PLATINUM PERSPECTIVES

Analysing how platinum replaced palladium in diesel shows 2021 platinum demand could rise by c.100 koz

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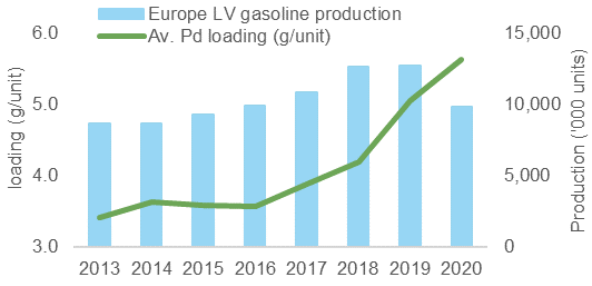
By 2012, Johnson Matthey (JM) showed that 800 koz per annum of then much cheaper palladium had replaced platinum in diesel autocatalysis. This started to reverse from 2014 as palladium had its third consecutive deficit and its cost benefit waned (*Fig. 2-4, page 2*). **Since 2017, when the palladium price exceeded that of platinum, catalyst fabricators and automakers have provided no further details regarding platinum replacing palladium in diesel cars and trucks.** We believe that platinum substituting palladium in diesel ended by 2019 (*Fig 1, page 2*) and was in some ways like recent and current substitution in gasoline. It was slow and less economically attractive for cars already in production to change catalysts. However, substitution happened far more quickly on new vehicle models, where new emissions systems were necessary to meet lower emissions limits. Here substitution could occur with almost no additional engineering, testing or certification costs.

Using published JM data only, to strip out palladium used in diesel shows (chart below left) that **gasoline palladium loadings increased by c.45% (3.9 g/car to 5.6 g/car) to meet Euro 6d in 2020.** The severe negative sentiment towards platinum, post Dieselgate in 2015, was due to the declining share of diesel cars in Europe and, from 2017, the decline in annual EU automotive platinum demand. This platinum usage decline should have been more severe, as Euro 6 loadings hardly grew as many new Euro 6 diesels continued to emit over 800 mg/km of NO_x on the road right up until September 2019. **Higher platinum demand was assumed to be reducing NO_x when it was actually replacing palladium in diesel.** By removing the platinum substituting palladium in diesel from JM Europe data, the chart below right shows minimal loadings growth. We believe this does not yet reflect the higher loadings required now, even with diesel emissions control in Europe moving almost entirely to SCR*, where higher urea dosing helps remove more NO_x. **The extreme technical challenge of reducing on-road NO_x levels from c.800 mg/km to the c.20 mg/km achieved, meant at least 20% - 40% more platinum was required** per SCR DOC** to convert more NO to NO_2, to react with the increased urea†. These higher platinum loadings, present from 2020, remain confidential to automakers and catalyst fabricators.

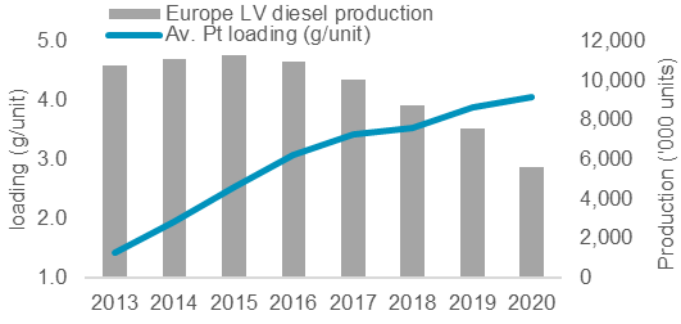
*Selective Catalytic Reduction (SCR)
**Diesel Oxidation Catalyst (DOC)
†NO_x stroage catalysts (NSC) and ammonia slip catalysts (ASC) can also be used and can increase platinum loadings

Removing palladium used in diesel from JM annual demand shows the rise in loadings to meet Euro 6d



Source: Johnson Matthey, LMC Automotive, WPIC Research

The full effect of far higher platinum loadings to meet Euro 6d could add over 100 koz per annum from 2021 onwards



Source: Johnson Matthey, LMC Automotive, WPIC Research

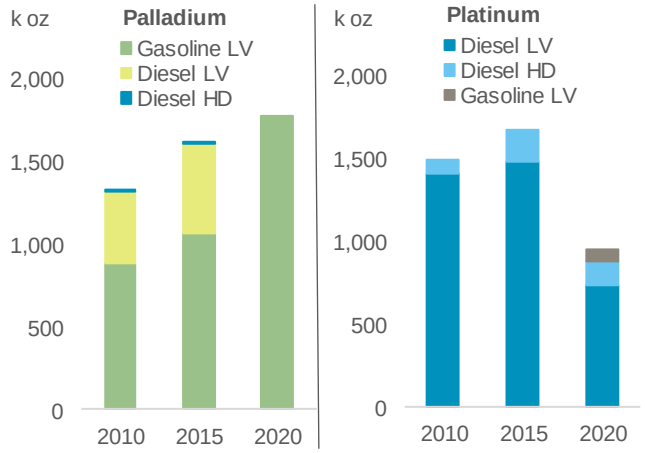
The pandemic-related fall in vehicle sales in 2020 and current platinum substitution for palladium in gasoline, has obscured diesel vehicle loadings trends. The full effect of the c.20% higher loadings per European diesel car could add over 100 koz of additional platinum demand from 2021 onwards. We expect the impact of higher diesel loadings and platinum substituting palladium in gasoline to more than counter lower platinum demand caused by vehicle microchip shortages.

Microchip shortages are projected to reduce the 2021 LV production forecast of 86m by c.1.1m. We expect substitution and higher loadings to more than compensate for this and further drive platinum automotive demand growth in 2021

Platinum's attraction as an investment asset arises from:

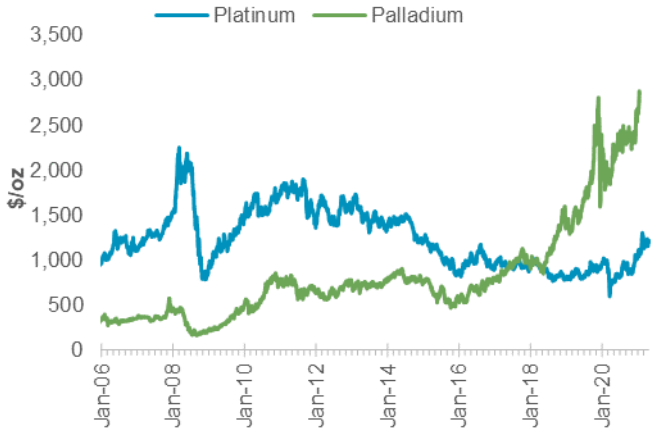
- Supply is relatively constrained with limited investment in platinum group metal (PGM) mine expansion
- Platinum price is near all-time lows relative to gold and at record lows relative to palladium
- Total PGM demand growth should continue due to increasingly restrictive emissions rules
- Market balance 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: Over 30% of European automotive palladium demand was used in diesel catalysts. We believe this volume was fully substituted by 2019



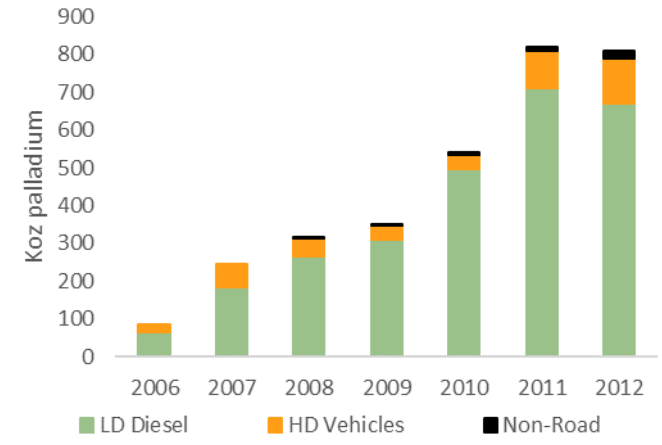
Source: Johnson Matthey palladium and platinum data, WPIC Research

Figure 2: Palladium discounts to platinum between 2007 and 2011 drove palladium use in diesel. Since 2017, platinum's discount pressured the reversal



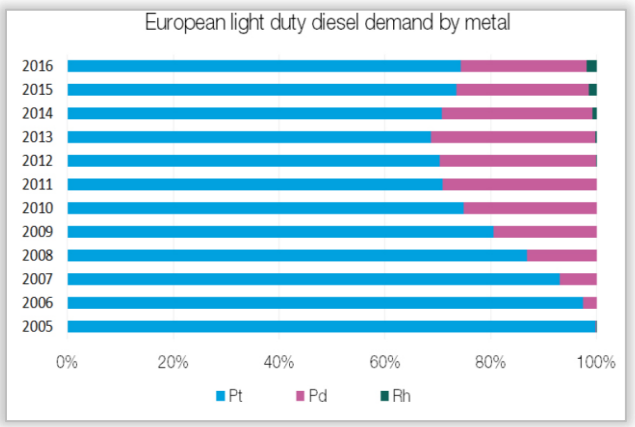
Source: Bloomberg, WPIC Research Note – Prices as of 23rd April 2021

Figure 3: Palladium use in diesel catalyst systems globally rose from c.250 koz in 2007 to over 800 koz in 2011



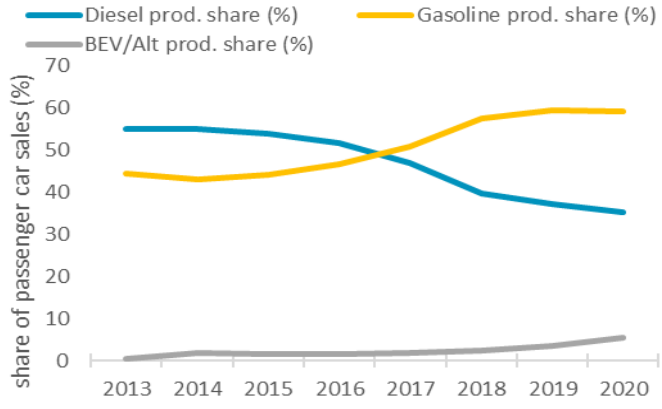
Source: Johnson Matthey, WPIC Research

Figure 4: Johnson Matthey published analysis of LV Diesel catalyst metal content ratios showing palladium's diesel loading share peaked in 2013, then declined



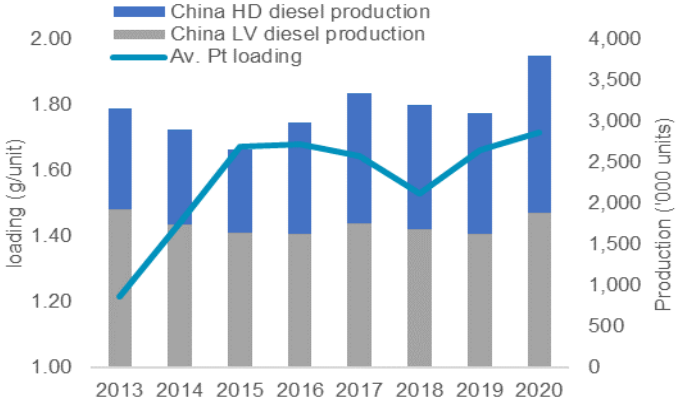
Source: Johnson Matthey Annual Review, November 2016, page 22

Figure 5: The Impact of Pt-Pd substitution in European LV production has been masked by Dieselgate effect on diesel vehicle demand



Source: OICA, LMC Automotive, KBA, SMMT, ANFIA, ANFAC, CCFA, WPIC Research

Figure 6: China average platinum loadings have risen by over 40% from 2013, as tightening emissions legislation has driven higher loadings



Source: ChinaAutoInformation.net, Johnson Matthey, WPIC Research

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