



## Aligning tomorrow's demand with the PGM supply basket

COO, Richard Stewart

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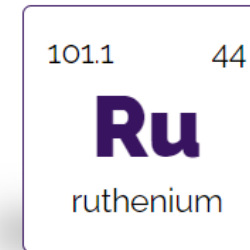
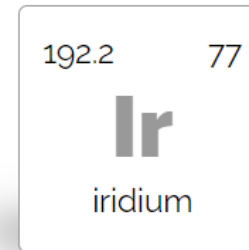
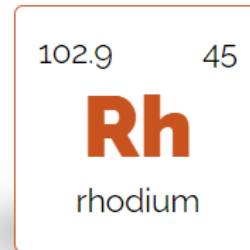
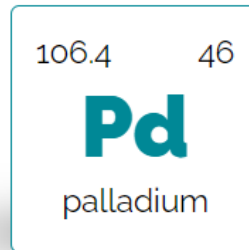
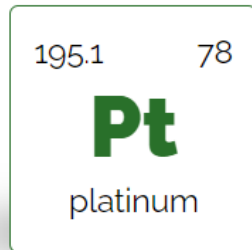
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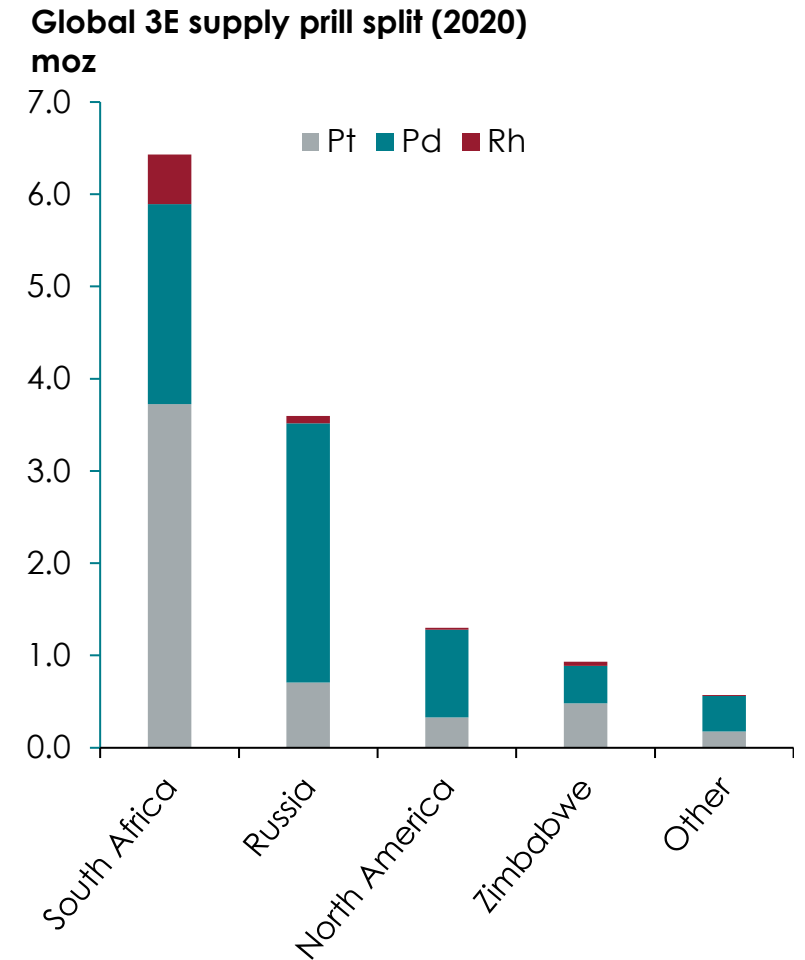
*“It all starts and ends in the market...”*

Barry Davison, 2015



## Three simple facts about PGMs that drive the market

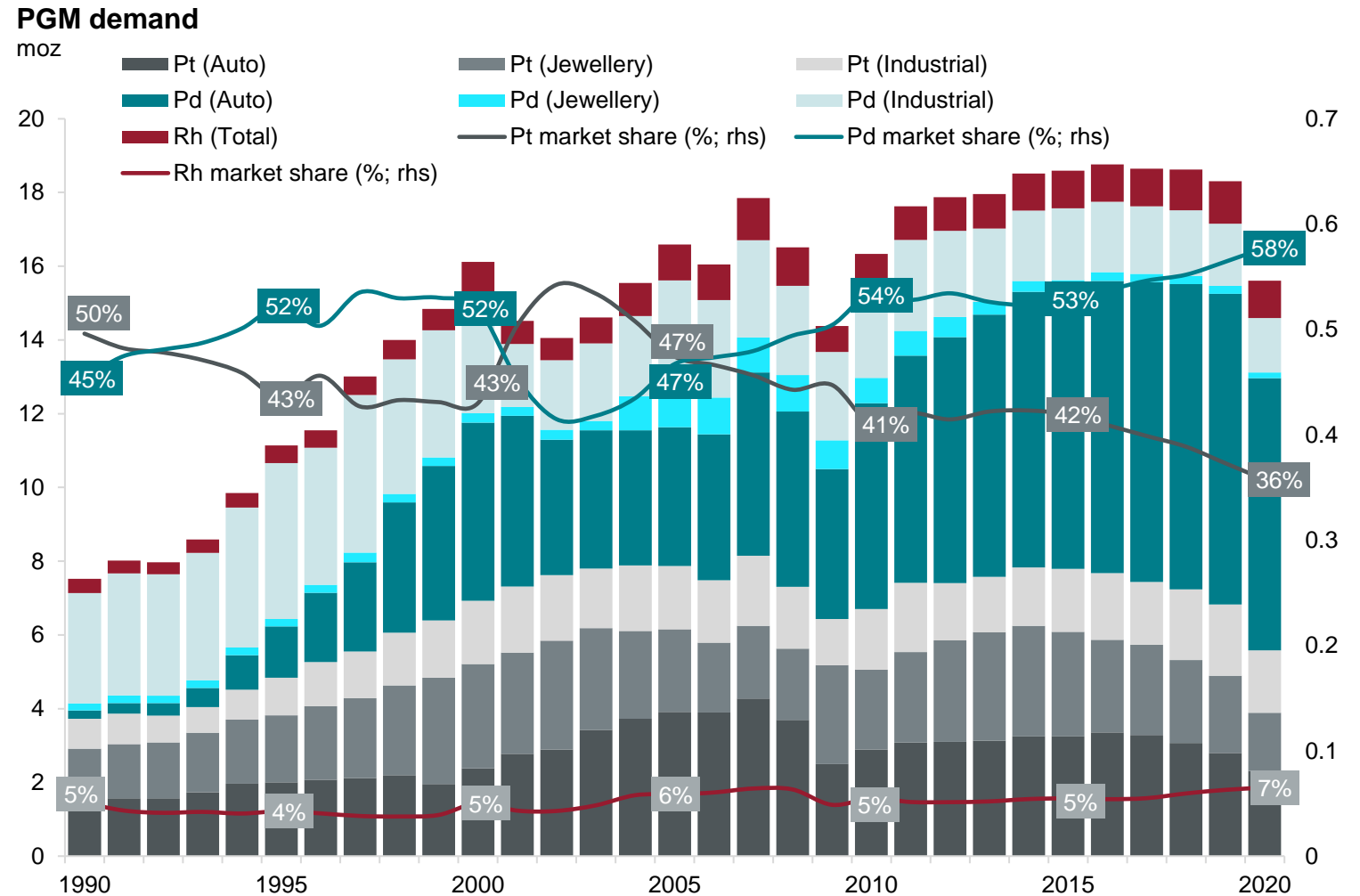
- The chemical properties (corrosion and oxidation-resistance, biocompatibility, high melting temperature, good conductivity and electronic and catalytic properties) of PGMs make them **unique**
  - Auto catalysts, jewellery, medical, glass, electronics
- PGMs can often be **substituted** by other PGMs to a greater or lesser extent
- PGMs are **mined in a basket** and we cannot selectively extract specific PGMs



**PGMs metals should not be considered individually**

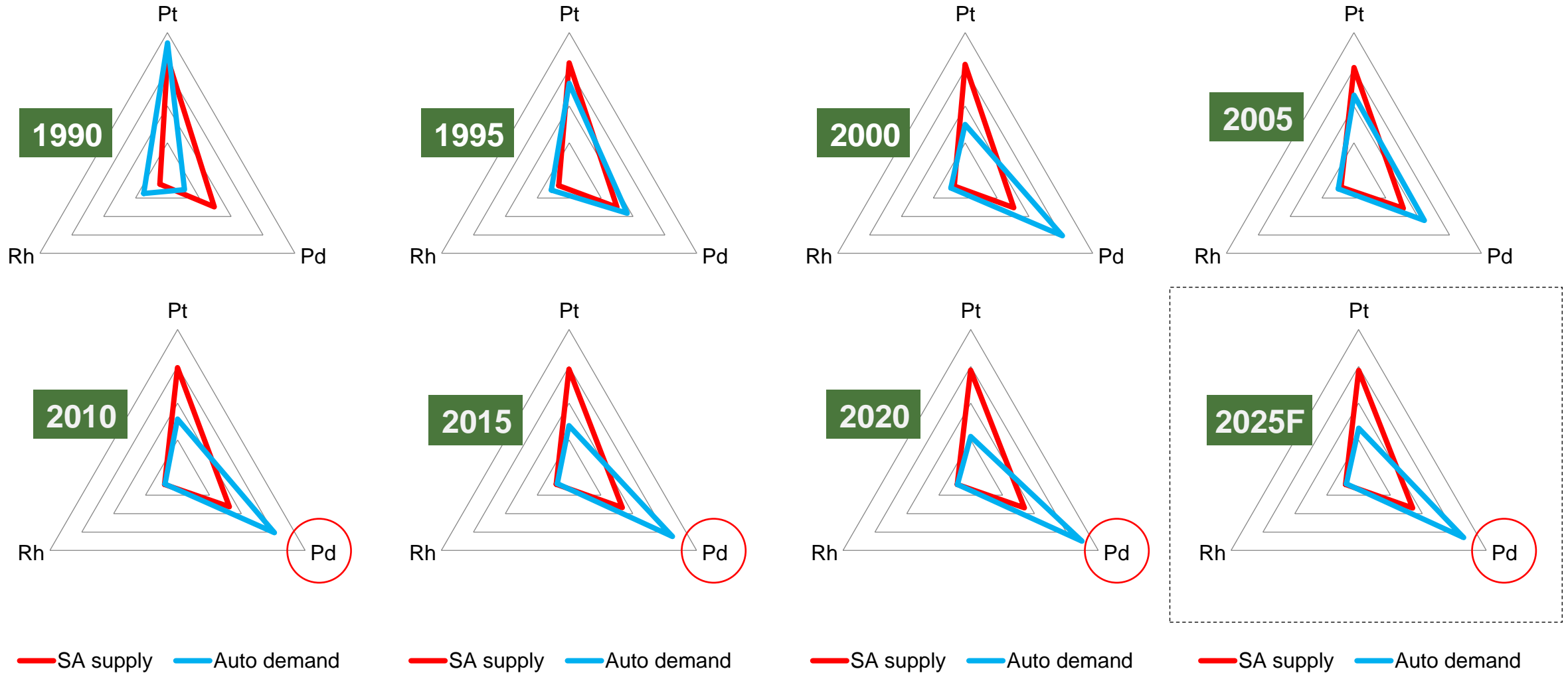
## The evolving 3E demand split over the last three decades

- Demand growth has been driven primarily by autocatalysts
- Declining market share of platinum over the last 15 years with a corresponding growth of palladium
- Pt industrial demand largely price inelastic and growth correlated to global GDP
- Jewellery demand steadily declining in the last 5 years after peaking in 2014



Three decades of strong growth with primary supply supplemented by recycling

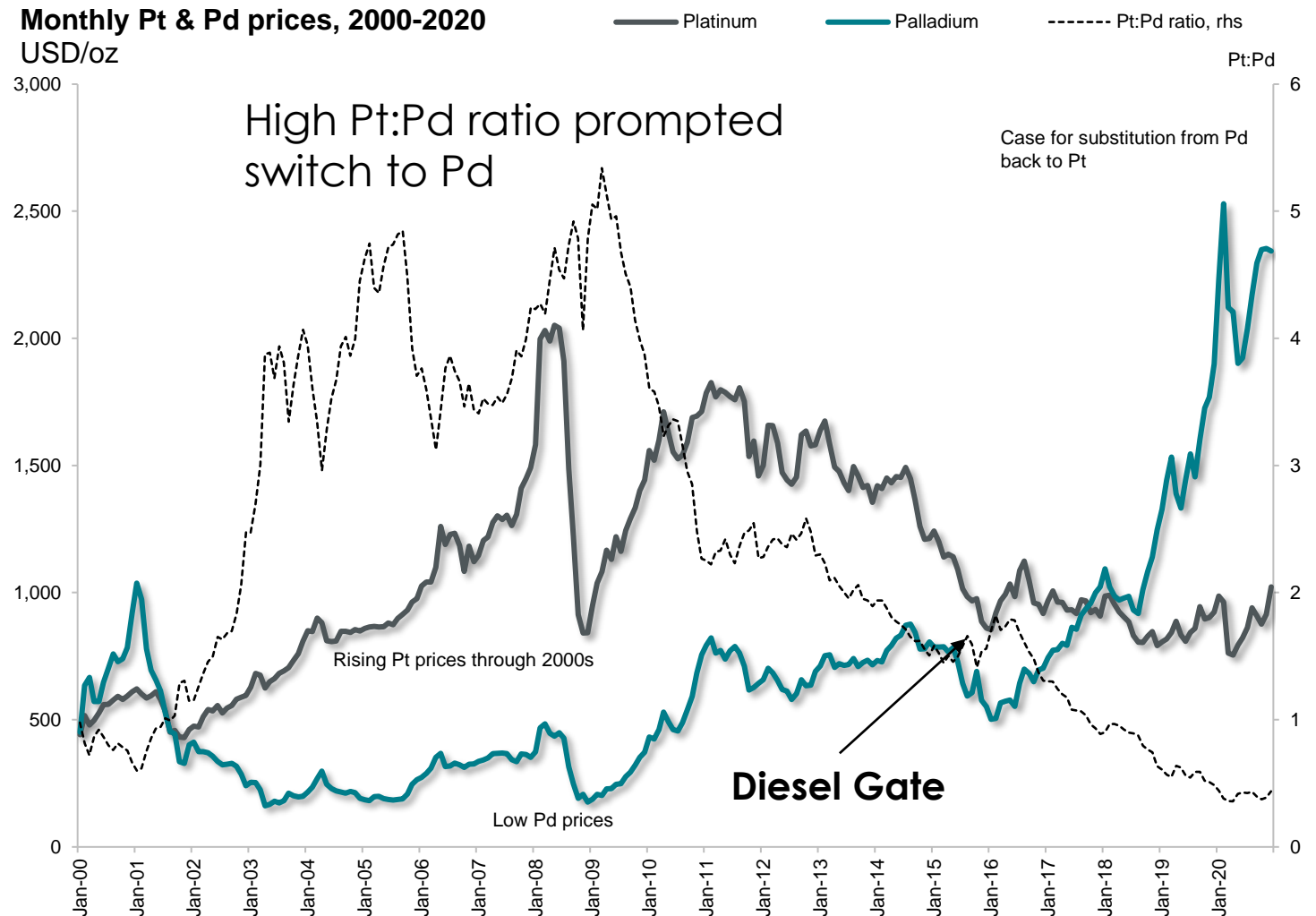
# Automotive PGM demand was historically aligned to SA production



A structural change in the demand basket occurred during the last decade

## ...but rising costs of SA supply and low Pd prices led to a switch

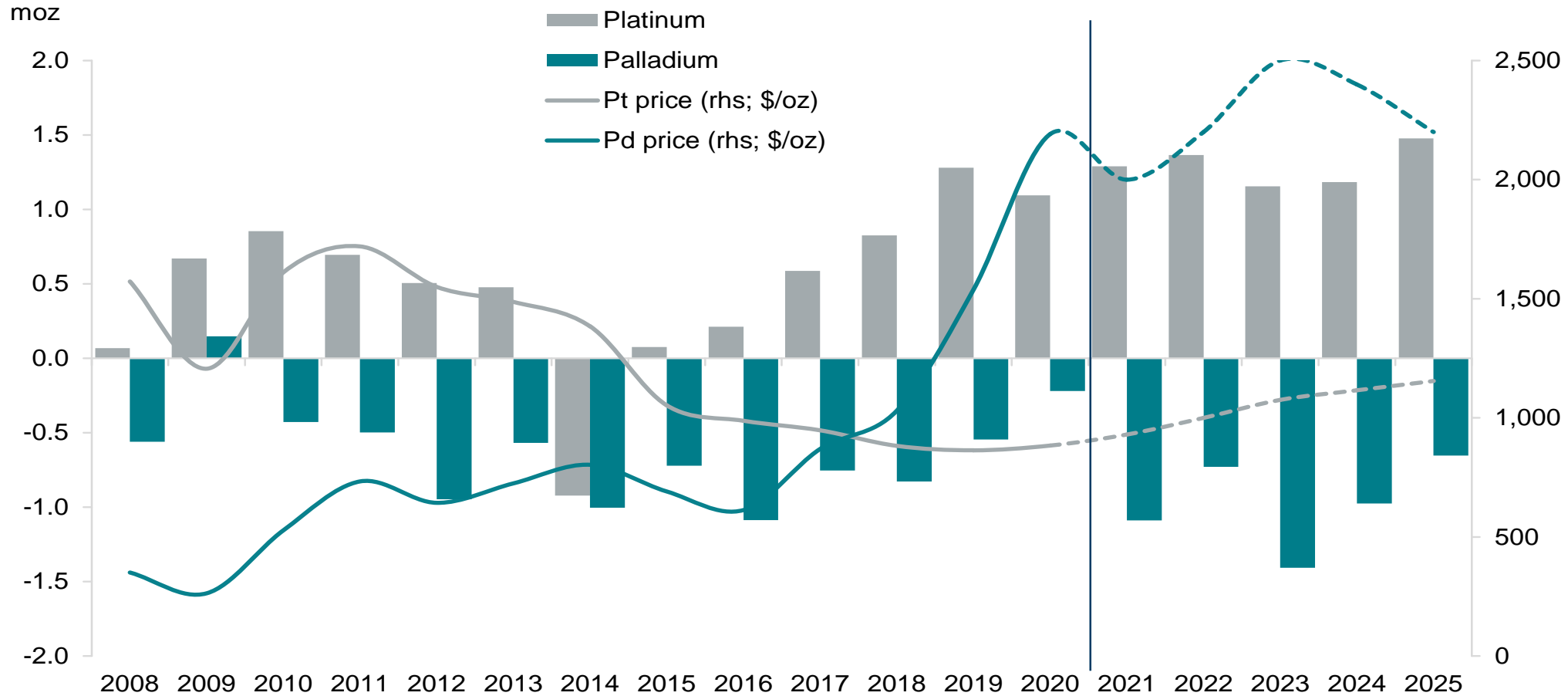
- PGM automotive demand aligned well to the 3E (Pt, Pd, Rh) ratio of supply from South Africa through the 1990s and into the early 2000s
- The cost of South African production rose steeply, while the palladium demand and associated price remained low, promoting substitution and adoption of more palladium-rich auto-catalysts
- Automotive PGM demand has been out of kilter with SA supply for the past decade as catalyst ratios have moved predominantly towards palladium, compounded by the reduction in demand from diesel



**Price and technology drove substitution**

# The result was a market out of balance

## Supply-demand balance



**An unsustainable market balance that would lead to demand destruction**

Source: SFA (Oxford)

\*Pre-investment demand

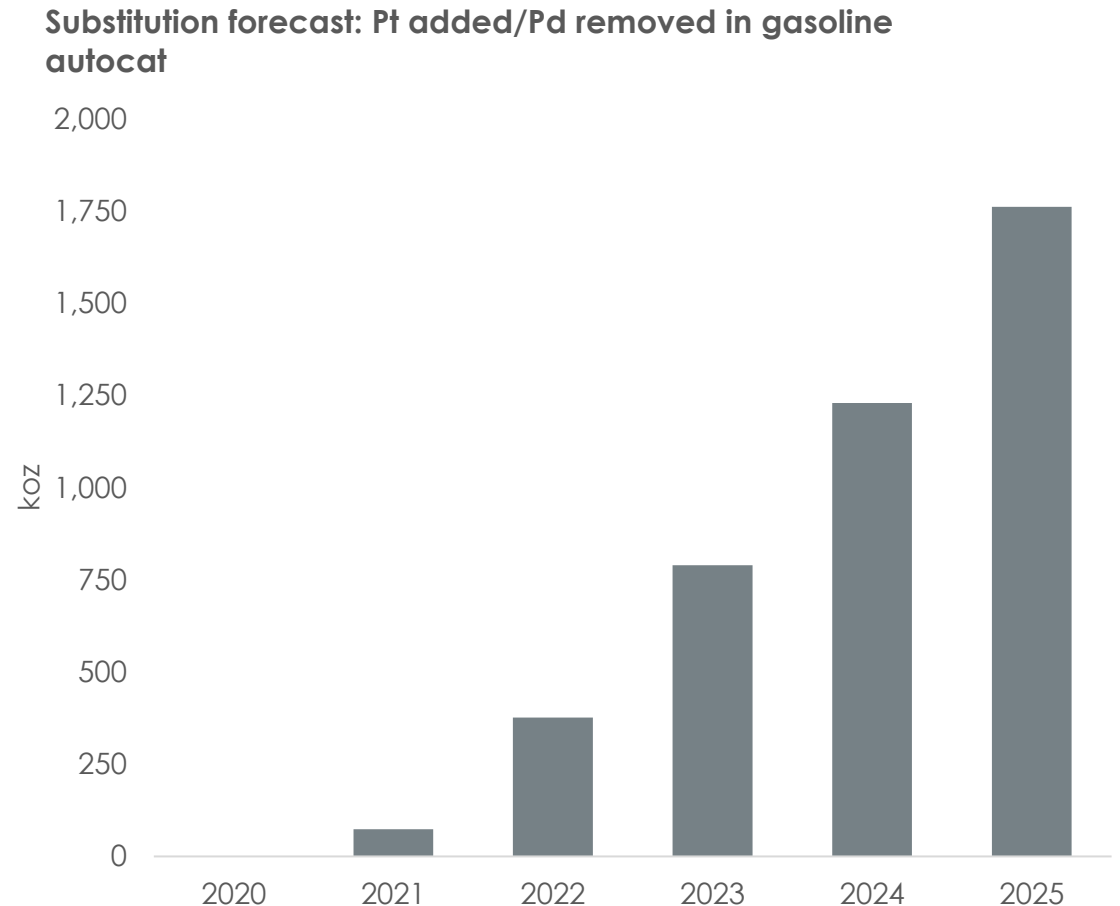


## In April 2019 we presented the following slide

- If global demand mix does not match global supply mix, we will be faced with:
  - **demand destruction of palladium**
  - an **over supplied platinum market**
- Primary supply will continue to be mined as a **fixed basket** at a ratio of roughly 4:5 Pt:Pd globally
- Auto manufacturers' short-term thinking is evidently not driven by PGM costs or supply balance:
  - PGM costs remain relatively small in the total cost of automobiles
  - Reputational impact post “Dieselgate” is significantly higher than catalyst cost considerations
  - Risk of change appears greater than cost of maintaining status quo
  - What happens when PGM mix is no longer a price issue but a physical security of supply issue?
- If we do not get the balance right, it could result in a **permanent shift in the PGM market dynamics**
- The biggest lever we have to pull is **substitution of palladium by platinum**

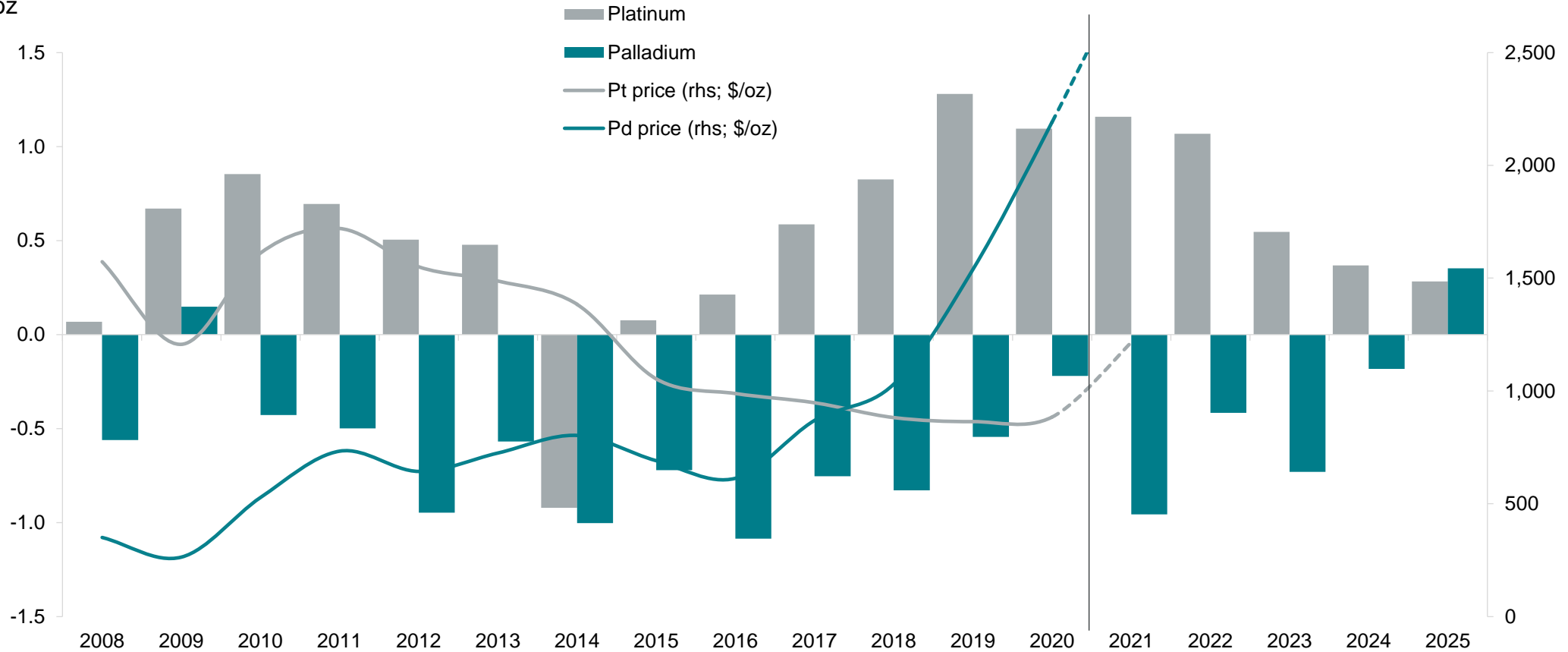
## Substitution outlook

- During 2018 to 2020, Sibanye-Stillwater, together with Impala Platinum supported research undertaken by BASF to optimise the PGM content in a tri-metal catalyst
- Aim was to substitute Pd with Pt in gasoline autocats to mitigate the deepening forecast Pd deficits
- Research was undertaken with a view to providing a solution for our end customers before they realised they needed it
- We had a “ready solution” for our customers when the market tightened
- On the basis of the current substitution forecast the “investment cost” of this research comes in at under \$15/oz



# Substitution has driven a more sustainable market outlook

**Supply-demand balance**  
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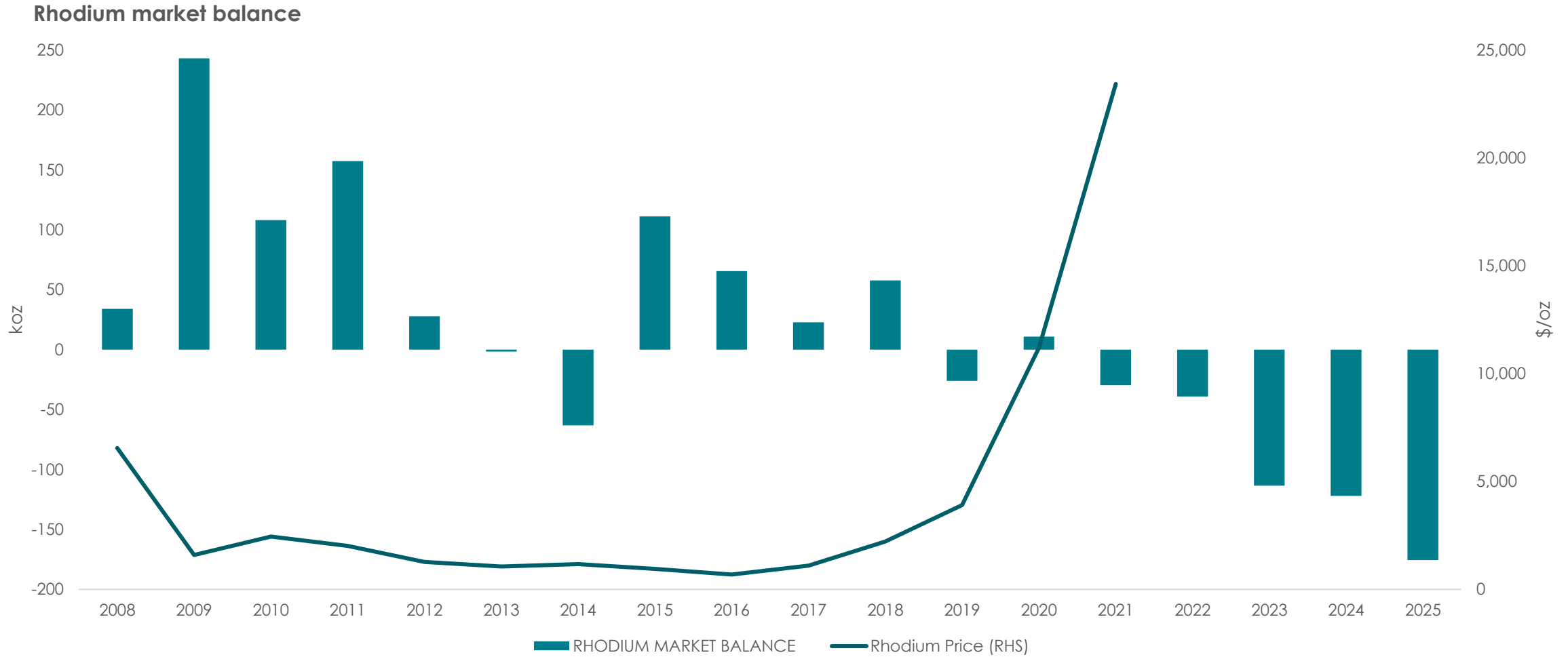
## A market brought back into a sustainable balance

\*Pre-investment demand

## ■ What has history taught us?

- Despite exhaust emissions control being introduced as early as the 1950's and 1960's in selected cities, it was the **advent of the tri-metal catalyst** in the 1990's combined with a more **regional regulatory framework** that drove primary PGM demand
- **Substitution driven by price elasticity** has occurred at least twice in the last two decades
- Industrial PGM applications are largely price inelastic, primarily driven by the unique qualities of PGMs
- Jewellery demand has been a significant underpin to the platinum market that is not driven by PGMs unique characteristics and is therefore price elastic and **vulnerable to myriad external macro-economic forces**, much like other consumer goods
- Demand is created and managed by **external** market forces, **the progress of technology** and **market development**

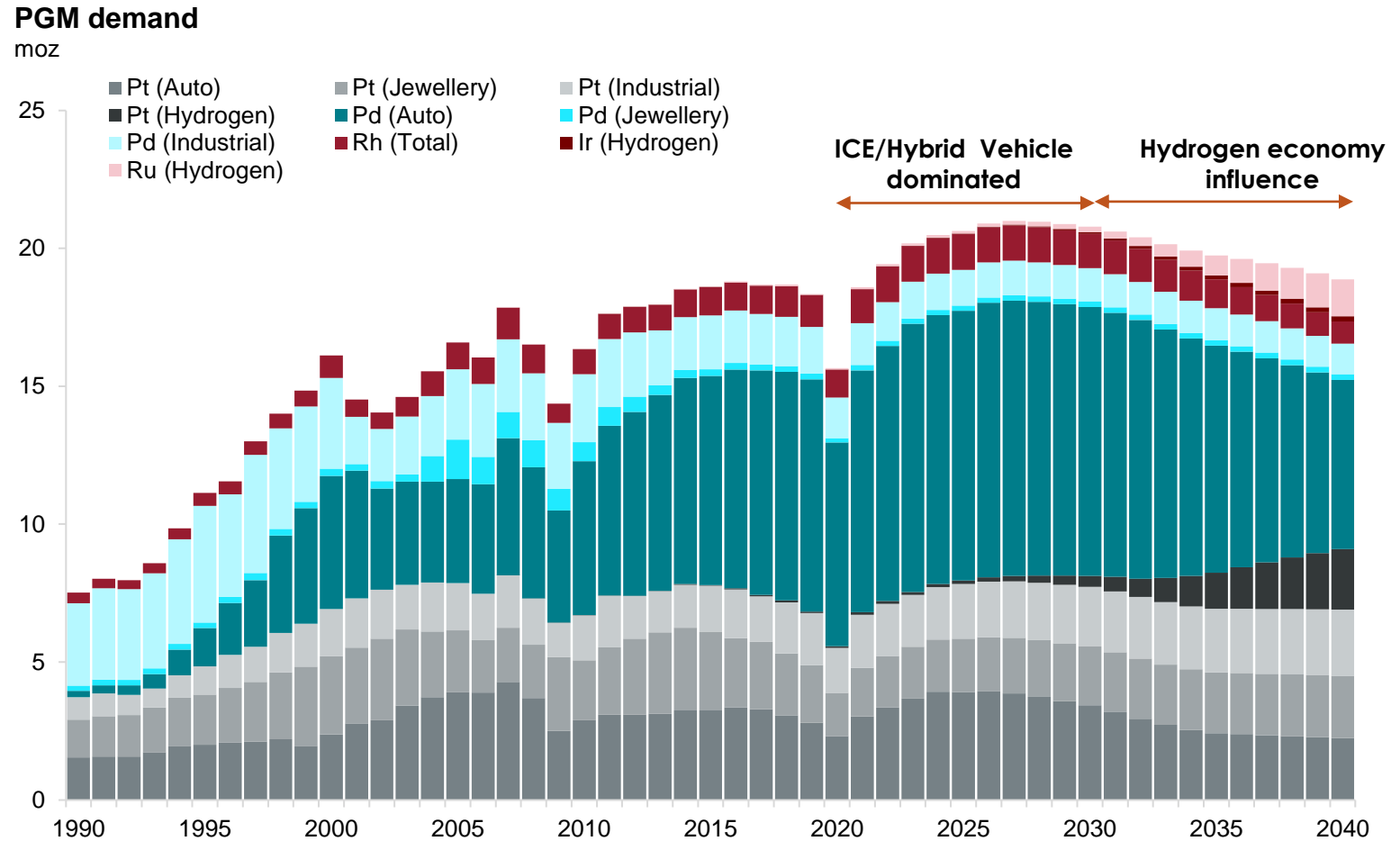
# The next five year challenge - Rhodium



**The likely solution is substitution of Rh with Pd**

# The forecast demand split the next two decades

- Demand in the next decade is still going to be driven by autocatalysts
  - 1% CAGR for ICE (including hybrids)
  - Increased PGM loadings
  - 18% CAGR for BEV
  - 29% CAGR for FCEV
- The increasing importance of the hydrogen economy in the next decade is going to underpin platinum demand and minor metals (Ir and Ru) are going to become increasingly important in the demand mix



Looking forward, the 5E basket becomes increasingly important

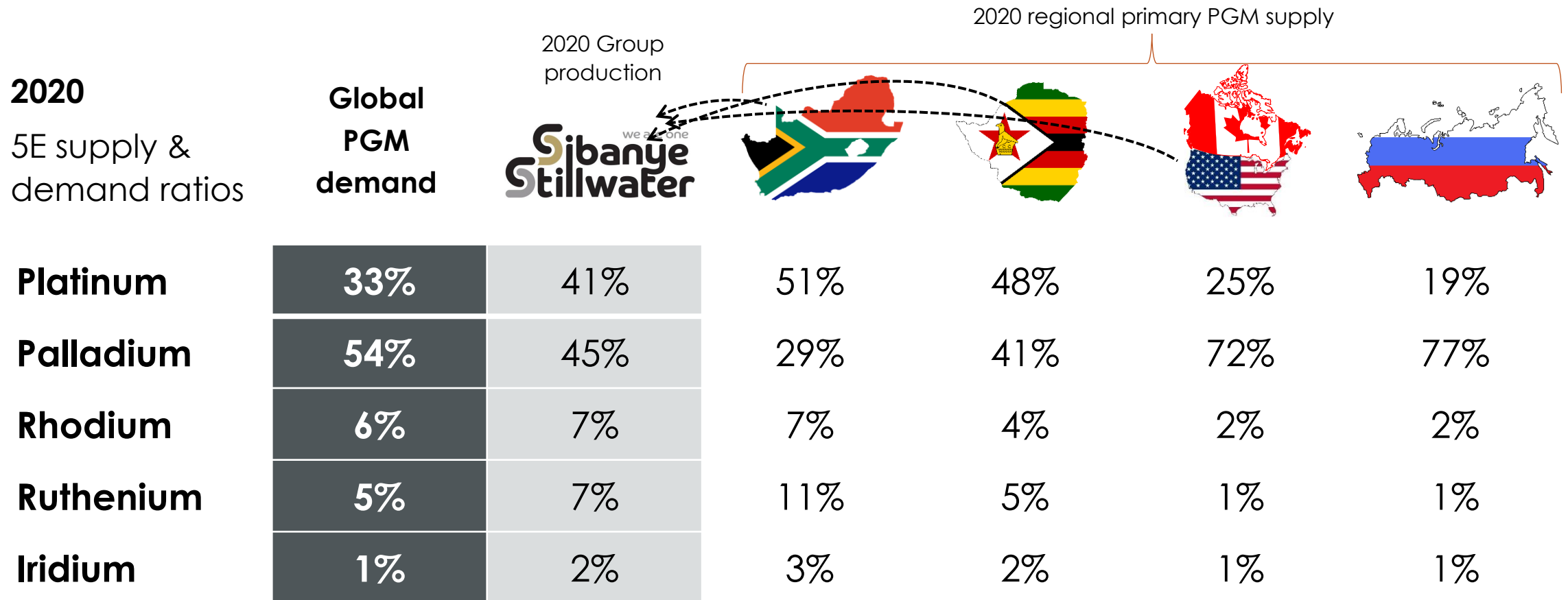
# Strategically positioning for the future



Sibanye-Stillwater has grown through a series of strategic acquisitions

## A unique diversified PGM production base

- Better aligned to the demand mix than any of our peers operating in only one geographic region



Percentages based on 2020 SSW group production including recycling



## Positioned to supply the metals for today and tomorrow

- The company's mix of PGMs, including ruthenium and iridium, mean it is well-positioned to be a major supplier of the key enabling metals for the hydrogen economy while delivering palladium and rhodium for ICE vehicles nearer term

2025F	Pd	Pt	Rh	Ru	Ir
Sibanye-Stillwater 5E production ratio	48%	39%	6%	6%	2%
Global 5E demand ratio	49%	39%	6%	5%	1%
Sibanye-Stillwater share of global supply*	15%	17%	19%	25%	22%

The right prill split for the short and medium term and investing in the metal supply for the longer term

## Conclusion

- **The unique characteristics of PGMs** and relatively small market size means demand can be significantly influenced by both **external environmental changes and technology advances**
- Similar to the 1990's where the PGM market was on the cusp of a structural change driven by emissions regulations, **today the advent of the hydrogen economy provides a similar opportunity**
- **The PGM demand mix has been out of kilter with supply**, which has led to sustained palladium deficits and the current rhodium shortages
  - **The supply chain must work together** to ensure that investment is made today, to secure the metals required for the future
- **Alignment of the PGM producer basket with demand** is critical for the sustainability of PGM end uses, particularly for the hydrogen economy
- For PGM suppliers, it is strategically important **to influence demand trends and supply optimal metal mixes for future needs**
  - **Sibanye-Stillwater** is fostering **strategic partnerships** with end users, fabricators and catalyst manufacturers
  - **Sibanye-Stillwater** has **built a unique PGM portfolio** that can provide the metals of today, tomorrow and the next decade



Questions