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# PLATINUM QUARTERLY

## Q3 2016

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22nd November 2016

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### FOREWORD

It has been two years since we created the World Platinum Investment Council (WPIC). I am extremely proud of the work undertaken by the team to establish our Council, to provide insights and unique perspectives on the platinum market, and to create new market development opportunities.

We are pleased to play our part in the development of the global platinum market. The responses from market participants to our efforts, are overwhelmingly positive and very welcome.

When we launched the Council in November 2014 I emphasised our intention to enhance investors' understanding of the fundamentals driving this market. Today's *Platinum Quarterly* report, which includes analysis of the third quarter of 2016, a forecast for the full-year 2016 and a forecast for 2017, provides an excellent opportunity for me to once again scrutinise the fundamentals underpinning platinum.

We believe that platinum fundamentals are strong and will remain so in 2017. However, there remains a disconnect between the platinum price and its fundamentals. The views propagated by some commentators describe, and attempt to support, an overly negative view of future demand growth and an overly positive view of supply growth. We firmly believe that the opportunities for investors considering platinum as an investment are considerable.

2017 will see the platinum market remain in deficit for the sixth year in a row. Platinum sales from above ground stocks become increasingly less likely, diminishing the ability of these stocks to meet deficits. Consequently, after six years of deficits, fundamentals are now more pertinent than ever.

That said, today's *Platinum Quarterly* clearly highlights critical challenges and headwinds for the market that require scrutiny and objective explanation.

Jewellery demand is expected to be down by 10% in 2016, with China suffering a comparatively difficult year compared to 2015, when fabricator demand was more buoyant. There have been weaker than expected retail sales in China during 2016. This is primarily due to the impact of the government's crackdown on gold gifting, which reduced footfall in retail outlets. This depressed retailers' demand from fabricators, many of whom were also long on platinum stock.

While this is disappointing, we do not believe for one moment that China's jewellery market has suddenly gone ex-growth. We remain confident that the rate of urbanisation, long-term growth in disposable income and the effectiveness of jewellery promotion will continue to drive platinum jewellery sales growth in the medium term.

The success of the Indian market, up 15% in 2015, also underpins our longer-term confidence in overall platinum jewellery demand. The very successful Evara Blessings campaign and the promotion of platinum jewellery for men has helped to drive new demand in a market that is predicted to grow a further 16% in 2017. Overall global jewellery demand is forecast to grow by 2% next year.

Global automotive platinum demand is forecast to dip by just 1% in 2017 according to today's report. Western Europe remains the largest autocatalyst market for platinum where, although metal demand is expected to soften in 2017, automakers grapple with strategies to simultaneously meet far tougher CO<sub>2</sub> and real world driving NO<sub>x</sub> limits.

It is important to recognise the resilience of autocatalyst-related platinum demand in the context of some of the weak analysis and stark headlines putting forward an overly negative outlook. Let me be clear, and hopefully give potential investors reassurance: Platinum will remain at the vanguard of lowering diesel emissions for many years to come. It also plays a crucial catalytic role in fuel cell electric vehicles. This demand will be considerable in the medium term, as evidenced by ongoing launches by major automakers of hydrogen fuel cell electric cars, with the Toyota Mirai and Hyundai ix35 the most prominent to date.

Our stated goal is to provide investors with the necessary information to support informed decisions. Consequently, the WPIC has invested an increasing amount of time engaging with key participants in the diesel debate, including leading think-tanks, municipalities, politicians and, of course, the media in an effort to inject balance, crisp analysis and much-needed pause for thought on this matter.

The rise of battery electric vehicles is one area where we should take a breath, to assess the difference between perception and reality. Battery electric vehicle demand is not going to eclipse demand for the combustion engine anytime soon. In 2015, there were just over 330,000 battery electric vehicles (BEVs) sold around the world, some way short of the 88 million light duty vehicle purchases in that year. Sales of BEVs are growing but even the most bullish forecasts predict just a 2 per cent share of the global vehicle market by 2025.

As our name suggests, investment demand is of particular interest to the WPIC. Total investment demand is forecast to be 350 koz in 2016, while the projected figure is 250 koz in 2017.

Strong buying in October has more than reversed the third quarter's dip in global ETF holdings, but for 2016 as a whole ETF holdings are projected to decline modestly. Meanwhile, total bar and coin demand is expected to be strong for the full year. This is a more moderate continuation of the extremely high levels of buying seen in 2015, as Japanese investors have eased back on their purchases. Bar and coin demand is forecast to remain healthy in 2017.

2016 saw the WPIC launch a number of new market development initiatives to stimulate demand and improve investor access to platinum. They included: a new partnership with Swiss refiner Valcambi SA to expand availability of platinum bar and coin products worldwide; joining forces with BullionVault to include platinum in the online marketplace for physical precious metals; and also supporting the promotion of Mitsubishi's physically backed Platinum ETF in Japan.

With a number of new opportunities already close to fruition, we look forward to announcing new initiatives in 2017 that will help to further boost demand for physical platinum. But that is for the future.

I would like to end where I began: fundamentals. We should all set aside the negative hyperbole that sometimes clouds platinum demand and supply. Both supply and demand will reduce by 2% next year, which will once again lead to a deficit in 2017. Against this background, the platinum price discount to gold is, to say the least, surprising. The discount is the largest in history, and has lasted for the second longest period of just four such periods in the last 40 years.

We believe that platinum continues to be an attractive asset for many more investors than currently own it.

Thanks again for your support.

**Paul Wilson, CEO**

# PLATINUM QUARTERLY Q3 2016

**Table 1: Supply, demand and above ground stocks summary**

	2015	2016f	2017f	2016f/2015 Growth %	2017f/2016f Growth %	Q2 2016	Q3 2016
<b>Platinum Supply-demand Balance (koz)</b>							
<b>SUPPLY</b>							
<b>Refined Production</b>	<b>6,150</b>	<b>5,970</b>	<b>6,070</b>	<b>-3%</b>	<b>2%</b>	<b>1,665</b>	<b>1,595</b>
South Africa	4,465	4,235	4,300	-5%	2%	1,220	1,160
Zimbabwe	405	475	445	17%	-6%	115	115
North America	385	400	400	4%	0%	105	100
Russia	715	675	740	-6%	10%	180	175
Other	180	185	185	3%	0%	45	45
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+45</b>	<b>+40</b>	<b>-70</b>	<b>-11%</b>	<b>N/M</b>	<b>+60</b>	<b>-105</b>
<b>Total Mining Supply</b>	<b>6,195</b>	<b>6,010</b>	<b>6,000</b>	<b>-3%</b>	<b>0%</b>	<b>1,725</b>	<b>1,490</b>
<b>Recycling</b>	<b>1,710</b>	<b>1,860</b>	<b>1,745</b>	<b>9%</b>	<b>-6%</b>	<b>480</b>	<b>510</b>
Autocatalyst	1,190	1,230	1,235	3%	0%	340	315
Jewellery	515	625	505	21%	-19%	140	195
Industrial	5	5	5	0%	0%	0	0
<b>Total Supply</b>	<b>7,905</b>	<b>7,870</b>	<b>7,745</b>	<b>0%</b>	<b>-2%</b>	<b>2,205</b>	<b>2,000</b>
<b>DEMAND</b>							
<b>Automotive</b>	<b>3,395</b>	<b>3,390</b>	<b>3,360</b>	<b>0%</b>	<b>-1%</b>	<b>890</b>	<b>795</b>
Autocatalyst	3,255	3,250	3,210	0%	-1%	850	760
Non-road	145	145	145	0%	0%	35	35
<b>Jewellery</b>	<b>2,880</b>	<b>2,580</b>	<b>2,625</b>	<b>-10%</b>	<b>2%</b>	<b>620</b>	<b>665</b>
<b>Industrial</b>	<b>1,685</b>	<b>1,720</b>	<b>1,610</b>	<b>2%</b>	<b>-6%</b>	<b>450</b>	<b>440</b>
Chemical	600	610	585	2%	-4%	145	175
Petroleum	160	170	105	6%	-38%	45	45
Electrical	165	160	155	-3%	-3%	35	45
Glass	200	195	175	-3%	-10%	75	45
Medical and Biomedical	230	230	230	0%	0%	65	45
Other	330	355	360	8%	1%	85	85
<b>Investment</b>	<b>305</b>	<b>350</b>	<b>250</b>	<b>15%</b>	<b>-29%</b>	<b>90</b>	<b>40</b>
Change in Bars, Coins	525					110	70
Change in ETF Holdings	-240					-15	-85
Change in Stocks Held by Exchanges	20					-5	55
<b>Total Demand</b>	<b>8,265</b>	<b>8,040</b>	<b>7,845</b>	<b>-3%</b>	<b>-2%</b>	<b>2,050</b>	<b>1,940</b>
<b>Balance</b>	<b>-360</b>	<b>-170</b>	<b>-100</b>	<b>-53%</b>	<b>-41%</b>	<b>155</b>	<b>60</b>
<b>Above Ground Stocks</b>	<b>4,140*</b>	<b>2,315</b>	<b>2,045</b>	<b>-7%</b>	<b>-5%</b>		

Source: SFA (Oxford). \*As of 31st December 2012. NB: Numbers have been independently rounded.

Notes:

1. All estimates are based on the latest available information. They are subject to revision in our subsequent quarterly reports in the event that additional information is identified.

2. The WPIC did not publish quarterly estimates for 2013 or the first two quarters of 2014. However, quarterly estimates from Q3 2014 and Q4 2014 are contained in previously published PQs which are freely available on the WPIC website. Quarterly estimates from Q1 2015 and half-yearly estimates from H1 2015 are included in Tables 3 and 4 respectively, on pages 17-18 (supply, demand and above ground stocks).

3. The 2016 forecast is based on historical data and trends as well as modelling, with varying degrees of accuracy depending upon the supply or demand category. Investment demand is expected to be the least predictable segment. Some historical views are based on data and modelling that pre-date WPIC publication of PQ.

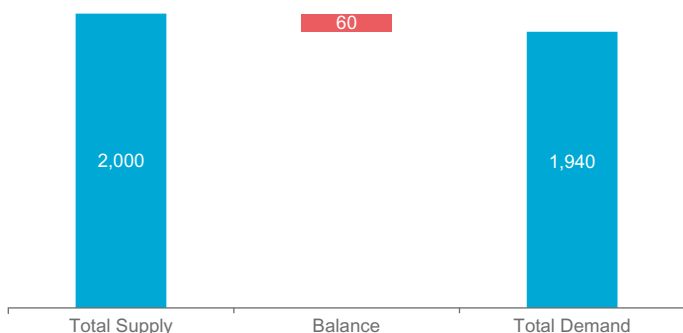
## 2016 THIRD QUARTER PLATINUM MARKET REVIEW

Total mining supply in the third quarter of 2016 declined 14% (-235 koz) quarter-on-quarter to 1,490 koz as refined supply from South Africa dipped 4% to 1,160 koz, owing to several safety stoppages and, after two quarters of refined stock sales to cover unexpected mine stoppages, producers replenished their inventory by 105 koz. Secondary supply increased by 6% to 510 koz, as a result of a gain in jewellery recycling from retailer destocking in China, that more than offset a decline in autocatalyst recycling, taking total supply to 2,000 koz (-9% quarter-on-quarter).

Total global demand fell 5% (-110 koz) quarter-on-quarter to 1,940 koz. Declines in automotive (-95 koz), industrial (-10 koz) and investment (-50 koz) demand were partially offset by greater jewellery consumption (+45 koz). Jewellery demand of 665 koz was up 7% quarter-on-quarter but down 16% year-on-year and much lower than anticipated as consumer demand in China didn't match expectations and retailers' high stock levels reduced the need for new metal purchases by fabricators ahead of the National Holiday. The third quarter typically sees seasonally lower autocatalyst demand which was 795 koz in Q3'16, down 11% quarter-on-quarter, but only 3% lower year-on-year.

With supply falling by more than demand quarter-on-quarter, the market balance narrowed to a surplus of 60 koz in the third quarter (Chart 1) from 155 koz in Q2'16.

**Chart 1: Supply-demand balance, koz, Q3 2016**

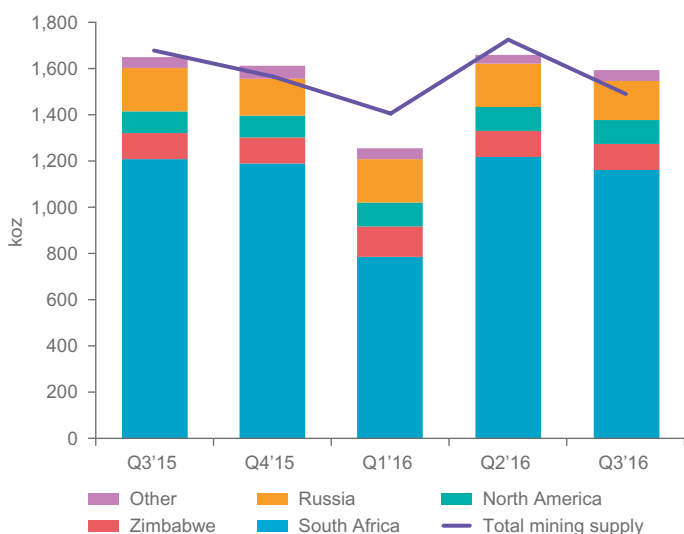


Source: SFA (Oxford)

## Supply

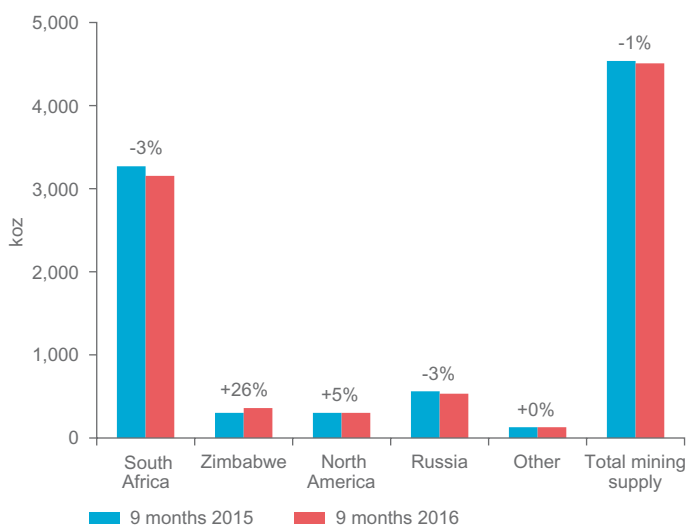
Total mining supply decreased by 14% quarter-on-quarter to 1,490 koz (-11% year-on-year) in Q3'16. Refined production fell by 4% quarter-on-quarter to 1,595 koz (-3% year-on-year) (Chart 2). However, cumulative refined production for the first nine months of 2016 totalled 4,515 koz (Chart 3), which is just 1% lower than the corresponding period of 2015. Following two quarters of refined stock reduction (-210 koz), there was an inventory build in Q3'16 of 105 koz.

**Chart 2: Global refined production**



Source: SFA (Oxford)

**Chart 3: Global refined production**



Source: SFA (Oxford)

Refined production from South Africa in Q3'16 was 5% lower than in Q2'16, at 1,160 koz. The major producers reported fatalities during the quarter, including three separate fall-of-ground incidents which resulted in Section 54 stoppages. Production was also negatively impacted by temporary shaft closures relating to a fire and a fall-of-ground that occurred during Q1'16 and Q2'16 respectively. A smelter outage reduced refined production by around 6 koz in Q3'16.

Supply from Russia dropped by 8% year-on-year in Q3'16, and by 3% on the previous quarter. A nickel smelter closure led to the re-routing of production to other smelters resulting in a pipeline lock-up of some material. Refined production for the first nine months of the year was 3% lower than the corresponding period of 2015.

Zimbabwe maintained production at 115 koz both quarter-on-quarter and year-on-year in Q3'16. Refined output for the first nine months of 2016 increased by 26% year-on-year owing to a release of concentrate in Q1'16 that had built up during the 2015 smelter outage. North American supply was down by 5% quarter-on-quarter but 11% higher year-on-year owing to plant maintenance in the prior year period. Refined production for the January to September period was up 5% on the corresponding 2015 total.

Total recycling gained 6% quarter-on-quarter to 510 koz in Q3'16 as an increase in jewellery recycling (+55 koz) more than offset a decline in autocatalyst secondary supply (-15 koz).

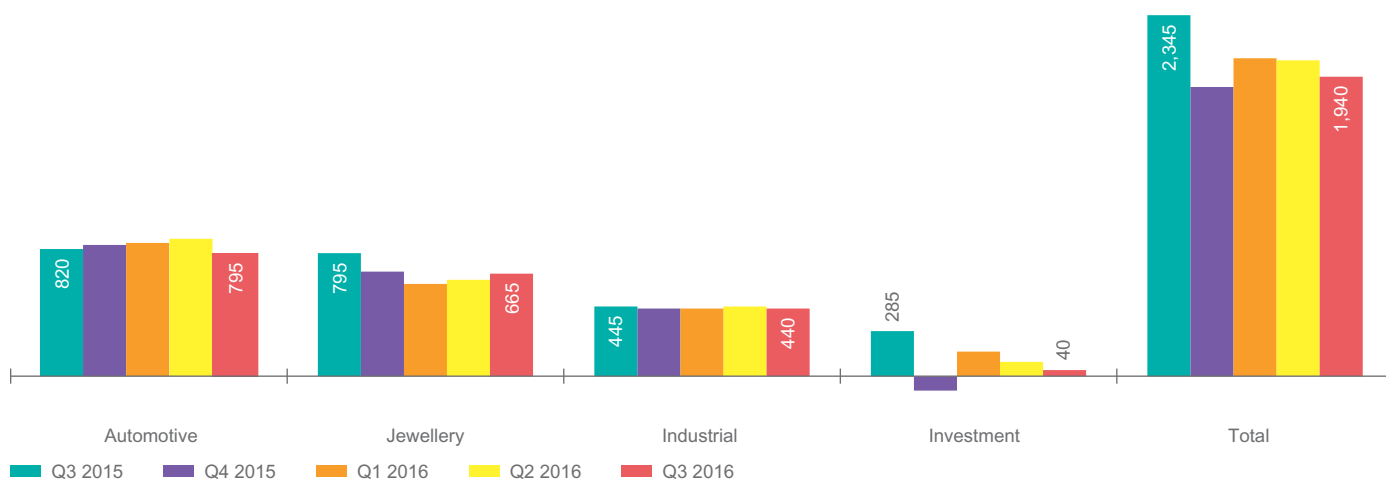
Jewellery recycling rose to 195 koz in the third quarter, which was significantly higher year-on-year (+75 koz) and quarter-on-quarter (+55 koz) than what were lower than normal levels in the comparison periods. China and Japan both experienced a higher level of recycling than that in Q2'16 as platinum prices were somewhat higher, up 10% in yuan and 3% in yen in Q3'16. A major contributor to recycling in China was a return of stock from retailers driven by lower than expected retail sales in Q3'16.

Platinum recovered from scrapped autocatalysts was 315 koz in the third quarter, 7% higher year-on-year but down 7% quarter-on-quarter. The level of recycling was still somewhat subdued as, while the platinum price was up 8% quarter-on-quarter which maintained the flow of scrapped converters from scrapyards to refineries, scrap steel prices dropped by 21% quarter-on-quarter in Q3'16 and reduced the number of vehicles being scrapped.

## Demand

Total global platinum demand was 1,940 koz in Q3'16 (Chart 4), down 5% quarter-on-quarter and 17% year-on-year. The main contributing factor to the decline was seasonally lower autocatalyst demand which was 795 koz in Q3'16, down 11% quarter-on-quarter (-95 koz), but only 3% lower year-on-year. Investment and industrial demand were down 50 koz and 10 koz respectively compared to the previous quarter, whereas jewellery demand was 45 koz higher.

**Chart 4: Platinum demand, koz**



Source: SFA (Oxford)

## Automotive demand

Total automotive demand in the third quarter decreased 3% year-on-year and 11% quarter-on-quarter to 795 koz, in line with northern hemisphere summer holiday seasonality, with on-road demand down to 760 koz, as diesel shares continued to fall in Western Europe, the main market, while non-road demand was stable at 35 koz.

In Western Europe platinum autocatalyst usage declined 1% year-on-year as gains in vehicle production failed to offset the decline in diesel's market share. Diesel's share of new car sales fell to 47.9% in September 2016, down 1.4 percentage points from 49.3% a year ago. That takes the year-to-date diesel share to 49.5%, down from 51.7% in the previous year. Automakers increasingly take the view that the additional cost of PGM-based diesel aftertreatment cannot be tolerated in the smaller car segments. Diesel demand continues to be eroded in the small to medium vehicle segments, while remaining robust in the larger segments.

## Jewellery demand

Platinum jewellery demand in Q3'16 was 665 koz, up 7% from the previous quarter but down 16% year-on-year, and much lower than had been anticipated. The main reasons for this year-on-year decline were a high level of fabricator purchases in China in Q3'15, as platinum prices fell to a level not seen for several years, and weaker consumer demand in China in 2016, which had led to retailers holding excess stock, so fabricator purchases were much lower than typical for the third quarter. Chinese fabricator platinum demand increased by 15% quarter-on-quarter but contracted by 26% year-on-year in Q3'16.

Platinum jewellery purchases have fallen in China as sales volumes in the broader jewellery retail market have declined significantly. Lower footfall in stores owing to declining interest in gold investment products has adversely affected jewellery buying. Major jewellery retailers in China have seen significant declines in overall revenues. Chow Tai Fook, the largest Chinese jewellery retailer, reported total Q3'16 sales down 17% in the Chinese mainland and 33% in Hong Kong and Macau from the same period in 2015, as sales across all segments declined, in particular sales of gold investment products. Demographics were unhelpful in the bridal segment as marriage registrations were 7% lower year-on-year in Q3'16.

India's platinum jewellery retail sales improved and demand grew by 20% quarter-on-quarter in Q3'16. Men's platinum jewellery was heavily promoted and proved increasingly popular, along with couple rings and bangles/bracelets.

Jewellery demand in Japan suffered in Q3'16 as, despite improving consumer sentiment, a very hot summer reduced consumer traffic in stores, and platinum jewellery sales are estimated to have dipped by 4% quarter-on-quarter.

## Industrial demand

Third-quarter industrial demand decreased slightly year-on-year to 440 koz, primarily owing to fewer expansions and new glass fabrication facilities being built in the RoW compared to Q3'15. However, the fall in glass sector demand was largely offset by greater requirements for new propane dehydrogenation (PDH) plants in China and petroleum refining capacity expansion in North America, whilst platinum use in automotive sensors and fuel cells also increased year-on-year.

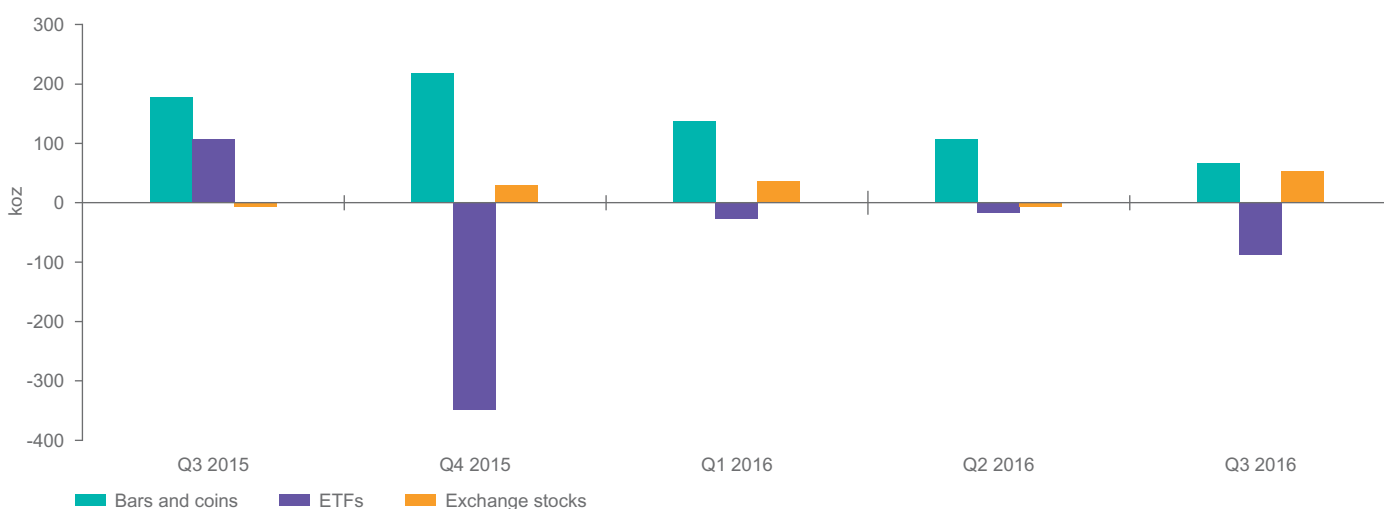
## Investment demand

In the third quarter, investment demand was 40 koz, substantially lower than in Q3'15 when bar purchases in Japan surged as the platinum price fell below ¥4,000/g. It was also down on the previous quarter, as bar and coin demand dipped to 70 koz and, while stocks held by exchanges increased by 55 koz, ETF holdings fell by 85 koz (Chart 5).

Coin sales had a relatively strong quarter as the US Mint released its American Eagle platinum bullion coin and the mintage of 20,000 coins sold out in just a couple of weeks, whereas bar buying was more subdued than in the previous quarter. The average price in yen was slightly higher in Q3'16 than Q2'16 and Japanese investors slowed their purchases.

Platinum held in ETFs declined by 85 koz during the quarter, but this was dominated by sales in the UK with only small changes to holdings occurring in other regions. Some UK investors may have taken the opportunity presented by a rising platinum price that was compounded by the fall in the pound after the EU referendum to take some profits, as they reduced their holdings by a total of 90 koz in July and August. At its peak in August the platinum price in sterling was up over 50% from the start of the year. The drop in the platinum price later in the quarter enticed a small amount of buying in late September which left UK ETF holdings down 81 koz on the quarter. US ETFs saw outflows of just 2 koz during the quarter, while South African investors' holdings dipped by 10 koz and Swiss ETF holdings gained 7 koz.

**Chart 5: Platinum investment**



Source: SFA (Oxford)

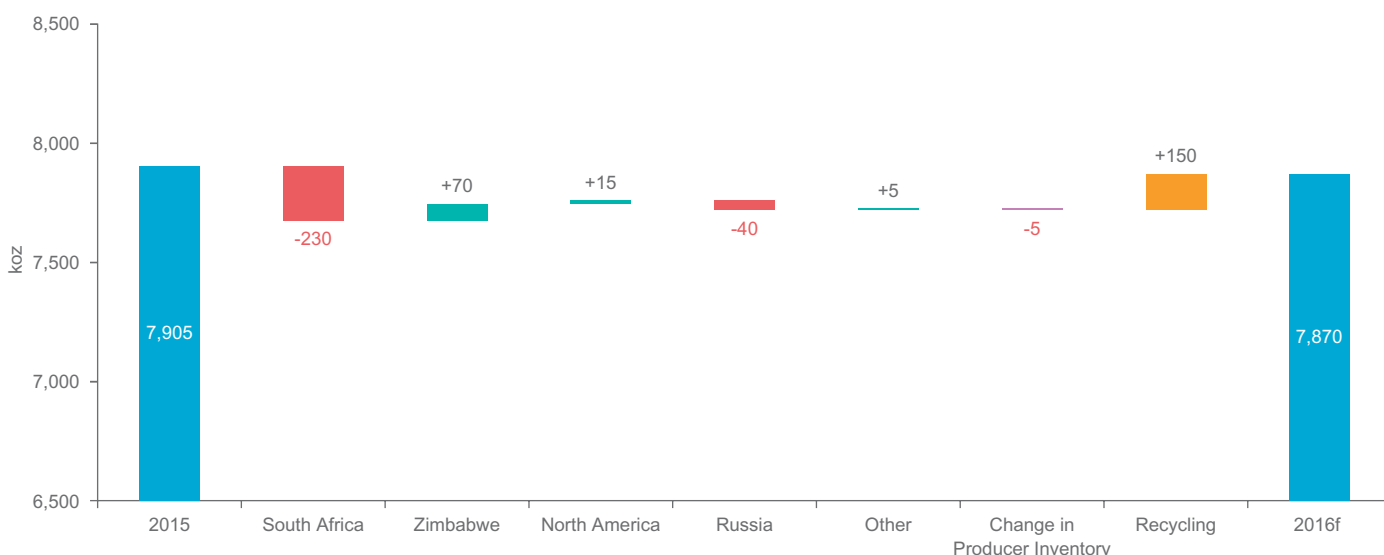
## 2016 FORECAST

Total platinum supply is forecast to be 7,870 koz in 2016, marginally lower year-on-year as lower refined production from South Africa and Russia outweighs gains in other regions and an increase in secondary supply (Chart 6).

Refined production is expected to be 5,970 koz, with total mining supply reaching 6,010 koz as net sales from producer inventories are anticipated. This is 3% lower year-on-year as declines in South Africa, from temporary shaft closures, and in Russia, from a reorganisation of processing facilities, more than offset gains in other regions.

The level of recycling expected in 2016 has been revised up from the last *Platinum Quarterly* and is projected to increase by 9% year-on-year to 1,860 koz. The main reason for the revision in secondary supply is the return of Chinese retailers' excess stock that had resulted from lower than anticipated retail sales during 2016. Globally, jewellery recycling is now projected to increase by 21% to 625 koz, while secondary supply from autocatalysts is estimated to expand by 40 koz (+3%) to 1,230 koz this year. The metal loadings in recycled catalysts have increased slightly this year but scrap steel price volatility has reduced scrappage rates.

**Chart 6: Changes in total supply, 2016f vs. 2015**



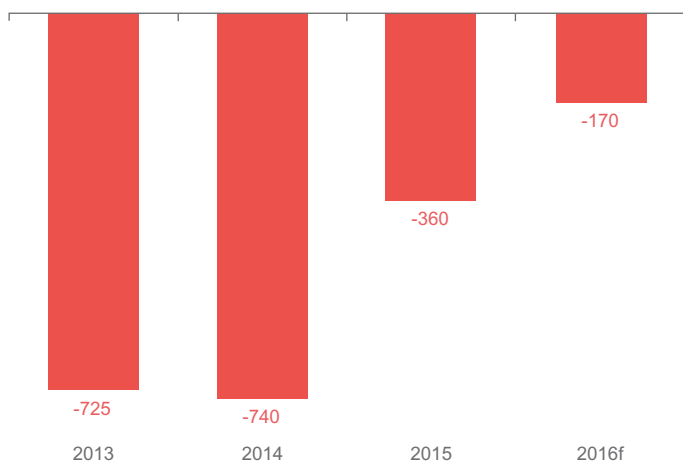
Source: SFA (Oxford)

Global demand is forecast to decrease by 3% year-on-year to 8,040 koz. Automotive demand is essentially flat year-on-year at 3,390 koz, while both investment and industrial requirements increase by 45 koz and 35 koz to 350 koz and 1,720 koz respectively. However, jewellery demand is projected to fall 10% year-on-year to 2,580 koz (-300 koz) owing to much lower demand in China, where a continued decline in retail sales and retailers' excess stocks have combined to reduce manufacturers' platinum requirements.



With global demand contracting by more than total supply, the market balance narrows to a deficit of 170 koz in 2016 (Chart 7).

**Chart 7: Supply-demand balance, koz, 2013-2016f**



Source: SFA (Oxford)

### Mine supply

Global refined supply is forecast to decline by 3% to 5,970 koz in 2016. South African production is estimated to be 5% (-230 koz) lower at 4,235 koz owing to shaft closures in 2015, and output from Russia is forecast to decrease by 5% (-40 koz) owing to a planned refinery closure. Processing of stockpiled concentrate and increasing production rates in Zimbabwe should see growth of 17% (+70 koz) year-on-year to 475 koz. Total mining supply is still expected to exceed 6,000 koz for the year, despite refined inventory restocking in the second half.

### Recycling

Platinum recovered via recycling is projected to grow by 150 koz (+9%) to 1,860 koz in 2016 as jewellery recycling is expected to increase by 21% year-on-year (+110 koz) mostly owing to the return of excess retailer stock in China. Secondary supply from autocatalysts is estimated to expand by 40 koz (+3% year-on-year) to 1,230 koz this year. The metal loadings in recycled catalysts have increased this year but scrap steel price volatility has lowered scrappage rates.

### Automotive demand

For the full year, automotive demand is estimated to reach 3,390 koz, essentially level with 2015 demand. Modest growth is anticipated from Western Europe as most of the individual markets are expected to grow overall in 2016, so rising total vehicle sales essentially offset the impact of the falling diesel share. Passenger car diesel share is forecast to fall to 50% for the full year in 2016, down from 52% in 2015.

## Jewellery demand

The outlook for global jewellery consumption has been revised down and it is now expected to decrease 10% to 2,580 koz (-300 koz) in 2016 owing to much lower fabricator demand in China, as continued weakness in retail sales has been compounded by high stock levels and retailer recycling.

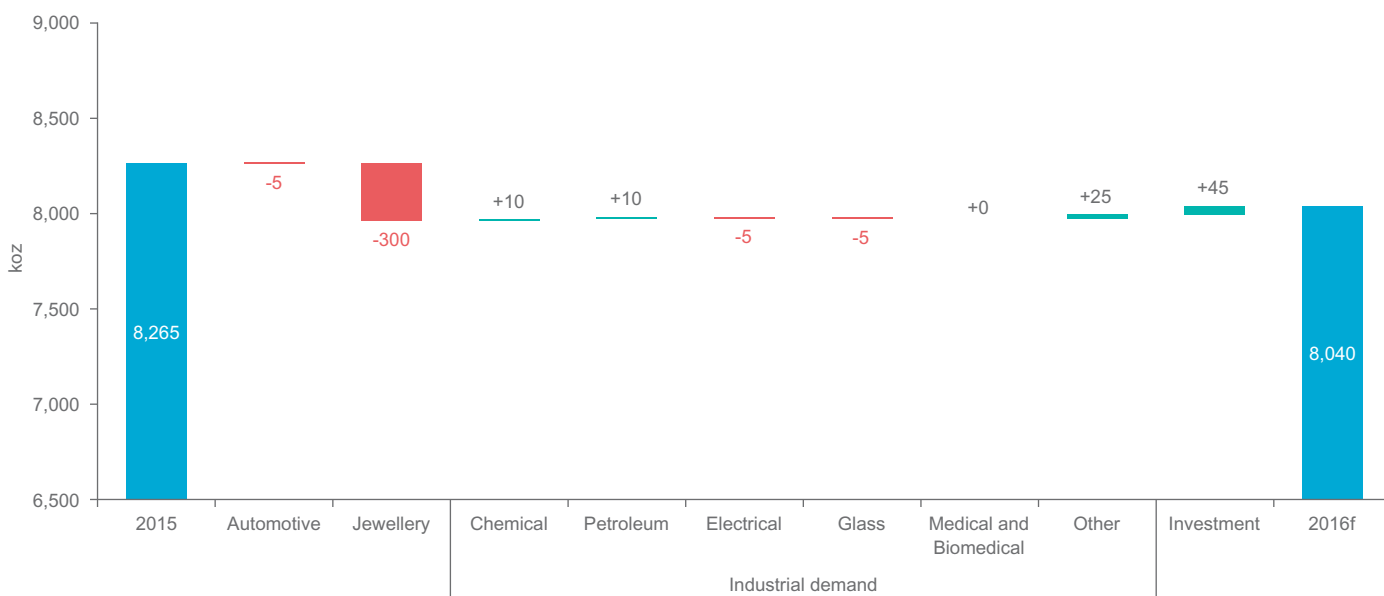
A number of factors have contributed to the on-going slowdown in jewellery sales and fabrication demand in China this year. Consumer sentiment has been weak in China and there is growing competition for consumers' luxury spending. Demand for gold investment products has fallen and this has resulted in lower footfall into stores. In addition, platinum jewellery is competing with 18K white gold and, while platinum jewellery is more expensive than gold jewellery owing to higher fabrication costs, when consumers return to upgrade jewellery they receive less trade in value for platinum than for gold. This may have resulted in some consumers seeing gold as relatively better value and contributed to weaker jewellery sales. Demographics are also working against platinum bridal jewellery in China as marriage registrations have slipped 4% year-on-year in the first nine months of the year.

Fabricators took advantage of the fall in the platinum price in the second half of 2015 to increase their purchases. However, the retail jewellery market has been struggling in 2016, with major retailers reporting significant year-on-year sales declines. This left retailers holding excess stock which resulted in increased recycling and depressed fabricators' demand for new metal. Trading on the SGE fell 14% year-on-year in the first nine months of the year reflecting lower fabricator buying. Expectations of seasonally strong fabricator stocking ahead of the National Day holiday also proved to be too optimistic and these factors along with a revision to Indian demand growth contributed to global jewellery demand being revised down by 305 koz from the previous *Platinum Quarterly*.

Indian jewellery demand growth has been revised down following a difficult first half when there was a strike by jewellery retailers. The second half of the year is expected to be much stronger with the festival and wedding season starting in October, and the outlook is still for solid growth of 15% year-on-year. Platinum Guild International's on-going Evara Platinum Blessings campaign and the promotion of men's jewellery are gaining traction and driving the rapid growth.

Changes in end-use demand from 2015 to 2016 are shown in Chart 8.

**Chart 8: Changes in demand by category, 2016f vs. 2015**



Source: SFA (Oxford)

### **Industrial demand**

Stronger demand for use in chemical catalysis, petroleum refining and other industrial end-uses is forecast to increase net platinum requirements to 1,720 koz (+2%) this year, although growth in these sectors is likely to be partially offset by minor reductions in electrical and glass demand. Greater nitric acid output and silicone production are anticipated to lift chemical demand in Western Europe and China respectively, whilst petroleum refining capacity expansion is expected to accelerate in North America and the RoW. Increasing platinum demand for use in commercially produced hydrogen fuel cells should boost consumption in other industrial end-uses, primarily in Japan and North America.

### **Chemical**

Higher usage in Western Europe (nitric acid) and China (silicone) is likely to raise platinum requirements to 610 koz (+2%) in 2016, outweighing declining demand in North America and the RoW. Greater silicone production and PDH capacity expansion are set to support demand growth in China, although lower PDH requirements are likely to decrease overall demand in North America and the RoW, owing to fewer new plants in these regions compared to last year.

### **Petroleum**

Following further delays to industry consolidation agreements in Japan, most of the anticipated refining capacity reductions in the country have been postponed until next year, reducing the amount of metal forecast to return to market from curtailed capacity in 2016. As a result, net demand in Japan is predicted to fall only marginally from 2015, whilst global platinum demand is now expected to rise to 170 koz (+6%) this year. Elsewhere, more rapid capacity expansion is likely to boost catalyst requirements in North America and the RoW, which should outweigh the platinum recovered from refinery reductions and closures in Western Europe.

### **Electrical**

Lower hard disk drive (HDD) demand is expected to soften platinum consumption to 160 koz (-3%) in 2016, as HDD shipments have decreased by 12% during the first nine months of the year and the full-year forecast is 11% below last year's level. The worst performing end-use market is likely to be computers, including desktops and laptops, with HDD usage in computers projected to decline by 19% this year. Platinum requirements for other electrical components are set to remain flat.

### **Glass**

The closure of glass fabrication facilities in Japan and Western Europe is forecast to weaken net demand to 195 koz (-3%) this year, although this is less of a fall than previously predicted owing to newly-identified projects in the RoW, which are slated to start operating in late 2016 and early 2017. Despite this, however, RoW requirements are still anticipated to be down compared to last year, although this should be offset by higher metal purchases for new plants and expansions in North America. In Japan, closures of liquid-crystal display (LCD) manufacturing capacity are likely to return platinum to the market and keep domestic demand net negative for the third successive year.

### **Other**

Platinum consumption in other industrial end-uses is projected to grow to 355 koz (+8%) in 2016, boosted by greater requirements in Japan, North America and China. Fuel cell industry development is expected to lift demand in Japan and North America, as adoption in various transport and stationary applications steadily rises, whilst higher vehicle production in China should increase platinum usage in automotive sensors.

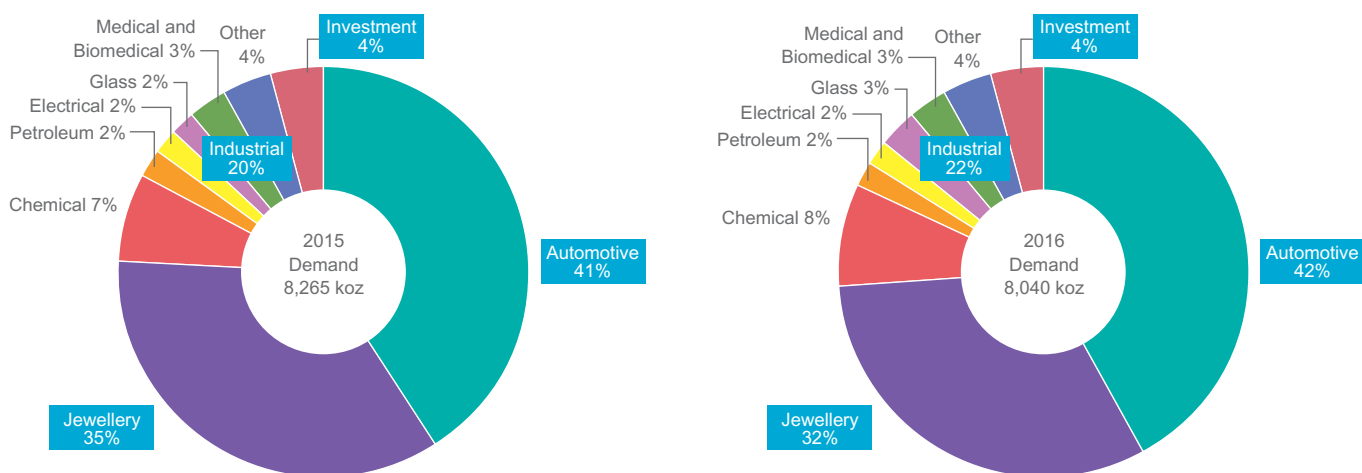
**Investment demand**

Total investment demand is forecast to be 350 koz in 2016. Strong buying in October has more than reversed the third quarter's fall in global ETF holdings, but for the year as a whole ETF holdings are projected to decline modestly.

Total bar and coin demand is expected to be robust, albeit not at such a high level as that seen in 2015, as Japanese investors have eased back on their purchases. The surge in buying that occurred in the second half of 2015, when the platinum price in yen fell below ¥4,000/g for the first time since 2012, has subsided, but purchases continue at a good pace as the platinum price has remained below ¥4,000/g so far this year. Coin demand has been supported by the US Mint making available both proof and bullion versions of the American Eagle platinum coin and the Austrian Mint producing a platinum Philharmonic coin.

In summary, demand shares by end-use are shown in Chart 9.

**Chart 9: Demand end use shares, 2016f vs. 2015**



Source: SFA (Oxford)

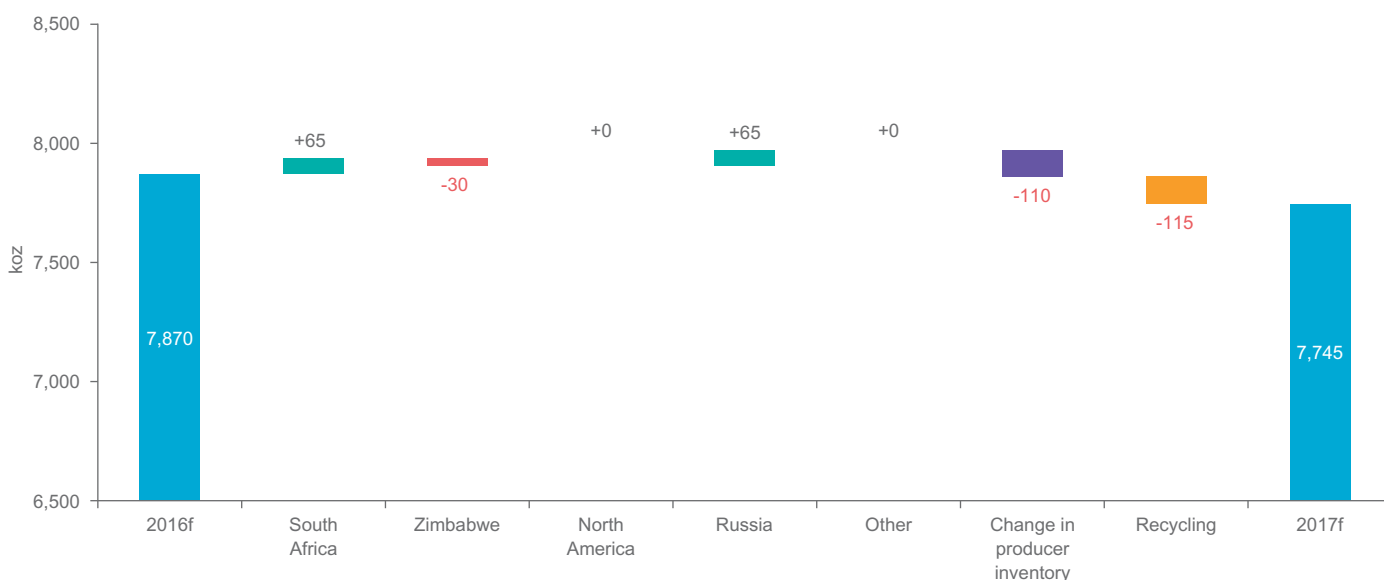
## 2017 OUTLOOK

Total global supply is forecast to dip 2% to 7,745 koz in 2017, mostly owing to a decline in secondary supply as jewellery recycling in China returns to a more typical level after retailer destocking raised it in 2016. Global demand is also expected to slip by 2% to 7,845 koz, as lower automotive, industrial and investment demand outweigh an increase in jewellery consumption, leaving the market with a deficit of 100 koz.

Global refined production is forecast to rise by 2% to 6,070 koz in 2017. With the exception of Zimbabwe, all regions are expected to sustain or increase production levels next year. The processing of a one-off concentrate backlog for Zimbabwe earlier this year, following a smelter outage in 2015, results in lower refined supply in 2017 (-6% to 445 koz). South African supply is forecast to grow by 2% to 4,300 koz owing to the ramp-up of two new mines and two replacement shafts, plus restoration of output from shafts temporarily closed in 2016. Production from Russia is predicted to recover to 740 koz (+10%), after a temporary dip in 2016 as a reorganisation of processing facilities was carried out, while supply from all other regions should hold steady at 585 koz. A net increase in refined inventory is expected – in the order of 70 koz – to lift producer stock levels towards typical ranges.

Secondary supply of platinum is forecast to decline to 1,745 koz next year (-6% year-on-year). Recycled platinum from autocatalysts is forecast to be little changed at 1,235 koz in 2017. The environment for recyclers is likely to remain difficult and scrap vehicle volumes in 2017 are expected to be slightly lower than 2016, but loadings in recovered autocatalysts are projected to increase which overall leads to essentially flat autocatalyst recycling. Global jewellery recycling is projected to drop back to 505 koz (-19%), as recycling in China is set to return to a more typical level.

**Chart 10: Changes in total supply, 2017f vs. 2016f**



Source: SFA (Oxford)

Global automotive platinum demand is forecast to dip by just 1% to 3,360 koz in 2017. Western Europe remains the largest autocatalyst market for platinum, but demand falls 3% as diesel market shares shrink steadily and the platinum content of diesel aftertreatment systems falls owing to changes in catalyst technology. Automakers vary in their strategies, but some do continue to rely on increasingly efficient diesel powertrains to meet their CO<sub>2</sub> emissions obligations. Diesel's share of passenger car powertrains is expected to continue its steady decline, to 48.5% in 2017.

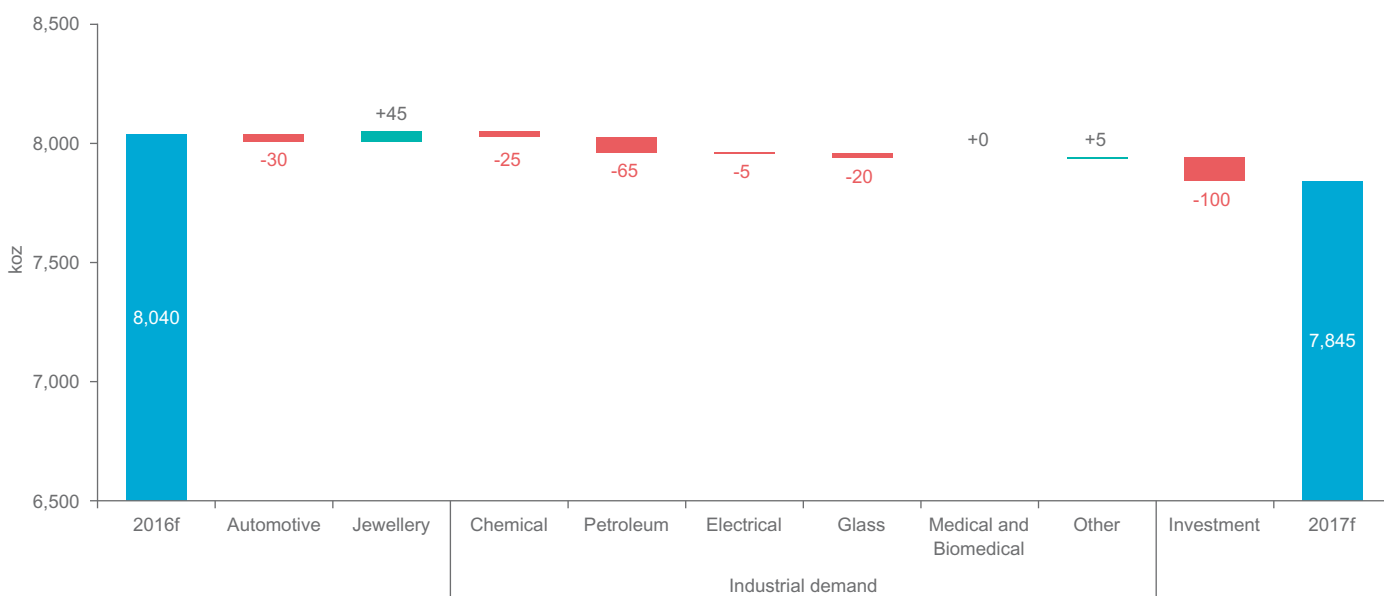
The US automotive market appears to be near a sales plateau, though remaining near the historical high. Despite events in 2015, several automakers have plans to release new diesel light vehicles for the US market in 2017, which demonstrates that automakers are already able to meet the stringent US emissions standards with a diesel engine.

The RoW countries, including India, are forecast to increase demand, offsetting Western Europe's decline. Indian demand assumes a resilient diesel share, but there are risks around air quality perceptions and the added cost of aftertreatment. The RoW countries, in particular Korea and Thailand, play an increasingly important part in sustaining platinum autocatalyst demand, driven by tightening emissions legislation and rising vehicle numbers.

Jewellery demand is forecast to be 2,625 koz in 2017, up 2% (+45 koz) from 2016. Indian demand is expected to grow 16% (+40 koz), as the on-going Evara campaign should continue to drive platinum jewellery sales, whereas consumption in Japan and China is projected to decrease slightly. The price differential to gold should continue to support demand in the US and Europe.

Lower requirements for use in petroleum refining, chemical catalysis and glass fabrication are estimated to weaken industrial demand by 110 koz (-6%) to 1,610 koz next year. The aforementioned delays to oil refinery consolidation and closures in Japan should result in a greater proportion of the anticipated capacity cuts occurring in 2017, returning platinum to market, whilst buying by Chinese on-purpose propylene producers should ease as fewer new PDH plants are scheduled to start up in the country next year. Elsewhere, the continued decline in HDD requirements is expected to reduce electrical demand, but this should be offset by gradual growth in the fuel cell industry in 2017.

**Chart 11: Changes in demand by category, 2017f vs. 2016f**



Source: SFA (Oxford)

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Total investment demand is projected to be 250 koz next year. Bar and coin demand is forecast to remain healthy in 2017 and a modest increase in ETF holdings is anticipated as the platinum price is expected to rise, but no new ETFs are scheduled to be launched. Bar purchases in Japan have been slowing during 2016 even though the platinum price has remained below ¥4,000/g, so while the yen is forecast to be slightly weaker in 2017, which should mean that the platinum price stays below ¥4,000/g, bar purchases in Japan are expected to be lower than in 2016.

### **ABOVE GROUND STOCKS**

The forecast market deficit of 170 koz in 2016 will reduce estimated above ground stocks to 2,145 koz at the end of the year, and with a deficit of 100 koz anticipated next year, above ground stocks are projected to end 2017 at 2,045 koz.

The WPIC definition of above ground stocks is: the year-end estimate of the cumulative platinum holdings not associated with exchange-traded funds, metal held by exchanges or working inventories of mining producers, refiners, fabricators or end-users.

# PLATINUM QUARTERLY Q3 2016

**Table 2: Supply, demand and above ground stocks summary – annual comparison**

	2013	2014	2015	2016f	2017f	2016f/2015 Growth %	2017f/2016f Growth %
<b>Platinum Supply-demand Balance (koz)</b>							
<b>SUPPLY</b>							
<b>Refined Production</b>	<b>6,070</b>	<b>4,880</b>	<b>6,150</b>	<b>5,970</b>	<b>6,070</b>	<b>-3%</b>	<b>2%</b>
South Africa	4,355	3,115	4,465	4,235	4,300	-5%	2%
Zimbabwe	405	405	405	475	445	17%	-6%
North America	355	400	385	400	400	4%	0%
Russia	740	740	715	675	740	-6%	10%
Other	215	220	180	185	185	3%	0%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>-215</b>	<b>+350</b>	<b>+45</b>	<b>+40</b>	<b>-70</b>	<b>-11%</b>	<b>N/M</b>
<b>Total Mining Supply</b>	<b>5,855</b>	<b>5,230</b>	<b>6,195</b>	<b>6,010</b>	<b>6,000</b>	<b>-3%</b>	<b>0%</b>
<b>Recycling</b>	<b>1,980</b>	<b>2,035</b>	<b>1,710</b>	<b>1,860</b>	<b>1,745</b>	<b>9%</b>	<b>-6%</b>
Autocatalyst	1,120	1,255	1,190	1,230	1,235	3%	0%
Jewellery	855	775	515	625	505	21%	-19%
Industrial	5	5	5	5	5	0%	0%
<b>Total Supply</b>	<b>7,835</b>	<b>7,265</b>	<b>7,905</b>	<b>7,870</b>	<b>7,745</b>	<b>0%</b>	<b>-2%</b>
<b>DEMAND</b>							
<b>Automotive</b>	<b>3,155</b>	<b>3,285</b>	<b>3,395</b>	<b>3,390</b>	<b>3,360</b>	<b>0%</b>	<b>-1%</b>
Autocatalyst	3,010	3,135	3,255	3,250	3,210	0%	-1%
Non-road	140	150	145	145	145	0%	0%
<b>Jewellery</b>	<b>2,945</b>	<b>3,000</b>	<b>2,880</b>	<b>2,580</b>	<b>2,625</b>	<b>-10%</b>	<b>2%</b>
<b>Industrial</b>	<b>1,525</b>	<b>1,570</b>	<b>1,685</b>	<b>1,720</b>	<b>1,610</b>	<b>2%</b>	<b>-6%</b>
Chemical	535	580	600	610	585	2%	-4%
Petroleum	115	65	160	170	105	6%	-38%
Electrical	190	190	165	160	155	-3%	-3%
Glass	145	175	200	195	175	-3%	-10%
Medical and Biomedical	220	220	230	230	230	0%	0%
Other	320	340	330	355	360	8%	1%
<b>Investment</b>	<b>935</b>	<b>150</b>	<b>305</b>	<b>350</b>	<b>250</b>	<b>15%</b>	<b>-29%</b>
Change in Bars, Coins	-5	50	525				
Change in ETF Holdings	905	215	-240				
Change in Stocks Held by Exchanges	35	-115	20				
<b>Total Demand</b>	<b>8,560</b>	<b>8,005</b>	<b>8,265</b>	<b>8,040</b>	<b>7,845</b>	<b>-3%</b>	<b>-2%</b>
<b>Balance</b>	<b>-725</b>	<b>-740</b>	<b>-360</b>	<b>-170</b>	<b>-100</b>	<b>-53%</b>	<b>-41%</b>
<b>Above Ground Stocks</b>	<b>4,140*</b>	<b>3,415</b>	<b>2,315</b>	<b>2,145</b>	<b>2,045</b>	<b>-7%</b>	<b>-5%</b>

Source: SFA (Oxford). \*As of 31st December 2012. NB: Numbers have been independently rounded.



# PLATINUM QUARTERLY Q3 2016

**Table 3: Supply, demand and above ground stocks summary – quarterly comparison**

	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q3'16/Q3'15 Growth %	Q3'16/Q2'16 Growth %
<b>Platinum Supply-demand Balance (koz)</b>									
<b>SUPPLY</b>									
<b>Refined Production</b>	<b>1,355</b>	<b>1,540</b>	<b>1,650</b>	<b>1,610</b>	<b>1,255</b>	<b>1,665</b>	<b>1,595</b>	<b>-3%</b>	<b>-4%</b>
South Africa	935	1,125	1,210	1,190	785	1,220	1,160	-4%	-5%
Zimbabwe	95	80	115	110	135	115	115	0%	0%
North America	100	100	90	100	100	105	100	11%	-5%
Russia	180	190	190	160	190	180	175	-8%	-3%
Other	45	45	45	50	45	45	45	0%	0%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+60</b>	<b>-5</b>	<b>+30</b>	<b>-40</b>	<b>+150</b>	<b>+60</b>	<b>-105</b>	<b>N/M</b>	<b>N/M</b>
<b>Total Mining Supply</b>	<b>1,415</b>	<b>1,535</b>	<b>1,680</b>	<b>1,570</b>	<b>1,405</b>	<b>1,725</b>	<b>1,490</b>	<b>-11%</b>	<b>-14%</b>
<b>Recycling</b>	<b>435</b>	<b>475</b>	<b>415</b>	<b>375</b>	<b>395</b>	<b>480</b>	<b>510</b>	<b>23%</b>	<b>6%</b>
Autocatalyst	315	310	295	270	280	340	315	7%	-7%
Jewellery	120	165	120	105	115	140	195	63%	39%
Industrial	0	0	0	0	0	0	0	N/M	N/M
<b>Total Supply</b>	<b>1,850</b>	<b>2,010</b>	<b>2,095</b>	<b>1,945</b>	<b>1,800</b>	<b>2,205</b>	<b>2,000</b>	<b>-5%</b>	<b>-9%</b>
<b>DEMAND</b>									
<b>Automotive</b>	<b>860</b>	<b>870</b>	<b>820</b>	<b>855</b>	<b>870</b>	<b>890</b>	<b>795</b>	<b>-3%</b>	<b>-11%</b>
Autocatalyst	825	830	785	815	835	850	760	-3%	-11%
Non-road	35	35	35	35	35	35	35	0%	0%
<b>Jewellery</b>	<b>745</b>	<b>670</b>	<b>795</b>	<b>675</b>	<b>600</b>	<b>620</b>	<b>665</b>	<b>-16%</b>	<b>7%</b>
<b>Industrial</b>	<b>405</b>	<b>410</b>	<b>445</b>	<b>435</b>	<b>435</b>	<b>450</b>	<b>440</b>	<b>-1%</b>	<b>-2%</b>
Chemical	160	140	165	130	150	145	175	6%	21%
Petroleum	40	40	40	40	40	45	45	13%	0%
Electrical	45	40	45	45	45	35	45	-0%	29%
Glass	30	45	70	65	60	75	45	-36%	-40%
Medical and Biomedical	50	65	45	65	55	65	45	0%	-31%
Other	80	80	80	90	85	85	85	6%	0%
<b>Investment</b>	<b>-10</b>	<b>115</b>	<b>285</b>	<b>-95</b>	<b>155</b>	<b>90</b>	<b>40</b>	<b>-86%</b>	<b>-56%</b>
Change in Bars, Coins	45	75	180	220	140	110	70	-61%	-36%
Change in ETF Holdings	-50	45	110	-345	-25	-15	-85	N/M	N/M
Change in Stocks Held by Exchanges	-5	-5	-5	30	40	-5	55	N/M	N/M
<b>Total Demand</b>	<b>2,000</b>	<b>2,065</b>	<b>2,345</b>	<b>1,870</b>	<b>2,060</b>	<b>2,050</b>	<b>1,940</b>	<b>-17%</b>	<b>-5%</b>
<b>Balance</b>	<b>-150</b>	<b>-55</b>	<b>-250</b>	<b>75</b>	<b>-260</b>	<b>155</b>	<b>60</b>		

Source: SFA (Oxford). NB: Numbers have been independently rounded. N/M means not meaningful.

# PLATINUM QUARTERLY Q3 2016

**Table 4: Supply, demand and above ground stocks summary – half-yearly comparison**

	H1 2015	H2 2015	H1 2016	H1'16/H1'15 Growth %	H1'16/H2'15 Growth %
<b>Platinum Supply-demand Balance (koz)</b>					
<b>SUPPLY</b>					
<b>Refined Production</b>	<b>2,895</b>	<b>3,260</b>	<b>2,920</b>	<b>1%</b>	<b>-10%</b>
South Africa	2,060	2,400	2,005	-3%	-16%
Zimbabwe	175	225	250	43%	11%
North America	200	190	205	3%	8%
Russia	370	350	370	0%	6%
Other	90	95	90	0%	-5%
<b>Increase (-)/Decrease (+) in Producer Inventory</b>	<b>+55</b>	<b>-10</b>	<b>+210</b>	<b>N/M</b>	<b>N/M</b>
<b>Total Mining Supply</b>	<b>2,950</b>	<b>3,215</b>	<b>3,130</b>	<b>6%</b>	<b>-3%</b>
<b>Recycling</b>	<b>910</b>	<b>790</b>	<b>875</b>	<b>-4%</b>	<b>11%</b>
Autocatalyst	625	565	620	-1%	10%
Jewellery	285	225	255	-11%	13%
Industrial	0	0	0	0%	0%
<b>Total Supply</b>	<b>3,860</b>	<b>4,040</b>	<b>4,005</b>	<b>4%</b>	<b>-1%</b>
<b>DEMAND</b>					
<b>Automotive</b>	<b>1,730</b>	<b>1,675</b>	<b>1,760</b>	<b>2%</b>	<b>5%</b>
Autocatalyst	1,655	1,600	1,685	2%	5%
Non-road	70	70	70	0%	0%
<b>Jewellery</b>	<b>1,415</b>	<b>1,470</b>	<b>1,220</b>	<b>-14%</b>	<b>-17%</b>
<b>Industrial</b>	<b>815</b>	<b>880</b>	<b>885</b>	<b>9%</b>	<b>1%</b>
Chemical	300	295	295	-2%	0%
Petroleum	80	80	85	6%	6%
Electrical	85	90	80	-6%	-11%
Glass	75	135	135	80%	0%
Medical and Biomedical	115	110	120	4%	9%
Other	160	170	170	6%	0%
<b>Investment</b>	<b>105</b>	<b>190</b>	<b>245</b>	<b>133%</b>	<b>29%</b>
Change in Bars, Coins	120	400	250	108%	-38%
Change in ETF Holdings	-5	-235	-40	N/M	-83%
Change in Stocks Held by Exchanges	-10	25	35	N/M	40%
<b>Total Demand</b>	<b>4,065</b>	<b>4,215</b>	<b>4,110</b>	<b>1%</b>	<b>-2%</b>
<b>Balance</b>	<b>-205</b>	<b>-175</b>	<b>-105</b>		

Source: SFA (Oxford). NB: Numbers have been independently rounded. N/M means not meaningful.

# PLATINUM QUARTERLY Q3 2016

**Table 5: Regional demand – annual and quarterly comparison**

	2013	2014	2015	2016f	2017f	2016f/2015 Growth %	2017f/2016f Growth %	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016
<b>Platinum gross demand (koz)</b>														
<b>Automotive</b>	<b>3,155</b>	<b>3,285</b>	<b>3,395</b>	<b>3,390</b>	<b>3,360</b>	<b>0%</b>	<b>-1%</b>	<b>860</b>	<b>870</b>	<b>820</b>	<b>855</b>	<b>870</b>	<b>890</b>	<b>795</b>
North America	425	465	475											
Western Europe	1,350	1,440	1,545											
Japan	580	590	570											
China	130	125	115											
India	160	160	170											
Rest of the World	510	505	520											
<b>Jewellery</b>	<b>2,945</b>	<b>3,000</b>	<b>2,880</b>	<b>2,580</b>	<b>2,625</b>	<b>-10%</b>	<b>2%</b>	<b>745</b>	<b>670</b>	<b>795</b>	<b>675</b>	<b>600</b>	<b>620</b>	<b>665</b>
North America	200	230	250											
Western Europe	220	220	235											
Japan	335	335	340											
China	1,990	1,975	1,765											
India	140	175	220											
Rest of the World	60	65	70											
<b>Chemical</b>	<b>535</b>	<b>580</b>	<b>600</b>	<b>610</b>	<b>585</b>	<b>2%</b>	<b>-4%</b>	<b>160</b>	<b>140</b>	<b>165</b>	<b>130</b>	<b>150</b>	<b>145</b>	<b>175</b>
North America	55	60	65											
Western Europe	105	110	105											
Japan	15	15	10											
China	200	225	245											
Rest of the World	160	170	175											
<b>Petroleum</b>	<b>115</b>	<b>65</b>	<b>160</b>	<b>170</b>	<b>105</b>	<b>6%</b>	<b>-38%</b>	<b>40</b>	<b>40</b>	<b>40</b>	<b>40</b>	<b>40</b>	<b>45</b>	<b>45</b>
North America	40	25	-25											
Western Europe	-45	-15	70											
Japan	10	-35	5											
China	80	-5	45											
Rest of the World	30	95	65											
<b>Electrical</b>	<b>190</b>	<b>190</b>	<b>165</b>	<b>160</b>	<b>155</b>	<b>-3%</b>	<b>-3%</b>	<b>45</b>	<b>40</b>	<b>45</b>	<b>45</b>	<b>45</b>	<b>35</b>	<b>45</b>
North America	10	15	10											
Western Europe	5	10	10											
Japan	15	15	15											
China	75	70	55											
Rest of the World	85	80	75											
<b>Glass</b>	<b>145</b>	<b>175</b>	<b>200</b>	<b>195</b>	<b>175</b>	<b>-3%</b>	<b>-10%</b>	<b>30</b>	<b>45</b>	<b>70</b>	<b>65</b>	<b>60</b>	<b>75</b>	<b>45</b>
North America	5	10	0											
Western Europe	-10	15	10											
Japan	0	-25	-5											
China	90	85	95											
Rest of the World	60	90	100											
<b>Medical and Biomedical</b>	<b>220</b>	<b>220</b>	<b>230</b>	<b>230</b>	<b>230</b>	<b>0%</b>	<b>0%</b>	<b>50</b>	<b>65</b>	<b>45</b>	<b>65</b>	<b>55</b>	<b>65</b>	<b>45</b>
North America	90	90	90											
Western Europe	75	75	75											
Japan	20	20	20											
China	15	15	20											
Rest of the World	20	20	25											
<b>Other industrial</b>	<b>320</b>	<b>340</b>	<b>330</b>	<b>355</b>	<b>360</b>	<b>8%</b>	<b>1%</b>	<b>80</b>	<b>80</b>	<b>80</b>	<b>90</b>	<b>85</b>	<b>85</b>	<b>85</b>
<b>Investment</b>	<b>935</b>	<b>150</b>	<b>305</b>	<b>350</b>	<b>250</b>	<b>15%</b>	<b>-29%</b>	<b>-10</b>	<b>115</b>	<b>285</b>	<b>-95</b>	<b>155</b>	<b>90</b>	<b>40</b>
<b>Total Demand</b>	<b>8,560</b>	<b>8,005</b>	<b>8,265</b>	<b>8,040</b>	<b>7,845</b>	<b>-3%</b>	<b>-2%</b>	<b>2,000</b>	<b>2,065</b>	<b>2,345</b>	<b>1,870</b>	<b>2,060</b>	<b>2,050</b>	<b>1,940</b>

Source: SFA (Oxford). NB: Numbers have been independently rounded.

## GLOSSARY OF TERMS

### Above ground stocks

The year-end estimate of the cumulative platinum holdings not associated with: exchange-traded funds, metal held by exchanges or working inventories of: mining producers, refiners, fabricators or end-users. Typically, unpublished vaulted metal holdings from which a supply-demand shortfall can be readily supplied or to which a supply-demand surplus can readily flow.

### BDH

Butane dehydrogenation; catalytic conversion of isobutane to isobutylene.

### Bharat Stage III/IV standards (BS-III, BS-IV)

Bharat Stage III is equivalent to Euro 3 emissions legislation. Introduced in 2005 in 12 major cities across India and enforced nationwide from April 2010. Bharat Stage IV is equivalent to Euro 4 emissions legislation. Introduced in 2010 in 14 major cities across India and set to be enforced nationwide from April 2017.

### Bharat Stage V/VI standards (BS-V, BS-VI)

Early in 2016 the Indian government announced the intention to 'leapfrog' Bharat Stage V and move directly to Bharat Stage VI, equivalent to Euro 6, in 2020.

### Conformity factor (CF)

The EU is to allow automakers to exceed current Euro 6 NO<sub>x</sub> limits, giving time to adapt to new real-world driving emissions rules. From September 2017 for new models and from September 2019 for new vehicles, a CF of up to 2.1 (110%) will be allowed over the 80 mg/km NO<sub>x</sub> limit. This CF will be phased out at the latest in 2021, then from January 2020 (new models) and January 2021 (new vehicles) a lower CF of 1.5 will be allowed, reflecting statistical and technical uncertainty of the tests.

### Diesel oxidation catalyst (DOC)

A DOC oxidises harmful carbon monoxide and unburnt hydrocarbons, produced by incomplete combustion of diesel fuel, to harmless carbon dioxide and water.

### Diesel particulate filter (DPF) and catalysed diesel particulate filter (CDPF)

A DPF physically filters particulates (soot) from diesel exhaust. A CDPF adds a PGM catalyst coating to facilitate oxidation and removal of the soot. The terms are often used interchangeably.

### Emissions legislation

Tailpipe regulations covering emissions of particulate matter, hydrocarbons and oxides of nitrogen.

### ETF

Exchange-traded fund. A security that tracks an index, commodity or basket of assets. Platinum ETFs included in demand are backed by physical metal.

### Euro V/VI emission standards

EU emission standards for heavy-duty vehicles. Euro V legislation was introduced in 2009 and Euro VI in 2013/2014; will be widely adopted later in other regions.

### Euro 5/6 emission standards

EU emission standards for light-duty vehicles. Euro 5 legislation was introduced in 2009 and Euro 6 in 2014/2015; will be widely adopted later in other regions.

### Form factor

The size of a hard disk drive (e.g. 2.5-inch or 3.5-inch) which varies depending on the device the drive is used in.

### GTL

Gas-to-liquids is a refinery process that converts natural gas to liquid hydrocarbons such as gasoline or diesel fuel.

### HDD

Hard disk drive.

### HDV

Heavy-duty vehicle.

### koz

Thousand ounces.

### LCD

Liquid-crystal display used for video display.

### LCV

Light commercial vehicle.

### Lean NO<sub>x</sub> traps (LNT)

Rhodium-based, catalyses the chemical reduction of NO<sub>x</sub> in diesel engine exhaust to harmless nitrogen.

### Metal-in-concentrate

PGMs contained in the concentrate produced after the crushing, milling and froth flotation processes in the concentrator. It is a measure of a mine's output before the smelting and refining stages.

### **moz**

Million ounces.

### **Net demand**

A measure of the theoretical requirement for new metal, i.e. net of recycling.

### **Non-road engines**

Non-road engines are diesel engines used, for example, in construction, agricultural and mining equipment, using engine and emissions technology similar to on-road heavy-duty diesel vehicles.

### **OECD**

Organisation for Economic Co-operation and Development, consisting of 34 developed countries.

### **oz**

A unit of weight commonly used for precious metals.  
1 troy ounce = 1.1 ounces.

### **Paraxylene**

A chemical produced from petroleum naphtha extracted from crude oil using a platinum catalyst. This is used in the production of terephthalic acid which is used to manufacture polyester.

### **PDH**

Propane dehydrogenation, where propane is converted to propylene.

### **PGMs**

Platinum-group metals.

### **Producer inventory**

As used in the supply-demand balance, the change in producer inventory is the difference between reported refined production and metal sales.

### **Refined production**

Processed platinum output from refineries.

### **Secondary supply**

Recycling output.

### **Selective catalytic reduction (SCR)**

PGM-free, converts harmful NO<sub>x</sub> in diesel exhaust to harmless nitrogen, via a tank of urea solution. Used in heavy-duty diesel vehicles, increasingly competes with LNT in light-duty diesel vehicles.

### **SGE**

Shanghai Gold Exchange.

### **Stage 4 regulations**

European emission standards implemented in 2014 for non-road diesel engines.

### **Three-way catalyst**

Used in gasoline cars to remove hydrocarbons, carbon monoxide and NO<sub>x</sub>. Largely palladium-based now, some rhodium.

### **Tier 4 stage**

Emissions standards phased in between 2008 and 2015 in the US for non-road vehicles.

### **WPIC**

The World Platinum Investment Council.

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### **Ounce conversion**

1 million ounces = 31.1 tonnes.

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