PLATINUM ESSENTIALS

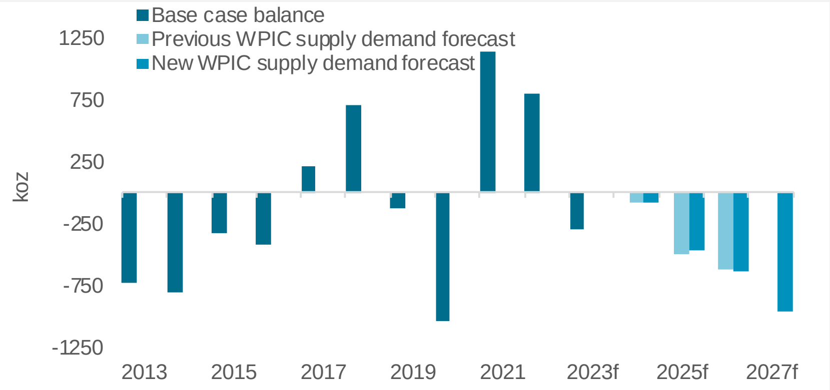
Updating WPIC's two- to five-year supply/demand outlook: Sustained platinum deficits

Having recently published the latest Platinum Quarterly, which presented an outlook for 2023, this report contains updated estimates for platinum supply/demand balances in the years 2024-2026 as well as initial estimates for 2027. On a like-for-like basis, total demand is slightly down on previous estimates, but significant cuts to mine supply guidance result in much deeper deficits. However, with published mine supply guidance now updated, we have based our supply forecasts on the mid-point of guidance ranges (previously the low-point). This has resulted in supply demand balances that are broadly unchanged from previously. 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.

All estimates in this report are based upon publicly available information and WPIC in-house analysis*. Our demand forecasts include a slight worsening of the economic outlook since September as well as a modest downgrade to automotive production estimates, predominantly in Europe. The impact is that total demand has been trimmed. The supply outlook has seen more significant reductions, albeit the net impact on market balances is broadly neutral. Our previous supply estimates aggregated the bottom end of guidance ranges as production challenges, which had emerged in 2022, had not yet been reflected in longer term guidance, which is typically only updated once a year. Now that the majority of mining companies have updated longer-term guidance, we have moved to using the mid-point of these ranges. Significant downgrades have resulted in the mid-point of guidance being reduced to below the previous bottom end of aggregate guidance in South Africa, but the impact is positive for Russia, although estimates there are still based upon the pre-sanctions outlook.

The net impact is for the supply/demand balances to be broadly unchanged from our previous outlook with a deficit of 81 koz in 2024 deepening considerably in 2025 and continuing to grow towards almost a million ounces by 2027. As before, we continue to emphasise that these figures do not capture excess imports into China. As we have recently highlighted, China has absorbed much of the world's above ground platinum stocks, leaving limited inventories to meet any shortfalls in the rest of the world, ex-China.

Figure 1. WPIC projects platinum deficits from 2023 deepening to 2026



Source: SFA (Oxford) from 2013 to 2018, Metals Focus from 2019 to 2022, Company guidance, WPIC Research from 2023

Edward Sterck
Director of Research
+44 203 696 8786
esterck@platinuminvestment.com

Brendan Clifford
Head of Institutional Distribution
+44 203 696 8778
bclifford@platinuminvestment.com

World Platinum Investment Council
www.platinuminvestment.com
Foxglove House, 166 Piccadilly
London W1J 9EF

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**WPIC in-house supply research is based solely on 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‡			
	2020	2021	2022f	2023f	2024f	2025f	2026f	2027f
PLATINUM SUPPLY								
Refined mine production					Production at mid-point of aggregate guidance ranges			
- South Africa	3,298	4,678	4,012	4,047	4,709	4,594	4,580	4,513
- Zimbabwe	448	485	478	502	494	592	592	592
- North America	337	273	269	319	311	319	334	334
- Russia	704	652	678	654	698	698	698	698
- Other	202	208	205	205	192	192	194	194
- Producer inventory movement	-84	-93	-5	0	0	0	0	0
Total mining supply	**4,906**	**6,204**	**5,637**	**5,726**	**6,404**	**6,395**	**6,398**	**6,331**
Total recycling	**1,930**	**1,937**	**1,669**	**1,740**	**1,857**	**1,821**	**1,856**	**1,850**
Total supply	**6,835**	**8,141**	**7,306**	**7,466**	**8,261**	**8,216**	**8,254**	**8,181**
PLATINUM DEMAND								
Automotive	**2,402**	**2,635**	**2,964**	**3,288**	**3,688**	**3,800**	**4,028**	**4,180**
Jewellery	**1,830**	**1,953**	**1,953**	**1,954**	**1,812**	**1,842**	**1,860**	**1,878**
Industrial	**2,098**	**2,450**	**2,110**	**2,316**	**2,283**	**2,491**	**2,453**	**2,530**
Total investment	**1,544**	**-45**	**-525**	**212**	**560**	**560**	**560**	**560**
- Bar and coin	578	332	340	507	310	310	310	310
- ETF	507	-238	-550	-275	250	250	250	250
- Stocks held by exchanges	458	-139	-315	-20	0	0	0	0
Total demand	**7,874**	**6,993**	**6,502**	**7,770**	**8,342**	**8,693**	**8,900**	**9,147**
Supply/demand balance	**-1,039**	**1,147**	**804**	**-303**	**-81**	**-478**	**-646**	**-966**

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

‡WPIC estimates and analysis are based upon publicly available information

Source: Metals Focus from 2019 to 2023f, Company guidance, WPIC Research from 2024f

Introduction

The WPIC's 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. For the avoidance of doubt, all estimates for 2024 to 2027 included in this report are WPIC forecasts, with the exception of mine supply which is based upon public 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 customers, that provides an outlook for all PGMs.

WPIC's base case published supply/demand projections for 2024 to 2027 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 edition published in September 2022. Since then, we have seen a small further deterioration of the macroeconomic overlay for the world as a whole, however, some regions do look more vulnerable than others. Europe, for example is at risk from high energy prices slowing industrial production, whereas China is finally relaxing COVID restrictions, which brings the potential for accelerated economic growth as the country unlocks, but also risks to the health system and employee attendance levels. We have accommodated the additional economic and European headwinds in our new year two-to-five outlook but have not tried to estimate the impact of China exiting zero-COVID at this time.

Our key projections for the period 2024-2027 are as follows:

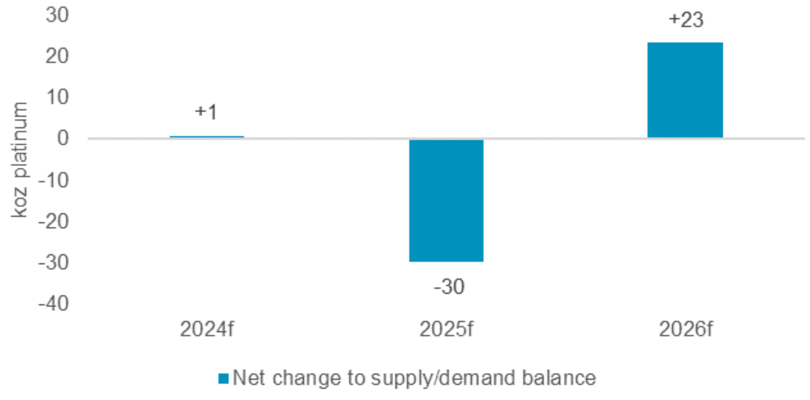
- **Total mining supply** is broadly unchanged, with reduced guidance from South Africa being offset by a move to using the aggregated mid-point of the published guidance ranges versus the bottom end of the range previously.
- **Recycling supply** is reduced by an average of 0.5% (29 koz) on the ongoing reduction in vehicle scrappage reducing the supply of scrap autocatalysts.
- **Automotive demand** for platinum is down by an average of 2.2% or (85 koz), in 2024 and 2025, predominantly on production challenges expected in Europe, in combination with some adjustments to the drivetrain mix.
- **Jewellery demand** is down by an average of 0.5% (10 koz) on a slightly worse economic outlook.
- **Industrial demand** for platinum is up by 0.9% (22 koz) on a slight increase to capacity addition expectations.

Mine supply expectations are broadly unchanged, but this reflects a change to using the middle of the guidance ranges after updates to guidance that include ongoing production challenges.

Total demand has reduced by an average of 0.4%.

- **Investment demand** for platinum is unchanged since our previous outlook.

Figure 3. Near-term reductions in platinum supply forecasts more than offset the weaker demand outlooks in 2025 but the deficit is slightly reduced in 2026



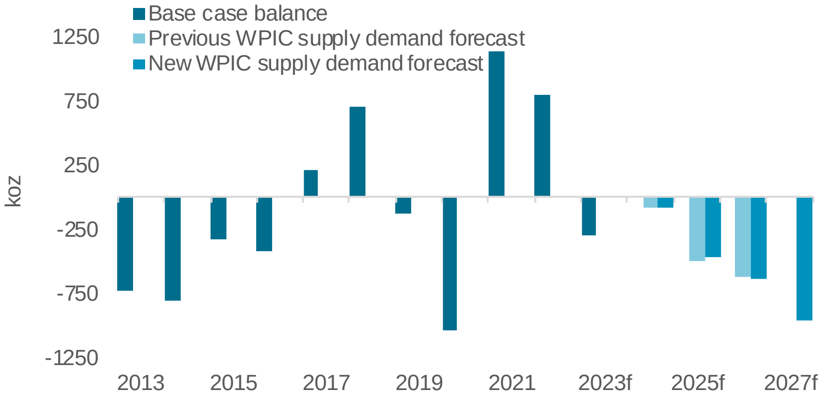
Source: WPIC Research

Conclusion – Year-on-year deficits

As shown below, in the greater scheme of the scale of the deficits, the net impact of the changes to our forecasts are minimal for 2024-2026, whilst the initial estimates for 2027 are for a deficit approaching 1 Moz. The key conclusion from this update is that the confidence in consistent and deepening deficits is increased.

One slight anomaly is the relatively small deficit in 2024 coming after a deficit of more than 300 koz in 2023 and ahead of a deficit of almost 500 koz in 2025. This reflects a combination of lower industrial demand on fewer capacity additions, but also a fairly significant year-on-year (‘24 vs. ’23) increase in primary mine supply as indicated by aggregate company guidance. Note that medium to longer term company guidance may not incorporate power availability problems continuing in South Africa, or the impact of sanctions on mining equipment and spares availability in Russia.

Figure 4. Platinum is expected to be in modest deficits in 2023 and 2024, moving to deepening deficits from 2025 and beyond



Source: SFA (Oxford) from 2013 to 2018, Metals Focus from 2019 to 2022, Company guidance, WPIC Research from 2023

Platinum outlook relatively recession proof, at least in the near-term

With geopolitical tensions and macroeconomic uncertainties continuing, the global economic outlook has continued to worsen, leading to a further erosion of consumer purchasing power. Current projections are for 2023 to be the year that is most significantly impacted, with the outlook improving in 2024, although still remaining weak.

The platinum outlook for 2023 as published in the last *Platinum Quarterly* incorporates recessionary risks, whilst the demand outlook for 2024 and beyond presented in this report, include the economic overlay in the table below. Note that we have used consensus GDP less consensus CPI estimates as an approximation of the change in consumer purchasing power.

Significant macro uncertainties abound.

Figure 5. Estimated changes to real consumer purchasing power versus the end of 2021

	2023	2024
North America	-3.9%	-1.2%
Western Europe	-5.7%	-0.9%
Japan	-0.3%	0.1%
China	2.6%	2.8%
Rest of the World	-3.0%	-0.5%

Source: Bloomberg, WPIC Research

Whilst the economic outlook appears somewhat shaky, the platinum market is, perhaps, surprisingly well insulated from the challenges ahead, at least in the near term.

We see the greatest risks to regional demand being in Europe.

Starting with automotive demand, while an erosion of spending power will impact the ability for some consumers to purchase new vehicles, we estimate that recessionary levels of consumer demand remain above the production levels that the automakers are expecting to be able to deliver. Added to which, and more difficult to quantify, after two years of significant automotive production shortfalls there remains an element of pent-up demand for replacement vehicles, partially offset by the lower mileages driven during COVID allowing for some vehicles to be run for longer. If there is a risk to automotive demand for platinum it is more on the ability of the automakers to hit production targets, specifically in Europe where high energy prices are driving a rebalancing of manufacturing between different production facilities.

Platinum ETF disinvestment is expected to slow then reverse. We think exchange stocks will have been drawn to minimum sustainable levels by year-end, eliminating this source of supply.

Industrial demand is also relatively well protected from recessionary headwinds. Industrial demand for platinum is influenced more by multi-year capacity addition decisions rather than short-term demand fluctuations. With capacity additions for 2023 mostly committed to financially and in terms of construction progress, downside risks are biased to 2024 should capacity additions be deferred on the grounds of uncertain economics and end product demand.

Recessionary factors have been applied to reforecast specific demand estimates.

Jewellery demand is the area with the most significant downside risks in the near-term. Although the economic outlook is factored into forecasts, a worsening of consumer purchasing power beyond current forecasts would almost certainly flow through to reduced jewellery purchasing. At the same time, the bridal market, approximately one third of jewellery markets, is typically relatively recession resistant.

Investment demand is another area of uncertainty. Whilst bar and coin tend to be resilient, or even grows, during recessionary periods, the outlook for ETF investments and exchange stocks are harder to call. As we highlighted in a recent report, there have been economic rationales behind ETF disinvestment and exchange stock outflows. ETF disinvestment has most likely been a function of asset class agnostic investors rotating into the futures or forward markets, which have been in backwardation. Exchange stock outflows have been the result of high lease rates encouraging holders to move stocks off-exchange to lease out. With lease rates normalising and backwardation easing, we expect both exchange stock outflows and ETF disinvestment to slow and then cease. Exchange stocks, in particular, are back to minimal sustainable levels.

Investment demand has been strongly influenced by market factors.

ETF disinvestment does not necessarily mean investors are pivoting away from platinum, but may be investing more efficiently.

Mining – Isn't always straightforward

One significant risk to the outlook is on the supply side, particularly with regard to mining. Inflationary and recessionary risks are likely to impede go-ahead decisions for large capital projects; for platinum, these are mostly replacement. For new projects rising interest rates also compress expected returns unless there is a corresponding increase in commodity prices, which have not yet manifested.

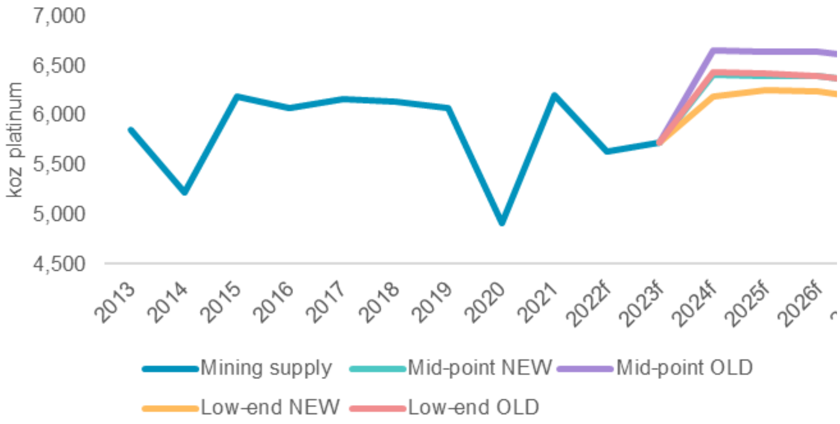
More specific to platinum, there are some significant headwinds that have impeded supply plans for 2022. ESKOM, the South African state energy supplier has been struggling with a number of well publicised problems that have resulted in rolling load shedding (blackouts) around the country, with a particular impact on the optimal running of smelters. In total producer guidance for platinum production in 2022 has been downgraded by more than 500 koz since the beginning of the year. Production from Russia has, on the other hand, been pretty consistent, but Nornickel has warned that sanctions are impacting its ability to procure mining equipment and spares, and that may be a problem in terms of sustaining production in the medium to longer term. Although these challenges became more stark during 2022, neither Nornickel or the South African producers had reduced medium to longer term guidance, purely because longer term updates are usually only provided on an annual basis.

ESKOM and sanctions against Russia present significant and ongoing risks to PGM supply.

Risks to Russian production as well as self-sanctioning could accelerate platinum for palladium substitution in catalytic converters.

The South Africans have for the most part now updated guidance, with reductions across the board, but Nornickel has pulled estimates. We deliberately do not take a view on production levels, and so stick to guidance. However, if guidance is stale relative to current events we will move to the upper or lower end of guidance ranges as appropriate, and collectively across all producers. As it was previously clear that longer-term guidance was out of date with current events, we elected to use the bottom end of guidance ranges. Now that guidance has been updated, even if it may seem a little optimistic, we have moved to using the middle of the guidance ranges. Nornickel has pulled medium- and longer-term guidance, but for consistency across all companies we are still using the last published outlook. Moving to the mid-point of guidance results in a cut to the outlook from South Africa, partially offset by an increase in expectations for production from Russia. The mid-point of aggregate guidance is now aligned with the lower end of the guidance ranges we used previously.

Figure 6. Mine supply guidance ranges have been trimmed to the point that the mid-point of current guidance is in line with the mid-point of the previous low-end of aggregate guidance.

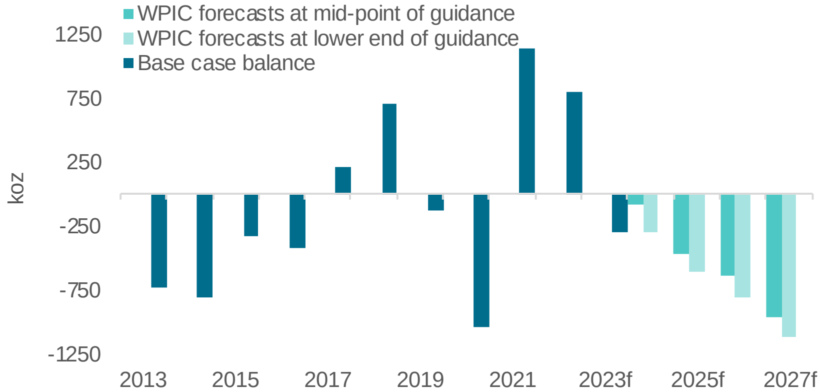


Source: Metals Focus 2019-2023f, SFA (Oxford) 2013-2018, Company guidance, WPIC Research

The mid-point of mining production guidance has now been reduced in aggregate to be aligned with the previous bottom end of guidance ranges.

As the production outlook is broadly unchanged versus our last 2-5 year supply/demand outlook, after accounting for the change to methodology, the supply/demand balances are more or less unchanged. However, if we were to continue to use the lower end of guidance ranges, as previously, the projected deficits would be much more meaningful. In 2024, the deficit would be 300 koz versus 81 koz in our base case analysis, and the 2027 deficit would be significantly more than 1 Moz.

Figure 7. Supply/demand balances at the mid and lower points of aggregate guidance.



Source: Metals Focus 2019-2023f, SFA (Oxford) 2013-2018, Company guidance, WPIC Research

Using the bottom-end of guidance ranges would result in significantly deeper deficits.

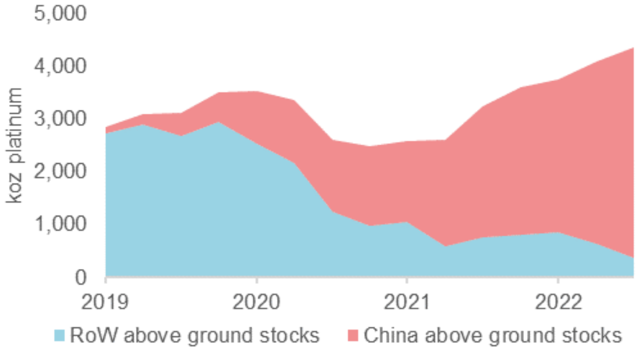
Whilst we are sticking to guidance and a rigorous methodology, we can comment that it is not clear if medium to longer term guidance fully captures the challenges facing ESKOM and/or the risk to production from Russia as sanctions tighten (and Nornickel potentially loses personnel to the draft). Therefore, there are certainly risks to the downside in terms of production.

On the influence of above ground stocks

We have previously commented on the concentration of above ground stocks in China, where they are geographically captive and unavailable to fill deficits in the rest of the world. It is difficult to accurately estimate the levels of above ground stocks within a margin of error of +/- one million ounces. Even so, they are now thought to be extremely low ex-China, and the stocks in China are expected to be released to the domestic market only after a significant increase in the platinum price.

Above ground stocks are concentrated in China, creating inventory management risks in the rest of the world.

Figure 8. The majority of above ground stocks have migrated to China since 2019, leaving limited inventories in the rest of the world to offset any platinum market deficits.



Source: Bloomberg, WPIC Research

So, what is the longer-term prognosis for platinum? Ultimately, commodity markets self-solve. If there is a surplus, then prices fall until supply is curtailed. If there is a deficit then prices rise until there is demand destruction or substitution occur. As the orebodies are polymetallic, these standard models are not as clear cut for PGMs as they might be for other commodities, but the broad principles still apply. If these deficits manifest as projected, we would expect the price differential between platinum and palladium to close and substitution of platinum for palladium to slow or potentially reverse over time to be the trend in catalytic converters. This would liberate platinum for use in the hydrogen industry.

Commodity markets self-solve for surpluses or deficits; for platinum this may mean slowing platinum substitution to alleviate shortages, but only if the price is right.

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 the information to support informed decisions e.g. the *Platinum Quarterly* and monthly *Platinum Perspectives* and *Platinum Essentials*. 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.

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 224 koz p.a. over the years 2024-2026.
- 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.
- We think automotive production levels remains constrained below the level of consumer recessionary demand, but a worsening of the outlook could prove our estimates to be optimistic. Potentially balancing this risk, we have taken a conservative view on the levels of platinum for palladium substitution in gasoline vehicles.
- 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 (which are expected to end 2022 as long run minimum levels), 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 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, for this inaugural report, 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 2024-2027:

Refined mining supply: The WPIC was established by several PGM mining companies, and consequently we do not attempt to forecast future mined supply of platinum. To be able to present a supply/demand forecast to assist investors in making more informed investment decisions 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.

The production outlook for 2022 was characterised by continual downgrades to the annual production guidance as producers were caught off-guard by production challenges over and above the levels anticipated when setting guidance at the beginning of the year. Specific to South Africa, these were accentuated by power shortages related to ESKOM's well publicised difficulties, whereas in Russia, Nornickel cautioned that sanctions were restricting its access to mining equipment spares and reagents. Companies typically only change longer-term guidance once a year, usually around year end, so although a number of guidance adjustments were made for 2022 the longer-term guidance ranges were not revised until annual investor updates (mainly in the first two weeks of December), which resulted in us using the bottom end of guidance ranges for the first two two-five-year outlooks. Now that most longer-term guidance ranges have been updated, we have moved to using the mid-point of all production guidance ranges, which feed into our overall supply/demand forecasts.

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 attempted 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, in practice 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. Consequently, we include bar and coin investment demand of 310 koz p.a., and ETF demand of 250 koz p.a. 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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