests the potential for more downgrades. Constrained 2023 recycled platinum supply looks likely to persist as vehicle ages rise. From a demand perspective, the automotive sector continues to present several forecast variables over the 5-year period. Although vehicle demand has recovered faster than expected, longer term platinum automotive demand reduces due to some palladium for platinum substitution starting in 2026f, lower diesel LV market share in Europe and, a reduction in LV fuel cell adoption rates.

Our revised forecasts reflect a reduction in both our platinum supply and demand between 2025 to 2027. The net impact is for sustained annual platinum market deficits of between 500 koz and 612 koz. The projected deficits are smaller than those in our previous estimates, but still material (fig. 1), with additional risks to supply as highlighted above.

All estimates in this report are based upon publicly available information and WPIC in-house analysis*. *This report complements, but is entirely separate from, the one year forward outlook we publish in our Platinum Quarterly (PQ), which is prepared independently for us by Metals Focus.*

Figure 1. WPIC projects platinum deficits from 2023



Source: SFA (Oxford) from 2014 to 2018, Metals Focus from 2019 to 2024f, Company guidance, WPIC Research from 2025f

**WPIC in-house supply research is based solely on publicly published supply data, including forward looking guidance, with any adjustments noted. It does not represent the views of any WPIC members or those of Metals Focus which independently prepare our Platinum Quarterly reports. Demand data is based on public data but includes WPIC in-house analysis.*

Figure 2. Supply/demand summary table

	PUBLISHED PLATINUM QUARTERLY ESTIMATES†				WPIC ESTIMATES‡			
	2021	2022	2023f	2024f	2025f	2026f	2027f	2028f
PLATINUM SUPPLY								
Refined mine production					Production at mid-point of aggregate guidance ranges			
- South Africa	4,678	3,915	3,905	4,099	4,169	4,132	4,142	4,024
- Zimbabwe	485	480	502	506	552	597	619	619
- North America	273	263	268	302	319	330	334	334
- Russia	652	663	684	634	624	624	624	624
- Other	208	201	193	201	201	199	199	199
- Producer inventory movement	-93	43	57	0	0	0	0	0
Total mining supply	**6,204**	**5,565**	**5,608**	**5,743**	**5,865**	**5,881**	**5,918**	**5,800**
Recycling								
- Autocatalyst	1,589	1,255	1,048	1,132	1,251	1,323	1,367	1,491
- Jewellery	422	372	353	362	339	338	337	339
- Industrial	67	68	70	73	78	93	101	110
Total recycling	**2,078**	**1,696**	**1,471**	**1,567**	**1,668**	**1,754**	**1,806**	**1,940**
Total supply	**8,282**	**7,261**	**7,079**	**7,310**	**7,532**	**7,635**	**7,724**	**7,740**
PLATINUM DEMAND								
Automotive	**2,555**	**2,867**	**3,262**	**3,312**	**3,418**	**3,321**	**3,259**	**3,249**
Jewellery	**1,953**	**1,899**	**1,852**	**1,903**	**1,882**	**1,916**	**1,942**	**1,970**
Industrial	**2,536**	**2,335**	**2,652**	**2,367**	**2,376**	**2,581**	**2,593**	**2,591**
Total investment	**-56**	**-640**	**385**	**82**	**430**	**430**	**430**	**430**
- Bar and coin	324	225	305	172	310	310	310	310
- ETF	-241	-558	50	-120	120	120	120	120
- Stocks held by exchanges	-139	-307	30	30	0	0	0	0
Total demand	**6,988**	**6,461**	**8,150**	**7,663**	**8,105**	**8,247**	**8,224**	**8,240**
Supply/demand balance	**1,294**	**800**	**-1,071**	**-353**	**-573**	**-612**	**-500**	**-500**

†The Platinum Quarterly report and data are prepared independently for the WPIC by Metals Focus

‡WPIC estimates and analysis are based upon publically available information

Source: Metals Focus from 2021 to 2024f, Company guidance, WPIC Research from 2025f

Introduction

The WPIC's two- to five-year platinum supply and demand projections are intended to complement the estimates and forecasts published in our *Platinum Quarterly*, but they look further into the future and allow for longer-term scenario analysis. The *Platinum Quarterly* report and data are prepared independently for the WPIC by Metals Focus, with Metals Focus's estimates provided on a one year forward basis (currently 2024). For the avoidance of doubt, all estimates for 2025 to 2028 included in this report are WPIC forecasts, with the exception of mine supply which is based upon publicly published company guidance. Specifically, WPIC has made no use of any data or views included in Metals Focus's separate five-year forecast available to its clients, that provides an outlook for all the major PGMs.

WPIC's base case published supply/demand projections for 2025 to 2028 provide the ability to run scenario analysis on different parts of the supply/demand landscape.

The WPIC has not attempted to develop further in-country and in-industry relationships to obtain fresh/incremental data and the information and sources used to develop our supply/demand model are all in the public domain.

Please see the appendix for a complete description of the methodologies we have used to develop each model and section of this report as well as a risk analysis for our forecasts.

Key projections

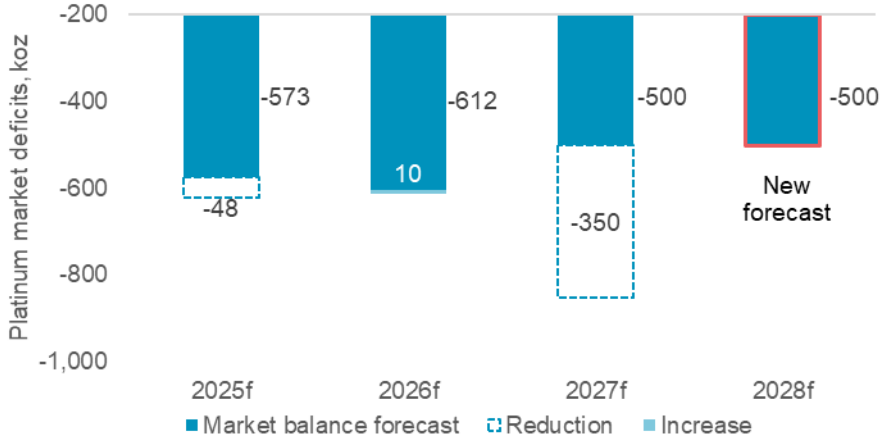
Our revised outlook is compared to the supply/demand *Platinum Essentials* two-to-five year outlook published in *June 2023*. Since then, the macroeconomic overlay has improved, albeit remaining volatile and subject to geopolitical tensions. With inflation slowing and trending towards national targets, central bank rhetoric suggests we are near to or at peak interest rates. That said, no consensus has formed over how long interest rates will remain elevated. Regionally, the US appears well placed to achieve a soft landing, while European growth is slowing, and a mild recession appears likely. Meanwhile, China faces ongoing uncertainty given challenges in its debt laden property sector. We have accommodated the additional economic considerations in our revised two- to five-year outlook.

For the period 2025-2028, we have made the following key revisions to our projections:

- **Primary supply** was reduced by an average of 2% (135 koz platinum p.a.) following various company announcements to defer growth, and/or restructure or idle production. These announcements stem from deteriorating profitability caused by lower PGM prices, notably palladium and particularly rhodium.
- **Total secondary supply** is forecast to be 6% lower on average (111 koz platinum p.a.) which reflects lower scrap supply due to lifestyle and affordability trends keeping existing vehicles on the road for longer.
- **Automotive demand** is forecast to be 11% lower on average, attributable to revisions in the drivetrain mix and the inclusion of palladium for platinum substitution from 2026 onwards.
- **Industrial demand** is forecast to be 1% higher on average (23 koz platinum p.a.) due to upward revisions for chemicals and glass platinum demand offsetting decreases to petroleum and electrical platinum demand.
- **Investment demand, always measured on a net basis,** is forecast to be 30 koz lower on average based on our methodology of averaging annual demand since 2013 (i.e. since the beginning of the *WPIC Platinum Quarterly* dataset).

Both platinum supply and demand expectations have been lowered in our latest 2-5 year outlook.

Figure 3. Changes to platinum markets deficits are most material in 2027f



Source: WPIC Research

Conclusion – year-on-year deficits

The net impact of the changes to forecast market balances are for the deficits to remain broadly stable, but still material, in comparison to our previous projections of ongoing growing deficits. Platinum market deficits are expected to average 7% of demand between 2025 to 2028 (503-613 koz p.a.). The platinum investment case remains compelling as consecutive years of platinum market deficits highlights strong demand and constrained supply. We expect market deficits to cause above ground stocks to fall from 23 weeks of demand at the end of 2023 to 6 weeks of demand by the end of 2028, potentially their lowest level since records began (*historical data*).

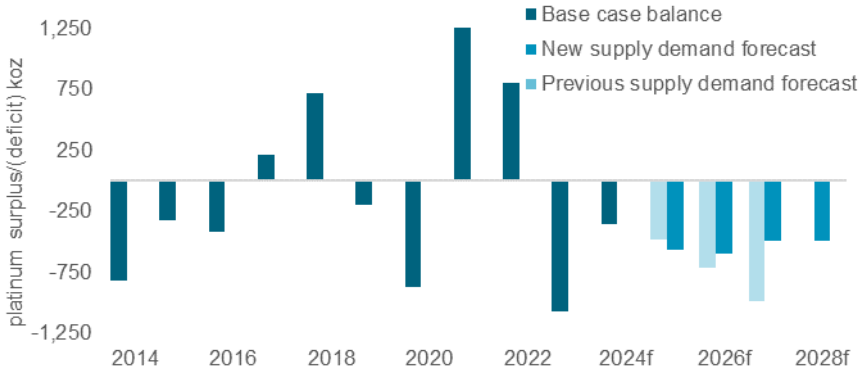
Supply-side risks biased to the downside

Whilst we are confident in the outlook for sustained deficits, there is the potential that they could be deeper than projected. We are continuing to use the mid-point of aggregated published mining company production guidance. Barring a year-end update in December 2023 from Amplats and Tharisa, guidance was, in general, last updated following companies' June 2023 financial reporting. PGM prices have continued trending lower through the second half of 2023, leaving a greater proportion of mined production generating loss making ounces. WPIC estimates that around 25% of primary PGM supply is loss making using financial year 2022 reported costs (*link*), or around 1.3 Moz of annual platinum production. Several producers including Sibanye-Stillwater, Amplats, Implats, Tharisa, Wesize and Sedibelo have announced measures to improve profitability. Should low prices be protracted, this may result in restructuring unprofitable supply which could lead to deeper deficits within our two- to five-year horizon. Elsewhere, although these risks appear to have lessened for the time being, there are further supply risks from a worsening power shortage in South Africa and sanctions on Russian output. While energy availability improved in the second half of 2023 in South Africa and Nornickel recorded normalised production, these risks should be kept front of mind. As recently as December 2023, the G7 announced a ban on Russian diamonds effective January 2024. Additionally, the UK is sanctioning Russian origin commodities, although palladium is yet to be targeted.

Supply will require supply from above ground stocks to meet platinum demand through consecutive years of deficits.

It is worth considering the impact of supply risk on deficits. Each 1% change in mine supply equates to 60 koz of platinum, which in turn represents a +/-11% change to the average market deficits of 550 koz between 2025 to 2028.

Figure 4. The platinum deficit is expected narrow in 2024 on increasing supply before returning to consistently deeper deficits from 2025



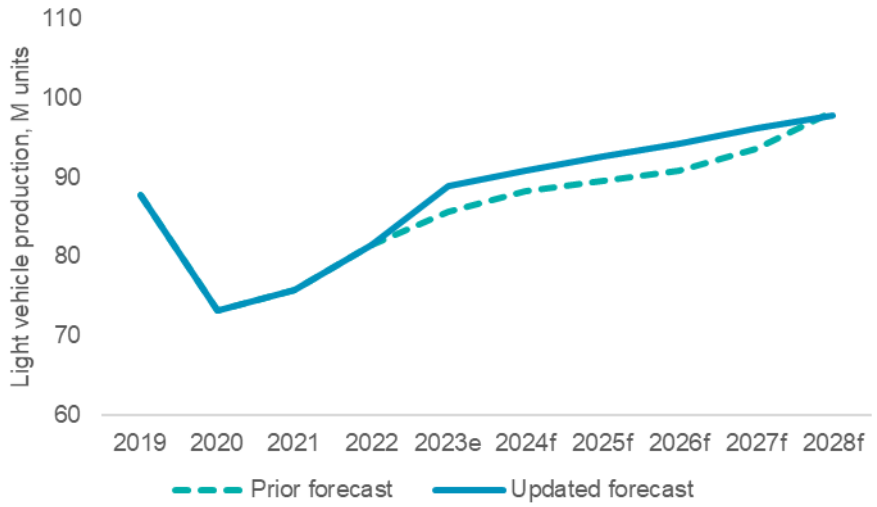
Source: SFA (Oxford) from 2014 to 2018, Metals Focus from 2019 to 2024f, Company guidance, WPIC Research from 2025f – 2028f

Platinum demand outlook most sensitive to the automotive sector

Light-duty volumes increased by an estimated 8% y/y to 89M units in 2023, exceeding projections from the start of the year. This growth confirmed expectations that pent-up automotive demand from COVID and the chip-shortage would offset deteriorating macro conditions and persistent geopolitical factors. Our light-duty production forecasts (including light commercial) have been revised upwards by two to three million units per annum between 2025f to 2027f (Fig. 5) following the faster than expected recovery of the sector and expectations for demand to reach 91M units in 2024f.

Automotive volumes have recovered faster than expected.

Figure 5. Automotive production has recovered faster than expected from the COVID pandemic and supply-chain bottlenecks of 2020 to 2022

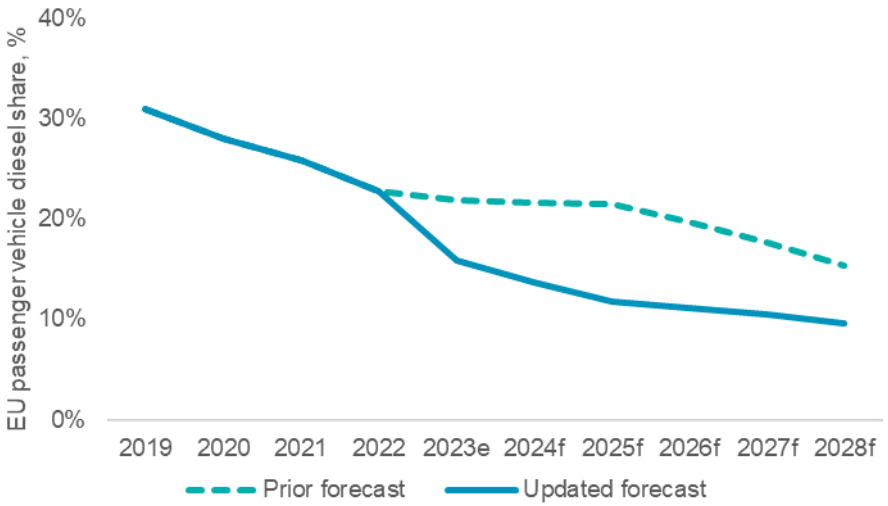


Source: OICA, WPIC Research

Notwithstanding higher absolute volumes, our automotive platinum demand forecast is reduced by an average of 423 koz per annum between 2025 to 2027. The three primary factors underpinning lower automotive platinum demand are 1) reduced diesel market share in Europe, 2) the beginning of palladium-for platinum-substitution, and 3) downward revisions to light-duty FCEV market penetration.

The erosion of diesel penetration rates accelerated in 2023.

Figure 6. European diesel market share continued decreasing through 2023 and is now comparable to BEV



Source: ACEA, WPIC Research

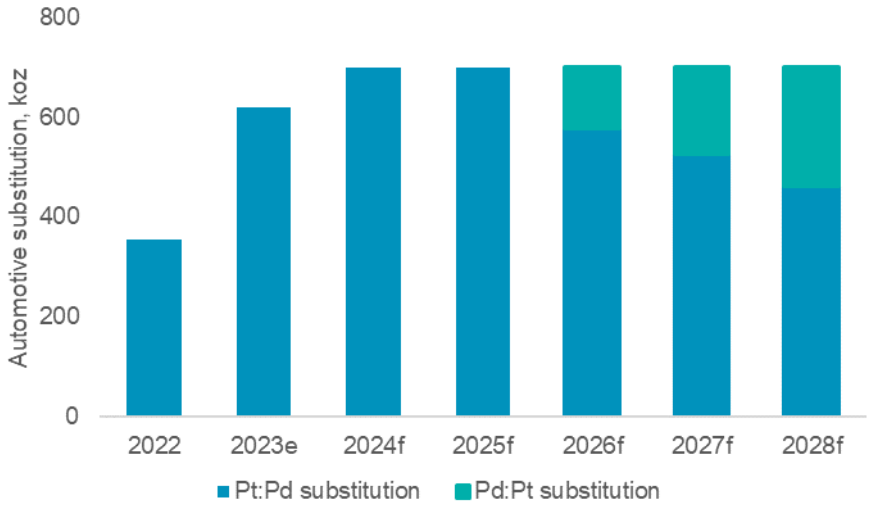
Passenger car registration data from ACEA continues to point to a decline in European diesel market share. Data to October 2023 highlights that diesel's year-to-date market share has declined to 13.9% in 2023 from 17% in the prior year. WPIC had previously expected that the broader recovery in the automotive sector would help to mitigate diesel's declining market shares across Europe. Accordingly, our revised diesel market share forecasts accelerate short-term erosion while tapering medium-term market share losses (Fig. 6). Lower diesel production accounts for approximately -210 koz per annum of platinum demand between 2025 to 2027, or half the total decline.

Platinum for palladium substitution is estimated at 620 koz in 2023.

In our latest *Platinum Quarterly*, platinum-for-palladium substitution reached an estimated 620 koz in 2023e and is forecast to reach 700 koz in 2024f. With palladium prices declining by 38% during 2023, there is less economic incentive to substitute platinum for palladium in new vehicle models since the price differential of US$80 per ounce has declined from its maximum of US$1,880 per oz in March 2022. Furthermore, substitution on new vehicle models is likely to be further disincentivised as palladium market balances trend into surplus from 2025f (*link*) and platinum market balances accumulate deficits from 2023. We expect these factors to cause the economic incentive to reverse recent substitution trends, albeit at an initially slow pace. Our revised automotive forecasts now include palladium for platinum substitution from 2026f at 125 koz increasing to 240 koz by 2028f (Fig. 7). Importantly, the long lead times to certify autocatalysts on new vehicle platforms ensures that platinum's gains leading up an inflection of substitution are largely embedded for that model's lifecycle (typically seven-years).

We expect palladium for platinum substitution to commence from 2026 based upon the relative supply/demand imbalances. However, perceived risks to Russian palladium supply could support a continued preference for platinum from western automakers.

Figure 7. Platinum for palladium substitution is expected to peak at ~700 koz in 2025 before palladium for platinum substitution starts from 2026



Source: Metals Focus 2022 to 2024f, WPIC Research from 2025f

Fuel Cell Electric Vehicle update

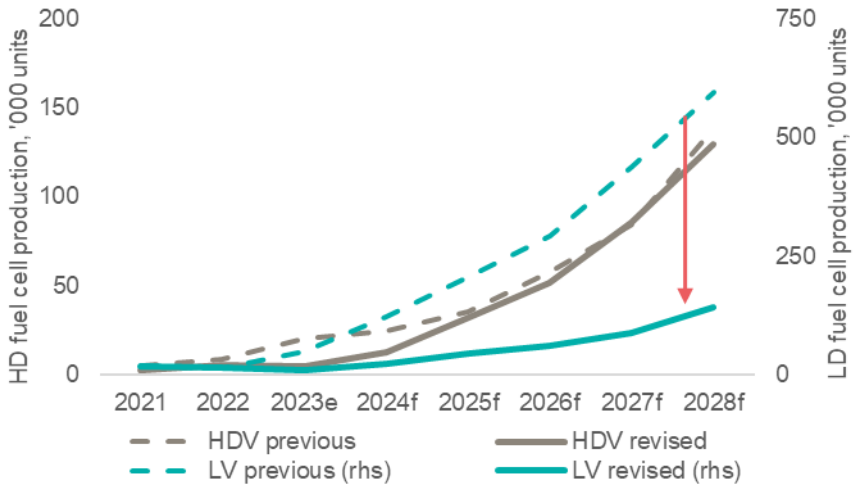
The hydrogen economy has made strides over the past twelve months with some clarity on policy support. Looking at upstream green hydrogen production, the IEA has increased its forecast of planned electrolysis capacity by 74% to around 800 GW by 2035 (versus a year ago). The rising number of hydrogen projects suggests increasing confidence in hydrogen's role in decarbonising our world. WPIC estimates that platinum demand from the fuel cell electric vehicle (FCEV) market was between 15 koz to 20 koz in 2023, accounting for 0.5% of total automotive platinum demand. By 2028f, FCEV platinum demand is forecast to reach ~300 koz, an up to twenty-fold increase in five years (Fig. 9).

Growing FCEV demand partially mitigates declining platinum automotive demand from emissions control systems. However, FCEVs appear less likely to play a meaningful role in decarbonising passenger vehicles because:

- A bottom-up analysis of fuel cell production capacity indicates installed capacity will reach around 79 GW by 2030f. Fuel cells remain better suited to decarbonising heavy-duty transport and logistics compared to battery technology because higher utilisation rates can be achieved. We have kept our long-term HDV forecasts for fuel cells in line with previous estimates, albeit the ramp-up is initially slower. WPIC expects around three-quarters of fuel cell stacks to be used in commercial applications, while the remaining capacity can be used for some niche passenger applications, where fuel cells offer a systems weight advantage. This implicitly caps how many LV's can be produced at around 200,000 units per annum by 2030 which is approximately 75% less than our previous forecasts (Fig. 8).
- Sectors with no decarbonisation technology substitutes (e.g. steel) will have a greater incentive for clean hydrogen utilisation compared to sectors such as light-duty transport where battery electrification is available as an alternative. Accordingly, scarce clean hydrogen supply will likely be prioritised for use in hard-to-abate sectors.
- Battery technology is a substitute for fuel cells in passenger vehicles. BEV market share has quadrupled since 2020 to 12% in 2023 with technology advancements, improved charging availability, government subsidies, and new model rollouts. Despite its imperfections, BEV's first-mover advantage has entrenched it as the incumbent route to decarbonise passenger vehicles.

The hydrogen economy is making strides, but light duty transport using FCEV is likely to be a niche end-use over the forecast period.

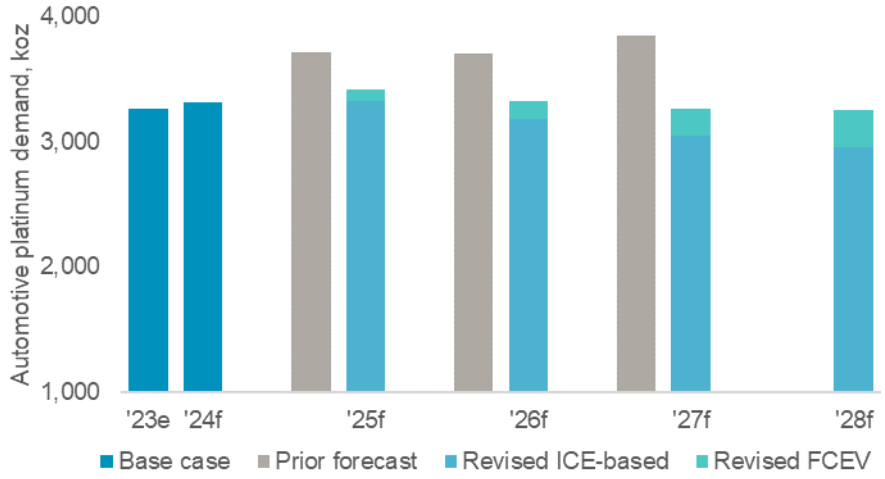
Figure 8. The evolution of market dynamics makes it less likely for light-duty FCEV production to scale over the next five years



Source: IEA, Company data, WPIC Research

Our automotive platinum demand discussion has focussed on the primary drivers impacting downward revisions to our automotive platinum demand forecasts. These were diesel penetration, reverse substitution, and light-duty FCEV adoption rates. However, our outlook further reflects the above-mentioned faster automotive demand recovery, the watering down of Euro 7 emissions legislation and revised BEV penetration forecasts. Individually, these factors were small in terms of their incremental impact to platinum demand (<50 koz per annum) and cumulatively offset of one another.

Figure 9. Rising FCEV platinum demand offsets the gradual decline in ICE-based platinum automotive demand



Source: Metals Focus 2023 to 2024f, WPIC Research from 2025f

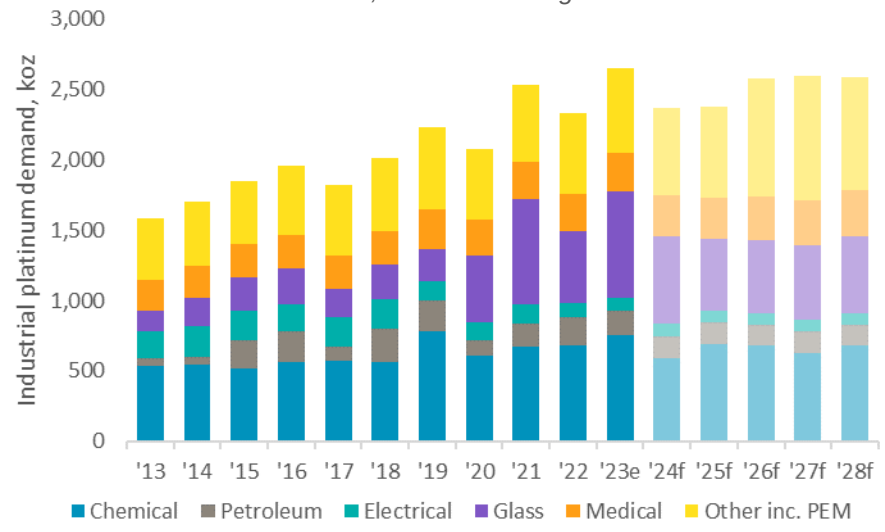
The variables inherent in estimating automotive platinum demand invariably elevates forecast risks. However, it is an exaggeration to infer that automotive platinum demand is set to collapse against the backdrop of increasing BEV penetration. Given its prominence in discussions, we note that our 2030 BEV penetration rate forecasts were lowered from 34% to 32% largely on the back of affordability, lithium availability and deferred ICE bans. Despite significant, yet pragmatic, downgrades to our automotive platinum demand forecasts, we highlight that automotive platinum demand is expected to average 3.3 Moz between 2025 to 2028 which is in-line with 2023 and 2024 demand estimates.

Automotive demand for platinum will be resilient despite increasing BEV market share.

Industrial platinum demand taking a breather but fundamentals still attractive

Our industrial platinum demand forecasts are revised 1% higher on average (~23 koz) between 2025 to 2027. The average hides short-term downgrades to industrial platinum demand that are later offset by medium-term demand upgrades. Industrial platinum reached record demand levels of 2,652 koz in 2023 due to capacity growth in the glass and chemicals markets. Reflecting the current economic overlay, and an approximation of the impact of the timing of capacity additions, industrial demand is forecast to ease in 2024 and 2025.

Figure 10. Industrial platinum demand has delivered robust growth of 5.3% CAGR between 2013 to 2023e, almost double global GDP



Source: SFA (Oxford) 2013 to 2018, Metals Focus 2019 to 2024f, WPIC Research from 2025f

From 2026f, WPIC forecasts a recovery in industrial platinum demand underpinned by a normalised investment environment as interest rates are likely to be lower than current levels. On a more granular level, we highlight the following assumptions within our industrial platinum demand forecasts.

- The “Other” segment is forecast to account for the largest share of industrial platinum demand from 2026f as PEM electrolysis projects begin to commission and scale.
- After benefitting from significant capacity additions in 2023, and platinum for rhodium substitution, platinum glass demand will re-base and trough in 2025f, albeit still at an historically elevated level. Nevertheless, demand should return to growth thereafter, since construction lightweighting remains a key trend for growing fibreglass market share. Notably, wind turbine capacity is expected to increase by a 9.5% CAGR between 2022 and 2030 which will support fibreglass demand.
- Platinum supports process efficiency and reduces energy consumption within chemicals end-markets. However, platinum demand within chemicals markets is forecast to be rangebound within our two- to five-year outlook. We expect the rate of Chinese chemical plant additions to slow given prior additions within their five-year national strategy. Moreover, substitution opportunities could arise from lower palladium prices.
- Petroleum and electrical end markets are forecast to remain in a structural decline of ~3% pa. as fossil fuel refining and mechanical disk drives lose market share respectively.
- Medical demand is forecast to increase 3% CAGR over the next five years due to both an aging population and PGMs being used in more applications. Growth from medical markets is forecast to offset lower demand from both the petroleum and electrical markets.

Industrial platinum demand has increased by >5% CAGR between 2013 to 2023.

Recycling supply headwinds to be more persistent than previously expected

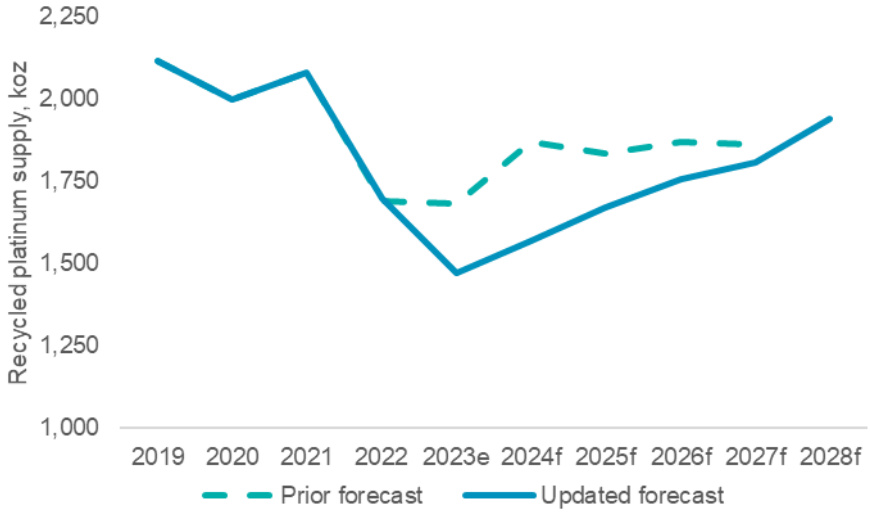
Between 2021 and 2023, recycled platinum supply decreased by 29%. While supply is expected to recover by 7% in 2024f, at 1.6 Moz, this is 17% below the average ten-year supply. Our recent *Platinum Perspectives* highlighted that lifestyle changes, affordability and short-term catalyst hoarding are embedded trends in automotive recycling. In summary, vehicles are being held for longer periods of time since 1) lifestyle changes like work-from-home have caused a ~5% reduction in annual milage and 2) vehicle finance costs have increased by ~22% since 2020 due to higher vehicle prices and interest rates.

Since vehicles are being run for longer before being scrapped, we have increased the time lag between platinum’s use in an autocatalyst and platinum’s recovery through recycling to around 14-years. In addition to rising vehicle ages, reports suggest that where scrapped catalysts are being recovered, recyclers may be hoarding material at current low spot prices (PGM basket -40% YTD) in hopes of higher prices in the future. It is likely that some variables will normalise over our forecast period to 2028 and we accordingly model diminishing downward automotive recycling revisions versus our prior forecasts. Moreover, by 2027f downward revisions to automotive are largely offset by upgraded recycling forecasts for the jewellery and industrial sectors where we expect:

- Jewellery recycling to increase along with modestly recovering platinum jewellery demand, and
- Platinum used in electrical and petroleum applications to increasingly enter the open-loop recycling equation since there is lower capacity for closed loop recycling within these declining markets.

Vehicles are being used for longer periods of time due to lifestyle and affordability considerations.

Figure 11. Recycled platinum supply forecasts were revised lower on automotive usage and affordability factors



Source: Metals Focus 2019 to 2024f, WPIC Research from 2025f

Mining – risks biased to the downside

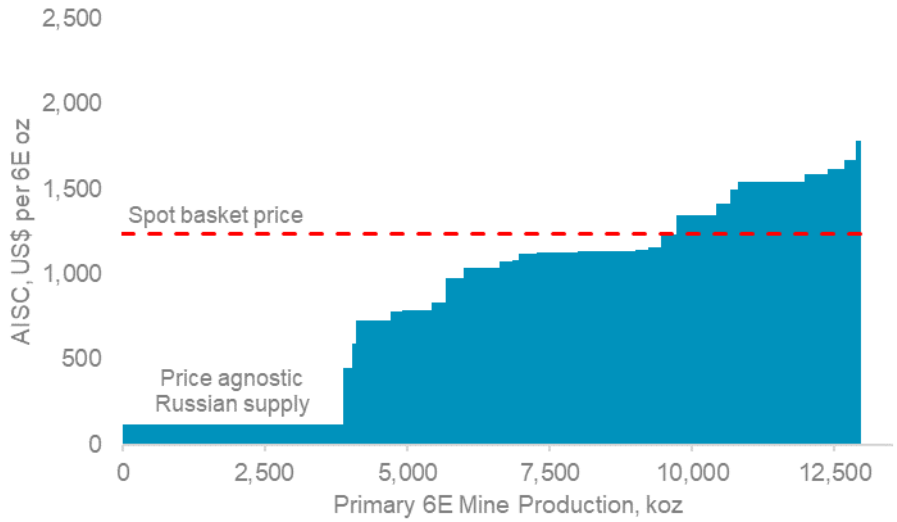
We do not forecast mine supply, but instead use the mid-point of aggregate public guidance ranges issued by the PGM mining companies. Longer term guidance is typically only updated once a year, either with annual results or at an annual investor day. Consequently, guidance can lag shorter-term changes and challenges.

Over the past two-years, mining supply risks have stemmed from challenges such as processing capacity constraints, electricity curtailments, cable theft and other crimes, as well as extreme weather events. These factors were largely operational and led to average mine supply for 2022 and 2023 being 6% below average mine supply since 2015.

Over the course of 2023, operational risks have seemingly diminished. Eskom's load curtailment frequency has decreased through H2'23 and smelters have returned from planned and unplanned maintenance shutdowns. Total mined platinum supply is forecast to increase by 2% in 2024f due to fewer disruptions. However, as operational challenges are alleviating (albeit not completely gone), economic challenges materially rose through 2023. The PGM basket price decreased by around 40% during 2023, primarily due to lower rhodium and palladium prices. These declines have reduced mining profitability and we estimate that around 25% of primary PGM supply is generating negative cash margins at current basket prices and 2022 costs.

Low PGM prices have made several mines uneconomical to operate.

Figure 12. A quarter of mined supply is generating negative margins at spot PGM prices



Source: Company data, Bloomberg, WPIC Research, 2022 cost curve, spot basket price at US$1,250 per oz

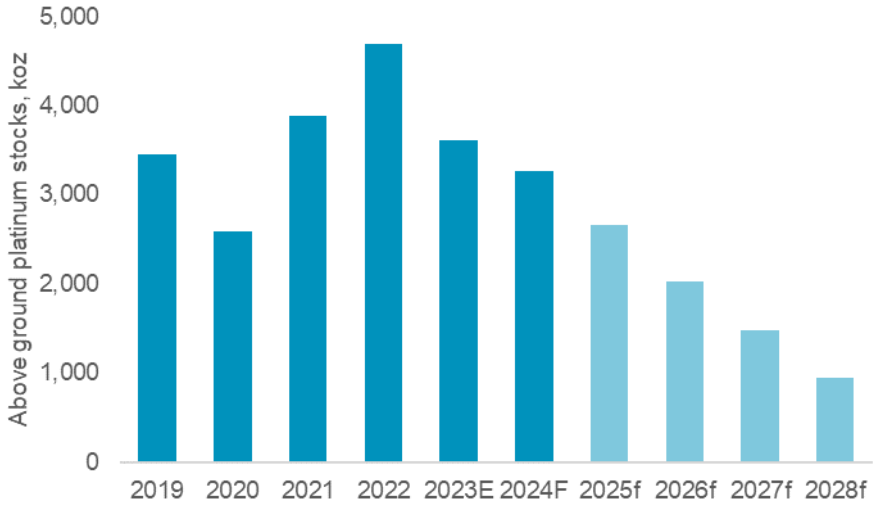
Sibanye-Stillwater, Amplats, Implats, Tharisa, Wesize and Sedibelo have responded to low prices by announcing restructuring initiatives. These include deferring growth projects, headcount reductions and placing some mines into care and maintenance. Confirmed announcements include Amplats growth deferral, Karo greenfield mine deferral and some restructuring and idling from Wesizwe and Sedibelo Platinum respectively. Relative to previous guidance estimates, the mined platinum supply outlook is ~3% lower in 2025f (190 koz) decreasing to ~1% lower by 2027f (76 koz). However, with an estimated 1.3 Moz of loss-making platinum ounces annually, a protracted downturn in PGM basket prices could increasingly pressurise miners to restructure, thereby underpinning risks that mine supply could be downgraded.

Capacity reductions are typically a last resort measure from PGM miners.

Above ground stocks

The significant deficits projected for 2023 and beyond are expected to result in the market drawing heavily from above ground stocks to meet demand requirements. We estimate that above ground stocks will fall to only six weeks of demand by the end of 2028, potentially their lowest level since records begin.

Figure 13. Above ground stocks will decrease on platinum market deficits



Source: Metals Focus 2019-2024f, WPIC research 2025f onwards and above ground stock estimate pre-2012

The question is, are sufficient above ground stocks available at the current platinum price to meet demand requirements, or will the price need to move higher to entice material into the market?

Platinum is forecast to record average supply deficits of 550 koz between 2025 to 2028.

Conclusion - supply/demand balances for 2025-2028

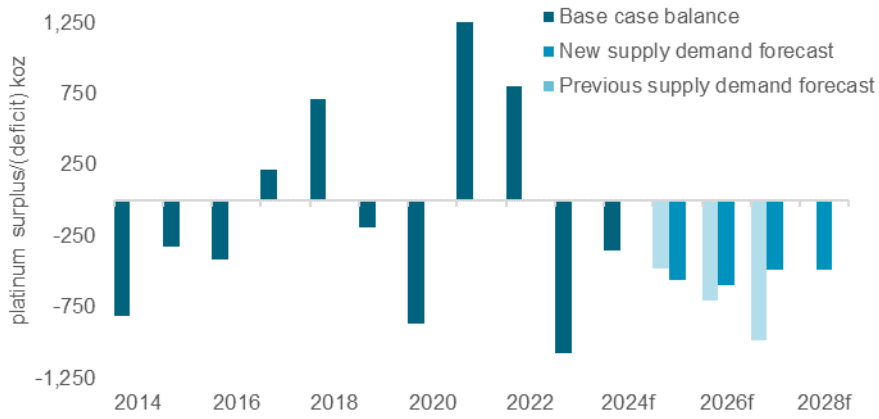
Having updated our supply/demand outlook for 2025 to 2027 and in presenting our first forecast for 2028, we highlight three considerations:

Firstly, platinum markets are expected to record consecutive years of deficits through this period. Given relatively inelastic demand, this will require the market to draw down above ground stocks to fulfil shortfalls. It is not known what platinum price will be necessary to attract the portion of above ground stocks required to meet the supply shortfall, nor what impact having around 80% of above ground stocks located in China (and effectively unavailable), will have on metal flows and price.

Secondly, platinum demand is resilient, with a long tail in automotive ICE demand, continued strength in industrial demand, and robust prospects for incremental growth from the hydrogen economy. Despite applying substantial downgrades to our platinum demand forecasts, the attractiveness of the platinum investment case is highlighted by platinum market deficits still averaging 7% of demand between 2025 to 2028 (~550 koz).

Finally, the precipitous decline of PGM prices during 2023 suggests around 25% of primary PGM supply is generating negative margins at 2022 costs. Should weak prices persist, it risks forcing a supply side response which may deepen already substantial platinum market deficits. This further enhances the platinum investment case, since demand is likely to remain largely inelastic in the short-term, therefore implying higher prices are required to incentivise ongoing platinum supply.

Figure 14. Supply/demand balances at the mid and lower points of aggregate guidance



Source: Metals Focus 2019-2024f, SFA (Oxford) 2014-2018, Published company guidance, WPIC Research 2025f – 2028f

Platinum is forecast to record average supply deficits of 550 koz between 2025 to 2028 with supply risks having the potential to exacerbate the deficits.

WPIC aims to increase investment in platinum

World Platinum Investment Council - WPIC- was established by the leading South African PGM miners in 2014 to increase investment ownership in platinum. This is done through both actionable insights and targeted development. We provide investors with information to support informed decisions e.g. through *Platinum Quarterly, Platinum Perspectives* (monthly) and *Platinum Essentials* (now monthly). We also analyse the platinum investment value chain by investor, product, channel and geography and work with partners to enhance market efficiency and increase the range of cost-effective products available to investors of all types.

WPIC is not regulated to provide investment advice: see *Notice and Disclaimer*.

Appendix I – Risks to forecasts

- Small changes can have significant impacts on supply/demand balances. For example a 5% change in total mine supply moves the supply/demand balance by an average of 293 koz p.a. over the years 2025-2028.
- The most significant risks to our outlook derive from macroeconomic factors which would similarly impact the demand for all commodities. Principally the risks that the combination of slowing economic growth and inflation bring to bear on consumer demand for goods that either contain platinum or for which the manufacturing process uses platinum.
- The evolution of the drivetrain in transport remains uncertain. Accelerating battery vehicle market share gains would negatively impact platinum demand. We think battery vehicle market share gains will decelerate versus the period between 2020 to 2023 given base effects and headwinds such as costs, slow charging infrastructure rollouts and a lack of feature parity (e.g. range).
- The impact of a recessionary environment on industrial and jewellery demand could be more severe than we have allowed for.
- Investment demand is potentially where the greatest risks lie. We are most confident in our projections for bar and coin demand and exchange stocks, but the risk of a continuation of the momentum behind ETF disinvestment is potentially significant. However, a clear shift in supply/demand balances into deficits should act to discourage further “net” selling.

Appendix II – WPIC outlook methodologies

Preamble

The WPIC’s platinum supply and demand model is intended to complement the one year out forecast published in our *Platinum Quarterly*, but to look further into the future to provide the basis for longer-term scenario analysis of particular aspects of supply and demand. The *Platinum Quarterly* report and data are prepared independently for the WPIC by Metals Focus.

The WPIC has not attempted to develop in-country and in-industry relationships to obtain data and the information and sources used to develop the underpinnings of WPIC’s supply/demand model are all in the public domain.

Despite us having granular views of each demand segment, we have chosen, to use a simplified and conservative approach to forecasting. This provides us with our best current base case to allow scenario analysis while we increase modelling detail and publish more granular results in future reports.

Different methodologies in different segments

The WPIC’s platinum supply/demand methodology is built up as follows for the years 2025-2028:

Refined mining supply: Our refined mining supply outlook is strictly based on each company’s public guidance for future production. This applies for WPIC members and non-members alike.

Companies typically only change longer-term guidance once a year, usually with their financial year end, or during annual investors days (often in December). We use the aggregate of the mid-point of public published company guidance for setting our supply outlook, however, the infrequency with which longer-term guidance is updated means that the longer-term outlook may not reflect more recent events. For example, coming into the end of 2023, a number of companies have reacted to falling palladium and rhodium prices by suspending operations and development projects but longer-term guidance may not yet have been updated.

The guidance published by the PGM mining companies is typically provided for the combination of PGMs contained in the ore bodies mined by the respective companies, and expressed on a six-, four-, or two-element basis (6E, 4E or 2E respectively) including either: platinum, palladium, rhodium, ruthenium, iridium and gold; platinum, palladium, rhodium and gold; or platinum and palladium. Where guidance excludes specific reference to platinum, we have calculated refined platinum guidance by using the historical production ratios of these metals as published by the specific company. Where individual PGM mining companies do not provide refined mine supply guidance or where such guidance does not cover the period to 2026, we forecast that platinum mining supply remains at the level of the final year for which guidance, or production, is available. We have remained impartial to: the extent of mineral reserves and resources, the ability to extend mine lives, any potential smelter, precious or base metal refinery capacity constraints, the technical hurdles or timelines to complete capital projects, and the impact a change in PGM prices might have on mined supply.

Recycling supply: Automotive recycling can be determined by purchasing consecutive annual global vehicle registration data and determining detailed regional scrappage rates to apply to average vehicle platinum loadings, when manufactured, per region. We have not chosen to fund this high-cost exercise and have used a simplified approach using the published average vehicle life across all regions and determining the portion of annual platinum demand in the year of manufacture that reflects as recycled supply at the end of that average life. We use the average of this ratio over the past 20 years to calculate our forecast. Jewellery and industrial recycling rates are projections based upon historical ten-year trends.

Automotive demand: Automotive demand projections are a function of the WPIC's drivetrain outlook in combination with estimated autocatalyst platinum loadings and engine sizes for different vehicle categories in different geographies. Automotive production and the drivetrain estimates are based upon historical production numbers and trends as well as announced future regulations and WPIC's view of the pace of electrification and the phasing out of internal combustion engines. Future platinum loadings in autocatalysts are based upon historical loadings that are available in the public domain or can be calculated from published data, adjusted for WPIC's estimates of the impact of regulatory changes in different geographies, such as tightening emissions standards, as well as the rate of substitution of platinum for palladium in gasoline engines. FCEV demand for platinum has been added to the automotive demand outlook as a separate demand component.

Jewellery demand: The outlook for jewellery is predicated on recent historical trends by geography, projected into the future, with some allowance for a slowing of the trend away from platinum jewellery in China, and a return to modest growth in India.

Industrial demand: Industrial demand projections are based upon historical trends within each sub-category. This results in relatively steady trend projections, whereas in practice industrial demand is more volatile, depending upon the timing of capacity additions. Nonetheless, while industrial demand can be volatile, the multi-year trends have been very consistent and do provide a good guide to the future, added to which the annual volatility seen within each industrial sub-category tends to even each other out when totalled up. Platinum industrial demand is the demand segment most closely correlated to global economic growth over the long term. Despite the compound annual growth of platinum industrial demand over the past 30 years significantly exceeding global growth, our forecast, based on more recent historical trends, is closer to forecast global growth. Projected stationary fuel cell and electrolyser demand have been included in the other industrial category.

Investment demand: While we have granular insight into investment demand due to the views of our many product partners around the world and our regular interaction with investors, we have chosen to use a ten-year historic average of investment demand as the basis for our forecasts. This is to reduce the dramatic positive impact of extremely strong global ETF demand in 2019 and 2020 and similarly strong bar and coin demand in 2020 and 2021. Furthermore, we have not included the likely impact on investment demand of any material changes in price. For example, if the market is seen with successive, and increasing deficits as we are projecting, then it is likely that investors might expect the platinum price to move higher to reflect the shortage of metal available to the market and consequently increase their exposure by purchasing platinum metal or ETFs. This would in turn accentuate future deficits. We do not attempt to capture this iterative process and rather choose to maintain future investment demand at a level based on a ten-year historic average. We have assumed a net change in stocks held by exchanges of zero each year over the forecast period as those flows are typically short-term in nature to address atypical developments in the physical market and furthermore, primarily reflect the movement of metal between visible and non-visible inventories.

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