

PRECIOUS APPRAISAL

No. 5
21st February 2022



MARKET SPOTLIGHT

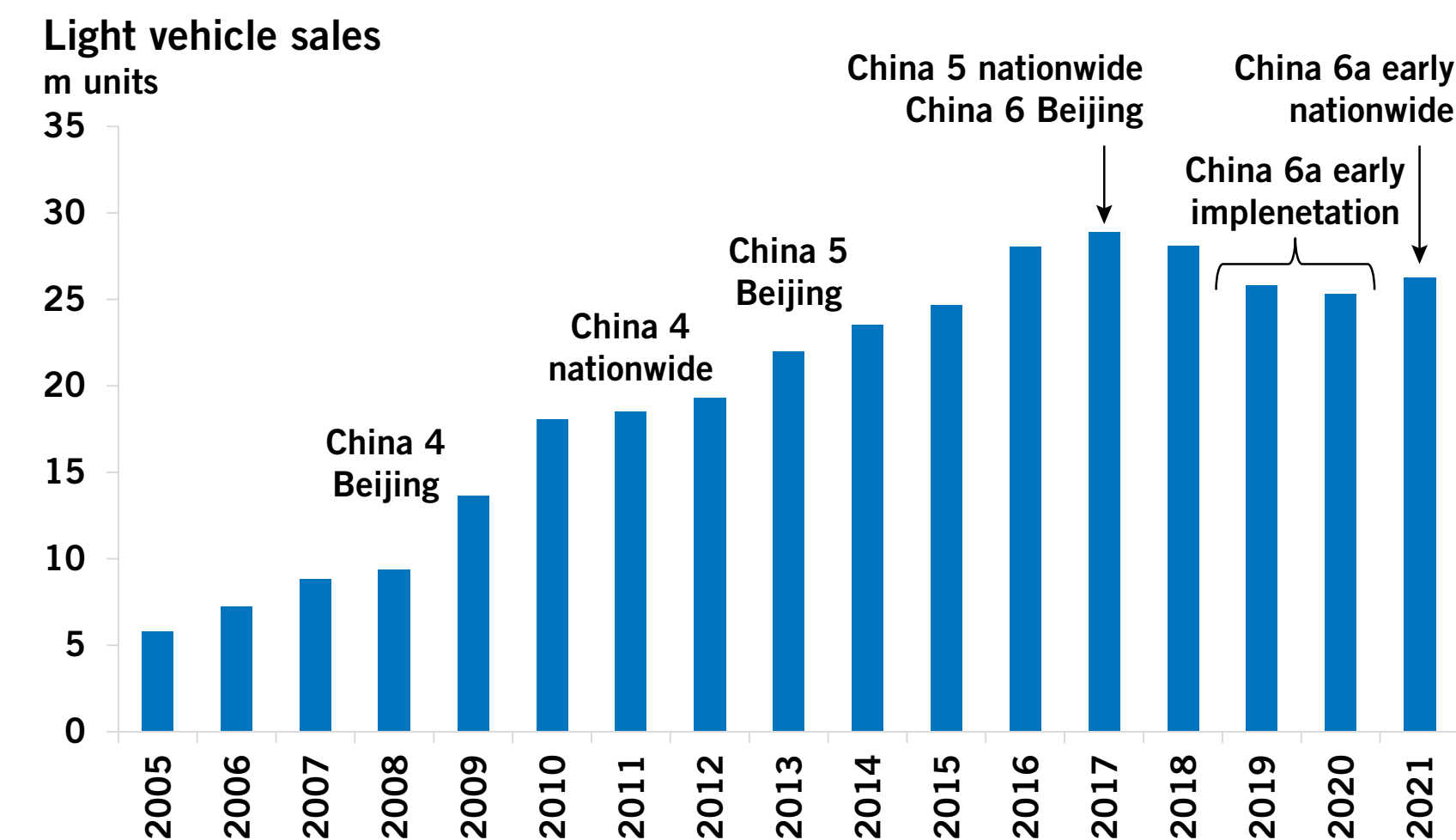
Recycling in China is piling up

The potential for PGM recycling from autocatalysts is considerable in China as increasing numbers of vehicles will be scrapped in the coming years. Heraeus and BASF are forming a joint venture company in China to offer a world-class recycling solution for precious metals. The JV company will enable the circular economy through recycling spent catalysts, including autocatalysts, with the recovered metals used to make new products. Recycling has a much lower CO2 footprint than mining and would reduce China’s reliance on imports. China currently uses around 3 moz of palladium p.a. for automotive and other industrial catalysts, the majority of which is imported.

China has been the largest light-vehicle market since 2009, when sales exceeded 10 million units for the first time. Since then, sales in the country have grown to well over 25 million units, with a peak of almost 29 million in 2017 and over 26 million last year. The rapid rise in car sales has meant that the numbers of vehicles on the road has also been rising dramatically to around 300 million. With a typical life of around 10 years, increasing numbers of those vehicles are now reaching the end of their lives and being scrapped.

Chinese emissions regulations have caught up to developed market levels with the introduction of China 6. This means that metal loadings on autocatalysts have increased significantly in the last 10 years. Beijing and other major cities tended to introduce the new standards first, with a nationwide rollout following later. China 5 was introduced in Beijing in 2013 and nationwide from 2017, the same year that Beijing moved to China 6. China 6a now applies nationwide and the move to real world emissions testing in China 6b is scheduled for 2023. This is likely to increase catalyst loadings further.

Secondary palladium supply could rise rapidly. Light vehicles in China are mostly gasoline and the catalysts predominantly contain palladium, with small amounts of platinum and rhodium. At present, mostly China 4 and older vehicles are being scrapped, but increasingly China 5 vehicles will be scrapped in the coming years. The amount of palladium recovered is expected to rise rapidly to more than 0.5 moz by 2025 and could be more than double that in the long term. Rhodium loadings were relatively low until the introduction of China 6, but even so the amount of rhodium recovered could increase by several tens of thousand ounces in the next few years.



Source: SFA (Oxford), China Automotive Information Net

PRECIOUS APPRAISAL

21st February 2022

01 MARKET SPOTLIGHT

02 GOLD

03 SILVER

04 PLATINUM

05 PALLADIUM

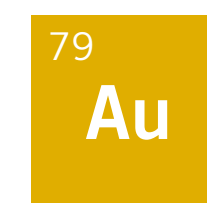
06 RHODIUM, RUTHENIUM, IRIDIUM

07 TRENDS AND INVESTMENTS

08 ABOUT HERAEUS

PRECIOUS METALS REVIEW

Gold



	CLOSE	WEEKLY CHANGE	HIGH	DATE	LOW	DATE
\$/oz	1,896	3.23%	1,902	18/02/2022	1,845	15/02/2022
€/oz	1,674	3.95%	1,675	18/02/2022	1,625	15/02/2022

Inflation and the Ukraine crisis boost the gold price. Gold ended the week higher, but failed to hold above \$1,900/oz. Traders had been awaiting publication of the minutes of the Federal Open Market Committee's last meeting. When these were published on Wednesday, they revealed a cautious attitude towards taking measures to deal with inflation. With no immediate signs that the Federal Reserve was looking to bring forward its plans to end asset purchases and start to increase interest rates in March, the dollar weakened, stimulating both equities and gold. The gold price was further strengthened by growing concern that Russian troop movements on its border with Ukraine and reports of military activity in Ukraine's eastern provinces were signals of an imminent invasion by Russian forces.

Gold jewellery demand was strong during the Chinese New Year period. The Shanghai Gold Association reported that gold jewellery consumption in Shanghai reached RMB1.1 bn over the New Year holiday during the first week of February. This was 12% higher than in 2021. Travel restrictions due to sporadic outbreaks of Covid-19 are thought to have contributed to some of the additional purchasing. From July 2021, the average gold price spread between Shanghai and London increased, reaching \$12 in December before falling back to \$6.30 in January, indicating rising physical demand as the New Year approached and while the gold price was relatively soft.

PRECIOUS APPRAISAL

21st February 2022

01 MARKET SPOTLIGHT

02 GOLD

03 SILVER

04 PLATINUM

05 PALLADIUM

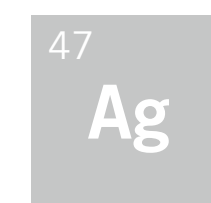
06 RHODIUM, RUTHENIUM, IRIDIUM

07 TRENDS AND INVESTMENTS

08 ABOUT HERAEUS

PRECIOUS METALS REVIEW

Silver



	CLOSE	WEEKLY CHANGE	HIGH	DATE	LOW	DATE
\$/oz	23.94	2.82%	24.09	18/02/2022	23.08	15/02/2022
€/oz	21.14	3.52%	21.21	18/02/2022	20.36	15/02/2022

Coeur Mining met its output guidance for 2021, but only just. The company increased its output by 6% quarter-on-quarter to 2.6 moz in Q4'21. This resulted in total production of 10.1 moz for the year, falling within last year's guidance of 9.7-12.15 moz. Guidance for 2022 is slightly less optimistic at 9-11 moz, as planned mill maintenance and declining grades affect its operations in Mexico and the US. Coeur's most productive asset in 2021, the Palmarejo Mine in Chihuahua, Mexico, produced 6.8 moz or approximately 4% of the country's total silver output.

The silver price edged higher last week, but underperformed gold. With geopolitical uncertainty still swirling around the situation in Ukraine, gold has been the preferred safe haven.

PRECIOUS APPRAISAL

21st February 2022

01 MARKET SPOTLIGHT

02 GOLD

03 SILVER

04 PLATINUM

05 PALLADIUM

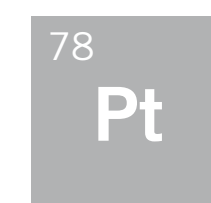
06 RHODIUM, RUTHENIUM, IRIDIUM

07 TRENDS AND INVESTMENTS

08 ABOUT HERAEUS

PRECIOUS METALS REVIEW

Platinum



	CLOSE	WEEKLY CHANGE	HIGH	DATE	LOW	DATE
\$/oz	1,074	5.16%	1,100	18/02/2022	1,009	15/02/2022
€/oz	948	5.86%	968	18/02/2022	889	15/02/2022

Prospects for platinum industry consolidation in South Africa advance. Royal Bafokeng Platinum (RBP) has recommended that shareholders accept a mandatory buyout offer from Impala Platinum. This was triggered in December 2021 after Impala built a 35% shareholding in RBP. Northam Platinum has also acquired about a third of RBP's shares. The attraction of RBP lies in the high-grade and comparatively shallow platinum and base metal-rich Merensky Reef ore reserves in South Africa. While the acquisition is unlikely to change the level of platinum production in South Africa in the short term, RBP's contiguity to the Impala Lease Area would offer mining efficiencies and a low cost base, giving flexibility to adjust production.

Platinum price breaks out of its recent trading range. The continuing tensions between Russia and the West over Ukraine stimulated safe-haven buying of platinum last week, causing the price to break through resistance around \$1,050/oz but it failed to push above \$1,100/oz.

PRECIOUS APPRAISAL

21st February 2022

01 MARKET SPOTLIGHT

02 GOLD

03 SILVER

04 PLATINUM

05 **PALLADIUM**

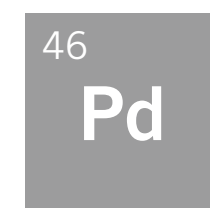
06 RHODIUM, RUTHENIUM, IRIDIUM

07 TRENDS AND INVESTMENTS

08 ABOUT HERAEUS

PRECIOUS METALS REVIEW

Palladium



	CLOSE	WEEKLY CHANGE	HIGH	DATE	LOW	DATE
\$/oz	2,318	5.16%	2,424	17/02/2022	2,191	15/02/2022
€/oz	2,041	5.86%	2,108	14/02/2022	1,931	15/02/2022

Rapid growth in electric vehicles has not dented palladium. Global EV sales reached 6.75 million units in 2021, 108% more than in the pandemic-affected year 2020, according to The Electric Vehicle World Sales Database. Comprising passenger vehicles, light trucks and light commercial vehicles, the global share of EVs (BEVs & PHEVs) in global light-vehicle sales was 8.3% compared to 4.2% in 2020. BEVs accounted for 71% of total EV sales and PHEVs, which have autocatalysts, represented the other 29%. Even with the continued growth in BEV sales forecast this year, and the chip shortage still holding back production to some extent, palladium demand is predicted to increase by 8% and exceed 10 moz. The palladium price is likely to remain firm amid the tensions around Ukraine.

A new emissions waiver for California would add momentum to EV sales. The US federal Environmental Protection Agency (EPA) is expected to reissue a waiver to California allowing the state to apply emissions rules that are more stringent than federal standards, a privilege withdrawn under the Trump administration. The California Air Resources Board is in the process of developing regulations that would accelerate the transition to zero emission vehicles and strengthen CO₂ emission standards for new light-duty cars and trucks sold in the state. Federal fuel-efficiency standards are already under review and a final ruling from the EPA on tighter vehicle greenhouse gas emissions is awaited. With its waiver reinstated, California would almost certainly apply stricter regulations to the nation's largest automobile market. This could put further pressure on sales of internal combustion engine vehicles and long-term demand for palladium. Last year, light-vehicle sales in California were almost 1.9 million (12% of US total) and 9.5% were BEVs (source: California New Car Dealers Association).

PRECIOUS APPRAISAL

21st February 2022

01 MARKET SPOTLIGHT

02 GOLD

03 SILVER

04 PLATINUM

05 PALLADIUM

06 **RHODIUM, RUTHENIUM, IRIDIUM**

07 TRENDS AND INVESTMENTS

08 ABOUT HERAEUS

PRECIOUS METALS REVIEW

Rhodium, Ruthenium, Iridium



	RHODIUM	RUTHENIUM	IRIDIUM
Reporting Week	\$19,550/oz	\$575/oz	\$4,200/oz
Previous Week	\$19,700/oz	\$575/oz	\$4,200/oz

Currently, a few thousand ounces of iridium are used in proton exchange membrane (PEM) electrolyzers. Conventional PEM electrolyzers use iridium, which is a highly effective catalyst, because it can withstand the harsh acidic environment in an electrolyser, remaining active over a period of many years. However, iridium is the smallest PGM market at around 250 koz p.a. To enable the use of PEM electrolyzers to increase along with the growth envisaged for the hydrogen economy in the long term, the amount of iridium used per MW will need to be reduced. Researchers continue to look at base metal catalysts, such as cobalt oxides, which can be active for the required reaction but corrode quickly, or manganese oxides, which are more durable but less active. However, much more work will be needed to match iridium's properties. The rhodium price dipped slightly last week, while iridium and ruthenium prices were flat.

PRECIOUS APPRAISAL

21st February 2022

- 01 MARKET SPOTLIGHT
- 02 GOLD
- 03 SILVER
- 04 PLATINUM
- 05 PALLADIUM
- 06 RHODIUM, RUTHENIUM, IRIIDIUM
- 07 **TRENDS AND INVESTMENTS**
- 08 ABOUT HERAEUS

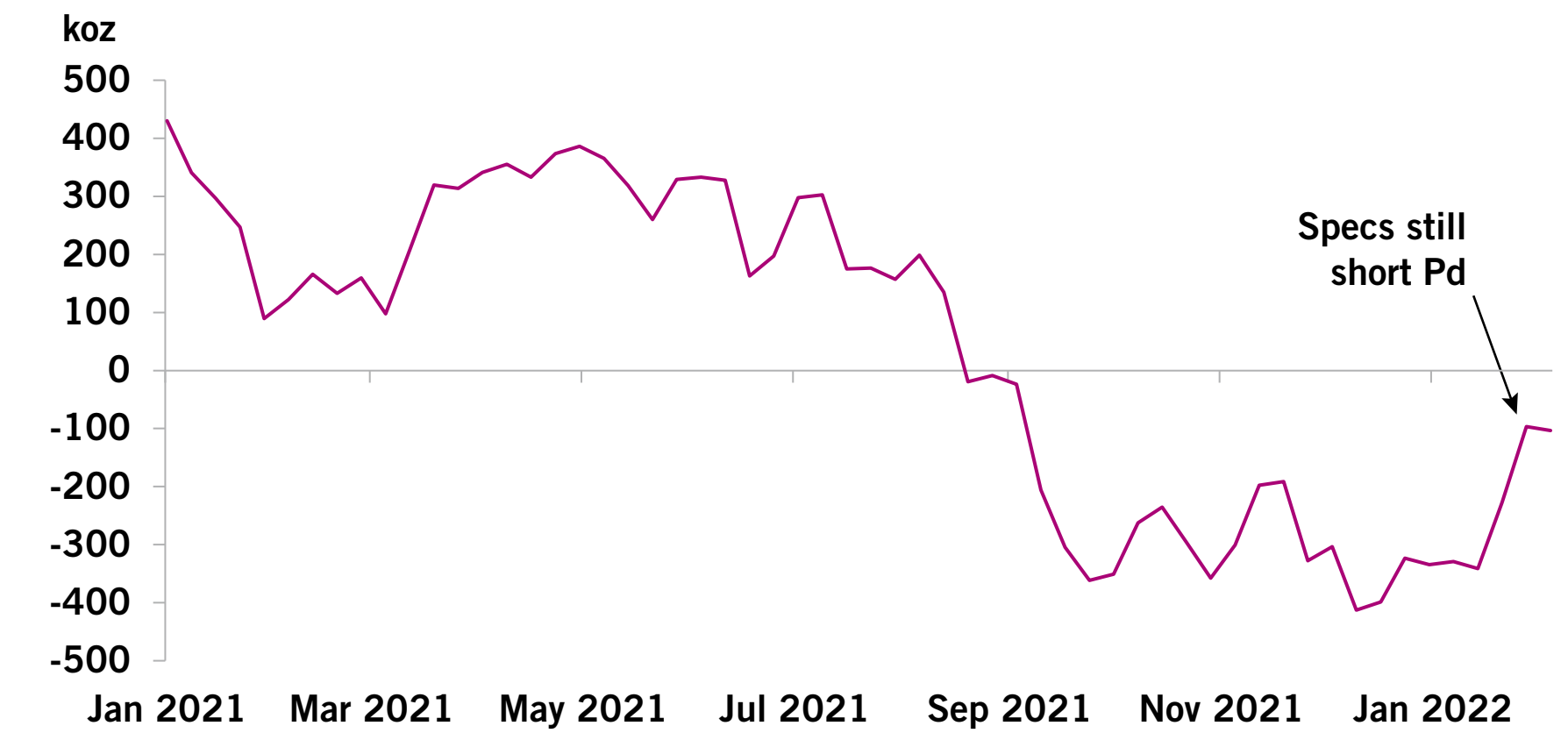
TRENDS AND INVESTMENTS

Palladium price



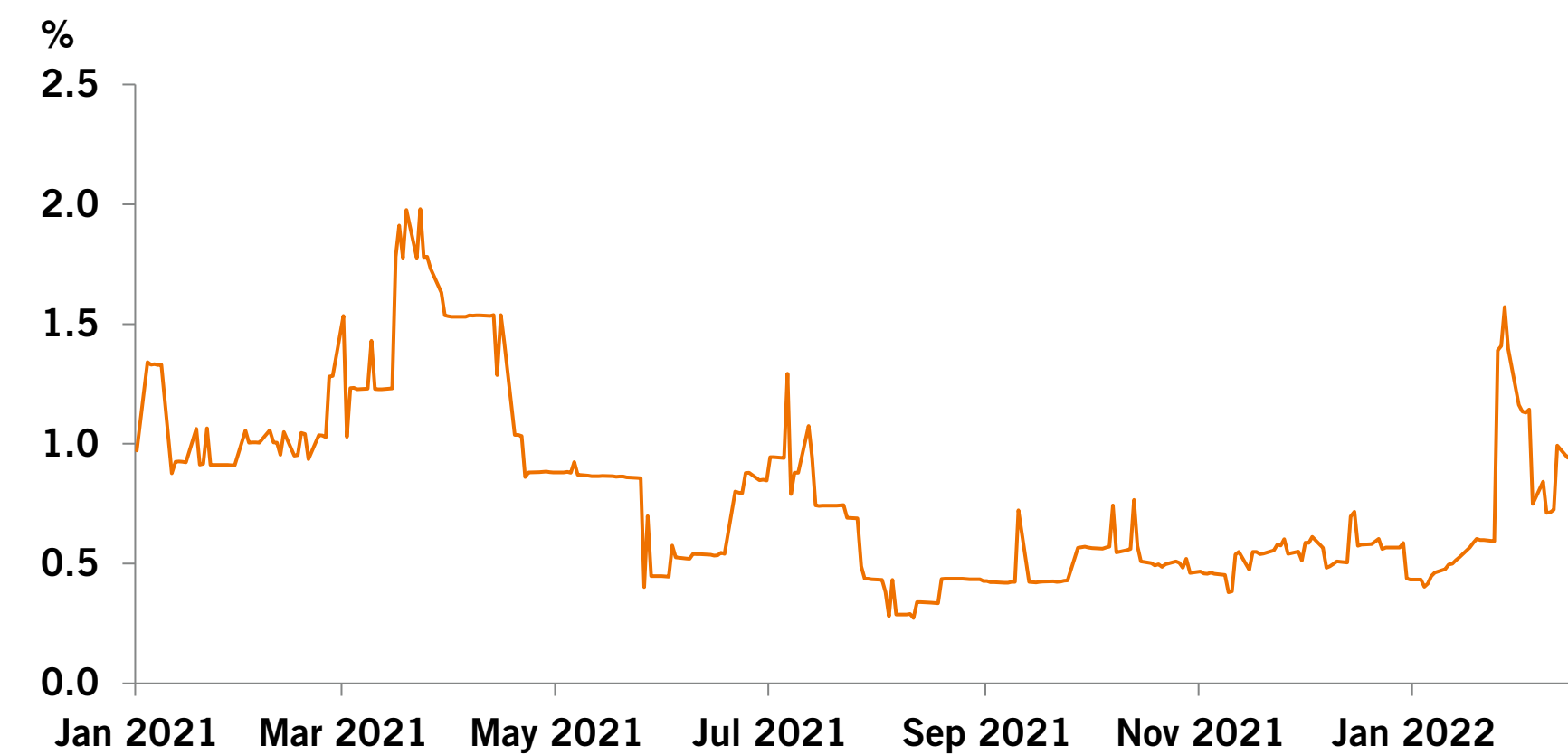
Source: SFA (Oxford), Bloomberg

Speculators net position in Pd



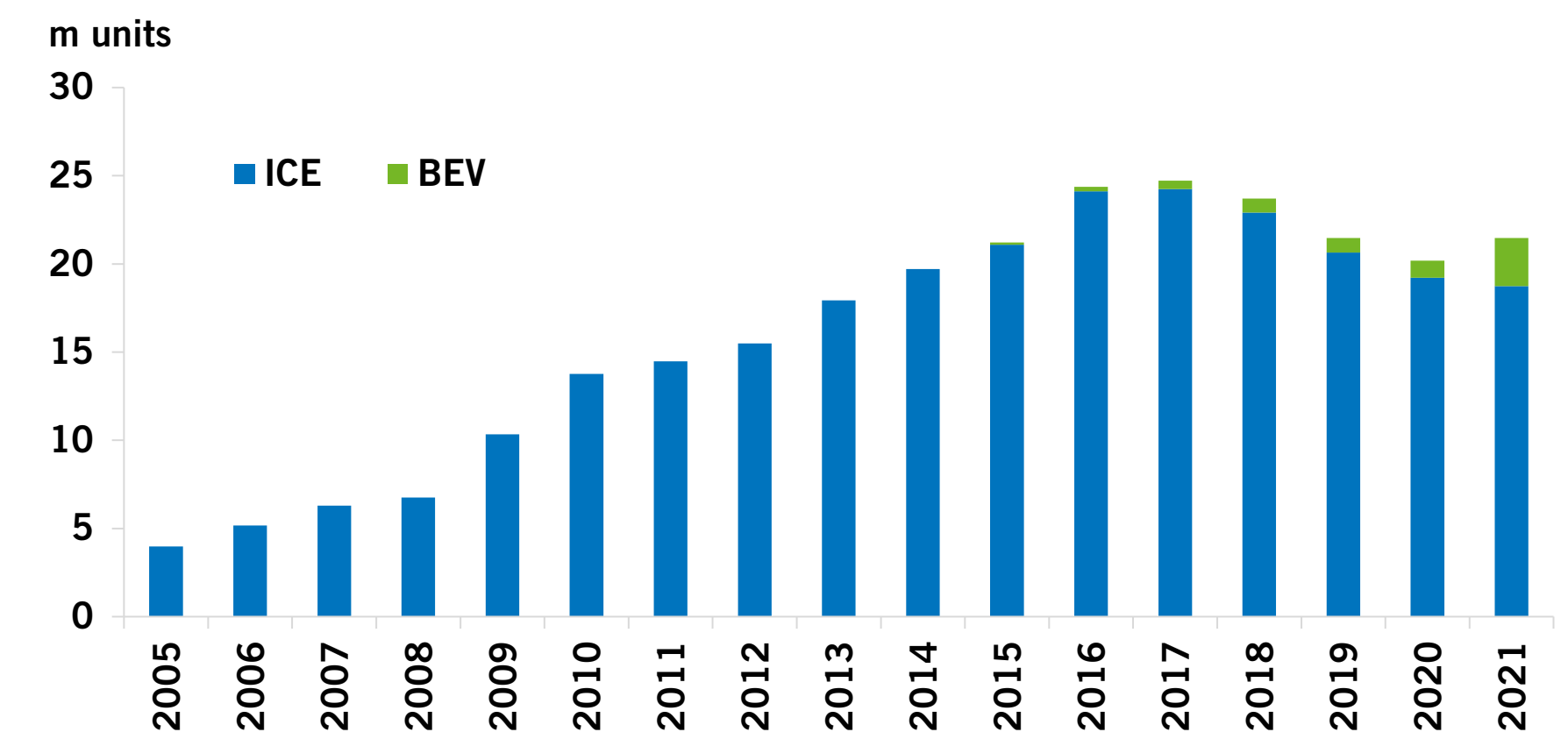
Source: SFA (Oxford), Bloomberg

Palladium lease rate indicator



Source: SFA (Oxford), Bloomberg

Chinese car sales



Source: SFA (Oxford), Bloomberg, China Automotive Information Net

PRECIOUS APPRAISAL

14th February 2022

- 01 MARKET SPOTLIGHT
- 02 GOLD
- 03 SILVER
- 04 PLATINUM
- 05 PALLADIUM
- 06 RHODIUM, RUTHENIUM, IRIIDIUM
- 07 TRENDS AND INVESTMENTS
- 08 **ABOUT HERAEUS**

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