



Johnson Matthey  
Inspiring science, enhancing life

## Palladium and rhodium in an electrified world

---

IPMI European conference November 2022

Dr Stewart Brown – Market Research Manager – Johnson Matthey PLC

## CONFIDENTIALITY

**The information and materials contained within this presentation are confidential and must not be replicated or redistributed under any circumstances without the prior written consent of Johnson Matthey Market Research.**

**For further information on the assumptions behind these slides, please contact Johnson Matthey Market Research.**

## DISCLAIMER

Johnson Matthey PLC endeavours to ensure the accuracy of the information and materials contained within this presentation, but makes no warranty as to accuracy, completeness or suitability for any particular purpose. Johnson Matthey PLC accepts no liability whatsoever in respect of reliance placed by the user on information and materials contained in this presentation, which are utilised expressly at the user's own risk. In particular, this presentation and the information and materials in this presentation are not, and should not be construed as, an offer to buy or sell or solicitation of an offer to buy or sell, any regulated precious metal related products or any other regulated products, securities or investments, or making any recommendation or providing any investment or other advice with respect to the purchase, sale or other disposition of, any regulated precious metal related products or any other regulated products, securities or investments including, without limitation, any advice to the effect that any precious metal related transaction is appropriate or suitable for any investment objective or financial situation of a prospective investor. A decision to invest in any regulated precious metal related products or any other regulated products, securities or investments should not be made in reliance on any of the information or materials in this presentation. Before making any investment decision, prospective investors should seek advice from their financial, legal, tax and accounting advisers, take into account their individual financial needs and circumstances and carefully consider the risks associated with such investment decision. This presentation does not, and should not be construed as acting to, sponsor, advocate, endorse or promote any regulated precious metal related products or any other regulated products, securities or investments.

# Johnson Matthey PMM Market Research

- Team of analysts dedicated to analysis of the pgm markets
- Deep insight into end-use product applications and markets, primary supply and recycling, and what this means for future market balances
- Short & long term analysis for internal and customer strategic planning
- JM has published reports on the PGM markets since 1985
- Next Pgm Market Report to be published May 2023



<http://www.platinum.matthey.com/services/market-research/pgm-market-report>

# Summary

- **The energy transition will result in major shifts in the Platinum Group Metal (PGM) markets:**
  - ❖ Demand for auto emissions catalysts will decline over the longer term.
  - ❖ Demand for PGM in hydrogen economy, other clean energy and sustainability applications to increase.
- This opens up **new development opportunities for palladium and rhodium.**
- Despite increasing uptake in fuel cells, opportunities also remain for further development in **platinum.**



# Why specifically palladium and rhodium?

## Price

- Prices are high by historical standards
- But could fall in future as traditional uses of these metals decrease

## Availability

- Current demand exceeds supply
- This is likely to reverse in future

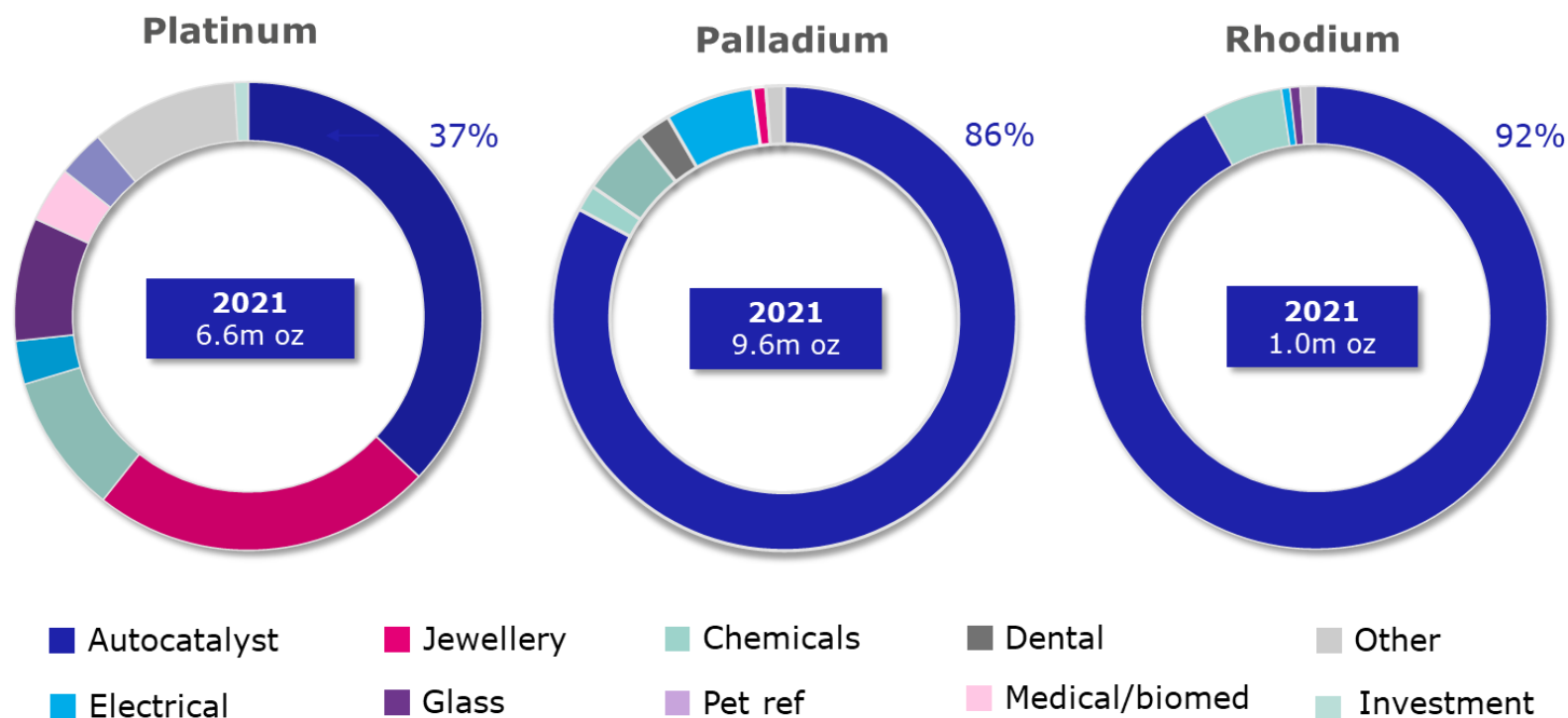
## Market structure

- The energy transition will disrupt traditional markets and will lead to structurally imbalanced metal markets – particularly for mining by-products such as Pd and Rh.
- But it also brings opportunities, with new requirements for advanced materials and catalysts



# Autocatalyst demand dominates Pd & Rh demand, less so Pt

## Gross demand by sector

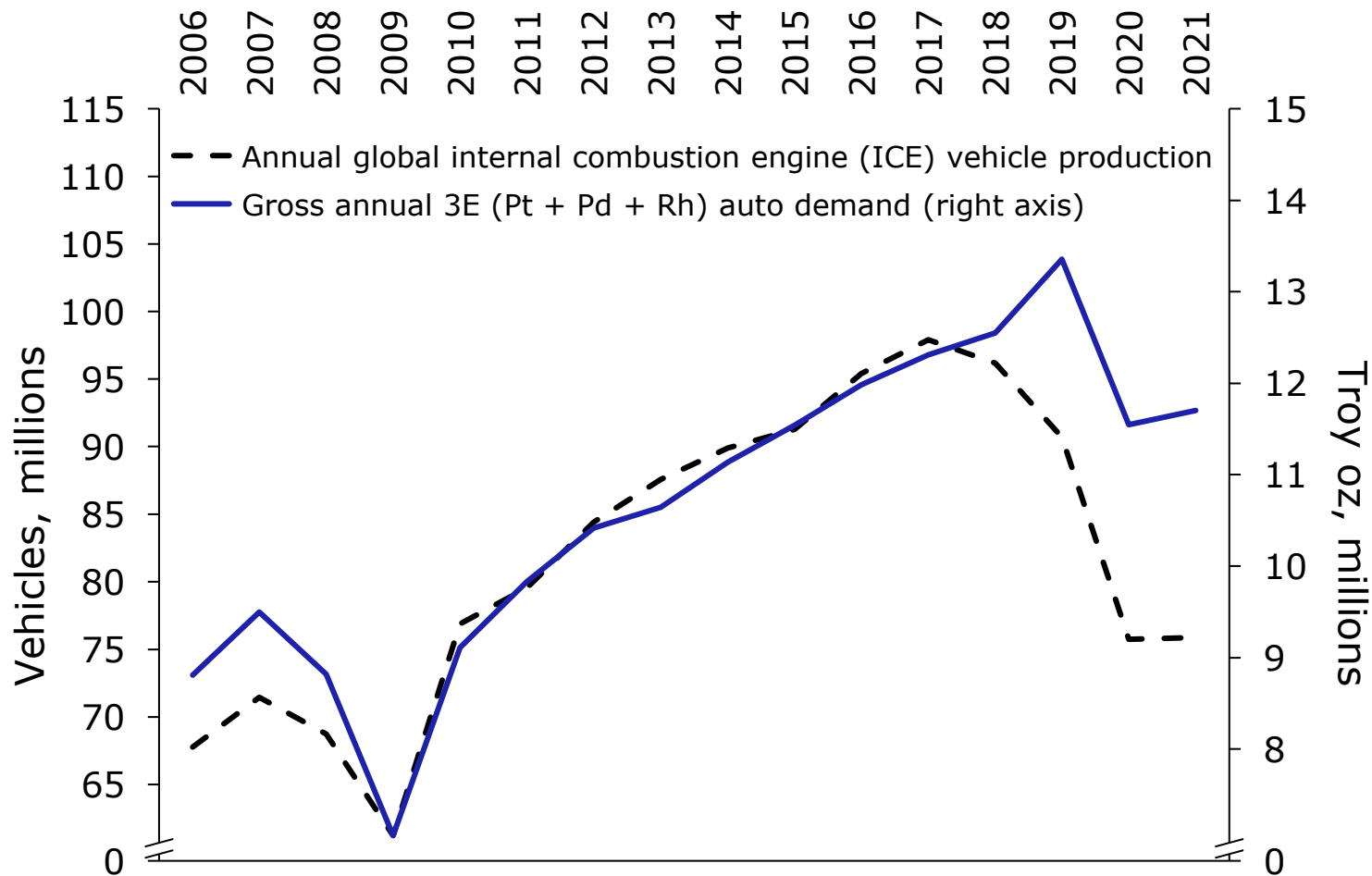


The vast majority of palladium and rhodium supplied to the market is used in **emissions control catalysts** for gasoline and diesel fuelled vehicles.

Platinum is also used in these catalysts but has a more diverse market, with widespread use in various industries (including **fuel cells**), and a substantial, price-elastic **jewellery** market.

**Zero emissions vehicles** (battery electric and fuel cell electric vehicles) do not require pgm emissions control.

# The automotive market has to date driven pgm demand



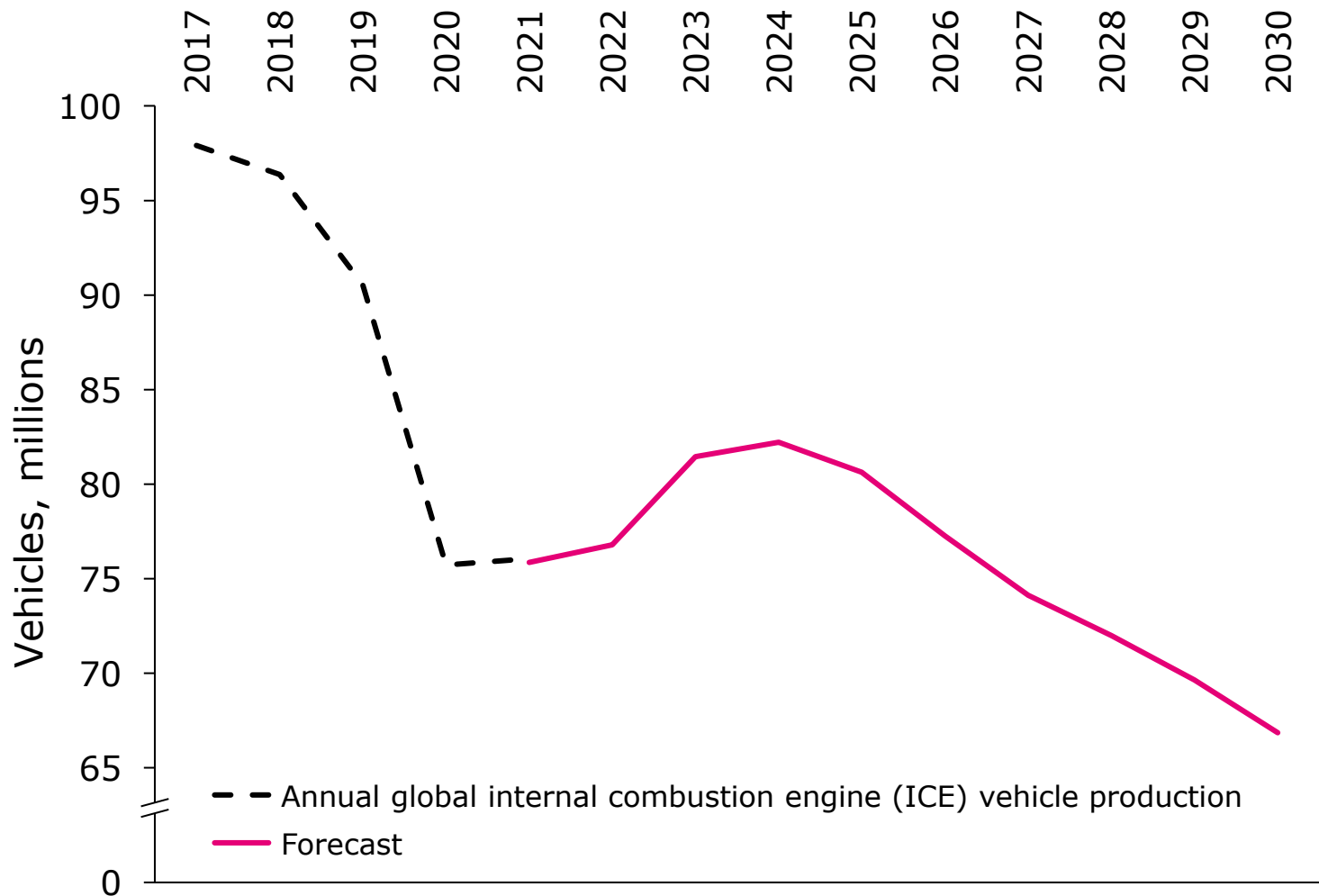
Vehicle numbers based on LMC Automotive (light vehicles) and LMC /KGP (commercial vehicles), April 2022 data  
ICE vehicles include hybrids with gasoline or diesel engines. Also includes CNG & flex fuel vehicles.

Use of pgm in automotive emissions catalysts increased by nearly **90%** between 2009 and 2019, tracking growing production of vehicles with internal combustion engines.

Recently, with **increasingly stringent vehicle emissions regulations**, pgm consumption has trended above vehicle production growth.

This growth has mainly impacted **palladium** and **rhodium**.

## This major Pd & Rh market is set to turn to decline



Vehicle numbers based on LMC/S&P Global Mobility (light vehicles) and LMC Automotive/KGP (commercial vehicles), April 2022

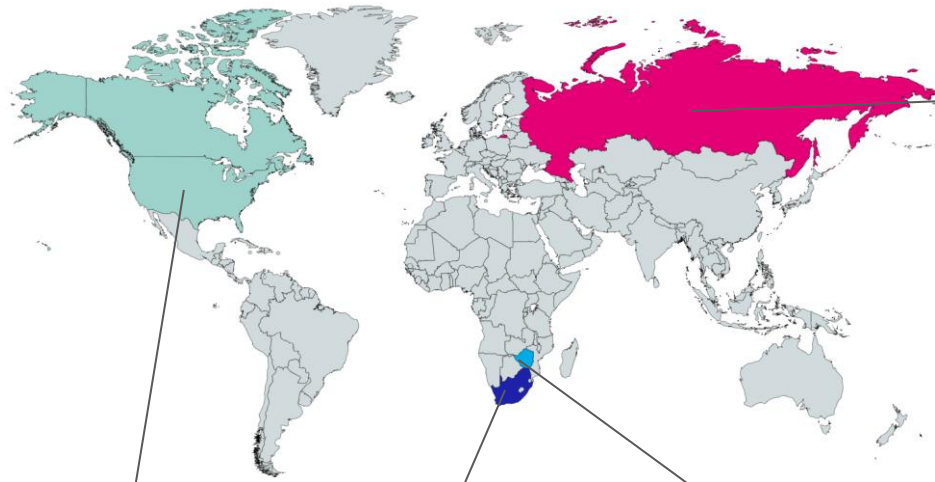
There is **significant uncertainty** regarding the future of the vehicle market, with wide variation in available forecasts.

As in the forecast shown here, in the near term, production of vehicles with internal combustion engines (ICE) is widely expected to stage a post-Covid recovery.

However, annual production of ICE vehicles will return to decline in the mid 2020s as **fully electric vehicles take increasing market share.**



# Mined supply of palladium & rhodium is relatively inelastic

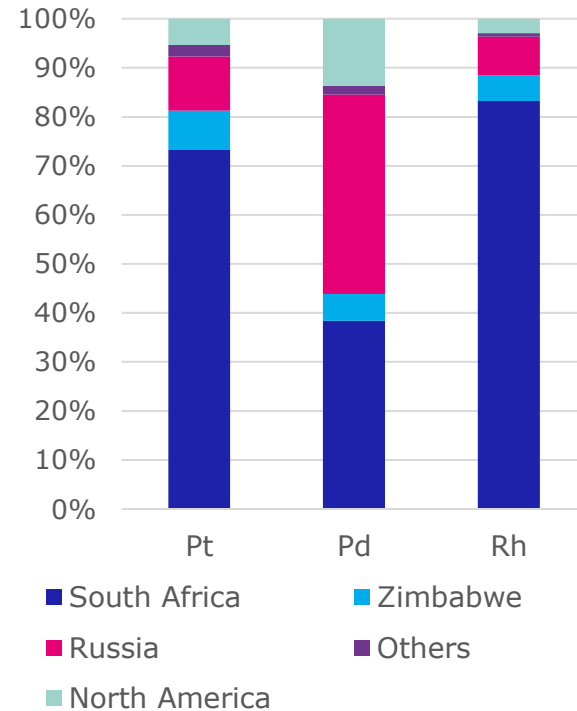


**Russia**  
 11% of global Pt  
**41% of global Pd**  
 8% of global Rh

**North America**  
 5% of global Pt  
 14% of global Pd  
 3% of global Rh

**Zimbabwe**  
 8% of global Pt  
 5% of global Pd  
 5% of global Rh

**South Africa**  
**73% of global Pt**  
 38% of global Pd  
**83% of global Rh**



As mining **by-products** or **co-products**, palladium\* & rhodium have inelastic supply.

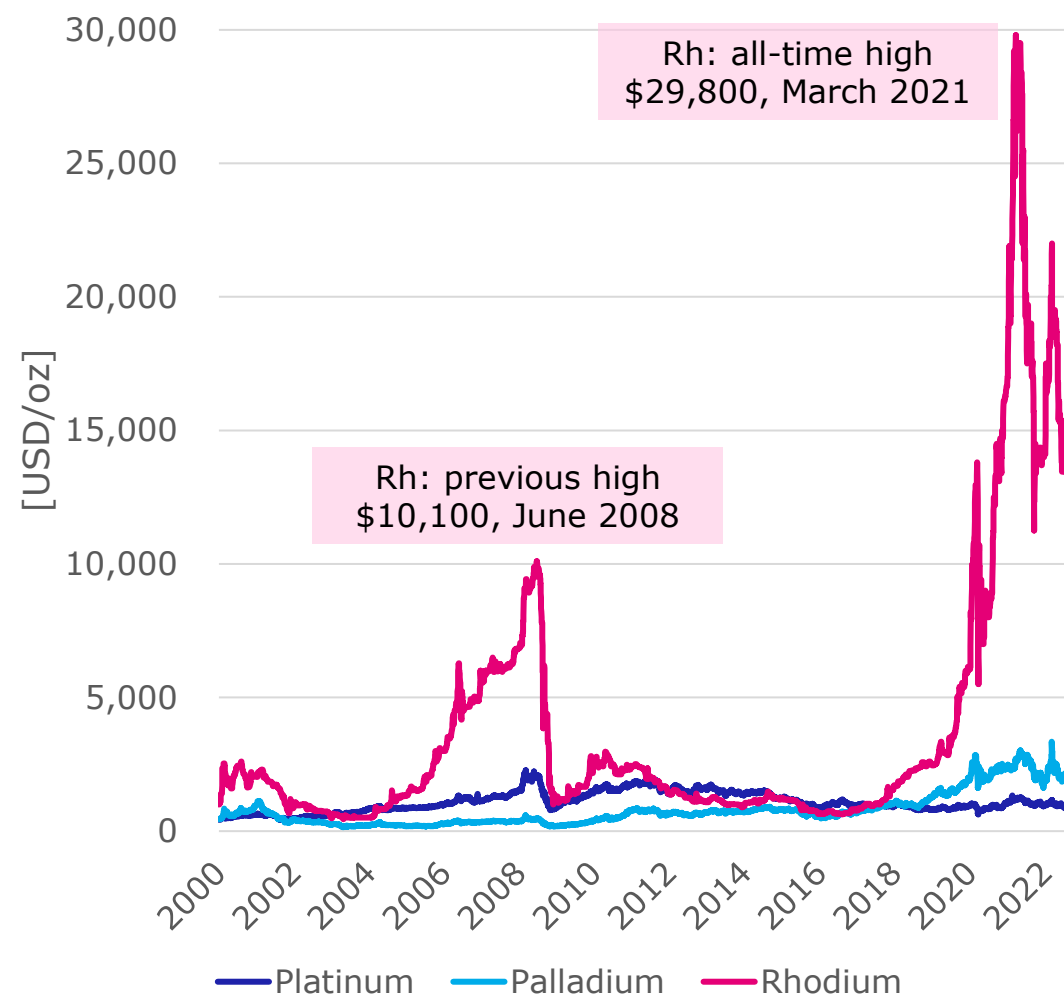
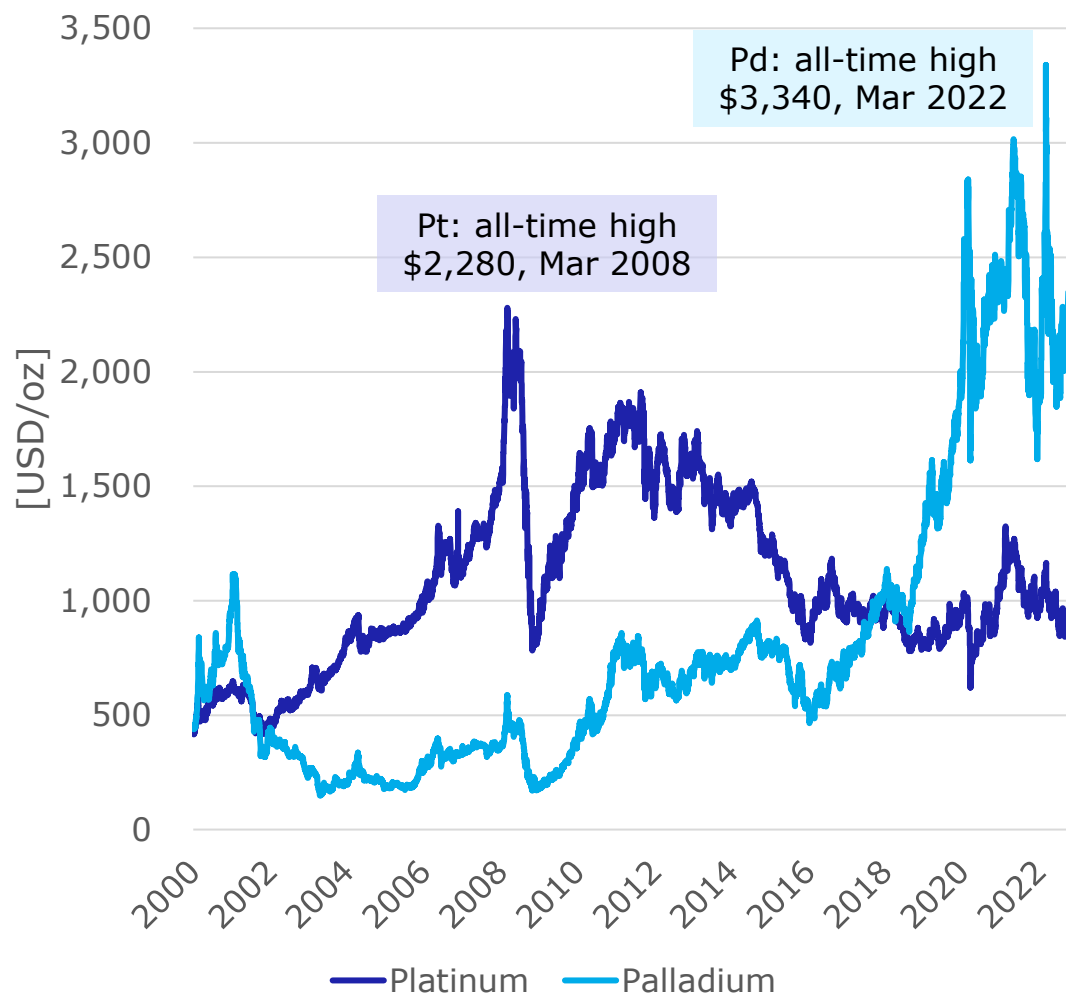
Historically, mine production of these metals has not **significantly reacted** to supply shortfalls or excesses.

Output of these metals is mainly dictated by output of **platinum** in Southern Africa and **nickel** in Russia.

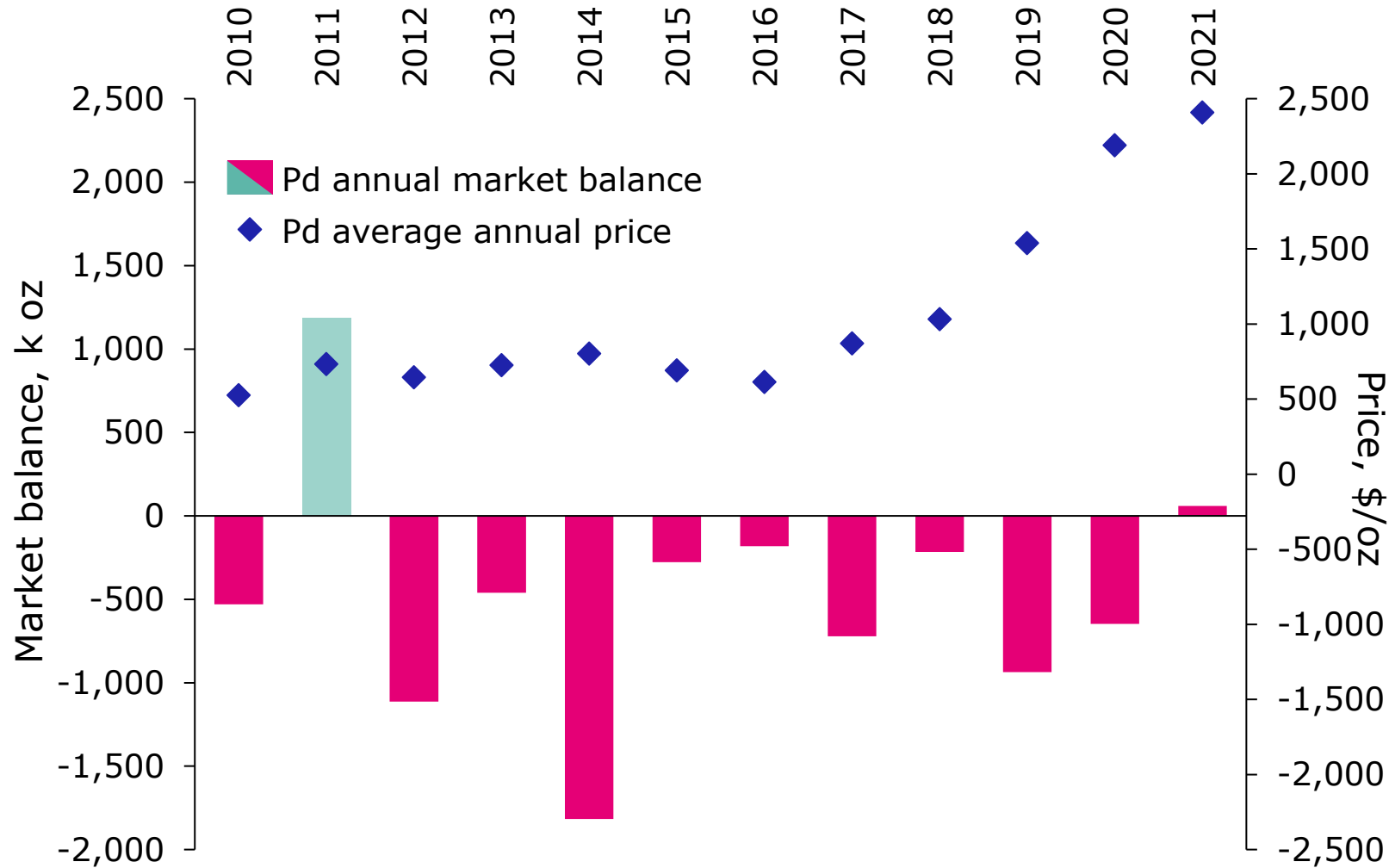
\* A small amount of palladium is mined as a primary product in North America.

# Auto demand has driven Pd & Rh price strength

## Some supply-side factors also at play



# A persistent market deficit has led to historically high Pd price



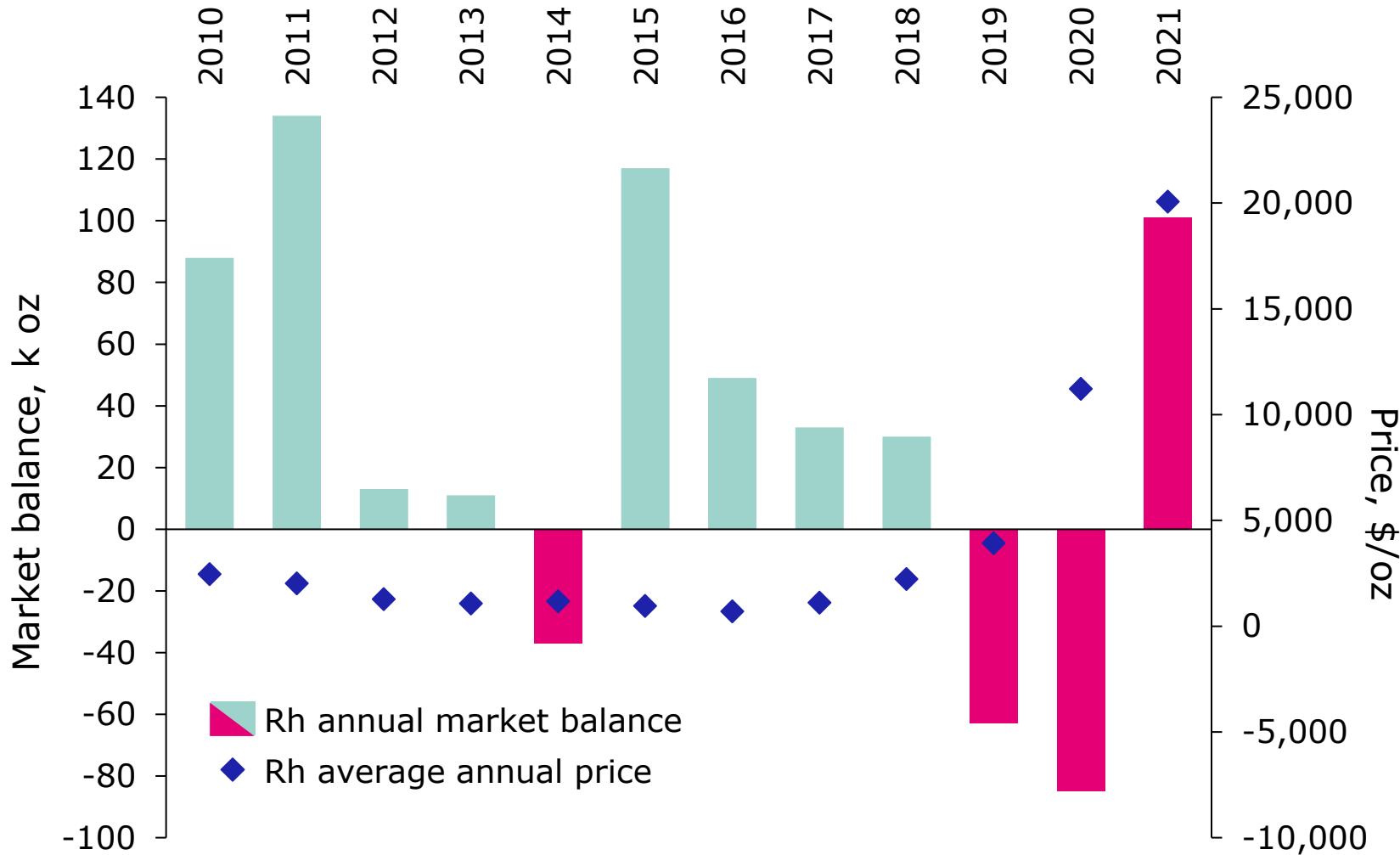
Between 2002 and 2018, Pd price never exceeded \$1,000/oz.

Since 2012, the palladium market has been in deficit (annual shortfall), due to growing auto demand.

Substantial market stocks, built up over previous years of surplus, filled the deficit and moderated price response for some years.

Price started moving higher as these stocks were drawn down.

# A recent, deepening deficit has led to record high Rh price



In the last decade, Rh price has typically remained well below \$5,000/oz, at times below \$1,000/oz.

Since 2019, driven by growing auto demand, the Rh market has moved into a deepening deficit (shortfall).

With limited market stocks available, this has translated into substantial upward price pressure, exacerbated by intermittent mine supply interruptions.

# In future, the imbalance for Pd and Rh is likely to revert to surplus



Automotive emissions control requirements are set to decrease with growing uptake of fully electric vehicles



Mined supplies will be supported by ongoing strong platinum and nickel production, and supply of recycled metal could increase



**Declining ICE vehicle production** will ultimately translate into lower Pd and Rh use.

In the absence of **new demand areas**, consumption of these metals will decline into the longer term.

We do not expect Pd and Rh **supplies** to match this decline – they could even increase.

This is likely to result in a return to previously 'typical' market conditions for these metals – that is, **persistent surpluses and much lower prices** than today.

# The future for palladium and rhodium?



**Emerging market:**  
Hydrogen economy



**Emerging market:**  
Alternative fuels &  
chemicals



**Alternative catalysts:** Potential  
for base metal  
replacement



**Future Tech:**  
Photocatalysis,  
batteries, CO2  
chemistry?

# Conclusion

- **The energy transition will result in major shifts in the Platinum Group Metal (PGM) markets:**
  - ❖ Demand for auto emissions catalysts will decline over the longer term.
  - ❖ Demand for PGM in hydrogen economy, other clean energy and sustainability applications to increase.
- This opens up **new development opportunities for palladium and rhodium.**



A woman with long, wavy brown hair, wearing a bright yellow sweater and blue jeans, stands on a metal balcony with a railing. She is looking out over a vast, deep fjord with turquoise water, surrounded by steep, forested mountains. The scene is captured from behind her, emphasizing the expansive natural beauty.

JM

Johnson Matthey  
Inspiring science, enhancing life