



MARKET SPOTLIGHT

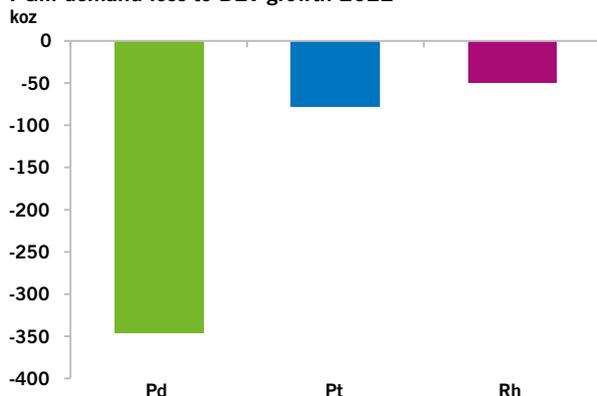
Despite auto sector challenges, palladium market is tight

In general, internal combustion engine (ICE) vehicles have been hit harder than battery electric vehicles (BEVs) by the semiconductor chip shortage this year, as customer demand for BEVs continued growing throughout the pandemic. Consequently, automakers did not cancel chip orders for their BEV models, but they did cancel chip orders for their ICEs, so they lost out on chip manufacturing capacity when diesel and gasoline sales started to recover towards the end of 2020. There is some overlap between BEVs and ICEs in their chip requirements, but there are some unique and higher-value chip designs for BEVs, making BEVs more of a priority for chipmakers to manufacture under current conditions.

Automakers' CO₂ emissions targets could also favour production of BEVs over ICEs this year and next. While automakers are making every effort to produce vehicles which maximise their margins (which currently tend to be their most highly profitable ICE models), they must also ensure that CO₂ emissions targets are met to avoid paying large fines, which is expected to favour BEVs. Stellantis, the largest light-vehicle brand in Europe, recently announced it intends to prioritise the manufacturing of its BEVs over ICE models while chip availability remains constrained.

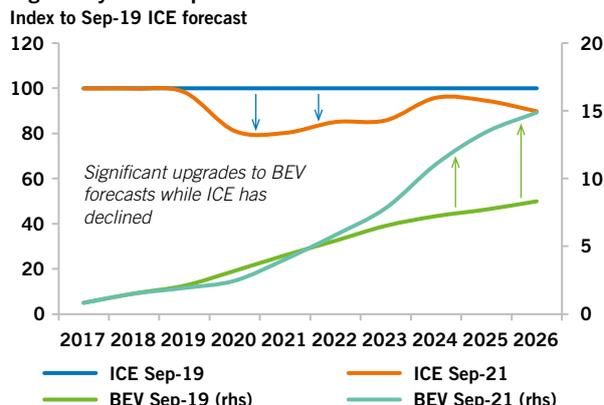
Increasing BEV penetration could remove close to 0.5 moz of PGM demand next year. The outlook for BEV production has been consistently revised up (even during the pandemic), while for ICEs it has been downgraded. By 2022, the BEV production forecast is now 20% higher than the forecast from 2019. This is mainly at the expense of ICE output, which is predicted to be around 14% lower in 2022 than earlier projections indicated. Next year, BEV penetration is forecast to remove an estimated 350 koz of palladium, 50 koz of rhodium and 80 koz of platinum from PGM demand growth.

PGM demand loss to BEV growth 2022



Source: SFA (Oxford), LMC Automotive. Note: Light-duty vehicle refers to passenger cars, pick-up trucks, SUVs and light commercial vehicles.

Light duty vehicle production forecast



However, if palladium recycling does not grow as expected or if there is any shortfall from Nornickel expansion plans, particularly if there is a period of pent-up automotive demand in a couple of years, then the palladium market could be tighter than anticipated. Over the long term, there may be a risk associated with BEV production forecasts arising from constrained battery material supply. Project supply is expected to keep up with predicted BEV output until 2026, but thereafter a potential divergence emerges between what demand is forecast and what supply can keep up with. **From a PGM perspective, such a potential shortfall in supply, potentially lithium, could then perpetuate some palladium demand in gasoline autocatalysts, if those BEVs not produced due to materials shortages are instead replaced by ICE-based cars (mainly gasoline hybrids).**



PRECIOUS METALS REVIEW

79 Au Gold

	Close	Weekly change	High	Date	Low	Date
\$/oz	1,768	0.55%	1,801	14/10/2021	1,750	11/10/2021
€/oz	1,525	0.35%	1,552	14/10/2021	1,514	11/10/2021

Stagflation fears boosted gold last week. The gold price rallied above \$1,800/oz last week, a bullish move after the metal's recent period of weakness, as stagflation concerns mount. Stagflation refers to a period of slow economic growth and relatively high unemployment, accompanied by rising prices (inflation). US inflation data published last week showed headline consumer prices rose by 5.4% year-on-year in September, marking the fifth

consecutive month of annual increases of 5% or more. A 0.4% month-on-month rise also surpassed market expectations. Historically, gold has performed well during periods of stagflation, and is likely to benefit from an increasingly negative real interest rate environment. The price pulled back after the midweek rally and closed the week flat as dollar strength remains a headwind for gold.

47 Ag Silver

	Close	Weekly change	High	Date	Low	Date
\$/oz	23.31	2.38%	23.59	15/10/2021	22.35	12/10/2021
€/oz	20.11	2.18%	20.33	14/10/2021	19.37	12/10/2021

The Covid-19 pandemic has accelerated R&D into the use of silver for antibacterial purposes. Silver-based biocides are widely used in a variety of medical applications owing to its antimicrobial properties which can kill bacteria and prevent infection. Current silver demand from the silver antimicrobial coating market, which includes medical devices, textiles and wound dressings among others, accounts for an estimated 10 moz annually. While this is

small in comparison to silver's overall industrial market (~500 moz), demand for silver-based antimicrobial coatings is expected to have witnessed strong growth over the past 18 months, and into the future, owing to the Covid-19 pandemic. Gold's price gain as US inflation exceeded expectations again in September allowed silver to move higher last week and managed to outperform.

78 Pt Platinum

	Close	Weekly change	High	Date	Low	Date
\$/oz	1,059	3.15%	1,065	14/10/2021	1,005	12/10/2021
€/oz	913	2.99%	918	14/10/2021	870	12/10/2021

South Africa eyes its role in the hydrogen economy. The South African government, in partnership with Anglo American Platinum, fuel cell company Bambili Energy, and energy group Engie SA, has completed a feasibility study for the development of a hydrogen valley in South Africa. Based on the potential for hydrogen demand and production, including access to renewable energy and PGMs, three key regions (Johannesburg, Durban and Mogalakwena/Limpopo) will now host pilot projects across the mobility, industrial and construction sectors. PEM electrolyzers using platinum catalysts are expected to

be the foundation for the development of a global green hydrogen economy, gradually replacing today's carbon-intensive hydrogen with a net zero carbon hydrogen fuel infrastructure. While electrolyzers are currently one of the smaller uses of platinum in the hydrogen economy (relative to fuel cells or industrial applications) at just 1% of demand last year, there is significant growth forecast over the next few years. By 2024, electrolyzers are predicted to account for 14% of hydrogen platinum demand at ~16 koz.



PRECIOUS METALS REVIEW

⁴⁶Pd Palladium

	Close	Weekly change	High	Date	Low	Date
\$/oz	2,081	0.22%	2,208	14/10/2021	2,038	12/10/2021
€/oz	1,794	0.04%	1,900	14/10/2021	1,770	12/10/2021

Palladium to benefit from price-induced substitution away from rhodium in some industrial applications. Industrial palladium demand is estimated to be 1.6 moz this year, an upward revision of ~160 koz from earlier forecasts owing to higher chemical catalyst requirements in China and Western Europe. Chemical demand for palladium is set to reach a record high this year from price-induced substitution away from rhodium in nitric acid catalyst gauzes. Overall industrial demand is still projected to continue on a downward trend over the next

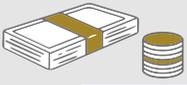
few years, but at a slightly slower rate than previously forecast. Industrial uses account for around 17% of overall palladium demand annually, but ongoing thrifting (using less metal) and substitution away from precious metals in some applications are expected to see the market share gradually decline in the medium term. The palladium price held above \$2,000/oz last week, but the fundamental outlook for 2021 has deteriorated so gains should be viewed with caution.

⁴⁵Rh ⁴⁴Ru ⁷⁷Ir Rhodium, Ruthenium, Iridium

	Rhodium	Ruthenium	Iridium
Reporting week	\$15,550/oz	\$670/oz	\$4,850/oz
Previous week	\$15,350/oz	\$670/oz	\$5,050/oz

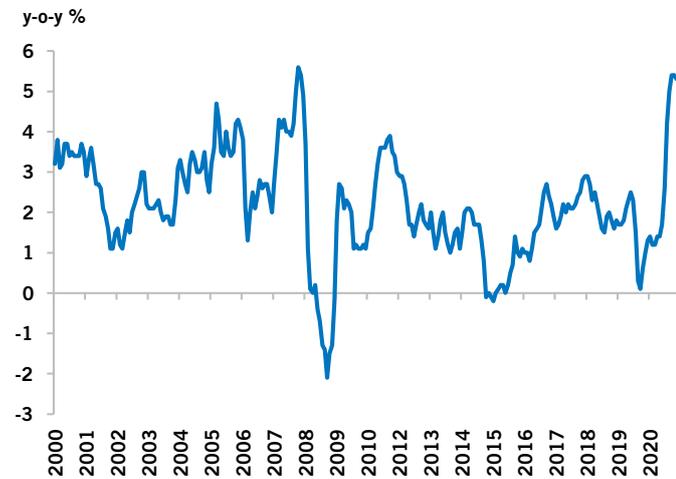
High rhodium prices are pushing industrial end-users to cut metal requirements. While the rhodium price has slipped from the record highs of >\$30,000/oz earlier in the year, it is still high by historical standards and the Rh:Pt and Rh:Pd price ratios remain elevated. As a result, some nitric acid producers and glass manufacturers are reducing the rhodium content of their products, either with palladium (nitric acid) or platinum (glass).

As a result, industrial rhodium demand forecasts have been revised down by 24 koz to an estimated 120 koz. However, owing to rhodium's superiority for catalyst durability and reaction efficiency, the scope for further substitution in these particular end-uses is limited. The rhodium price edged up 1.5% last week, while iridium slipped below \$5,000/oz for the first time since February as metal availability improves.



TRENDS AND INVESTMENTS

US consumer price index (CPI)



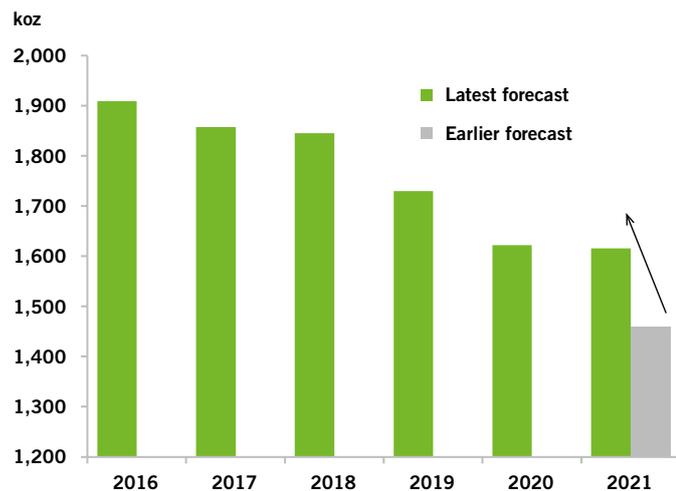
Source: SFA (Oxford), Bloomberg

Rhodium: palladium ratio



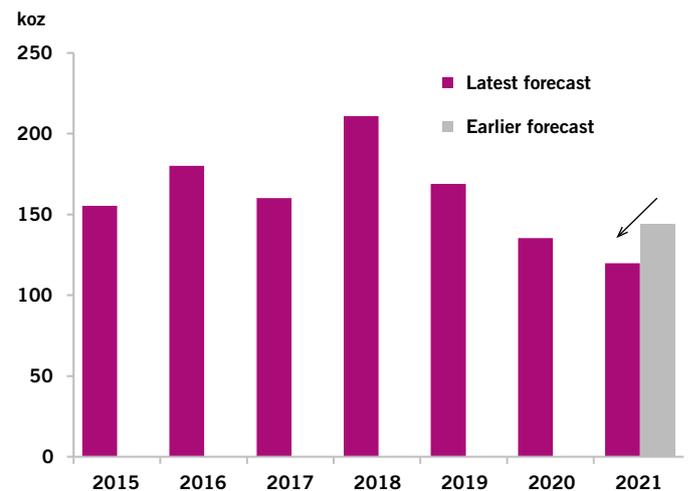
Source: SFA (Oxford), Heraeus

Industrial palladium demand



Source: SFA (Oxford)

Industrial rhodium demand



Source: SFA (Oxford)

Heraeus Precious Metals

Europe, Middle East, Africa & other regions

Phone: +49 6181 35 2750

edelmetallhandel@heraeus.com

South East Asia

Phone: +852 2773 1733

tradinghk@heraeus.com

www.herae.us/trading-market-report

Heraeus Precious Metals imprint can be found [here](#)

United States of America

Phone: +1 212 752 2180

tradingny@heraeus.com

China

Phone: +86 21 3357 5658

tradingsh@heraeus.com

The **HERAEUS PRECIOUS APPRAISAL** produced in collaboration with:

SFA (Oxford) Ltd

United Kingdom

Phone: +44 1865 784366

www.sfa-oxford.com



The Oxford Science Park, Oxford,
United Kingdom, OX4 4GA

DISCLAIMER

This document is being supplied to the recipient only, on the basis that the recipient is reasonably believed to be a professional market participant in the precious metals market. It is directed exclusively at entrepreneurs and especially not intended for the use of consumers. The material contained in this document has no regard to the specific investment objectives, financial situation or particular need of any specific recipient or organisation. It is not provided as part of a contractual relationship. It is not and should not be construed as an offer to sell or the solicitation of an offer to purchase or subscribe for any investment or as advice on the merits of making any investment. This report has been compiled using information obtained from sources that Heraeus and SFA (Oxford) Ltd ("SFA") believe to be reliable but which they have not independently verified. Further, the analysis and opinions set out in this document, including any forward-looking statements, constitute a judgment as of the date of the document and are subject to change without notice. There is no assurance that any forward-looking statements will materialize. Therefore,

neither SFA nor Heraeus warrants the accuracy and completeness of the data and analysis contained in this document. Heraeus and SFA assume no liability for any losses or damages of whatsoever kind, resulting from whatever cause, through the use of or reliance on any information contained in this document. However, in so far as a liability claim exists under German law, Heraeus and SFA shall have unlimited liability for willful or grossly negligent breach of duty. Unless expressly permitted by law, no part of this document may be reproduced or distributed in any manner without written permission of Heraeus. Heraeus specifically prohibits the redistribution of this document, via the internet or otherwise, to non-professional or private investors and neither Heraeus nor SFA accepts any liability whatsoever for the actions of third parties in reliance on this document. Prices quoted are interbank (offer) prices for gold, silver, platinum and palladium. Rhodium, ruthenium and iridium quotes reflect the Heraeus offer price at the time of writing.