

PLATINUM PERSPECTIVES

In 2021, 400 koz more platinum could replace palladium in addition to the 150 koz of expected 'substitution'

Public discussion by automakers and catalyst fabricators to date has focussed on replacing palladium with platinum in catalysts of vehicles already on sale. These substitution efforts started in 2016, driven then by looming palladium shortages and not price differentials. Implementation accelerated once annual cost savings could exceed testing and recertification costs, most likely on larger high-palladium content models. **Fabricators expect platinum demand from substitution defined in this way, to be c.150 koz in 2021 increasing to c.1.5 moz in 2025.** The North American market was a natural early substitution target because emissions are measured across automaker fleets, with emissions control systems replaced gradually over the 5-10 year lower-limit implementation periods.

However, in Europe and China new lower emissions levels must be met by a specified date. Because Euro 6d and China 6a were implemented by January 2021, **all car models to be sold in Europe and China in 2021 had their emissions systems redeveloped over the preceding three years. This meant that platinum could be used in place of palladium with almost no additional engineering, testing or certification costs** and with no public disclosure of these proprietary and confidential developments. This means that in 2021 gasoline vehicles expected to be produced in China (21.5 m) and Europe (10.7 m) could already have replaced some palladium with platinum. Our conservative scenario below, assumes that only 20% to 30% of vehicles were considered for a change in metal mix (despite the potential bottom line profit benefit of over \$1bn) and that the portion of palladium replaced by platinum is only 30% (well below the 50% achieved on some vehicles already on sale and the 75% believed possible). **This suggests that additional platinum demand in 2021 from pre-launch metal replacement in Europe and China alone could be between 285 koz & 428 koz, adding c.\$500m to OEM profits.**

Platinum replacing palladium prior to new gasoline vehicle launches could add over 400 koz to platinum demand in 2021

	Europe	China	Total
	2021	2021	2021
Vehicles (000s)	10,711	21,559	32,270
Annual palladium volume (koz)	1,977	2,774	4,751
Share selected for replacement (%)	20% - 30%	20% - 30%	20% - 30%
Share of Pt replacing Pd (%)	30%	30%	30%
Total annual Pt impact (koz)	119 - 178	166 - 250	285 - 428
Automaker saving (\$ mn)	\$144 - \$216	\$202 - \$303	\$346 - \$519

Source: OICA, LMC, China Auto Information.net, Bloomberg, WPIC Research

This new-vehicle annual platinum demand is additional to the 'substitution' on existing vehicles described in the first paragraph of this note. Any pre-launch platinum for palladium replacement prior to 2021, driven by growing platinum discounts, would not have been easily visible in published platinum demand data due to the Dieselgate-driven fall in the diesel passenger portion in Europe and, the pandemic-driven lower vehicle sales.

We believe levels of platinum replacing palladium in China could rise quicker than elsewhere as the automakers in China, state-owned JVs, do not have a forward book to soften price impacts as is the case in Europe and North America. The cost of palladium in autocatalysts in China alone has risen from \$2.1 billion in 2018 to \$5.7 billion in 2020.

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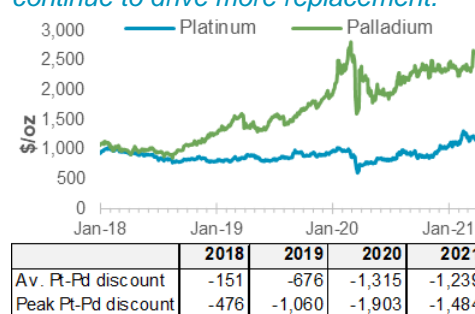
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Platinum's deep discounts to palladium continue to drive more replacement.



Source: Bloomberg, WPIC Research

Once platinum has replaced palladium in a catalyst, which is a bespoke match per vehicle model platform, the associated annual demand remains in place each year for the c.7-year life of the platform. If Pt and Pd prices moved to parity, removing the financial incentive to replace palladium, the annual platinum demand level would be sustained over the platform life.

Platinum's attraction as an investment asset arises from:

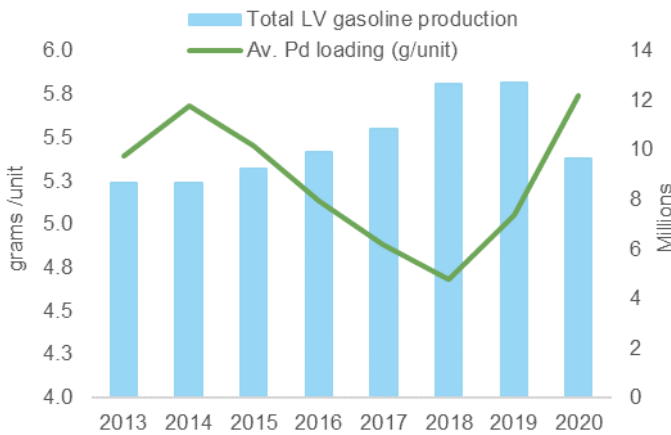
- Supply is relatively constrained with limited investment in new platinum group metal (PGM) mines
- Platinum price is near all-time lows relative to gold and at record lows relative to palladium
- Total PGM demand growth should continue due to increasingly restrictive emissions rules
- Market balance and price mismatches between palladium and platinum drives substitution
- Investment demand has surged as institutions begin to factor low price and positive fundamental outlook

Figure 1: Key auto market emissions regulations are driving higher autocatalyst PGM loadings, adding to substitution and replacement pressure

Country/Region	Regulation	Full implementation
EU	6d Temp (RDE1)	Sep-2019
	6d (RDE2)	Jan-2021
India	Bharat VI	2020
China	6a (LV)	Jan-2021
	6b (LV)	Jul-2023
	VI a (HD)	Jul-2021
USA	Tier 3	2017-2025

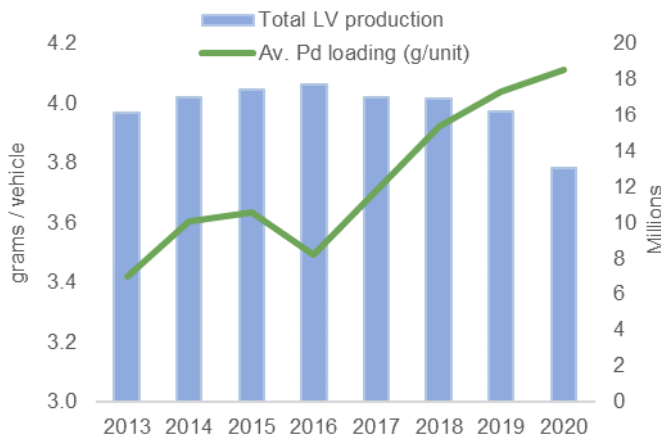
Source: Johnson Matthey, WPIC Research

Figure 3: Estimated European gasoline LV autocatalyst loadings are up by c.23% since 2018, reversing the impact of thrifting seen in previous years



Source: Johnson Matthey, ACEA, OICA, LMC Automotive, WPIC Research

Figure 5: The gradual introduction of US Tier 3 emissions regulations has seen North American gasoline LV average loadings rise by c.18% since 2016



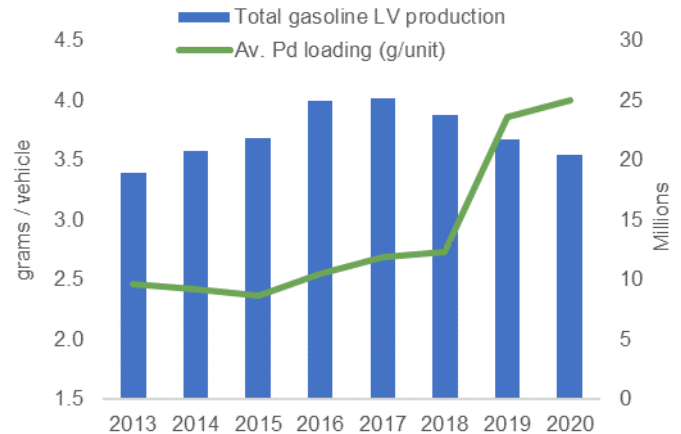
Source: Johnson Matthey, OICA, LMC Automotive, WPIC Research

Figure 2: Since 1990 PGM autocatalyst demand has risen 5.3 times while global auto sales rose 1.4 times, as tighter emissions controls have been implemented



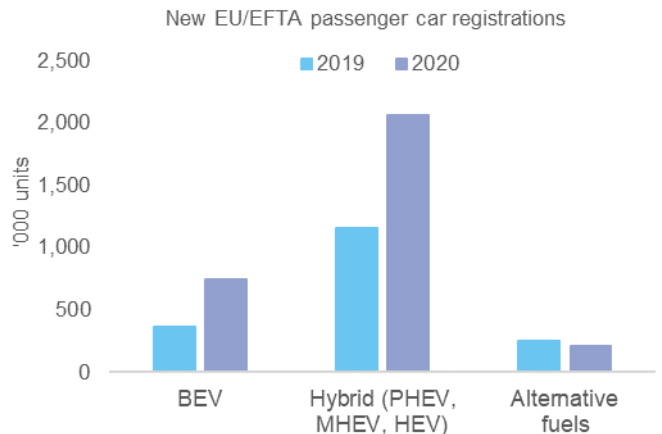
Source: Johnson Matthey, OICA, LMC Automotive, WPIC Research

Figure 4: Chinese average gasoline LV autocatalyst Pd loadings up c.47% ahead of full implementation of China 6b emissions regulations



Source: Johnson Matthey, China Auto Information.net, WPIC Research

Figure 6: Hybrid passenger cars with diesel/gasoline ICE engines continue to significantly outsell BEV in Europe, supporting PGM demand growth



Source: ACEA, WPIC Research

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