

PLATINUM ESSENTIALS

Jan'25, Five-year supply/demand outlook; platinum deficits persist, palladium's are deeper and last longer

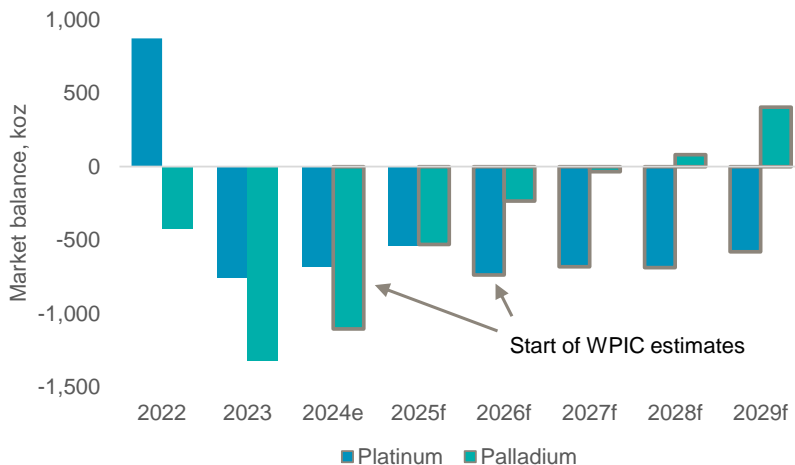
With our *Platinum Quarterly* ([link](#)) now running through 2025, this *Platinum Essentials* contains revised estimates for platinum supply/demand balances in the years 2026 to 2028 and our first estimate for 2029. Platinum market deficits established during 2023 and 2024 are set to persist throughout the forecast period through 2029f. WPIC expects platinum market deficits to average 672 koz pa from 2026 to 2029, or approximately 8% of demand. We have also updated our palladium forecasts to 2029f, where we expect deficits to 2027f (previously 2025f) before market surpluses emerge from 2028f.

Since our previous two- to five-year outlooks, many of the themes previously highlighted are persisting. In the automotive sector, slowing demand growth in light vehicle electrification is entrenched. Accordingly, we expect a long tail in automotive platinum group metals (PGM) demand, with modest erosion of -1.4% CAGR for platinum and -1.0% CAGR for palladium through 2029f. Our updated automotive outlook includes a deferred fuel cell electric vehicle ramp up. Elsewhere platinum demand is forecast to record 1% growth p.a. in both jewellery and industrial applications to 2029f, while palladium's price pull-back should incentive greater use in jewellery and industrial applications over the next five years. Investment demand forecasts utilise 10-year historic averages, which suggests growth of ~150 koz off 2024 levels for platinum.

Assuming PGM prices remain at or above current levels, we expect miners to spend 2025 consolidating on restructuring initiatives implemented during 2024. The aggregated mid-point of company guidance indicates supply erosion of -0.9% and -1.3% CAGR from 2024e to 2029f for platinum and palladium respectively. We believe forecast risks are higher for recycled PGM supply, particularly automotive supply. Although improving scrap availability should support future volume growth, low prices and overcapacity are weighing on profitability and disincentivising supply.

Consolidating the revised forecasts, we have reduced our platinum market deficits by an average of 25 koz (versus previous publications). Large mine restructuring announcements in the US and Southern Africa occurred after our prior palladium market forecasts; thus larger average revisions of -217 koz for supply and +156 koz for demand were made (versus previous publications).

Figure 1. PGM market balances 2022 to 2029f



Source: Metals Focus 2022 to 2023 (palladium) and 2022 to 2025f (platinum), Company guidance, WPIC Research

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WPIC's updated two- to five-year supply demand outlook for platinum incorporates only modest changes, with deficits expected to perpetuate for the foreseeable future.

The changes to the palladium outlook are more marked, with deeper-for-longer deficits, and the tipping point into oversupply pushed out from 2026 to 2028.

The forecasts in this report were generated before President Trump's inauguration and numerous policy announcements. Whilst these are on balance slightly negative for near-term PGM demand, we do not expect them to be of sufficient magnitude to materially change the platinum and palladium deficits laid out herein.

**WPIC in-house supply data 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. PGM supply and demand summary tables

	PUBLISHED PLATINUM				WPIC PLATINUM ESTIMATES			
	2022	2023	2024f	2025f	2026f	2027f	2028f	2029f
PLATINUM SUPPLY								
Refined mine production								
- South Africa	3,915	3,957	4,000	3,929	3,984	3,887	3,821	3,786
- Zimbabwe	480	507	504	522	552	562	546	557
- North America	263	275	252	232	228	219	210	210
- Russia	663	674	678	676	669	669	669	669
- Other	200	190	191	191	199	199	199	199
- Producer inventory movement	43	11	57	0	0	0	0	0
Total mining supply	5,563	5,615	5,683	5,550	5,633	5,536	5,446	5,421
Recycling								
- Autocatalyst	1,322	1,143	1,176	1,346	1,362	1,395	1,508	1,586
- Jewellery	372	331	335	347	319	323	327	329
- Industrial	69	71	76	81	97	106	115	122
Total recycling	1,762	1,544	1,587	1,774	1,778	1,823	1,950	2,037
Total supply	7,326	7,159	7,269	7,324	7,410	7,359	7,395	7,458
PLATINUM DEMAND								
Automotive	2,751	3,223	3,173	3,245	3,172	3,073	2,992	2,964
Jewellery	1,880	1,849	1,951	1,983	1,973	1,992	2,012	2,032
Industrial	2,336	2,449	2,434	2,216	2,465	2,436	2,541	2,503
Total investment	-516	397	393	420	539	539	539	539
- Bar and coin	259	322	171	151	303	303	303	303
- China bars ≥500g	90	134	157	170	170	170	170	170
- ETF	-558	-74	150	50	66	66	66	66
- Stocks held by exchanges	-307	14	-85	50	0	0	0	0
Total demand	6,451	7,918	7,951	7,863	8,149	8,040	8,084	8,039
Platinum supply/demand balance	874	-759	-682	-539	-739	-682	-688	-581
PALLADIUM SUPPLY								
Refined mine production								
- South Africa	2,238	2,337	2,266	2,314	2,296	2,251	2,222	2,213
- Zimbabwe	404	410	431	453	463	473	461	474
- North America	822	844	833	673	668	560	451	451
- Russia	2,790	2,692	2,762	2,730	2,730	2,730	2,730	2,730
- Other	234	228	234	234	234	234	234	234
- Producer inventory movement	0	0	0	0	0	0	0	0
Total mining supply	6,487	6,511	6,525	6,404	6,391	6,248	6,098	6,102
Recycling								
- Autocatalyst	2,377	2,144	2,193	2,568	2,842	3,111	3,312	3,560
- Jewellery	112	93	96	88	85	81	77	73
- Industrial	403	397	386	377	367	359	350	341
Total recycling	2,892	2,635	2,674	3,033	3,295	3,551	3,739	3,975
Total supply	9,379	9,146	9,199	9,437	9,685	9,798	9,837	10,077
PALLADIUM DEMAND								
Automotive	8,139	8,692	8,357	8,279	8,226	8,131	8,054	7,961
Jewellery	228	234	237	240	243	246	249	252
Industrial	1,504	1,454	1,423	1,429	1,430	1,436	1,433	1,439
Total investment	-70	87	287	20	20	20	20	20
Total demand	9,801	10,468	10,304	9,968	9,919	9,833	9,756	9,671
Palladium supply/demand balance	-422	-1,322	-1,105	-531	-234	-35	81	406

Source: Metals Focus 2022 to 2023 (palladium) and 2022 to 2025f (platinum), Company guidance, WPIC Research

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Introduction

The WPIC’s medium-term 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. Similarly, our palladium forecasts complement our platinum forecasts.

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 2025). For the avoidance of doubt,

- All estimates for platinum from 2026f to 2029f included in this report are WPIC forecasts, with the exception of mine supply which is based solely upon publicly published company guidance.
- Palladium estimates from 2024e to 2029f in this report are WPIC forecasts, again with the exception of public company guidance for mine supply.

Specifically, WPIC has made no use of any forward-looking 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 research is predominantly desk based and not focussed on developing in-country and in-industry relationships to obtain fresh/incremental data. 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.

WPIC’s base case published supply/demand projections for 2026f to 2029f provide the ability to run scenario analysis on different parts of the supply/demand landscape for platinum and palladium.

Key projections

Our revised outlook is compared to the supply/demand *Platinum Essentials* published in September 2024 for platinum ([link](#)) and May 2024 for palladium ([link](#)). Since our last updates, the macroeconomic landscape has been dominated by the re-election of Donald Trump in the US, his subsequent inauguration and the issuance of numerous executive orders that are intended to enact his policies. If fully implemented, his policies are likely to be net negative for near-term PGM demand and prices, but we have not accounted for them in this report due to the ongoing uncertainties.

Trump's trade policies are protectionist and revolve around the threats of [tariffs on imports](#). Tariffs are inflationary, however, their negative impact may be short-term upon implementation, as once the initial costs are in the "base", medium-term inflation should normalise. Accordingly, if inflationary pressures are limited to a 12-to-24-month period, the impact on automotive and jewellery PGM demand could be relatively limited in nature. Industrial PGM demand would only be impacted if inflation remains elevated and begins weighing on economic growth over a sustained period. Some reports are suggesting tariffs may get incrementally introduced and increased over time to reduce the impact of once-off price shocks. Under this scenario, inflation would likely peak lower but linger longer.

Trump is also attempting to ease emission legislation and water down the Inflation Reduction Act (IRA). We expect these actions to be net positive for PGM's due to increased ICE and petroleum demand on an easing of emissions legislation, which will outweigh the negative impact for platinum demand from slower hydrogen adoption in the. On average, each 1% loss or gain in US BEV light vehicle market share translates to ~25 koz of 2E PGM demand.

While a lot of the focus is on the impact of Trump's policies, for context it is worth defining the importance of the US to platinum and palladium demand. We estimate the US accounts for around 15% of global platinum demand and around 20% of palladium. On a broader basis, however, another potential impact of Trump's policies is to support a [stronger dollar](#), which would likely equate to weaker PGM prices in US dollar terms.

Generally, the themes of automotive PGM demand having a long tail and hydrogen having a slower ramp-up are not localised to the US, but rather more global. We discuss updates to automotive PGM demand from page 6, and hydrogen from page 10. On the supply side, with miners consolidating their 2024 restructuring efforts in 2025, we focus our discussion on updates to recycling supply from page 12 where we expect greater risks to our forecasts.

For platinum, we have made the following key revisions to our projections (i.e. revisions to 2026f-2028f and inclusion of 2029f), with market deficits reducing by a modest average of only 25 koz:

1. **Total supply** has been maintained stable, reflecting a 0.3% average reduction in mine supply offset by a 1.6% average increase to recycling.
2. **Total demand** is unchanged on average. Within total demand, automotive demand has been reduced by 1% on average (-32 koz) due revised fuel cell electric vehicle forecasts and 3% lower investment demand on average. These are offset by higher industrial demand.

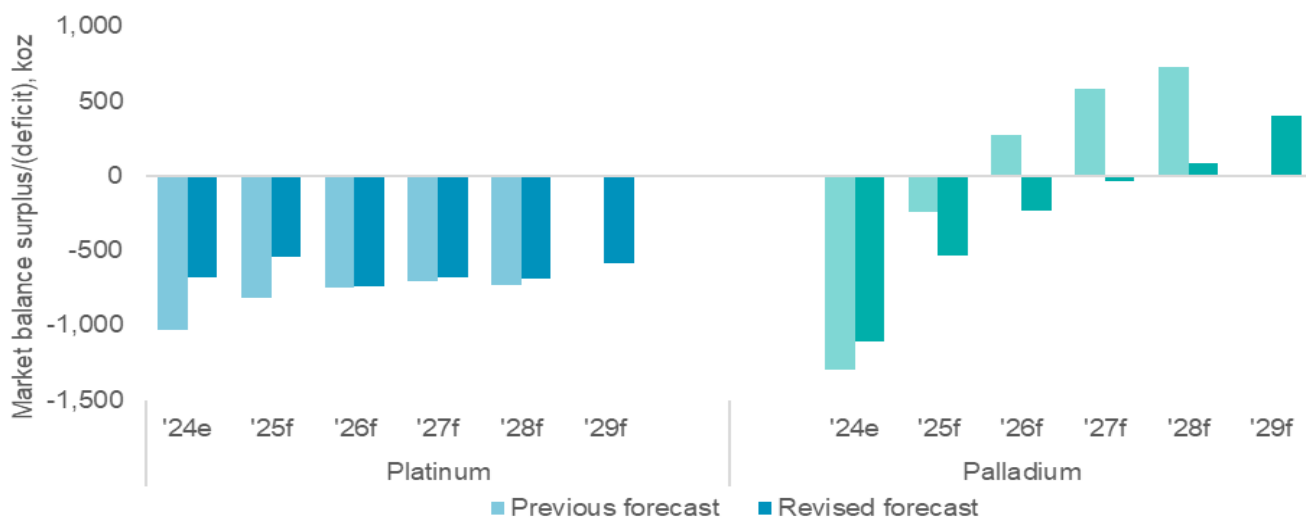
The forecasts in this report were generated before President Trump's inauguration and numerous policy announcements. Whilst these are on balance slightly negative for near-term PGM demand, we do not expect them to be of sufficient magnitude to materially change the platinum and palladium deficits laid out herein.

For palladium, we have made the following key revisions to our projections (i.e. revisions to 2024e-2028f and inclusion of 2029f):

- Total supply** has been decreased by an average of -2.2% due to mine restructuring in North America and South Africa, which has decreased our forecasts by an average of -2.4%. Recycling has been marginally tapered to reflect lower prices and overcapacity.
- Total demand** has been revised 1.6% higher on average. Upward demand revisions are underpinned by the jewellery and industrial segments where palladium's lower price should see it being reintroduced into more applications. Automotive demand forecasts are largely unchanged on balance, albeit revised lower in the short-term and higher in the medium-term.
- Market balances** are now forecast to be on average 420 koz tighter than previously, with the industry in deficit until 2027f (2025f previously).

Platinum market deficits are forecast to be somewhat stable, while palladium's shift from deficit to surplus has been deferred by two years to 2028.

Figure 3. Platinum market deficits are forecast to sustainably exceed >500 koz to at least 2029f, while palladium markets will move from deficits to a surplus by 2028f



Source: Metals Focus 2024 to 2025 (platinum), Company guidance, WPIC Research

Automotive outlook key for PGM demand

Both platinum and palladium demand are forecast to prove resilient over our forecast period to 2029f. We expect total platinum demand to increase from 7,951 koz in 2024e to 8,039 koz in 2029f. Jewellery, industrial and investment platinum demand are all expected to witness demand growth which more than offsets declining automotive platinum demand.

- We expect ex-China jewellery demand to continue recording growth, with the Rest of the World demand now large enough to more than offset potential weakness in China.
- Industrial platinum demand reflects platinum's versatility in supporting process and energy efficiency. We forecast demand linked to the chemicals, electronic and glass sectors to remain broadly stable, with growing medical and hydrogen linked demand more than offsetting lower petroleum and "other" demand.
- We use a ten-year historic average of investment demand as the basis for our forecasts from 2026f to 2029f (539 koz). Higher demand relative

Total platinum demand is forecast to increase from 7,951 koz in 2024 to 8,039 koz in 2029f, while palladium demand is expected to decline from 10,304 koz to 9,671 koz over the same period.

to 2024 appears reasonable when considering declining interest rates and successful Chinese market development.

Palladium demand will follow many for the themes seen for platinum. However, we expect palladium’s jewellery and industrial demand growth to outpace that of platinum’s due to a sharp reduction the palladium price, which should incentivise more palladium use. In contrast to positive jewellery and industrial trends, we expect palladium investment demand to normalise to historic trends (+20 koz pa) compared to an exceptional 2024 (+287 koz). Cumulatively, normalising investment demand and modest automotive demand erosion of around -1% pa underpin our forecasts for palladium demand to decline from 10,304 koz in 2024f to 9,671 koz in 2029f.

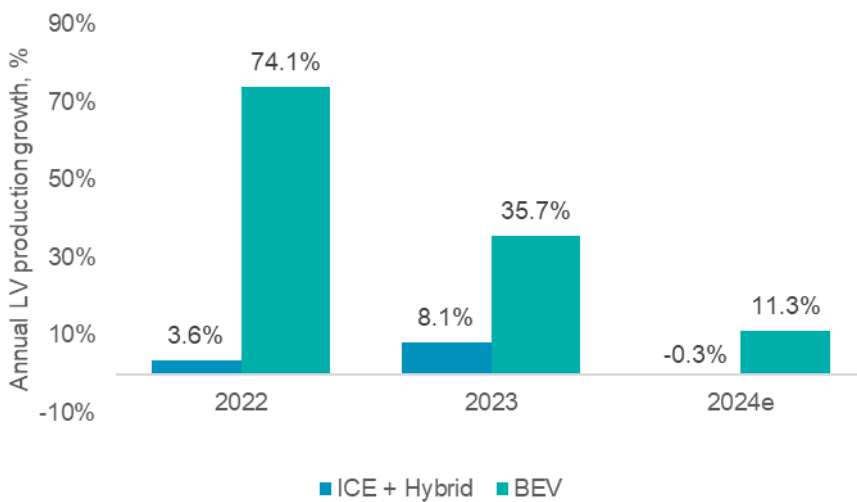
The following brief focuses on the two areas of demand that have the most significant changes versus the last two-to-five-year outlook, namely the automotive and hydrogen sectors.

1. Automotive demand has a long tail

During 2024, the automotive industry recorded a marked slowdown in battery electric vehicle (BEV) demand growth in the light vehicle segment. BEV production increased by 11% y/y to 11.6 million units in 2024, compared to 36% y/y growth in 2023 (Fig. 4). Slowing BEV production growth has been aligned with our “higher for longer” internal combustion engine (ICE) and hybrid demand thesis, where combined output declined by less than one percent in 2024e.

BEV demand growth slowed in 2024, implying slower than expected ICE and ICE-hybrid demand erosion of -0.3% y/y.

Figure 4. Despite increasing BEV production, ICE and hybrid vehicle production was resilient through 2024e



Source: Global data, OICA, Regional Autobody data, WPIC Research

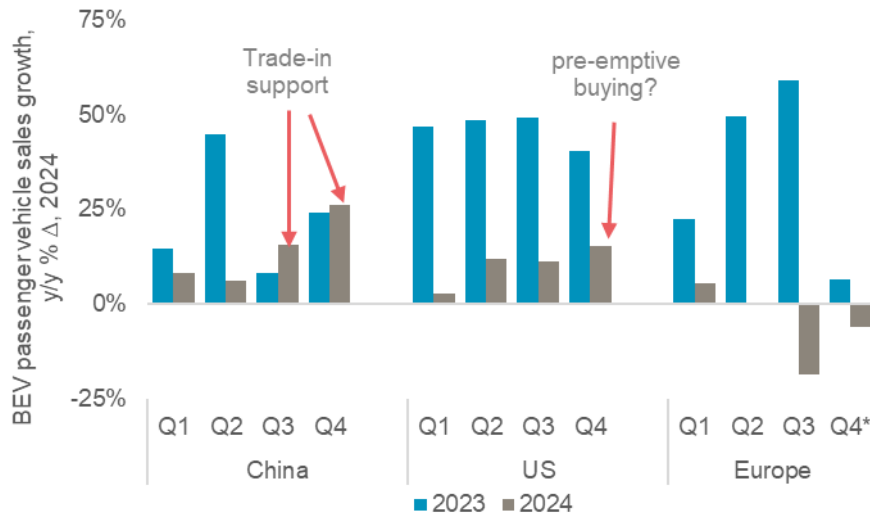
Although we have previously expected BEV demand growth to slow, what may be underappreciated about BEV demand in 2024 is that it appears to have been inflated by subsidies. Looking at quarterly BEV demand data, it can be seen that,

- China’s BEV demand growth accelerated in the second half of 2024 (Fig. 5) with the implementation of policies which offered subsidies of up to RMB 20,000 on new energy vehicle purchases (BEV, PHEV and EREV) when trading in an older ICE vehicle.

- US BEV demand growth accelerated in Q4'24 as consumers brought forward purchases ahead of President-elect Trump's potential watering down of IRA purchase credits.

In Europe, where BEV subsidies were on average less attractive in 2024 compared to 2023 (largely due to Germany scrapping its support), BEV registrations declined by -6.0% in 2024 according to trade body ACEA.

Figure 5. BEV sales growth appears to be correlated with the availability of subsidies



Convincing the next cohort of consumers to move to BEV is proving challenging, with growth rates highly correlated to financial subsidies.

Source: Regional Automotive bodies, WPIC Research

In 2025f, we expect global BEV demand growth to recover to ~20% y/y as,

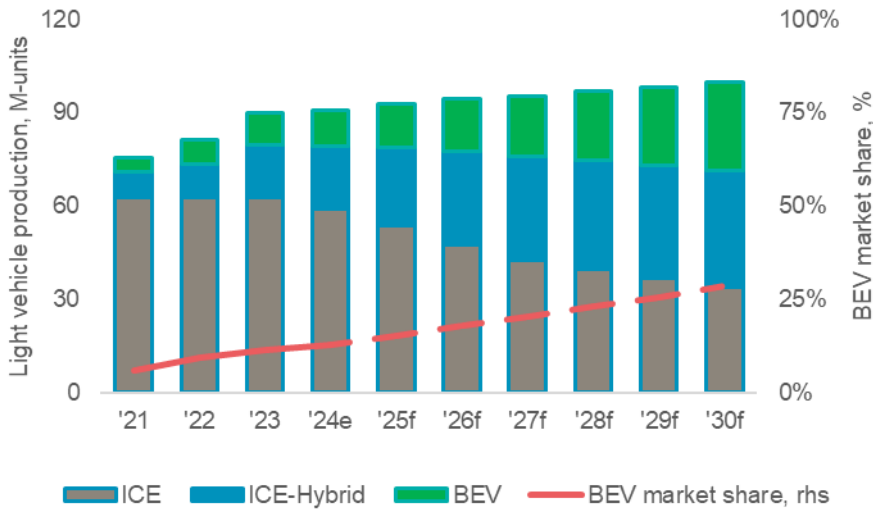
- China announced an extension to its trade-in subsidy scheme for 2025.
- Lower priced BEV models are beginning to launch in Europe and North America (albeit our analysis determined that these are no panacea to sharply increase growth, [link](#)).
- Automakers will aim to hike ICE prices and discount BEVs in order to avoid falling behind on regulated fleetwide emission reduction targets.

Notwithstanding our view for some accelerating BEV demand growth in 2025f, the almost binary “boom or bust” nature of BEV purchases alongside corresponding subsidies suggests downside risks could increase as subsidies inevitably get tapered over the medium and long-term. We forecast that BEVs will achieve a global LV market share of 29% in 2030f which is broadly unchanged with our previous forecasts.

Combined ICE and hybrid passenger vehicle demand is only expected to erode by -1.8% CAGR from 2024e to 2030.

Although we forecast BEV market share to effectively double from 2024e and 2030f, combined ICE and hybrid vehicle demand is only expected to erode by -1.8% CAGR over that corresponding period since absolute vehicle production is forecast to increase from ~91m to ~100m units.

Figure 6. ICE based vehicle production will remain resilient to 2030f despite a broad doubling of BEV market share between 2024e to 2030f



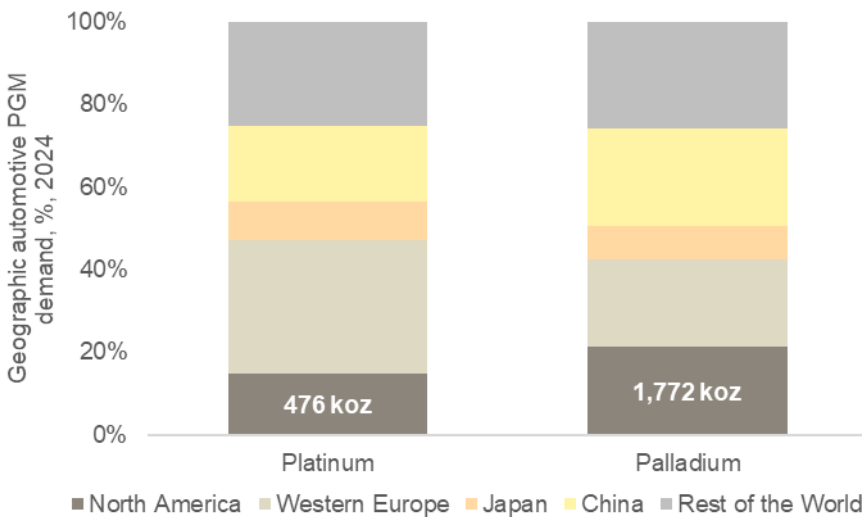
Source: OICA, Regional Autobody data, WPIC Research

US tariffs

We are awaiting the finalisation of any US tariffs since the US is a significant importer of automobiles. Mexico and Canada represent key manufacturing hubs for the US automakers, accounting for 38% of imports by value in 2023. There may be some reshoring of manufacturing, however, tariffs on vehicle imports are likely to negatively impact US vehicle sales and PGM demand. Palladium would suffer greater demand losses from weakening vehicle markets since US automotive palladium demand (1.8 Moz) is almost four times larger than platinum (Fig. 7).

The US new car market may be negatively impacted by tariffs on Mexican and Canadian imports. North American automotive PGM demand is approximately 15% to 20% of global consumption.

Figure 7. North American automotive PGM demand is skewed to palladium given a market preference for gasoline ICE vehicles

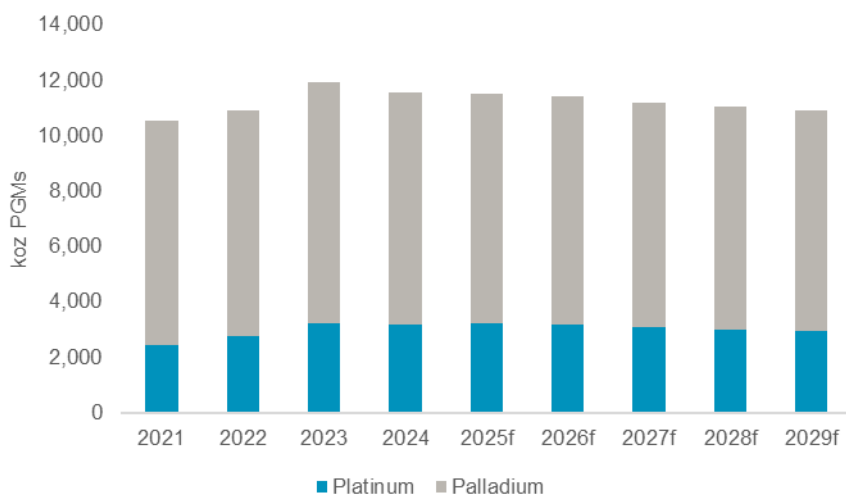


Source: Metals Focus (platinum), WPIC Research (palladium)

Translating drivetrain trends to PGM demand

We expect automotive platinum and palladium demand to broadly reflect ICE based drivetrain trends, that is somewhat resilient albeit exhibiting some erosion. Over the next five-years, we forecast automotive platinum and palladium demand will decline by -1.4% CAGR and -1.0% CAGR to 2029f.

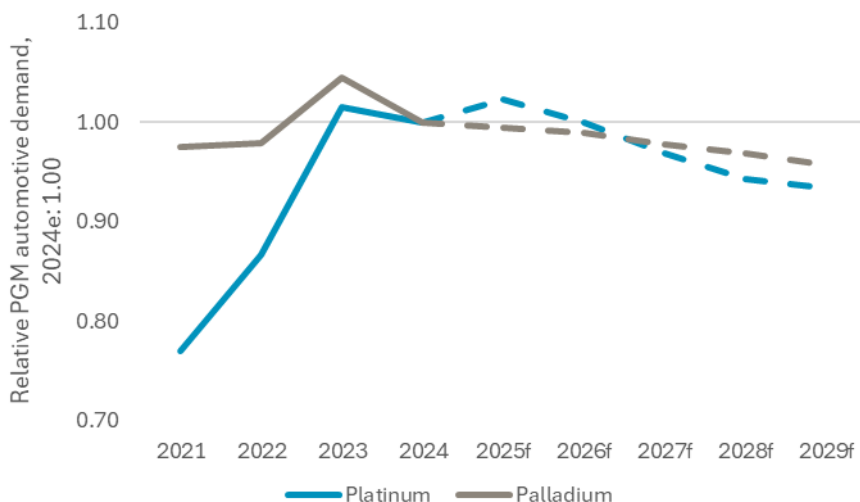
Figure 8. Automotive PGM demand has a long-tail with modest demand erosion largely reflecting trends in ICE-based vehicle production



Automotive platinum and palladium demand will only decline by -1.4% CAGR and -1.0% CAGR over the next five-years.

Source: Metals Focus 2021 to 2023 (palladium) and 2021 to 2025f (platinum), WPIC Research

Figure 9. On a relative basis, automotive demand for palladium will outperform demand for platinum in the forecast time period – this is due to substitution of palladium for platinum and a decline in LV diesel market share, before FCEV demand picks up in the 2030's



On a relative basis, ICE demand for palladium will slightly outperform ICE demand for platinum.

Source: Metals Focus 2021 to 2023 (palladium) and 2021 to 2025f (platinum), WPIC Research

We expect palladium's automotive demand to be more resilient than platinum between 2024 to 2029f. Although we would classify platinum's automotive demand erosion as modest, palladium's relative outperformance should stem from,

- Ongoing market share erosion of diesel passenger vehicles.
- Reverse substitution of platinum for palladium in gasoline vehicles (given broad price parity has been reached).

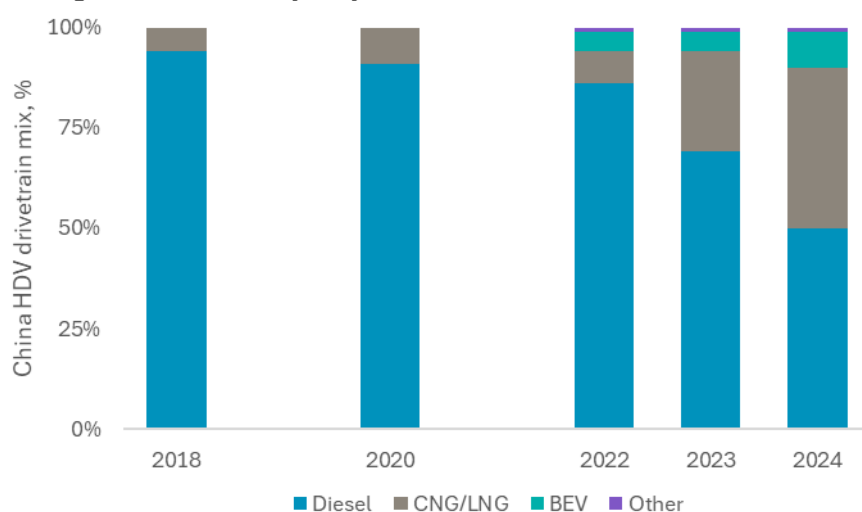
PGM thrifting in autocatalysts re-emerged as an investment theme during 2024 as reports suggested China's domestic autocatalyst producers had substantially reduced loadings. Johnson Matthey suggests that much of the initial PGM loadings gains witnessed ahead of China 6a emission legislation in 2020 (~20% increase) has been thrifted from catalysts (albeit loadings remain higher than under previous emission legislation).

CNG/LNG HD catalyst demand may offset thrifting

In our previous platinum two-to-five year outlook report ([September 2024](#)), we discussed our assumptions around thrifting in China. While that discussion was focussed on platinum, the rational similarly applies to palladium. However, a key trend in China that was not discussed was the growth in China's compressed and liquified natural gas (CNG/LNG) heavy-duty market. LNG vehicles have gained market share in the HD sector in China due to favourable policies and lower LNG prices (particularly in the North and North-Western provinces). LNG trucks utilise catalyst technology for emission control (similarly to combustion engines), however loadings are significantly higher than diesel trucks (>3x) and utilise palladium instead of platinum. At a headline level we believe the LNG truck market is helping offset some of the thrifting of palladium in China's passenger vehicle market.

Growing CNG/LNG HD catalyst demand in China could be a major boost to palladium demand

Figure 10. China's palladium automotive demand is benefiting from market share gains in LNG heavy-duty vehicles



Source: McKinsey & Co, Financial Times, WPIC research

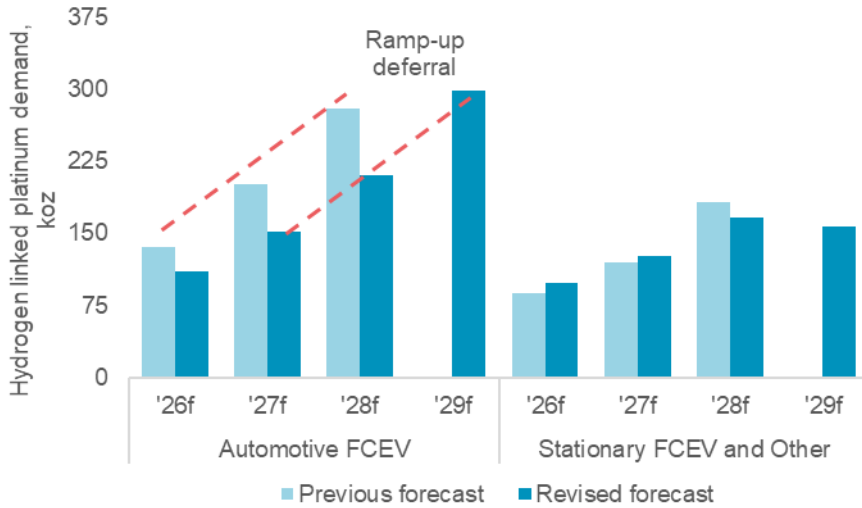
2. More delays to hydrogen

We note that platinum's automotive demand erosion is being partially offset by the emerging hydrogen fuel cell electric vehicle (FCEV). However, we have deferred our FCEV ramp-up profile by around 18-months versus our previous forecasts. FCEV platinum demand estimates remain subject to significant risks, with high costs, infrastructure challenges, and policy uncertainty weighing on the sector.

Many of the challenges facing hydrogen are conceptually similar to those facing the electric vehicle industry. However, these challenges are exacerbated by the hydrogen industry's lack of scale, where minor forecast adjustments have outsized impacts on medium-term demand projections. Accordingly, our ramp-up deferral results in a ~25% reduction in FCEV platinum demand between 2026f to 2029f. By 2029f, we expect FCEV production of ~400k vehicles with LCV and HDV constituting around 80% of FCEV output. We expect FCEV platinum demand of 299 koz in 2029f (Fig. 11), equivalent to 10% of automotive platinum demand.

The hydrogen economy is facing similar challenges to BEVs, where adoption rates are weighed by high costs, a lack of infrastructure and policy uncertainty.

Figure 11. FCEV will remain a niche technology across the automotive industry, however adoption will be biased towards commercial applications

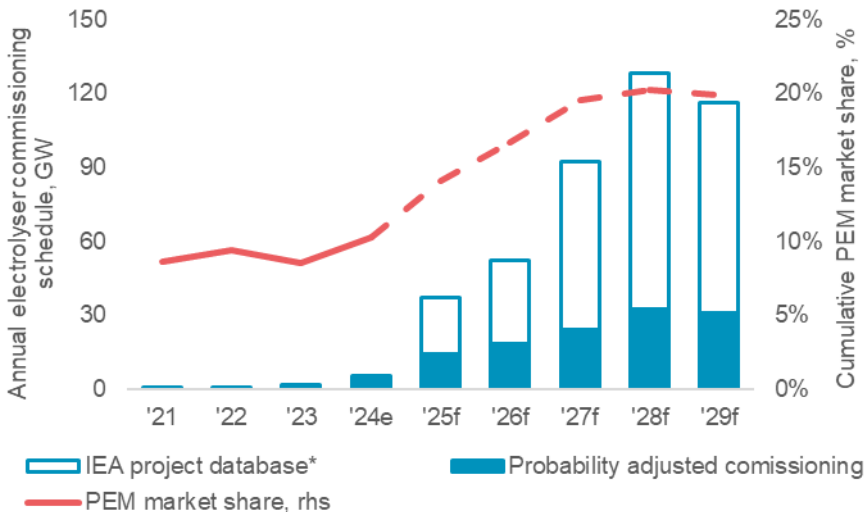


We expect FCEV to support 299 koz of platinum demand in 2029f, approximately 10% of total automotive demand.

Source: IEA, WPIC Research

Alongside FCEV, electrolysis and stationary fuel cells further support hydrogen linked platinum demand. WPIC utilises the International Energy Agency (IEA) electrolyser project database to forecasts platinum linked electrolyser demand. Given the prevalence of delays to electrolyser projects, we apply a risk weighting on projects which aims to account for the risks associated with developing projects from concept through final investment decision and ultimately to commissioning. Between 2025f to 2029f, we expect around 30% of the IEA’s project pipeline to be commissioned (Fig. 12), and around 20% of those projects to utilise platinum containing proton exchange membrane technology.

Figure 12. The commissioning of electrolysers will likely undershoot global project announcements given industry headwinds



We expect Proton Exchange Membranes (PEM) to achieve ~20% market share of the global electrolyser market.

Source: IEA, The Orange Group, WPIC Research

Palladium could have a role in hydrogen

Palladium research and development has increased over the past couple of years to find more industrial applications for the metal given declining prices and project market surpluses. Nornickel has been the most active palladium producer developing new markets for palladium since 80% of the company’s PGM production is palladium. Nornickel estimates incremental palladium demand from the hydrogen economy could reach 200-300 koz in the long-

term by substituting palladium with 1) 30% of the iridium used in PEM electrolyzers, and 2) 25% of the platinum used in fuel cells.

Our current supply demand forecasts exclude palladium’s adoption within the hydrogen economy since the reported efficiency gains are currently only getting achieved at lab scale and they’ll need proving at a commercial level. Moreover, Nornickel’s expectation for long-term demand adoption is suggestive of a post-2030f time horizon which is beyond the scope of our published forecasts.

Supply is underpinned by mining but growth hinges on recycling rates

Both platinum and palladium are forecast to record total supply growth over the next five-years to 2029f. However, on a granular basis, mine supply is expected to decline while recycling supply is expected to grow. In general, platinum and palladium follow similar trends in mine supply given palladium is mined as a co-product to platinum in Southern Africa and platinum is mined as a co-product to palladium in North America.

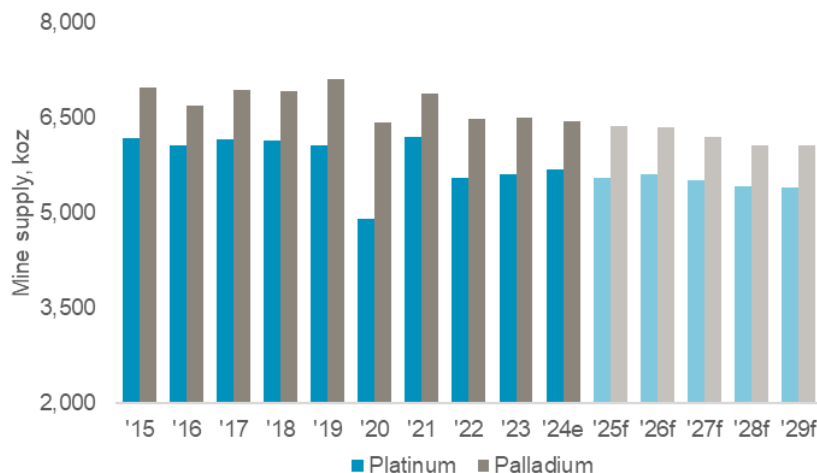
Given divergent automotive platinum and palladium demand trends during the 2010s, platinum’s supply trajectory does begin to materially differ from palladium’s due to recycling expectations to 2029f. We highlight that recycled automotive palladium supply growth of 10% CAGR from 2024 to 2029f underpins total palladium supply growth from 9,113 koz to 10,041 koz. Comparatively, total platinum supply growth is a modest, from 7,269 koz in 2024 to 7,442 koz in 2029f.

Platinum and palladium mine supply has recorded sustained erosion over the past decade and this trend is set to continue.

3. Is 2025 the year for recycling?

Last year, PGM mining companies announced and implemented several restructuring programs aimed at supporting margins given ongoing basket price pressure (Fig. 18). Initiatives included headcount reductions, closing unprofitable mining operations and deferring growth and replacement capex. Using company guidance (revised for restructuring announcements), we now expect mine supply to decrease by 2% y/y for platinum and 1% y/y for palladium in 2025f (Fig. 13).

Figure 13. PGM mine supply is forecast to continue its well-established trend of declining output due to declining investment spend in real terms



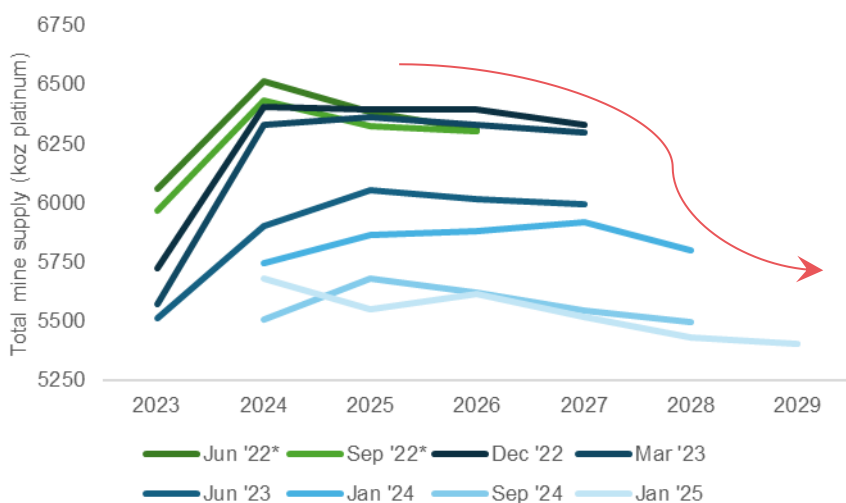
The aggregated mid-point of producer guidance suggests platinum and palladium mine supply will continue to erode going forwards.

Source: Metals Focus to 2023 (palladium) and 2019 to 2025f (platinum), SFA (Oxford) 2015 to 2018 (platinum), Company guidance, WPIC Research

The impact of restructuring needs to be seen in the context of expectations from 12-months ago, considering we use producer guidance for forecasting. In January 2024, guidance indicated mine supply would be 315 koz higher than Metals Focus' 2025f forecasts for platinum mine supply (per latest Platinum Quarterly, [link](#)).

We highlight downward revisions to mine supply guidance have been a reoccurring theme since our first two- to five-year outlook report in June 2022 (Fig. 14). As miners consolidate restructuring programs in 2025, supply risks appear skewed to recycling rates, which are likely to have a significant bearing on platinum and palladium market balances.

Figure 14. The aggregated mid-point of producer platinum guidance has moved progressively lower with each of our two-to-five-year supply/demand updates with almost a million-ounce reduction in the annual outlook.



Producer guidance for 2025 has been cut by almost 1Moz platinum since March 2023.

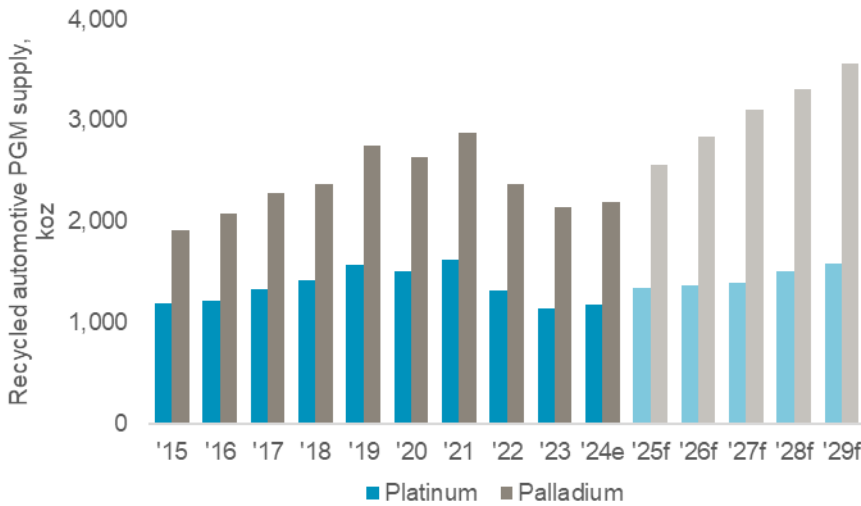
Source: Company Reports, Metals Focus, WPIC Research, *WPIC's Jun and Sep '22 two-to-five-year supply/demand outlooks used the lower end of the aggregated mid-point of guidance ranges, as guidance was lagging dynamic changes in the mining environment and did not reflect the lower levels of capital investment at that time

There are risks to recycling forecasts

Recycled PGM supply peaked in 2021 but was particularly depressed through 2022 to 2024 (Fig. 15). Scrap autocatalyst availability was negatively impacted by COVID, supply chain challenges, the cost-of-living crisis and higher financing costs which all played a part in fewer newer new vehicle purchases. Scrap availability was also likely impacted by pulling forward inventory during 2020 and 2021 as high PGM prices incentivised material to the market. This could have been compounded by the subsequent fall in the prices of palladium and rhodium prompting scrap yards to stockpile material in the hope of better prices in the future.

Automotive PGM recycling supply has been depressed since 2022.

Figure 15. PGM recycling should recover from the depressed levels recorded in 2023 and 2024



Source: Metals Focus to 2023 (palladium) and 2019 to 2025f (platinum), SFA (Oxford) 2015 to 2018 (platinum), Company guidance, WPIC Research

We believe several factors should support an uplift in automotive PGM recycling supply. Firstly, new vehicle production (Fig. 6) and sales volumes have recovered from the depressed levels reported during COVID and the semi-conductor shortages. With the new vehicle market normalising in 2023 and 2024, the used car market is in-turn rebalancing. The shortage of new vehicles in 2022/23 pushed consumers to the second-hand market, which resulted in a significant peak in used car prices in 2022 (Fig. 16). The improved availability of new vehicles has eased the competition in the second-hand market which is shown by declining used vehicle values and is likely to also be reflected in more of these vehicles being considered end of life and scrapped rather than being resold and run for longer.

Figure 16. Used car prices have declined over the past two years as new vehicle supply chain conditions normalise



Source: Manheim Automotive, WPIC Research

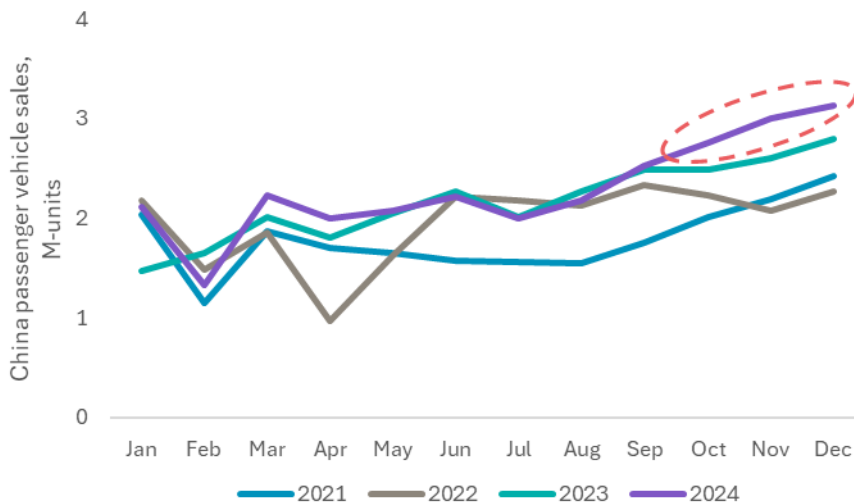
A partial reset in used vehicle prices suggests that new vehicle availability has improved.

Alongside normalising vehicle sales trends, which should replenish scrap autocatalyst supply, we believe market led factors in China and the US are further supporting increased scrap availability.

In China, we have previously discussed the subsidy program which was launched in July 2024 to support new energy vehicle sales. An NEV consumer

would need to scrap an ICE vehicle which was registered before June 2012 with China 4 emission standards (or lower) to be eligible for the maximum subsidy of RMB20,000. A less attractive new vehicle subsidy was offered for selling an old vehicle instead of scrapping the old vehicle. China’s monthly passenger vehicle sales data highlights that the trade-in program accelerated new vehicle purchases, with Q4 significantly stronger than prior years (Fig. 17). Given the incentives to scrap vehicles (for larger subsidies), these vehicles should in theory show up in recycling supply through 2025f, albeit they are likely to be palladium heavy rather platinum heavy catalysts. It is worth noting however, that an unfavourable change to the tax regime in China which has made recycling PGMs largely an unprofitable enterprise.

Figure 17. China’s trade-in subsidies supported passenger vehicle sales growth of 12.6% y/y in Q4 2024 which was double the FY 2024 growth rate



Source: CAAM sales data, WPIC Research

Trade in subsidies are supporting LV demand in China.

In the US, vehicle scrapping will get an influx following natural disasters which include Hurricane Helene in late September 2024 and the Los Angeles (LA) fires in January 2025. Market participants estimated that Hurricane Helene may have destroyed around 500 to 600 thousand vehicles. We expect most of these vehicles to make their way through the recycling value chain during 2025. Obviously, whilst these will add to recycling volumes, there should be reciprocal support for replacement vehicles, which could add a boost to automotive demand.

Natural disasters in North America

Another commonly, and already, mentioned challenge to recycled automotive PGM supply in 2023 and 2024 has been hoarding. Refiners noted that whilst scrapyards had begun seeing improved scrap vehicle availability through 2024, market participants were unwilling to sell autocatalysts to aggregators in the hope that weak PGM prices would recover to levels seen from 2020 to 2022. We believe that expectations are realigning to current PGM price realities in that the PGM basket prices have been broadly stable for the past 18-months (Fig. 18). Accordingly, “hoarded” catalyst scrap is likely to get released, if it hasn’t been already.

Natural disasters in North America, such as Hurricane Helene, may increase scrap availability, but will also support demand for new vehicles.

Figure 18. PGM basket prices have found support over the past 18-months, and subsequently traded sideways



Source: Bloomberg, WPIC Research

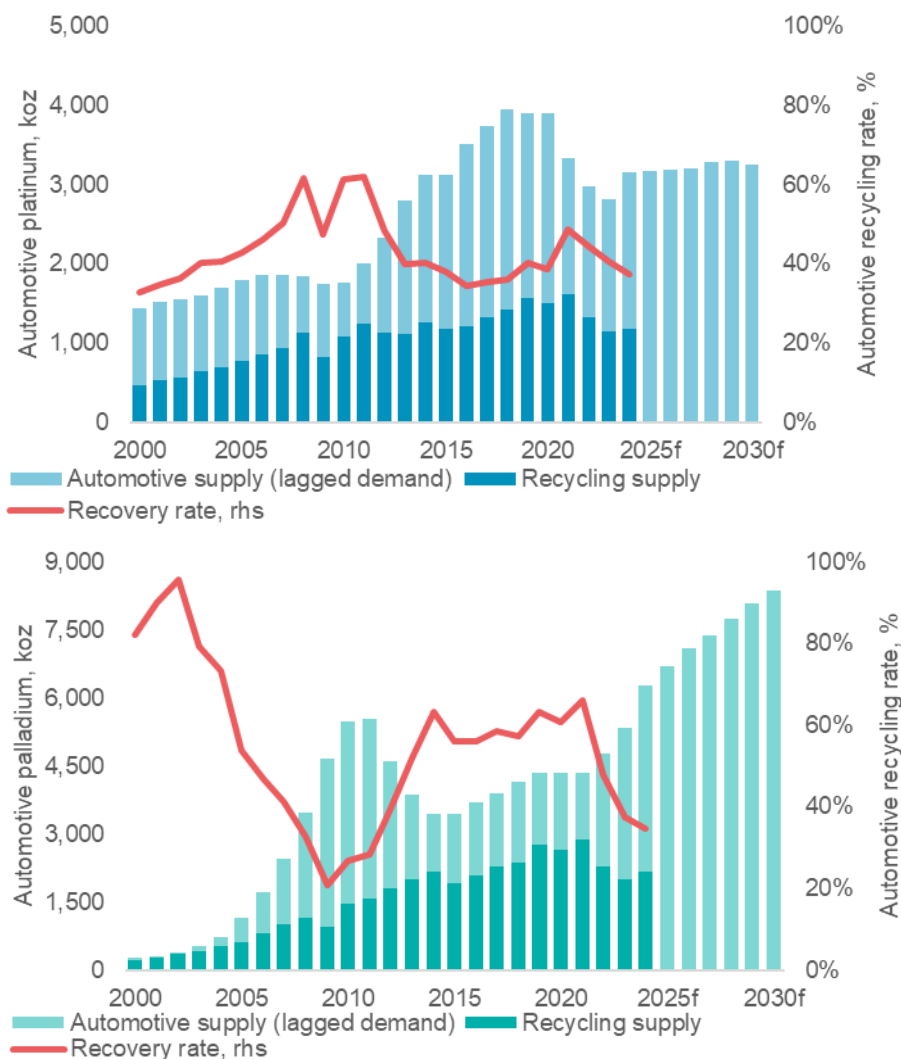
Over the medium-term to 2029f, our base case is that recycled automotive platinum supply increases at a 6% CAGR or ~410 koz in total, while palladium supply increases at a 10% CAGR or ~1,370 koz in total. Historic automotive PGM demand serves as future recycled automotive PGM supply. We typically use a lag between historic demand and future supply of 13-years, modified by a recovery factor, and figure 19 illustratively charts theoretical recycled automotive supply of platinum and palladium against actual supply. In our view, although we are expecting a partial recovery in the coming years, recycled automotive platinum supply probably peaked in 2021 considering automotive platinum demand peaked in 2007. In contrast, automotive palladium demand reported consistent growth through the 2010s and this historic demand will become future recycled automotive palladium supply.

Our base case is that recycled automotive platinum supply increases at a 6% CAGR and palladium at a 10% CAGR.

Whilst the conditions for growth in automotive PGM recycling appear to be present with improving scrap availability, supply could continue to surprise to the downside as it has done over the past two years. Although recycling is thought of as a margin business that supplies the lowest cost ounces, the industry is not immune to challenges such as overcapacity and low prices compressing margins.

In China, the government's emphasis on resource utilisation does not align with specific support measures for PGM recycling. Local enterprises lack access to tax rebates and subsidies, despite efforts to streamlining efforts by China's recycling industry organisations. These issues are compounded by overcapacity and low value scrap intake since older autocatalysts contained low levels of PGMs under China 4 and China 5 emission legislation. Although China 6 regulated vehicles will begin making their way into the recycling value chain, this will in aggregate be offset by the ~20% market share lost to BEVs, which have their own costs and recycling value chains.

Figure 19. The theoretical supply of palladium and platinum from the future scrapping of autocatalysts follow divergent trajectories



Forecast automotive recycling supply reflects the lagged effects of historical automotive demand trends.

Source: Bloomberg, WPIC Research

In the US and Europe, the recycling industry’s commentary is echoing that of China’s, where current prices and too much competition are compressing margins to unsustainable levels. The US’s competitiveness is further hampered by the additional KYC regulatory requirements stemming high levels of autocatalyst theft and illicit trade.

In our view, the headwinds facing PGM recycling suggest that future supply faces downside risks. However, we consider these downside risks as deferring supply growth as older vehicles continue to be scrap and their autocatalysts accumulated. This is unlike mining, where supply lost from missed production targets or asset restructuring, is lost permanently.

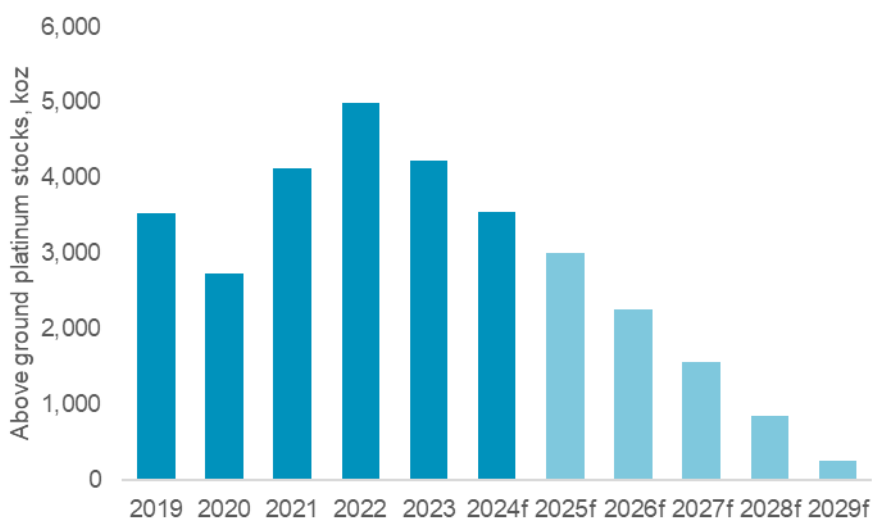
Conclusion - supply/demand balances to 2029

Having updated our supply/demand outlook to 2029f, we highlight that platinum markets will remain in a deficit throughout our forecast horizon. Notably, since platinum entered a deficit market in 2023, our forecast market deficits (including Metals Focus forecast deficits from 2023 through 2025) reflect consistency in that they lie within a narrow range from 540 koz to 760 koz. Platinum’s consistent and consecutive market deficits are underpinned by the metal’s stable demand outlook and lack of meaningful supply growth.

We expect platinum demand to increase at a 0.2% CAGR from 2024e to 2029f. We believe that platinum demand will benefit from its diversity of end-uses, as jewellery, industrial and investment demand growth will cumulatively offset minor automotive demand erosion (-1.4% CAGR from 2024e to 2029f). Platinum markets are forecast to record supply growth of 0.5% CAGR from 2024e to 2029f. Higher recycling output will more than offset eroding platinum mine supply (-1.0% CAGR, 2024e to 2029f).

To meet the supply shortfall of consecutive platinum market deficits, the industry is drawing down on above ground stocks (AGS). We estimate that platinum AGS will decline from 5.0 Moz in 2022 to 0.3 Moz by the end of 2029f (Fig. 20). That is a 95% reduction in AGS over seven years, which should tighten physical platinum markets resulting in upward price pressure for the metal. It is worth considering that if PGM prices do not rise over the near-term, more mine restructuring (akin to the announcements in 2024) may be necessary to support the miners' financial sustainability. This could accelerate AGS depletion, which reinforces the investment case for platinum.

Figure 20. Platinum supply deficits will drawdown above ground stocks from a peak of ~5,0 Moz in 2022 to 0.3 Moz in 2029f



Consecutive platinum market deficits will need to be met by above ground stocks which we expect to largely deplete by 2029f.

Resilient demand and negligible supply growth should support ongoing platinum market deficits of more than 0.5 Moz pa. to at least 2029f.

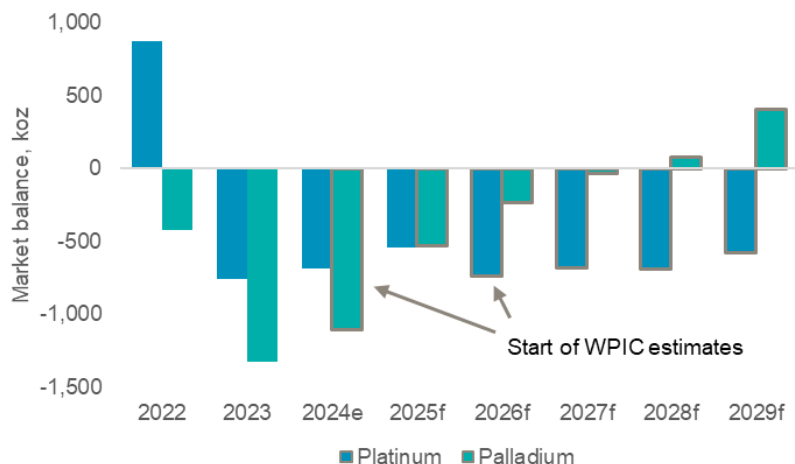
Source: Metals Focus 2019-2025f, WPIC Research

Palladium functionally shares many of platinum's supply demand themes. We expect palladium demand to prove resilient as slower electrification of the global drivetrain equates to higher for longer ICE demand and increasing hybridisation. Moreover, palladium mine supply is eroding as investment is curtailed to manage lower PGM prices. These factors have supported revisions to our supply/demand forecasts where palladium markets are now expected to be in deficit until 2027f (previously until 2025f).

Despite our expectations for tighter palladium markets, the key differentiation between palladium and platinum is automotive recycling supply. We expect palladium automotive recycling supply growth of 10% CAGR from 2024e to 2029f. The incremental 1.4 Moz of recycled palladium supply is the primary driver in sequentially swinging palladium markets from a deficit of 1.1 Moz in 2024e to a 0.4 Moz surplus in 2029f, which may detract from the metal's investment case (Fig. 21).

As we pointed out for platinum, if palladium prices remain low or decline further, miners may again consider restructuring unprofitable operations to support financial sustainability. Any action in this regard could further push out the tipping point for the palladium market to transition into a surplus, which would likely sustain market tightness and keep palladium at risk of sharp price rallies.

Figure 21. Supply/demand balances from 2022 to 2029f



Resilient demand and negligible supply growth should support ongoing platinum market deficits of more than 0.5 Moz pa. to at least 2029f.

Source: Metals Focus 2022 to 2023 (palladium) and 2022 to 2025f (platinum), Company guidance, WPIC Research

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.

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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 275 koz p.a. over the years 2026-2029.
- 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 return to ETF disinvestment is potentially significant US policies drive a return to inflation and result in a sustained higher interest rate environment.

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's palladium supply and demand model is a standalone piece of research, using WPIC's own data assessment to drive forecasts for the current year forwards. Historical data is sourced from Metals Focus.

WPIC's research is predominantly desk based and not focussed on developing in-country and in-industry relationships to obtain fresh/incremental data. The information and sources used to develop our 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.

The guidance published by the PGM mining companies is usually 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 or palladium, we have calculated refined platinum or palladium 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, modified with by regional economic projections.

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 is included in 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.

Industrial demand: Industrial demand projections are based upon a combination of sub-sector research, historical trends and macroeconomic expectations. This results in relatively steady trend projections, whereas in

practice industrial demand is more volatile, depending upon the timing of capacity additions. While industrial demand can be volatile, the multi-year trends have been very consistent offering 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, is for medium-term demand stability given recent demand growth.

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.

An exception to our investment demand forecasting methodology is China large bar demand ($\geq 500\text{g}$). The nascent segment is expected to record demand growth of 63% CAGR between 2019 to 2024e. Accordingly, using average demand, presents an unrealistic forecast for a demand segment which has delivered consistent growth. Until a longer time-series is established or demand stabilises, we believe it is prudent for our two- to five-year outlook to match the one-year demand outlook from the *Platinum Quarterly* report.

Elsewhere, we have not included the likely impact on investment demand of any material changes in price. For example, if the market is expected to have successive 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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