



INDIGO  
PRECIOUS METALS

## Investment Examination of a Very Rare Precious Metal

### WHY BUY RHODIUM

# RHODIUM

Dear Investor,

Thank you for downloading Indigo's guide to 'Why Buy Rhodium'.

This e-book guide is one in many we have put together to help guide investors in making informed decisions on investing in metals and the logic supporting these decisions, tailored not only for the new investors in the field of physical precious metals, but also well-established investors looking for more relevant information in governing their investment decisions.

We look forward to hearing from you.

**David Mitchell**  
Founder  
Indigo Precious Metals



We are not tax advisers and we would always recommend you seek out independent tax advice. This guide is only meant to be used as an aid and an introduction to physical precious metals investment.

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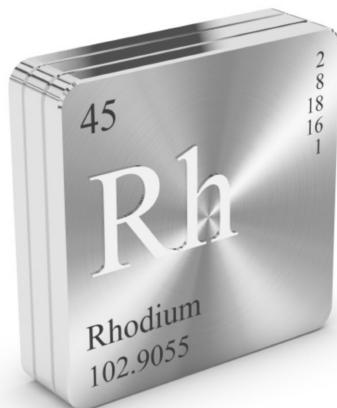
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# RHODIUM

## Investment Examination Update of a Very Rare Precious Metal

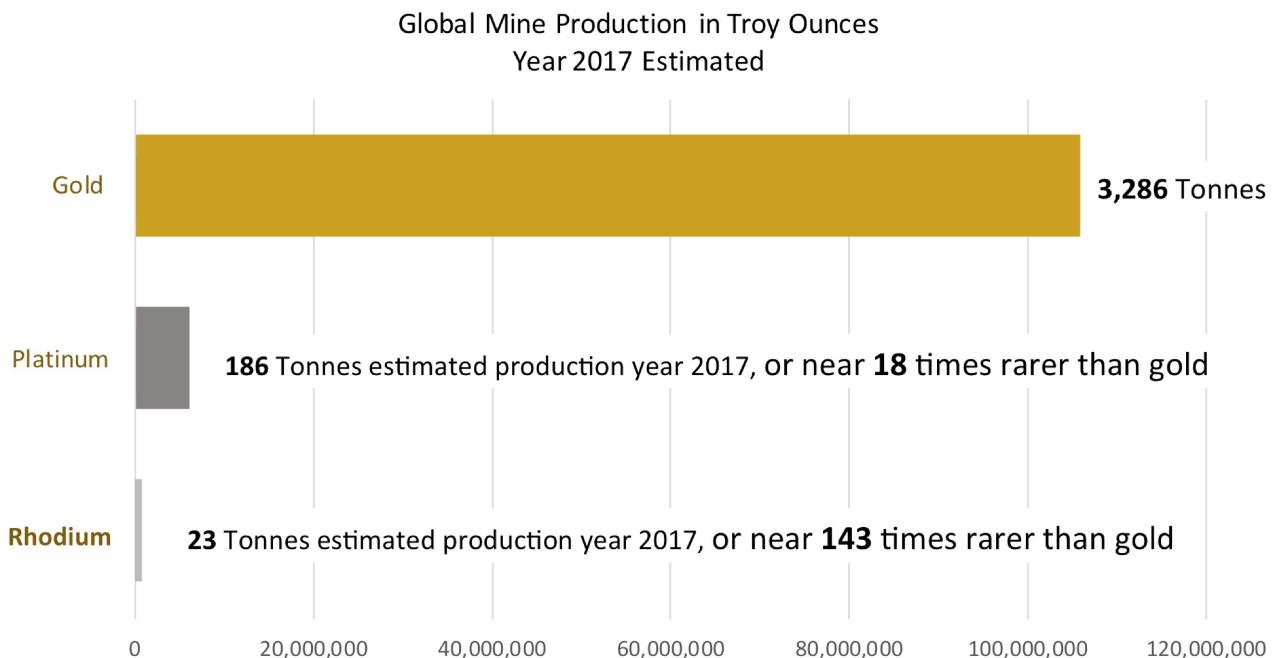
Updated: 14<sup>th</sup> May 2018

By David Mitchell



As the title suggests Rhodium (Rh) is a very rare metal, the silvery corrosive resistant luscious silvery white metal is a member of the Platinum Group Metals (platinum, ruthenium, palladium, osmium, iridium). It is considered the rarest and most valuable precious metal in the world, well above gold or platinum. The name rhodium comes from the Greek word "rhodon," meaning rose.

So how rare ?



Sources : Johnson Matthey, World Gold Council, USGS and CPM Group

Rhodium (Rh) serves as an essential and highly sought after industrial metal specifically for its unique properties. As an investment vehicle Rh has very much raised its head over the last 24 months due to extreme historical price divergences, the investment thesis is driven by a number of factors that make this rare metal a very attractive prospect indeed.

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## Industrial Usages of Rhodium, Supply & Demand Picture

The primary use of rhodium is of course in automotive as a catalytic converter that converts harmful unburned hydrocarbons and nitrogen oxide emissions into less noxious gases.

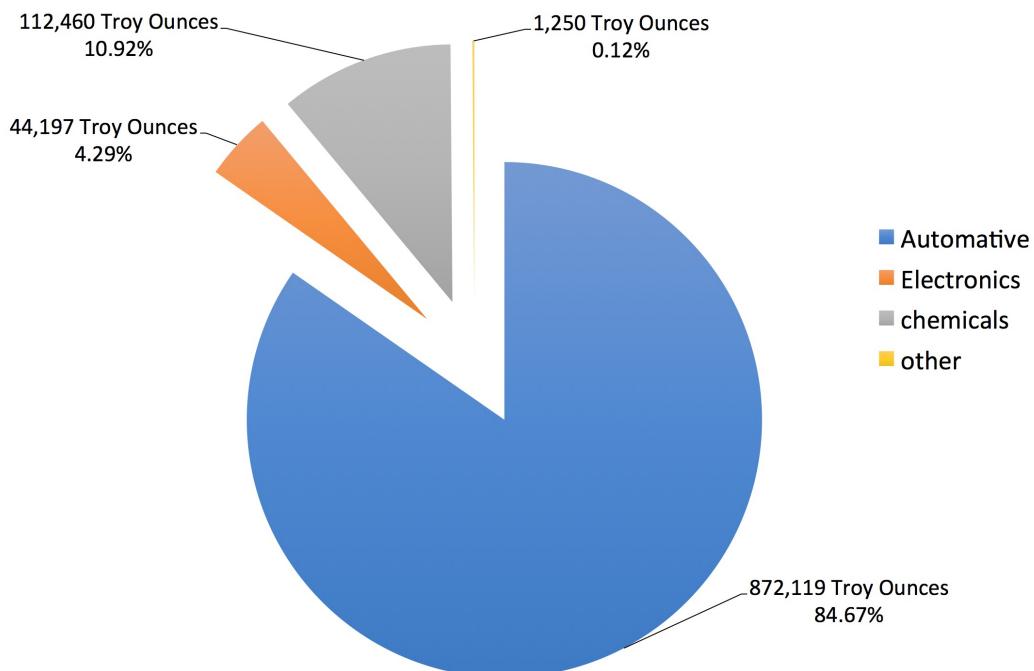
Rhodium is used as an alloying agent for hardening and improving the corrosion resistance of platinum and palladium, also used in the glass industry for the production of flat-panel glass and fiberglass.

Rhodium can be used to protect precious pieces of jewelry made of silver and gold, as well as silverware. Rhodium's physical appearance (shiny silver-white) and durability make it an excellent candidate for plating softer metals.

Other major applications of rhodium include furnace windings, electrodes for aircraft spark plugs, thermocouple elements, mammography systems, nuclear reactors.

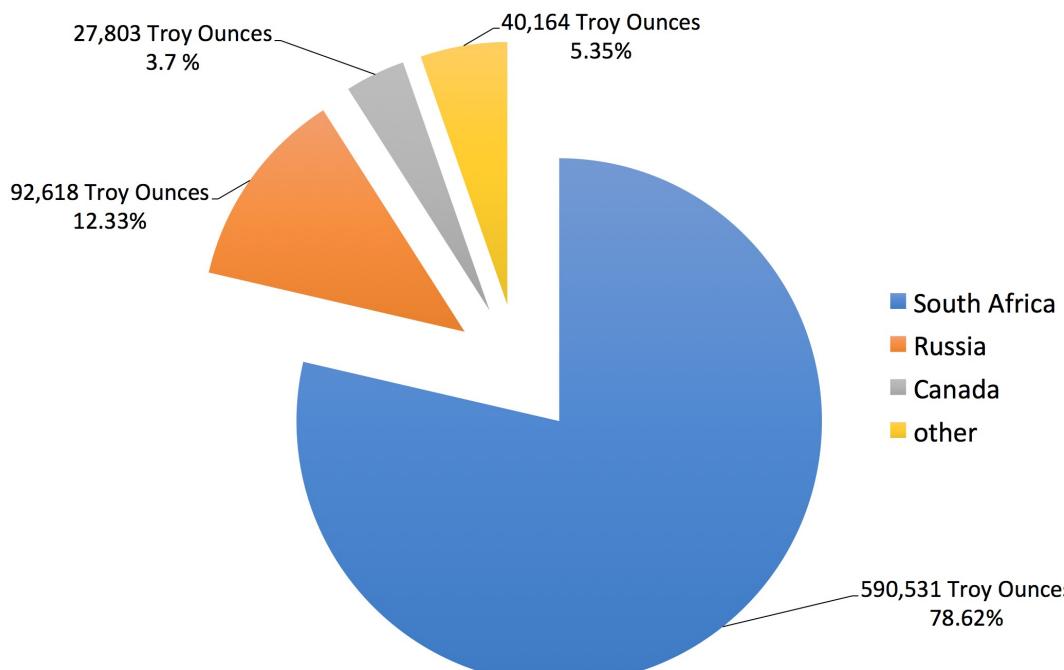
Rhodium is also the last metal to be extracted from the matte through a complex series of hydro-chemical and pyrometallurgical processes. This means it has the longest lead time and is the most costly to produce.

### Industrial Fabrication Demand Year 2017 1,030,025 Troy Ounces



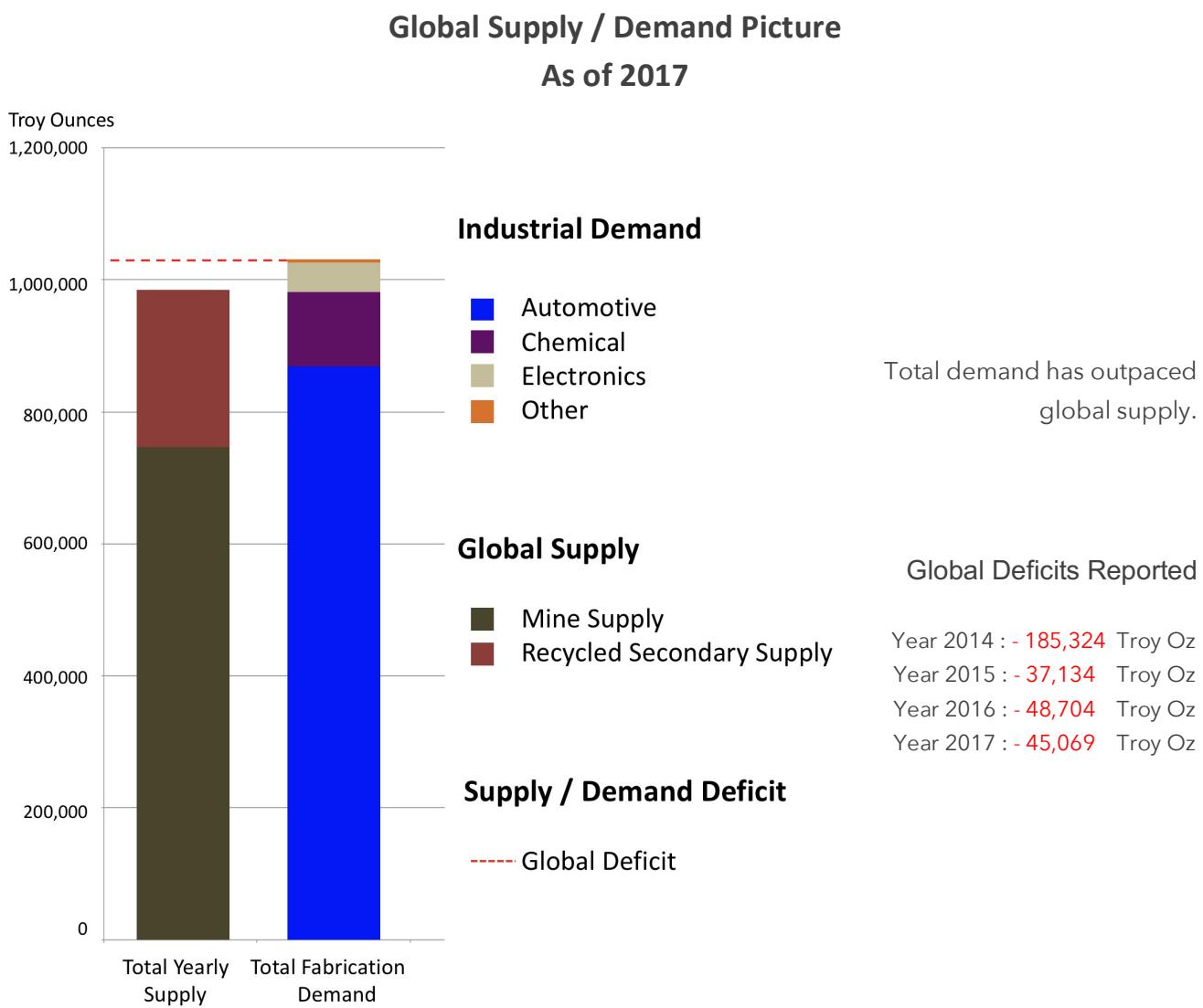
Source: CPM Group

### Global Mine Production Year 2017 751,116 Troy Ounces



Source: CPM Group

But more importantly, we are experiencing global supply / demand deficits for the last four-years of this important metal, see below....



Source: CPM Group

## Price Discovery of Rhodium, And What to Expect

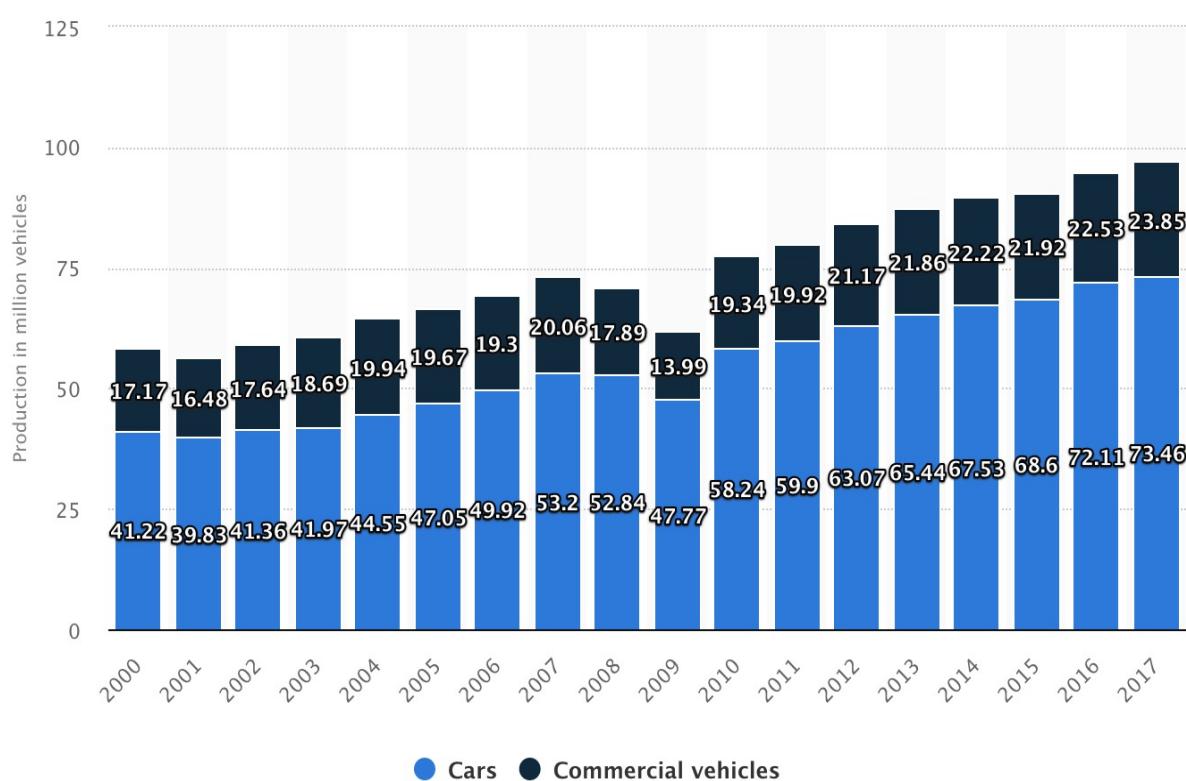
From a \$440 low in January 2004, prices ballooned near 23-fold to more than \$10,000 into year 2008, as industrial users hoarded the metal amid concern that South African mine supply would fall.

Platinum reached a record \$2,300 in 2008 (Rh was 4 times more expensive than Platinum) and palladium reached a six-year high.

'Manufacturers started using less rhodium in favour of other metals and increased recycling to cut costs, boosting producer-held inventories. Supply beat demand by a combined 488,000 ounces in four years through 2011', Johnson Matthey estimates.

The global financial crisis reduced demand considerably, while at the same time car manufacturers reduced the content loadings of rhodium in their catalytic converters in part due to new advances but more importantly to reduce production costs. The mine supply coming onto market, along with car manufacturers generally destocking, mixed with the depressed levels of industrial usage depressed prices from 2010 into August 2016, an unprecedented length of time in regard to this particular metal.

### Worldwide automobile production from 2000 to 2017 (in million vehicles)



But during this 6-year price hiatus an unprecedented surge in vehicle production took place, global manufacturer stockpiles were run down to extreme low levels, again driving the cycle strength in rhodium prices driven by the inevitable inventory re-building by automakers especially in China, and lack of inventory liquidation by any strategic holders of rhodium eventually pushed the price higher from US\$ 639 in July 2016 to a recent high in April 2018 of 2,120 US\$.

US\$ 2,000 was more of a physiological level and we expect it trade around this level for a while, but how do we measure the price moving forward from here?

We then have to take into consideration the supply picture and global demand pressures moving forward .....

- Rhodium Market in Deficit

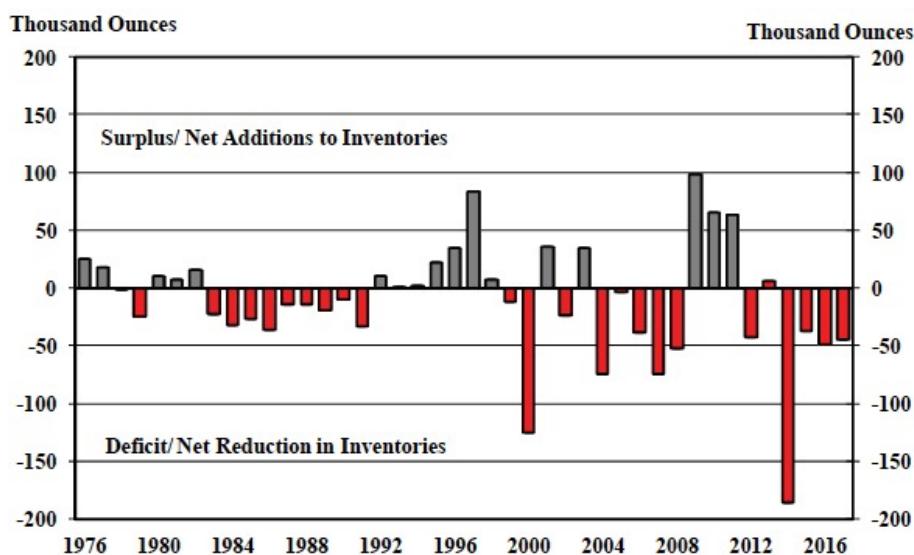
The rhodium market has been in deficit of newly refined metal plus recycled secondary supply relative to industrial fabrication demand for the fourth consecutive year in 2017. The market was in a deficit of over 45,000 ounces in 2017. A decline in South African mine supply and an uptick in fabrication demand were the primary reasons for the expansion of the deficit.

The supply deficit was initially filled by the Rhodium ETF which sold down from over 125,000 ounces in late 2013 down to holdings of below 60,000 ounces in late 2016, which is now just 8% of annual production.

The largest source of demand for rhodium is from auto catalysts, which again rose to an estimated 872,119 ounces in 2017.

Total rhodium industrial fabrication demand rose +1.3% in 2016 to a record 1.026 million ounces, followed by another increase in 2017 of 0.5%. Global demand is again forecast to increase in 2018 and again into 2019, driven by increased loading of rhodium in catalysts due to new government emission policies

### Rhodium Surplus / Deficit Inclusive of Re-cycled Rhodium



Source : CPM Group

- Government Environmental Emissions Standards

The ongoing tightening of emissions standards will continue to provide support to rhodium fabrication demand. We are aware the USA government under President Trump has rolled back emissions standards, but the rest of the world has not and has no inclination to roll back.

The latest standard, 'Euro 6', applies to new type approvals from September 2014 and all new cars from September 2015 and reduces some pollutants by 96% compared to the 1992 limits.

The Euro 6 test became more stringent from September 2017 with the addition of an extended on-road emission test known as Real Driving Emissions or RDE.

All new vehicle registrations are required to meet the corresponding emissions standard concentrating on.

CO = Carbon Monoxide

NOx = Oxides of Nitrogen

HC = Hydrocarbons

PM = Particulate matter

Volkswagen was especially caught out, and they announced back in January 2016 that they are proposing a new catalytic converter to fix vehicles affected by diesel emissions scandal, and future car production, this incorporates a heavier loading of rhodium, alongside platinum and palladium.

This underscores future rhodium demand.

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Source :

European Emission Directive:

<https://www.theaa.com/driving-advice/fuels-environment/euro-emissions-standards#euro6>

Reuters reports on China Emissions Standards ;

<https://www.reuters.com/article/us-china-autos-emissions/china-to-require-tougher-new-vehicle-emission-standards-for-2020-idUSKBN14C0Q4>

## • Essential Catalytic Qualities of Rhodium

It takes a precise combination of precious metals to help make catalytic converters an effective method for emission control.

Automotive exhaust contains three harmful pollutants, which are formed due to inefficiencies in the fuel combustion process. Hydrocarbons (HC) and carbon monoxide (CO) are formed as a result of the incomplete combustion of gasoline. Oxides of nitrogen (NOx) are created from the burning of the nitrogen present in the intake air at the high temperatures and pressures encountered in the cylinders during ignition. HC and NOx are major contributors to smog formation, and CO reduces the ability of the blood to pick up and transport oxygen through the body. Platinum, palladium, and rhodium have historically been the key active components used in these catalytic converters.

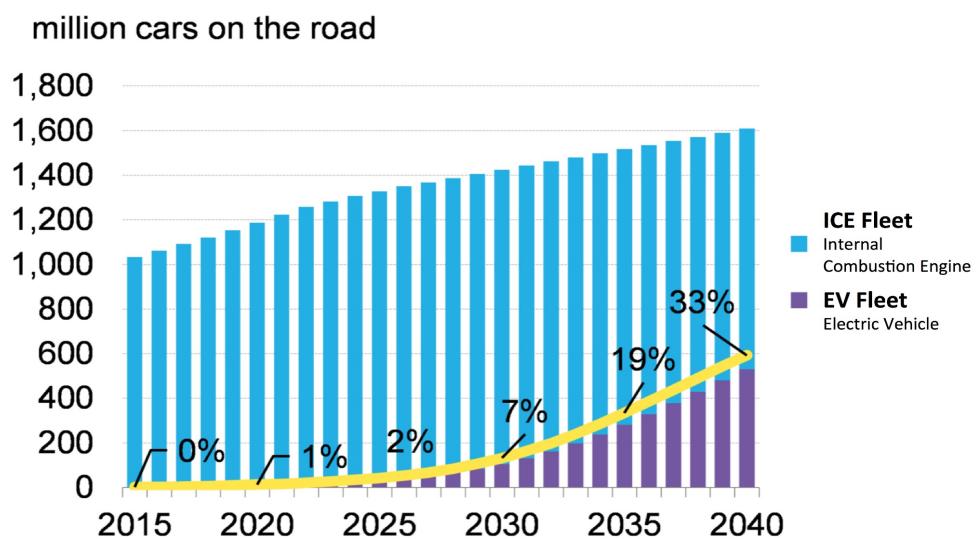
These precious metals are unique in their ability to facilitate the reactions of HC and CO with oxygen to produce water and carbon dioxide and to promote the reaction of CO with NOx to convert the NOx to harmless nitrogen gas. Rhodium is the key component here, in fact Rhodium is essential to fulfil the role to remove NOx from emissions.



- Future Car Gasoline and Diesel Engine Production and Usage

The optimal question from investors should be quite rightly the future of combustion engines, especially considering the largest source of industrial demand for rhodium is from auto-catalysts, which at 85% of overall industrial demand very much paints the future investment picture.

Advocates of future electric fleets of cars within the next 10 years are missing many important points of economic reality, firstly EV presently only make up less than 1% of present cars on the road. Even the most optimistic analysis is forecasting just 2% by year 2025, and only 7% by year 2030, within a greater production of cars on the road.



Source: Bloomberg Advanced Transport Team

Electric cars generally are offering an inferior product at a superior price point as far as present overall costs are concerned. Electric vehicles have less range, lower residual value, higher value cost, slow charging time, and are adversely impacted by cold or hot weather, among other issues such as the requirement of building out nationwide logistics to support car charging.

Internal-combustion-car manufacturers are not ignoring the threat of EV's. Innovation in fuel efficiency and reduced pollution continue especially with environmental government policies, enhancing internal combustion's appeal and longevity, as well as optimising the competition electric vehicles must beat and eventually overcome.

This involves continued rhodium demand story over the next couple of decades, without question.

## Understanding the Investment Cycles of Rhodium

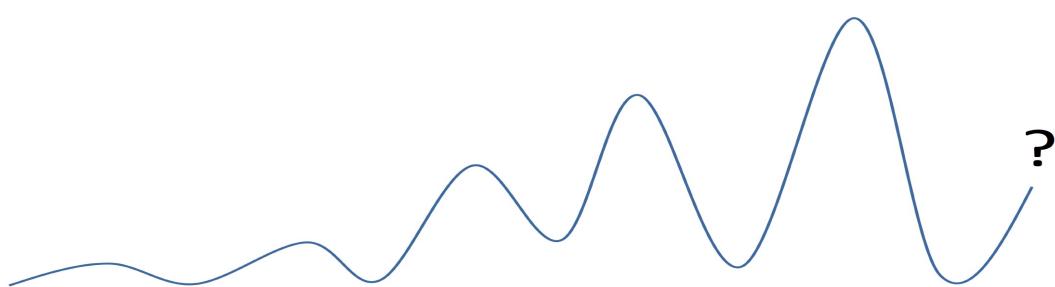
Rhodium is so rare and above-ground strategic inventory levels very small, reported at approximately 20% of global annual production, it simply cannot respond to changes in demand easily and therefore the price is driven by simple supply and demand factors.

About 140 ounces of gold will be mined for every one-ounce of rhodium as of 2017, and total output of rhodium will be just 12.5 % of platinum production.

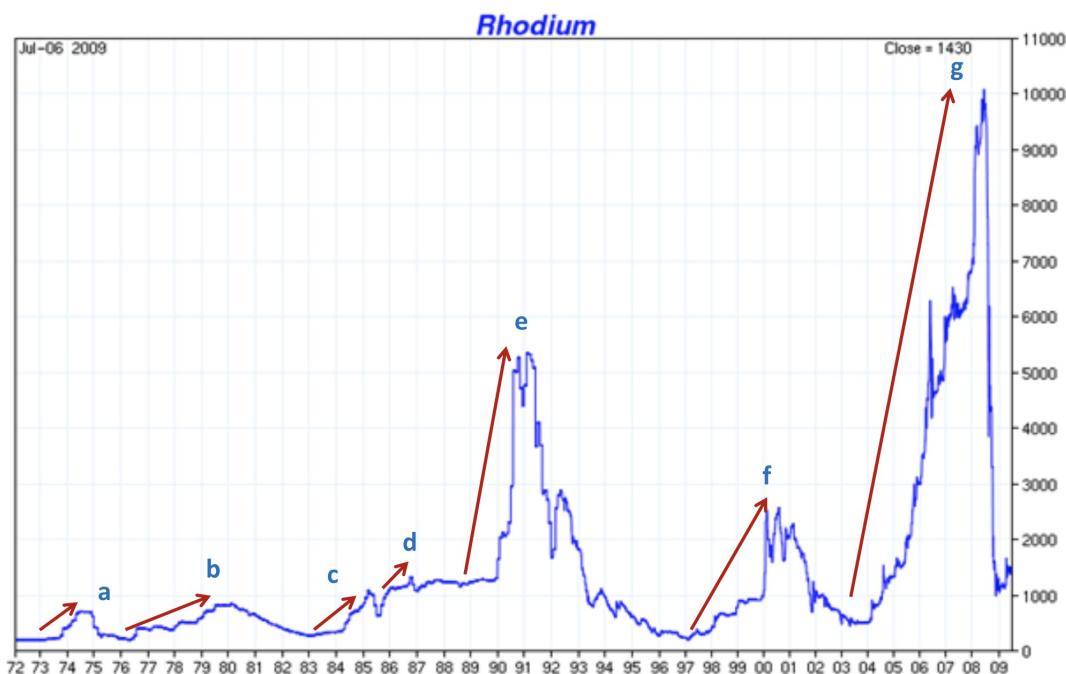
Deutsche Bank's rhodium-backed exchange-traded product, which began in 2011, have holdings equal to 8 % of annual supply, compared with 25 % for global palladium ETP's and 34 % for platinum funds', according to bank data and figures compiled by Bloomberg.

With this in mind, as you can imagine Rhodium's price has swung from very depressed oversold levels to very overpriced levels, flowing with the economic cycles, mining production supply, cost production, which very much drive these waves along with manufacturing adjusting their production loading and stock of the metal dependent on price.

These waves have no particular equilibrium but have similar wave lengths and actually quite readable in the bigger picture.



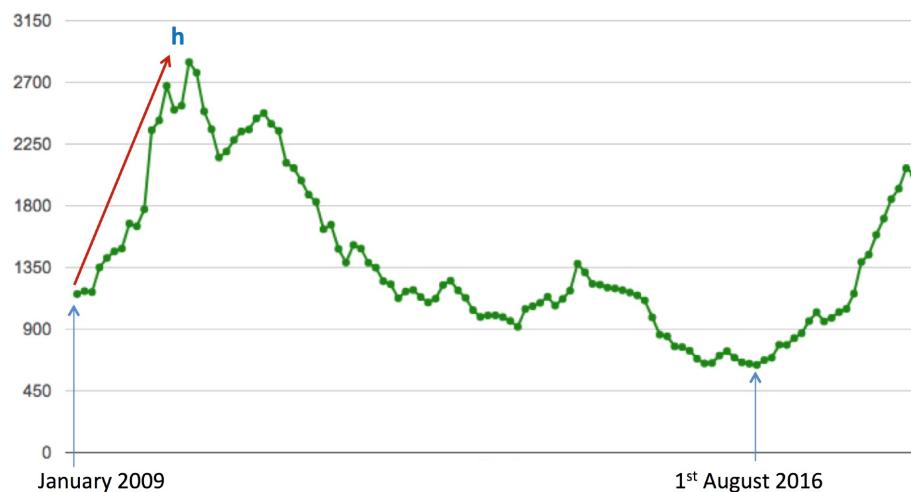
To give you an idea, let us look at an historical chart and the price performances below.



The following was the approximate moves based on monthly average prices ...

a.	January 1973 to Summer of 1974	+ 370 %
b.	May 1976 to May 1979	+ 412 %
c.	January 1983 to February 1985	+ 415%
d.	June 1985 to September 1986	+ 211%
e.	July 1988 to January 1991	+ 461%
f.	February 1997 to 1 <sup>st</sup> July 2000	+ 1,347 %
g.	January 2004 to June 2008	+ 2,280%
h. see below	January 2009 to April 2010	+ 248%

Recognising the supply/demand pressures and the overall value proposition highlights the investment perspective.



## Value Proposition, Quick Synopsis

Considering the facts that we have covered in the first 10 pages and what we actively know about PGM (Platinum Group Metals) mining, a quick bullet point synopsis would be helpful at this point.

- Historical revaluations leading into spikes of Rh coming from deep undervaluation's have been substantial. In fact, the price as of May 2018 is still only 20% of the 2008 highs, 40% of the 1991 high.
- From 2010 to August 2016 the rhodium price was depressed, which was an unprecedented length of time in regard to this particular metal, building up huge supply pressures.
- In fact, the supply / demand deficit was only filled by substantial sales of investment rhodium held within the DB rhodium ETC between years 2014 to 2016.
- Inclusive of re-cycled rhodium, the world is experiencing a yearly industrial demand deficit, and this is seen without the added pressure of investment demand.
- Global stockpiles of above ground rhodium are reported at between 15% to 20% of global mine production, an extremely small supply buffer.
- Rhodium is an essential ingredient in catalytic converters due to it being the integral ingredient in removing oxides of nitrogen (NOx) from exhaust emissions. It's been widely reported that China, emerging markets, Volkswagen and various other car manufacturers are actively in the market buying rhodium.
- Under new legislation by Europe, China and elsewhere, exhaust emissions are being tightened extensively from present levels, this demands higher loadings of the 3 metals, especially rhodium moving forward.
- Electric vehicles are not going to replace combustion engines in immediate future, even with the most optimistic forecasts of EV they will have under 10% within 15 years, and 20% of an overall growing global market share even within the next 20 years.
- Global automobile production is expanding fast, with new replacement vehicles being a major dynamic due to strong government environmental emission changes and hence replacement vehicles.
- Present supply of rhodium effectively only comes from just one country (80%), South Africa. Not only is this a precarious supply source, but the mining involves digging into magma rock at extreme depths and is fraught with structural supply risks. Hence strategic stock piling by end users will be very much the strategy moving forward.
- The extreme fine balance of supply and demand does not include prospective investment buying, which could easily tip this balance into disarray, leading to much higher prices.

## Baird Mint - Production of Investment Grade Rhodium Products

Baird's highly skilled refinery team have developed the processing and refining technology to such a level that the mint produces structural integrity in the finished rhodium product that is also supporting ring production in pure rhodium that can withstand shocks. This is by no means an easy task, which is confirmed by the fact that no other refiner at this time are doing this.

The problem in making Rhodium bars and coins, is that Rhodium is produced as a precipitate, not in solid form. A precipitation reaction is a reaction in which soluble ions in separate solutions are mixed together to form an insoluble compound that settles out of solution as a solid. That insoluble compound is called a precipitate.

The induction furnaces used to melt other precious metals do not melt the precipitate.

Other refiners have tried making solid Rhodium by sintering the precipitate (heating the precipitate in a mould so that the particles fuse together), but this resulted in a weak structure that crumbled and is very brittle.



The mint gets the precipitate molten so that it forms a solid structure. This solid is 40 times harder than gold but brittle by comparison. It is only malleable under very high pressure and will tear if not struck cleanly.

For the coins we use a three-stage minting process that involves striking each coin 12 times.

For an idea of Baird Mint investment products please see below .....

The full range of investment minted bars in Rhodium from 5 Troy Oz bars down to 1/10<sup>th</sup> oz.  
All the bars come in Baird Mint tamper proof packaging.



## First Ever Legal Tender Rhodium Coin in the World

Exclusively distributed by  
Baird & Co. Ltd

Launch date 15 May 2018

Struck in 999.0 rhodium

Minted to bullion standard, with just an additional 100 collectors Brilliant Uncirculated coins issued with numbered certificates in presentation boxes

The reverse features the Tuvalu South Seas Dragon

First mintage of just 1,000 bullion coins



# How to Invest in Precious Metals Like A Professional?

## For New and Current Buyers Alike

**New Buyers** - We totally and fully understand the psychological threshold that needs to be crossed with NEW buyers to this asset class. Understanding why one needs to be exposed to physical metals as the sole titleholder and legal owner is easy enough to comprehend, but to embrace this is as an active asset class and manage your own vaulted account can feel overwhelming at first. **We are here to help and guide you every step of the way**, we have done this for many novice clients and we have an experienced team on hand for this very purpose.

Storing your private wealth allocation is all important, we of course very much support and encourage the investor who wishes to collect personally or take delivery via insured shipment of their precious metal investments. This method works perfectly well for the smaller allocations and certainly contributes to a regular saving scheme.

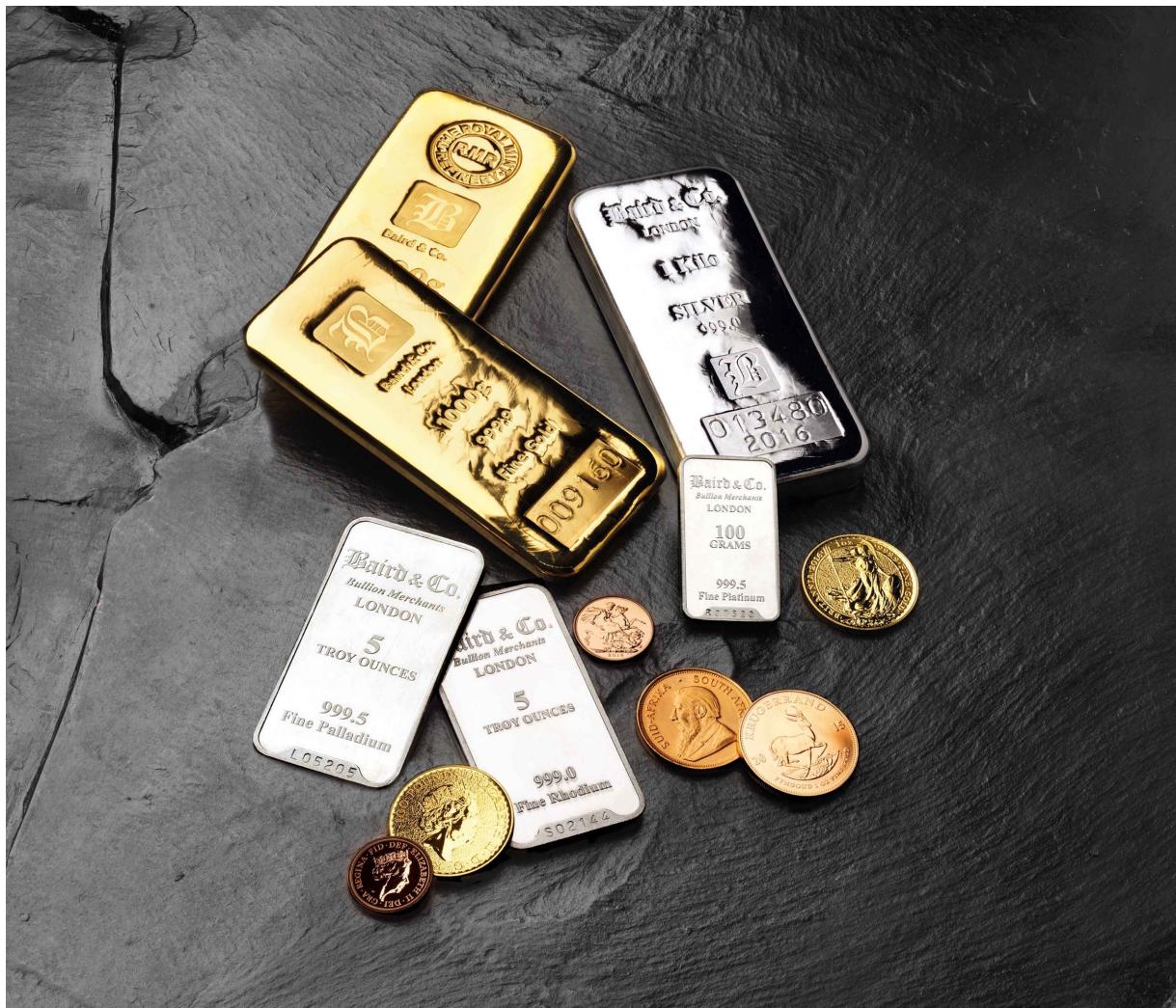
But to hold and trade metals as the professionals, family trusts, and wealthy do; then approaching a company such as Indigo Precious Metals (IPM Group) to work on your behalf to fully benefit from the following .....

- **For ultimate protection**
- **To have full liquidity** (the means of selling very quickly) **of any sized holdings**
- **Legal minimisation of tax, your metals held tax free in bonded vaults**
- **Best market prices of physical metals**
- **All unique bar numbers are checked and quoted into your vault with full certification given**
- **Held outside of the banking and financial system**
- **Personal wholly segregated client vaulting with direct personal control**
- **In one of the world's most secure vaulting facilities**
- **Fully insured by Lloyds of London**
- **Complete privacy & confidentiality**
- **Inspection visits welcomed and encouraged**
- **Regular inventory audits**
- **Zero solvency risks** – Your vaulted account is legally held solely under your own family name, our company has no legal right whatsoever over metal ownership title.
- **No Reporting Requirements** - There are no domestic or international reporting requirements for buying, selling or storing gold in Singapore.

Our company facilitates the purchase of **Gold, Silver, Platinum, Rhodium and Palladium**

We also source and vault the more rare metals such as **Ruthenium** and **Indium** on behalf of our clients.

Transact with us in **US\$, GBP, Euro, Sing\$ or MYR** on the latest live prices updated every minute.

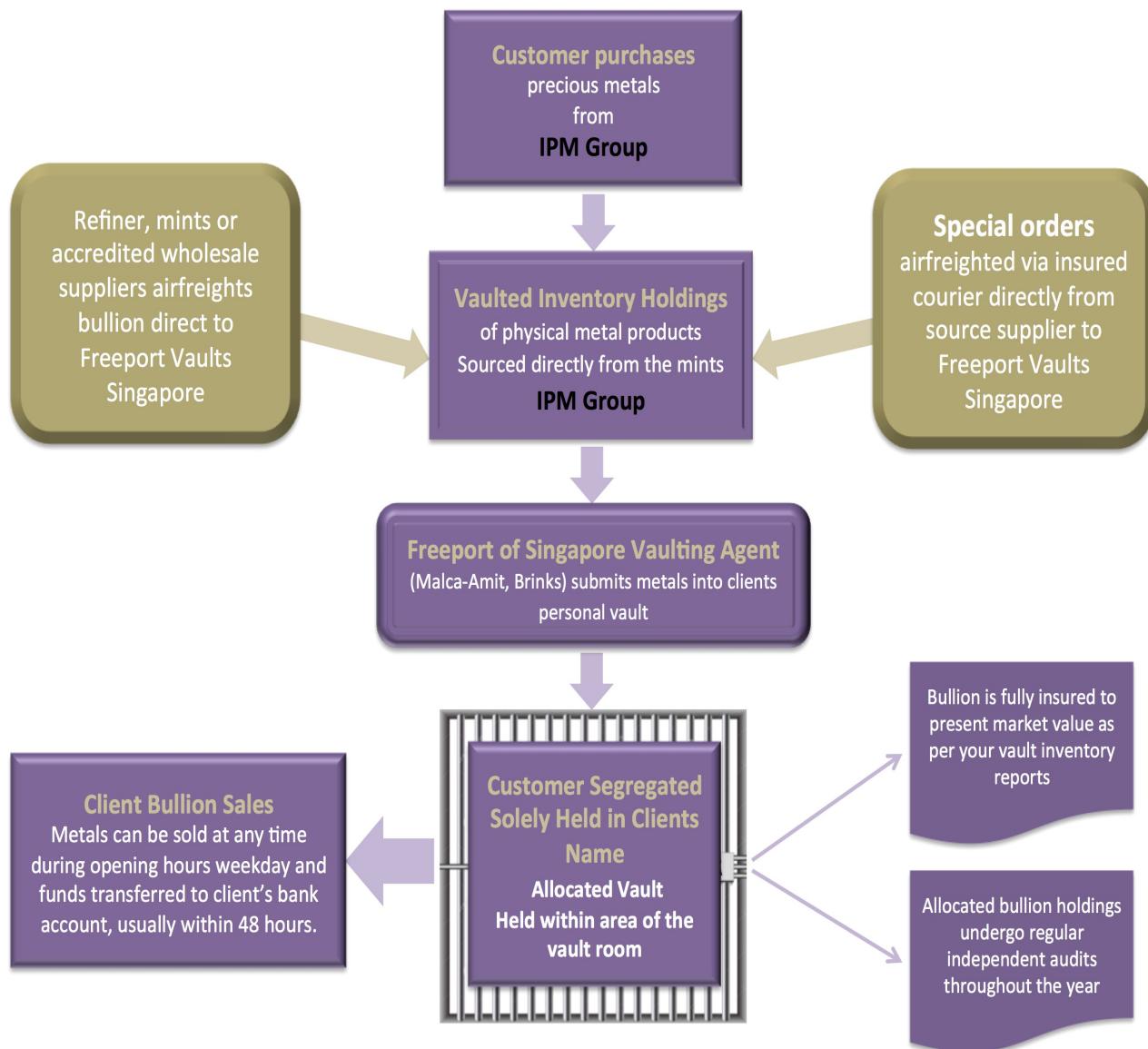


## Bonded Client Vaulting Flow Chart Diagram

### Singapore Freeport

#### Bonded Vaulting Facility

The World's Safest Storage and Trading Bullion Facility



**Please Note:** Our client's metals are held in their wholly segregated vaulted account under the client's family name and hence our company has no ownership title whatsoever.

The vast majority of bullion dealers around the world hold metals on behalf of their clients as sub-accounts and hence the legal title ownership actually falls to the company in question (counterparty risks). This is simply not the case when buying and storing with IPM Group, **100% client title ownership with no hidden costs in the safest and most advanced vaulting system anywhere in the world.**



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