

PLATINUM PERSPECTIVES

Platinum for palladium substitution makes economic and strategic sense and could take platinum into deficit

Platinum for palladium substitution in gasoline vehicles makes compelling economic and strategic sense at current prices and in the current geopolitical environment. We estimate that substitution in newly launched models could save automakers between US\$671M and US\$1,118M p.a., increasing annual platinum demand by between 512 koz and 853 koz, which at the upper end would push the market into a deficit.

Palladium has traded at an average premium over platinum of more than US\$1,300/oz since the beginning of 2020 (peaking at US\$2,014/oz on Russian sanctions), which on an economic basis alone, should have been driving additional substitution of platinum for palladium in gasoline autocatalysts. The ability to substitute in vehicle models that are already on the road is relatively limited and/or expensive, but there is significant flexibility to substitute in new models ahead of exhaust control certification on a 1:1 platinum for palladium basis.

The economic incentive has been in place since the price of palladium overtook platinum in 2018, bolstered by security of supply concerns given palladium's status as a byproduct of platinum and nickel production. However, **Russia's invasion of Ukraine and the sanctions against Russia have strengthened the substitution rationale**. Although Nornickel, which produces 38% of global mined palladium supply, has not been sanctioned and is still able to export metal, there remain risks that it may still be sanctioned in reaction to ongoing Russian aggression. There is also a moral question as to whether companies in countries opposed to the war should be buying Russian mined material.

There are significant financial and origin of supply incentives to drive platinum for palladium substitution in newly launched vehicle models

	Europe	China	N.A.	RoW	TOTAL
	2022	2022	2022	2022	2022
Gasoline vehicles (M)	9.0	19.7	12.2	17.8	58.6
Annual Pd demand (koz)	1,742	2,807	1,757	2,223	8,529
Annual newly launched models (%)	20%	20%	20%	20%	20%
Pt for Pd substitution level (%)	30% / 50%	30% / 50%	30% / 50%	30% / 50%	30% / 50%
Total annual Pt impact (koz)	105 / 174	168 / 281	105 / 176	133 / 222	512 / 853
Avg. Pd-Pt price differential (US\$/oz)*	1,311	1,311	1,311	1,311	1,311
Automaker savings (US\$M)	137 / 228	221 / 368	138 / 230	175 / 291	671 / 1,118

Source: Metals Focus, WPIC Research, Bloomberg, *Average since Jan 2020

We believe that up to 75% of the palladium in gasoline vehicle catalysts could be substituted by platinum without a loss of thermal stability. However, we conservatively show scenarios of 30% and 50% substitution and assume that 20% of annual vehicle sales are of newly launched models. Based upon production of 59M gasoline vehicles in 2022 across all vehicle categories, the two scenarios could save automakers between US\$671M and US\$1,118M. **This would result in additional platinum demand of between 512 koz and 853 koz p.a, which at the upper end would move the market into a deficit (fig. 6).** The country/region that could save the most is China, followed by the Rest of the World, with Europe showing the least benefit due to a smaller gasoline vehicle fleet. **It is worth noting that there are still no obligations for the automakers to publicly disclose any substitution, and so direct evidence that it is already occurring, and expected to accelerate, will be difficult to obtain. All we can do is reiterate that it makes economic and strategic sense to make the switch.** Furthermore, this is in addition to substitution which we believe has occurred on models launched prior to 2022.

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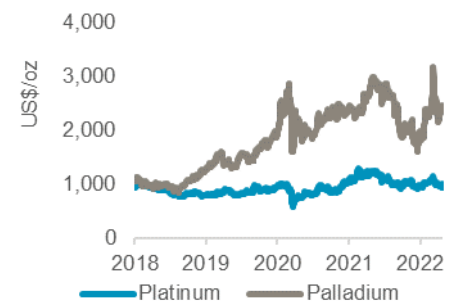
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*Palladium is trading at a sustained premium of US\$1,311/oz vs. platinum**



Source: WPIC Research, Bloomberg, *Average since Jan 2020

Platinum for palladium substitution in gasoline vehicles makes economic and strategic sense in newly launched models.

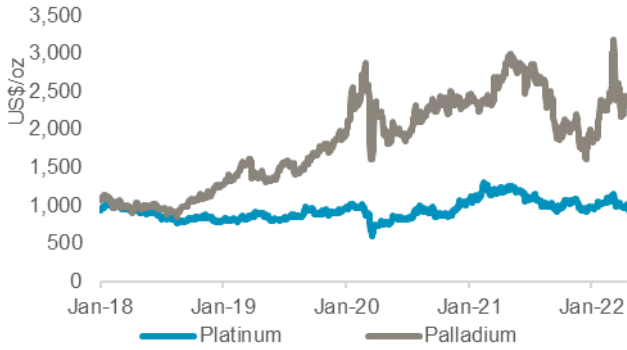
At a 30% substitution rate it could save the automotive industry US\$671M p.a. and increase demand for platinum by 512 koz p.a.

At a 50% substitution rate it could save the automotive industry US\$1,118M p.a. and increase platinum demand by 853 koz p.a., sufficient to move the platinum market into a deficit.

Platinum's attraction as an investment asset arises from:

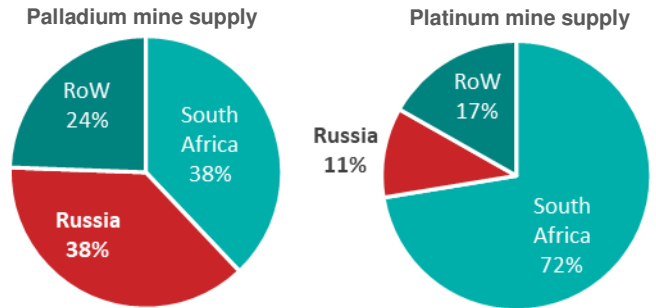
- Supply severely constrained for three more years despite some new investment in mining capacity
- Platinum price remains historically undervalued and significantly below both gold and palladium
- Automotive PGM demand growth should continue due to increasingly restrictive emissions rules
- Market balance and price mismatches between palladium and platinum drive substitution
- Investment demand is softer after two record years, but price and fundamentals remain attractive

Figure 1: Not only has the palladium to platinum price differential been supportive of substitution on 1:1 platinum for palladium basis...



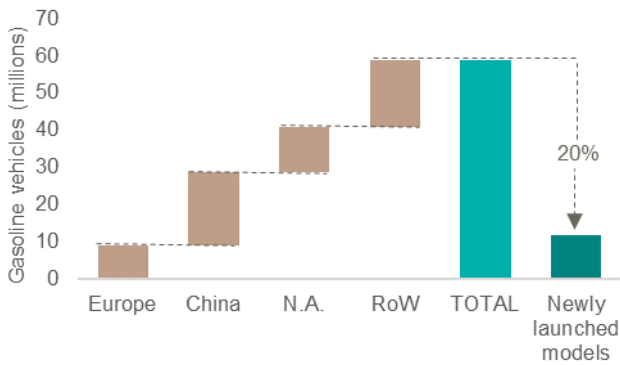
Source: Bloomberg, WPIC Research

Figure 2: ...but the significantly greater percentage of palladium supply sourced from Russia adds a strategic rationale to substitute on security of supply concerns.



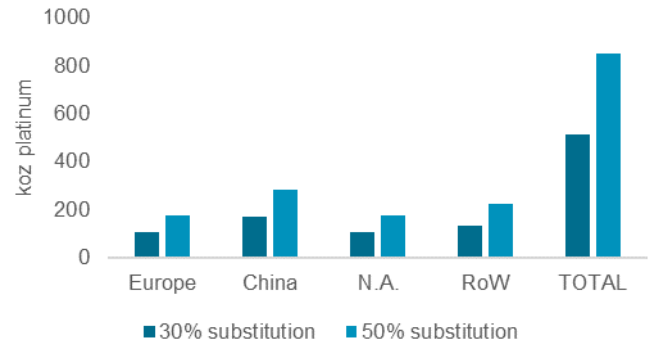
Source: Metals Focus, WPIC Research

Figure 3: Almost 12 million newly launched gasoline vehicles are suitable for quick substitution per year.



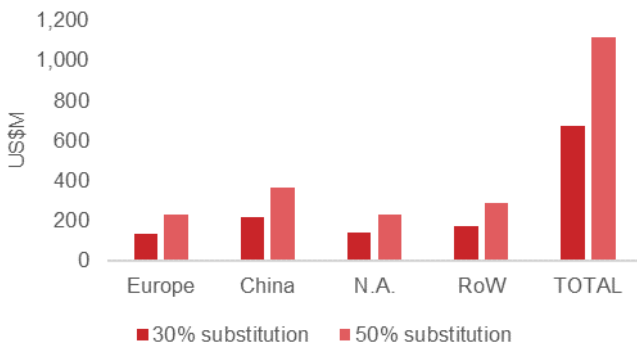
Source: WPIC Research

Figure 4: Substituting 30/50% of platinum in gasoline engines increases platinum demand by 512/853 koz.



Source: WPIC Research

Figure 5: Annual savings for the automotive industry could reach US\$671M at 30% substitution and US\$1,118M at 50% substitution.



Source: WPIC Research

Figure 6: Platinum for palladium substitution could be sufficient to move the 2022 market into a deficit at a 50% substitution rate in newly launched vehicle models.



Source: Metals Focus, WPIC Research

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