PLATINUM 2011

Interim Review

Johnson Matthey

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Background image: Autocatalyst scrap being recycled.

PLATINUM 2011

Interim Review

by **Jonathan Butler**

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Johnson Matthey

EXECUTIVE SUMMARY

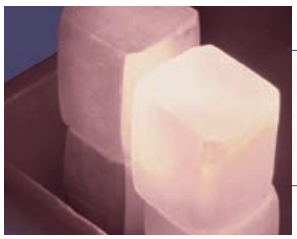
Gross demand for platinum is forecast to rise by 2% to 8.08 million ounces in 2011, close to pre-recession levels. However, continued strong demand will be more than matched by a rise in supplies and higher levels of recycling, therefore we predict that the platinum market will move to a small surplus of 195,000 oz this year.

Global supplies of platinum are expected to increase by 6% to 6.4 million ounces this year. We forecast that supplies of platinum from South Africa will rise by a modest 3% for the full year to 4.78 million ounces. Russian supplies are predicted to be flat at 825,000 oz. However supplies in North America are set to rise and growth is also expected in Zimbabwe as new production comes on-stream.

Platinum demand in autocatalysts is set to increase by 3% to 3.16 million ounces in 2011. Demand will increase in North America as production of light duty diesel trucks picks up. Purchasing of platinum for light duty vehicles in Europe and Japan will decline. In North America and Europe, another strong year is forecast for heavy duty truck production, which will benefit platinum demand.

Demand for platinum in the jewellery sector is forecast to be marginally higher than in 2010 at 2.47 million ounces. In China, we predict that gross platinum jewellery demand will rise by a modest 2% to 1.69 million ounces. We expect demand to soften in Europe due to higher prices and a move towards lower weights of individual pieces.

Gross industrial demand for platinum is predicted to increase to a new record high of 1.96 million ounces. As platinum melting tanks are installed for LCD glass manufacturing, demand will grow by 13% to 435,000 oz in the glass sector. Construction of new refining capacity in the petroleum industry will lift platinum demand by 24% to 210,000 oz.



Physical investment demand for platinum will once again be healthy, but at a lower level than last year. Investment is the only demand sector which will decline year-on-year, although it will remain positive at 495,000 oz driven by Japanese investment bar and exchange traded fund (ETF) buying.

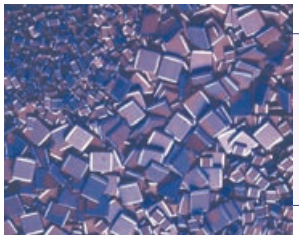
The rhodium market will be in oversupply by 123,000 oz in 2011. Gross demand is expected to grow by 2% to 905,000 oz but this will be outpaced by a 5% increase in supplies, to 768,000 oz, and a rise in recovery from recycled autocatalysts of 8% to 260,000 oz.

The palladium market is forecast to be in surplus by 725,000 oz in 2011, but only because of another year of sales from Russian state stocks. Without shipments of state stocks this year, the palladium market would essentially be in balance with rising autocatalyst and industrial demand and growth in mined supply, but softer investment and jewellery demand.

Sales of newly refined palladium are expected to increase by 5% to 6.67 million ounces in 2011. We believe that this will be supplemented by sales from Russian state stocks of 750,000 oz, bringing total supplies to 7.42 million ounces, a similar level to that in 2010.

Gross demand for palladium in autocatalysts is predicted to rise by 6% to 5.92 million ounces this year. Growth in vehicle production in Europe and North America in the first half of the year, coupled with palladium's greater use in diesel autocatalyst formulations, is expected to drive palladium demand in emissions control to historic highs.

We forecast that palladium investment demand will be negative by 215,000 oz in 2011. Investor sentiment appears to be less enthusiastic for palladium this year, with net liquidation in the ETF investment market in the nine months to the end of September 2011.



Industrial demand for palladium is forecast to rise by 7% to reach pre-recession levels of 2.65 million ounces. Purchasing of palladium in the electrical sector is set to remain strong as sales of new computer equipment stimulate the manufacture of palladium-containing components. With downstream demand from consumers in Asia, palladium demand in the chemical industry should also rise.

Gross demand for palladium jewellery is set to fall by 8% this year to 545,000 oz. Higher prices and weaker consumer sales have led some manufacturers to stop producing palladium jewellery in China. Palladium remains robust in Europe where it has a niche in the men's wedding band sector.

Recycling of palladium is forecast to rise by 19% to 2.2 million ounces. Higher numbers of scrapped vehicles will result in more palladium-loaded catalysts entering the refining stream in 2011. Recovery of palladium-containing electronic scrap should also rise, driven by legislation in Europe.

SUMMARY

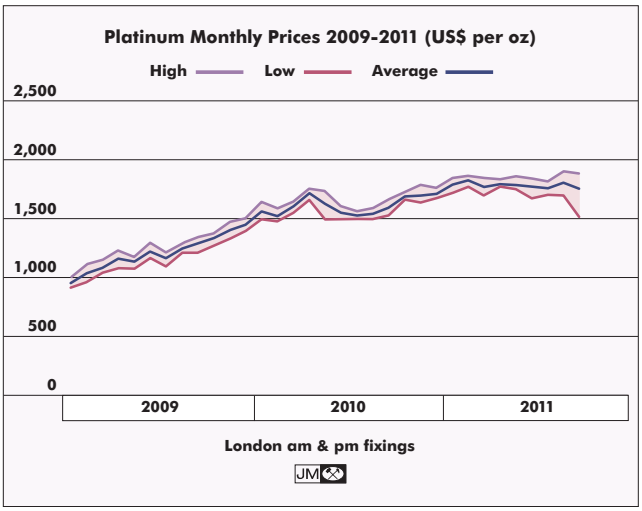
PLATINUM

- **The platinum market is forecast to be in a small surplus of 195,000 oz this year.**
- **Gross demand for platinum is predicted to grow by 175,000 oz to 8.08 million ounces in 2011, the highest level for four years.**
- **Global supplies of platinum are anticipated to increase by 6% to 6.4 million ounces, while recovery of platinum from recycling is set to rise by 3% to 1.88 million ounces.**
- **Platinum demand in autocatalysts is expected to total 3.16 million ounces this year, an increase of 3% compared with 2010.**
- **Industrial demand for platinum is predicted to climb to 1.96 million ounces in 2011, a record high.**
- **Purchases of platinum by the jewellery sector are set to be slightly higher than last year, at 2.47 million ounces. Investment demand, while positive, will decline.**

Gross demand for platinum is forecast to rise to 8.08 million ounces in 2011, close to pre-recession levels, with year-on-year growth in all sectors apart from investment. Despite economic uncertainty, platinum demand in autocatalysts is set to rise by 3% to a three-year high of 3.16 million ounces following a strong performance by the global automotive sector in the first half of the year. Commitments to build or expand capacity in a range of industrial sectors will raise industrial platinum demand by 12% to 1.96 million ounces, a record high. Even the traditionally price-sensitive jewellery sector is set to grow modestly, driven by demand in China, despite rising platinum prices for much of 2011. Physical investment demand is predicted to be lower than in 2010, but still positive at almost half a million ounces. Continuing strong demand is expected to be more than matched by growth in supplies and higher recycling. As a result, we predict that the platinum market will move to a small surplus of 195,000 oz in 2011.

Global supplies of platinum are forecast to rise to 6.4 million ounces in 2011. Most of the growth in supplies will come from North America and Zimbabwe, rather than South Africa. Mine output in South Africa in the first half of the year was disrupted by illegal strikes, poor productivity and a higher than usual number of safety stoppages at some operations. Shipments were maintained in the first half by sales from refined stocks and releases from the refining pipeline. Despite the operational difficulties, in production and sales terms the first half was relatively strong. In the second half of the year, we expect underlying production to show some improvement; overall we forecast that South African supplies of platinum in 2011 will rise by 3% to 4.78 million ounces.

With platinum output in Russia expected to be flat at 825,000 oz, growth in supplies is expected to be highest in North America, rising by 80% to 360,000 oz. Production of platinum at Vale's Sudbury mines is set to rise in 2011 with operations in full production following a year-long strike during 2009 and 2010. Higher output is also expected at Stillwater and North American Palladium. Growth is also forecast in Zimbabwe due to the start of production at the Unki mine.



Platinum traded generally higher in the first nine months of 2011 compared with 2010, but there were notable price dips in March, June and September.

Recovery of platinum from open loop recycling is once again expected to rise, by 3% to 1.88 million ounces. Higher numbers of autocatalysts from end-of-life vehicles are being returned for recycling, driven by a combination of better collection networks, higher pgm prices and higher scrappage rates. Platinum recovery is forecast to rise as a growing number of diesel catalysts enter the refining stream in Europe. Recycling of old platinum jewellery by consumers in Japan is expected to rise, but in China lower levels of manufacturing and retail scrap are predicted to lead to a fall in recycling levels, resulting in less platinum jewellery recycling overall.

Vehicle production worldwide is expected to be higher in 2011. Gross demand for platinum in autocatalysts will increase but the regional picture is mixed. Overall platinum demand in autocatalysts in Europe is forecast to decline modestly as higher

light duty vehicle production, particularly diesels, is offset by further substitution of platinum by palladium. In Japan, disruption to vehicle production from the March earthquake will result in lower vehicle output compared with 2010 with a consequent impact on platinum, which is still used by Japanese manufacturers in light duty gasoline vehicles. Disruption to Japanese manufacturers' transplants will also impact platinum purchases outside Japan. Platinum demand is set to increase in North America as production of light duty diesel trucks picks up. In heavy duty diesel emissions control, platinum demand is predicted to benefit from continued strong production of large trucks as freight operators renew their fleets following the recession. Although economic uncertainty in the second half of 2011 has the potential to impact production of both heavy and light duty vehicles, at the time of writing demand appears to be robust.

Industrial purchasing of platinum is set to grow to its highest ever level of 1.96 million ounces in 2011. A rise in demand of 13% to 435,000 oz is expected in the glass manufacturing sector as new LCD glass melting tanks are installed. Demand for LCD glass in consumer products such as televisions and mobile devices is driving capacity expansions of platinum melting tanks in Asia. However, overcapacity in the global glass fibre industry should keep demand for platinum in this segment subdued. Demand for platinum in petroleum refining is also set to increase by 24% to 210,000 oz as a result of expansions and new refining capacity. These include a renewable biodiesel plant in Europe which opened in September.

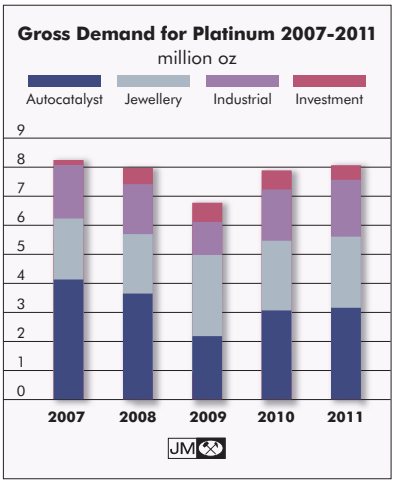
We are forecasting a marginal rise in platinum jewellery demand, by 2%, to 2.47 million ounces in 2011. We expect demand to soften in Europe and remain flat in Japan and North America. In China, we anticipate that plain platinum jewellery manufacturing will be supplemented with a greater range of gem-set pieces. At the consumer level, gold jewellery has been in great demand due to the rising price of gold and the perception of gold as a store of value. Some retailers report that they have reduced the amount of counter space given to platinum jewellery in favour of displaying more gold, and jewellery manufacturers have increased gold output, at the expense of platinum in some cases. However, the price premium of gold over platinum has recently led to some platinum stock building by manufacturers and retailers. As gold has achieved price parity or a premium with platinum, some consumers have also begun to see platinum's price as something of a bargain in comparison with gold. In the Rest of the World region, the Indian platinum jewellery market continues to grow rapidly from a low base. Demand should rise to over 80,000 oz in 2011.

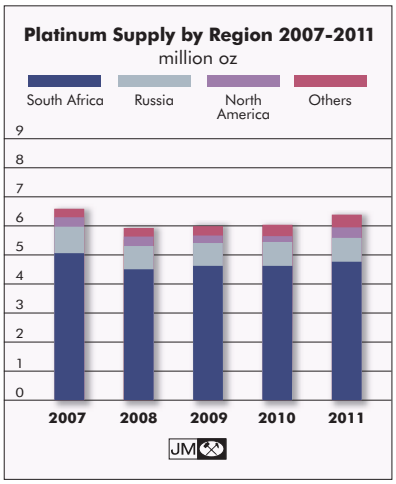
Investment demand for platinum is forecast to be 160,000 oz lower than in 2010 but still positive at 495,000 oz. The Japanese bar market is expected to show net investment this year as buying during downward price movements has exceeded disinvestment during periods of rising prices. Investment in the year to date indicates that the physically-backed platinum exchange traded fund (ETF) market will end the year in positive territory at 385,000 oz of net investment with relatively light redemptions even during periods of severe price drops.There has been limited production of platinum coins this year by the major Mints.

Platinum traded on average at $1,782 in the first nine months of 2011, some 13% above the level in the equivalent period last year. The price was generally buoyed by strong industrial demand as well as some ETF and speculative buying but fell victim to bouts of investor nervousness related to wider economic and political events, especially at the end of September. Overall in 2011, gross demand for platinum is set to grow by 175,000 oz to 8.08 million ounces, the second highest demand level after the 8.27 million ounces of demand seen in 2007. However, with supplies rising by almost 6% and greater levels of recycling, we anticipate the platinum market will end the year in oversupply.

Platinum Supply and Demand
'000 oz

Supply	**2009**	**2010**	**2011**
South Africa	4,635	4,635	4,775
Russia	785	825	825
Others	605	590	795
Total Supply	**6,025**	**6,050**	**6,395**
Gross Demand			
Autocatalyst	2,185	3,075	3,160
Jewellery	2,810	2,420	2,465
Industrial	1,140	1,755	1,960
Investment	660	655	495
Total Gross Demand	**6,795**	**7,905**	**8,080**
Recycling	**(1,405)**	**(1,830)**	**(1,880)**
Total Net Demand	**5,390**	**6,075**	**6,200**
Movements in Stocks	**635**	**(25)**	**195**





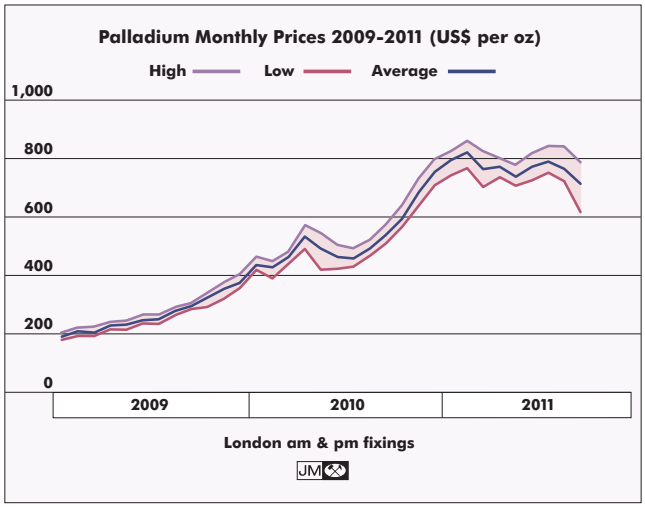
PALLADIUM

- **Due to anticipated shipments of Russian state stocks in 2011, the palladium market is forecast to move into a surplus of 725,000 oz.**
- **Sales of newly refined palladium are expected to rise by 5% to 6.67 million ounces in 2011. In addition, we allow for shipment and sale of 750,000 oz of palladium from Russian state stocks.**
- **Recycling of palladium is predicted to rise to 2.2 million ounces, an increase of 19%.**
- **Gross demand for palladium is expected to soften by 9% to 8.89 million ounces.**
- **Demand for palladium in autocatalysts should increase by 6% to a new record level of 5.92 million ounces. Industrial demand is set to grow by 7% to 2.65 million ounces, the highest since 2005.**
- **Palladium demand from the jewellery sector is forecast to fall, while investment demand will end the year in negative territory.**

Gross demand for palladium is forecast to grow strongly in the autocatalyst and industrial sectors in 2011. Autocatalyst purchasing is set to reach a record high of 5.92 million ounces, while demand across all industrial applications is anticipated to reach pre-recession levels of 2.65 million ounces. Jewellery and investment demand are expected to fall this year. In contrast with the notable performance of the physical investment market in 2010, demand for palladium in ETFs is expected to remain in negative territory for the full year of 2011, contributing to a fall in total palladium demand of 9% to 8.89 million ounces. Overall the market should be in surplus by 725,000 oz due to the impact of Russian state stock sales. Without shipments of Russian state stocks this year, the palladium market would essentially be in balance.

Supplies of palladium from current mining operations are forecast to rise this year by 5% to 6.67 million ounces. South African output is set to decline slightly as producers generally had a poor first half in terms of underlying production. Supplies were partly supplemented by releases of pipeline material but, unlike platinum, there was no significant net contribution from sales of refined stocks. Russian primary production is expected to total 2.7 million ounces this year, in line with Norilsk Nickel's target and only slightly lower than in 2010. Once again, Norilsk is anticipated to increase mining of disseminated ore to compensate for falling output from richer ore bodies. Following a year-long strike at Vale, which ended in 2010, we anticipate that processing of stockpiled material, plus improved grades at Stillwater and ramping-up at North American Palladium, will contribute to output in North America increasing by 60% to 945,000 oz. We anticipate higher production from relatively high palladium-content ore bodies in Zimbabwe as a result of expanded operations.

We forecast that sales of Russian state stocks of palladium this year will amount to 750,000 oz, a significant contribution to palladium supplies and higher than we anticipated in our May review. This figure is based on our belief that Gokhran, the State Precious Metals and Gems Repository, will have sold stock by the end of 2011.



Palladium traded higher in 2011 but the price was less volatile than in the previous two years, despite several downward corrections.

Recycling of palladium from the autocatalyst, electrical and jewellery sectors is forecast to rise by 19% to 2.2 million ounces this year. Higher sales of vehicles in Europe and North America in the first half of this year are expected to lead to more old vehicles being scrapped, and therefore more palladium-loaded catalysts entering the refining stream. Recovery of palladium-containing electronic scrap is also set to rise, driven by legislation in Europe. In China, recycling of palladium from the jewellery sector is expected to more than double as more manufacturing and retail scrap is returned for refining.

Gross demand for palladium is expected to see another good year in terms of core autocatalyst and industrial purchasing. Palladium demand from the global automotive

sector is forecast to increase by 6% to 5.92 million ounces on the back of impressive growth in vehicle production in the first half of this year in Europe, North America and the Rest of the World regions. In Europe, production of gasoline vehicles, which typically use palladium–rhodium aftertreatment, is set to decline slightly. However, as diesel vehicles take a bigger share of a growing market, overall palladium demand is expected to increase by 12% due to its further introduction into diesel autocatalysts. In addition, the full implementation of Euro 5 in light duty vehicles requires higher palladium loadings on average per gasoline catalyst. In China, in spite of an anticipated slowing of the double-digit growth in light duty vehicle production recently, palladium demand is expected to rise. Manufacturers have increased palladium loadings in order to meet China 4 light duty gasoline emissions legislation, which came into effect this year. Production of vehicles has declined in Japan in the aftermath of the March disaster, thus reducing palladium demand in three-way catalysts (TWCs) used in gasoline vehicles. A return to pre-disaster manufacturing levels of light duty vehicles is expected by the year-end.

Industrial purchasing of palladium is expected to rise to 2.65 million ounces this year, a return to pre-recession levels. Palladium demand in the electrical sector is set to remain strong at 1.49 million ounces as consumer and business purchasing of new computer hardware stimulates the manufacturing of palladium-containing components. Demand from the chemical industry is forecast to increase with strong purchasing of downstream consumer products such as textiles and packaging, particularly in Asia, which use palladium catalysts in their manufacture. In line with long-term improved dental health trends as well as competition from non-metal alternatives, we expect that palladium demand in the dental sector will remain flat this year.

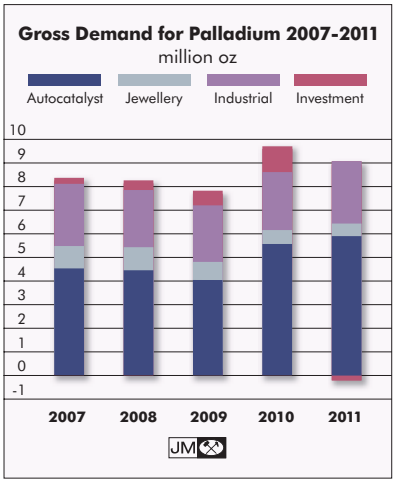
Only in the palladium jewellery and investment markets do we expect to see declining demand this year. Palladium jewellery demand is forecast to fall by 50,000 oz in 2011 to 545,000 oz. Palladium jewellery has gained ground in Europe and North America in recent years in the men's wedding band sector. However, higher metal prices are expected to keep demand flat in Europe, as lower weight pieces are manufactured to meet certain price points. In North America, a combination of higher prices and competition from cheaper alternatives has led to a softening of demand. In China, the largest market for palladium jewellery, high RMB prices of palladium have lowered consumer demand for a previously affordable metal and led some manufacturers to stop producing palladium jewellery.

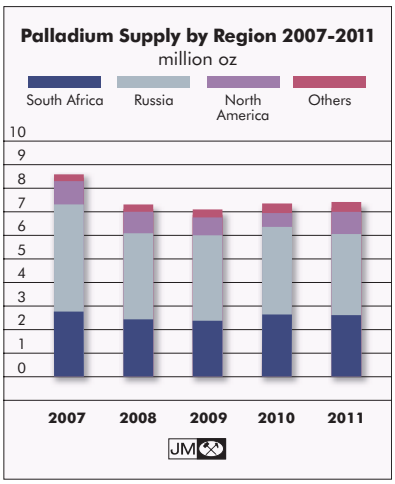
The physical investment sector this year has seen a marked turnaround in sentiment compared with 2010, when net inflows into ETFs made physical investment demand the third largest demand sector for palladium overall. Between May and September, palladium ETF holdings were on a generally downward trend, with pronounced periods of liquidation during price corrections related to wider economic circumstances, such as the eurozone and US debt crises and faltering confidence in economic recovery in developed markets. While some of this may have been distress selling, it is notable that many investors would have been in a position to take profit in 2011.

Palladium traded on average 61% higher in the first nine months of 2011 than in the same period the previous year. Although palladium remained supported by strong underlying fundamentals, there has perhaps been a feeling among investors that the metal could not repeat the remarkable price performance of 2010. Continuing weak economic conditions and negative market sentiment lead us to the view that ETF redemptions, as well as some liquidation in the coin and small bar market, will leave physical investment demand in negative territory by the end of the year.

Palladium Supply and Demand
'000 oz

Supply	2009	2010	2011
South Africa	2,370	2,640	2,610
Russia	3,635	3,720	3,450
Others	1,095	995	1,360
Total Supply	**7,100**	**7,355**	**7,420**
Gross Demand			
Autocatalyst	4,050	5,580	5,915
Jewellery	775	595	545
Industrial	2,400	2,465	2,645
Investment	625	1,095	(215)
Total Gross Demand	**7,850**	**9,735**	**8,890**
Recycling	**(1,430)**	**(1,850)**	**(2,195)**
Total Net Demand	**6,420**	**7,885**	**6,695**
Movements in Stocks	**680**	**(530)**	**725**





OTHER PGM

- **The rhodium market is forecast to be in surplus once again in 2011, by 123,000 oz.**
- **Supplies of rhodium are expected to grow by 5% to 768,000 oz in 2011.**
- **Gross demand for rhodium is set to rise by 18,000 oz to 905,000 oz. Strong purchasing by the glass manufacturing sector should partly offset a decline in autocatalyst demand.**
- **Recycling of rhodium from scrapped autocatalysts should rise by 8% to 260,000 oz.**
- **Demand for ruthenium is expected to soften to 811,000 oz with lower purchases by the electrical sector, but robust demand in electrochemical applications will continue.**
- **Iridium demand should remain solid at 342,000 oz with continuing strong demand for crucibles and in automotive spark plugs.**

Rhodium

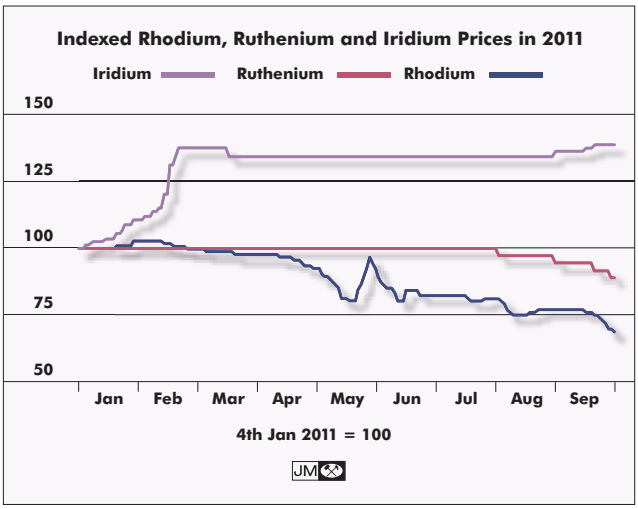
The rhodium market is forecast to remain in surplus by 123,000 oz in 2011 as increases in primary refined output as well as recycling outstrip growth in gross demand.

Rhodium supplies are forecast to increase by 34,000 oz in 2011 to 768,000 oz, supported by higher refined output by South African producers. Russian production should remain almost flat as output of metals is maintained by Norilsk Nickel despite falling grades. Supplies from North America should rise as producers ramp up to full production following disruptions in 2009 and 2010. We anticipate that additional supplies will come from Zimbabwe in line with rhodium beginning to be produced at Unki.

Recycling of spent autocatalysts is expected to return an additional 19,000 oz of rhodium to the market this year, bringing total recycling in 2011 to 260,000 oz.

Purchasing of rhodium by the global autocatalyst sector is set to decline by 22,000 oz to 705,000 oz in 2011 as the effects of thrifting and the Japanese earthquake are felt. Thrifting of rhodium from gasoline autocatalyst formulations became widespread among vehicle manufacturers in response to rising prices in the years prior to 2008. As a result, rhodium demand is expected to be flat or decrease in most regions this year. Rhodium purchasing for use in Japanese-made vehicles, the largest market for rhodium in autocatalysts, is expected to fall due to lower vehicle output in the aftermath of the March earthquake. In Europe, demand is forecast to decline due to thrifting as well as a fall in the number of gasoline vehicles produced as diesel output picks up. Only in China do we anticipate slightly higher rhodium demand in autocatalysts as manufacturers roll out China 4 compliant gasoline vehicles in line with national legislation in force from this year.

In LCD glass manufacturing, strong consumer demand for TVs and computer displays will drive purchases of rhodium for new and expanded glass substrate manufacturing facilities in China, Japan, South Korea and Taiwan. In the glass fibre industry, although expansion is subdued because of overcapacity, falling rhodium prices and rising platinum prices have encouraged manufacturers to switch from 10% rhodium–platinum alloys to higher-durability alloys containing 20% rhodium–platinum. Overall, demand for rhodium in glass making is predicted to rise by a quarter to 85,000 oz this year.



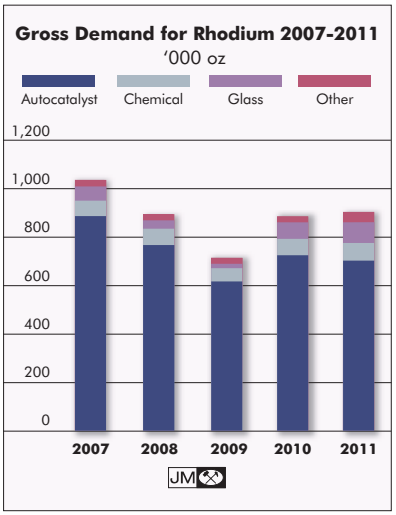
The iridium price reached record highs in the early part of 2011 with strong buying from the electrical sector. Rhodium's price softened, while ruthenium was mostly becalmed.

Demand for rhodium in the chemical sector is set to rise by 5,000 oz to 72,000 oz in 2011 due to expansion of oxo-alcohol and acetic acid production capacity, which uses rhodium catalysts. This is mainly driven by downstream demand for paints and adhesives, particularly in China.

With the launch of a rhodium ETF by Deutsche Bank in May this year, a new demand area for rhodium is identifiable

physically-backed investment. Perhaps due to rhodium's subdued price performance in 2011, as well as rhodium being almost exclusively an industrial metal, additions to the new ETF were modest in the first few months of its operation, with only around 14,000 oz of net inflows in the period to late September. However, purchases of rhodium for the newly-established ETF will account for most of the growth in our 'Other' category this year.

Rhodium traded 13% lower in the first nine months of this year compared with the equivalent period in 2010 as the growing supply–demand surplus impacted the price. Rhodium was less affected by market sentiment than platinum and palladium, however the price did tend to suffer during wider commodity sell-offs.

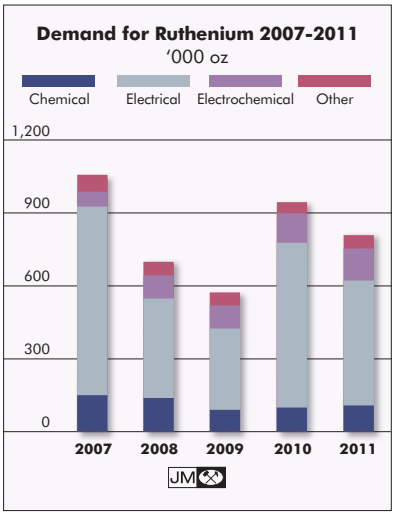


Ruthenium

Total ruthenium demand is forecast to be 14% lower in 2011, at 811,000 oz, than the previous year due to reduced purchasing by the electrical sector. The ruthenium market will remain adequately supplied from primary mining operations.

Sales of ruthenium-containing hard disk drives in computers and digital television recorders are set to grow again this year. However, demand for ruthenium is predicted to be lower due to improved manufacturing efficiencies which reduce work-in-progress inventories. Higher sales of electronic goods should help drive manufacturer purchases of ruthenium pastes for use in chip resistors and other electronic components.

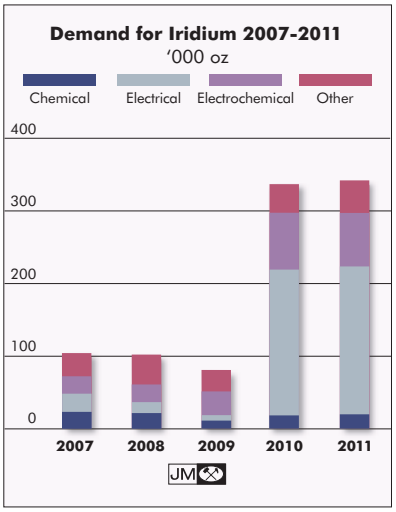
Demand for ruthenium in the chemical industry is predicted to rise with higher levels of purchasing of ruthenium catalysts for the production of ammonia and acetic acid. In the electrochemical sector, a continuing move towards more environmentally friendly membrane cell technology to replace older mercury and diaphragm technology in the chlor-alkali industry in China is expected to account for some demand, though at a lower level than in previous years. The use of ruthenium elsewhere in the electrochemical sector, such as in salt water chlorination of swimming pools, will grow in 2011.



Iridium

Another strong year for iridium demand is predicted, with total demand set to rise slightly to 342,000 oz in 2011. The exceptional levels of purchasing of iridium crucibles by the electrical sector last year are unlikely to be repeated in 2011, but electrical demand should remain high by historical standards at 204,000 oz. Underlying mine output of iridium is below the current level of demand but we expect the market to be balanced by sales from producer stocks.

Demand for iridium crucibles is expected to be high again as manufacturers continue to build capacity for producing single crystal sapphire, used in the manufacture of LEDs for backlit televisions. However, levels will be lower than in 2010 as capacity expansions are nearing completion in the Japanese industry. The high iridium price is also contributing to a shift to alternative technologies for crystal growing – the price of iridium has traded at historic highs during 2011. The use of iridium in phosphorescent emitter materials in organic light emitting diode (OLED) displays is also expected to account for some additional demand. Electrochemical demand is forecast to remain strong in 2011, mainly from the chlor-alkali industry, though at a slightly lower level than in 2010. As vehicle production is set to perform well this year driven by a strong first half, we anticipate that demand for iridium in spark plugs will continue to grow.



OUTLOOK

- **The platinum market is expected to be in surplus in 2012 but not by a significant amount.**
- **Supplies of platinum are forecast to increase next year due to rising mine output in South Africa and Zimbabwe.**
- **Although downside risks remain in the world economy, a rise in automotive demand for platinum is once again anticipated in 2012.**
- **Even with Russian state stock sales next year, the palladium market is likely to be fundamentally in deficit.**
- **Our expectations are that autocatalyst and industrial demand for palladium will grow. Investment demand will be positive but jewellery demand is expected to fall.**
- **Demand for rhodium is set to rise but the market will remain in surplus.**

OVERVIEW

At the time of writing, the prognosis for the world economy in 2012 is looking increasingly gloomy. In Europe, problems of sovereign debt in the eurozone periphery continue to be of concern. In North America, low rates of economic growth together with low inflation and stubbornly high unemployment leave little room for optimism in the short term. The Japanese economy, despite recovering well from the March 2011 earthquake, is still faced with the same issues of anaemic growth as before the disaster. China's attempts to engineer a soft landing for its economy appear to have been successful in slowing growth to more sustainable levels, but now risk lowering domestic demand. Prospects for economic growth in 2012 are most promising in the Rest of the World region. However, even in fast-growing countries such as Brazil and India, consumer confidence appears to be faltering. Although comparisons with the beginning of the recession in 2008 may be exaggerated, the next six months are likely to be difficult ones for the world economy as growth slows.

With the high degree of economic uncertainty worldwide at present, we cannot rule out the possibility that negative market sentiment, which so far has mainly impacted prices, could begin to materially affect physical demand for industrial commodities, including pgm. The trigger for this could be a failure of market confidence surrounding eurozone debt, perhaps as a result of disorderly debt restructuring in peripheral economies. Another might be further slowing of growth in key countries such as the USA or China. On the other hand, core European economies such as Germany have to date weathered the economic storm in the eurozone remarkably well and continue to be engines for growth, led mainly by export demand. Although the USA faces economic headwinds, the crisis over raising the debt ceiling in July 2011 has focused attention on staving off another recession. In China, the government remains committed to delivering sustainable GDP growth. Overall, the world looks set for a period of slower growth in 2012, with the risk of market pessimism turning into a genuine drop in physical demand. Although the dimmer economic outlook implies overall weaker purchasing of pgm, individual demand sectors require closer examination in order to determine their prospects.

PLATINUM

Supplies of platinum are forecast to increase in 2012, as is recovery from open loop recycling. On the demand side, although growth might be tempered by current macroeconomic uncertainty, there are strong demand drivers in the autocatalyst and industrial sectors. Overall, we anticipate that the platinum market will remain in a small surplus next year.

Supplies of platinum from South Africa once again have the potential to rise modestly in 2012 as a result of improved underlying production. Although the industry still faces possible disruption, recent developments give grounds for cautious optimism. The two biggest producers in South Africa recently signed two-year agreements with the National Union of Mineworkers, with headline wage increases of between 8% and 10% per year. These rates are well above CPI inflation but are lower than some of the recent wage settlements at South African producers and may mean there is less potential for disruption due to wage negotiations next year. Costs still remain high, which makes it challenging to invest in future capacity. However, the weakening of the South African rand during September 2011 has given producers a temporary reprieve on costs even though it comes at a time of lower pgm prices. This may potentially allow investment in new capacity if the weaker rand is sustained in the longer term.

Mining operations by Norilsk Nickel in Russia are expected to continue to experiencing falling grades; we anticipate

that refined output could fall in 2012. In North America, we anticipate that supplies will continue to be at stable levels following the return to normal production. In Zimbabwe, we forecast another increase in production despite continuing uncertainty over mine nationalisation. Although interruptions to output due to the political situation cannot be ruled out, we anticipate that 2012 will be a growth year as a result of investment already made by all producers to expand projects.

With an uncertain economic outlook affecting consumer confidence, in the next six months light duty vehicle production in Europe is unlikely to grow as it did in the first half of 2011. Despite this, the global automotive industry remains in good shape and considerably healthier than in 2008, with ample liquidity, lower debts, less spare capacity and less unsold inventory. Europe is already witnessing the beginning of a technology shift aimed at reducing fleet-average CO_2 emissions, which will be positive for platinum demand. In order to improve fuel economy, and lower CO_2 output, one manufacturer is due to introduce lean burn gasoline vehicles with platinum-containing lean NOx traps (LNT) in greater numbers in 2012. In North America, expected growth in total production, particularly of light duty diesel vehicles, will account for some additional platinum demand next year as will the return to full production levels at Japanese transplants in North America. In Japan, a ramp-up to full production is scheduled for the end of 2011, and there is scope for domestic sales of light duty vehicles to increase strongly in 2012 if consumer confidence returns. We forecast that demand for platinum in heavy duty diesel emissions control systems will continue to grow in Europe and North America as truck fleets are replaced following the recession in 2008 and 2009. In Europe we anticipate rising platinum demand due to a move to pgm-containing systems, similar to those currently used in North America, in order to meet Euro VI legislation which begins to come into force in 2013.

Slower growth worldwide, coupled with the expiry of economic stimulus measures in many countries, will impact consumption, thus generally lowering purchases of platinum in industrial applications. However, there are some grounds for optimism since commitments to build or expand capacity utilising pgm technology have already been made. Although the global glass fibre manufacturing industry will remain in overcapacity in 2012, with little demand for platinum melting tanks, we anticipate that a number of LCD glass manufacturing lines will open in Asia, stimulating purchases of platinum. In the electrical sector, current projections are for growth in consumer electronics sales next year and we therefore anticipate rising demand for platinum in hard disks.

The prospects for platinum jewellery demand in China remain robust, as platinum maintains its solid position in the bridal and self-purchase sector. However, the rising gold price and gold's consequent popularity with consumers has had some impact on platinum at retail level in 2011 and may do so again in 2012. If the current gold price premium is maintained, however, it may spur further increases in platinum demand by manufacturers and retailers as platinum is seen as something of a bargain. Manufacturers are currently stocking platinum in anticipation of forthcoming demand and we remain confident in the future of this market.

We expect physical investment demand for platinum to be positive in 2012, but the degree of acquisition in this sector is, as always, likely to be strongly dependent on price volatility. We judge that there is a core of long term investors in the platinum ETF market which is largely immune to short term price movements and that the sell-off of ETF positions in September 2011, like the sell-offs in March and May 2011, was largely of metal held by more speculative investors. Excepting a major crisis of investor confidence across industrial commodities, and supported by continuing low interest rates, we anticipate further physical investment in 2012, although at a lower level than in 2011.

Recycling of platinum in autocatalysts should increase once again in 2012 as more highly-loaded catalysts are scrapped. Overall, with a modest rise in supplies, higher recycling, and, despite the downside risks, healthy industrial and automotive demand, the platinum market should be in surplus again in 2012 but not by a significant amount.

PALLADIUM

We predict tighter palladium supplies overall in 2012, due to lower sales of Russian state stocks partly balanced by slightly higher output from South Africa. Overall demand should be healthy, but with the possibility that slower consumer spending could have knock-on effects on the autocatalyst and industrial markets. Even with some sales of Russian state stocks next year, we expect the palladium market to move into fundamental deficit.

South African supplies of palladium are expected to rise in 2012 in line with higher levels of mined output. Russian palladium supplies from primary mining are set to soften by a modest amount due to falling grades. However, we anticipate that some residual sales from Russian state stocks are likely, but at much reduced levels compared with the last few years.

North American supplies are forecast to fall as production returns to more normal levels. In Zimbabwe, palladium production is expected to grow in line with mine expansion.

In the automotive sector in Europe, vehicle production could fall due to slower economic growth coupled with weaker consumer spending. In North America, although we cannot rule out a drop in consumer spending, we anticipate higher vehicle production, which will positively impact palladium demand. We also anticipate further substitution of platinum with palladium in diesel autocatalyst formulations. In Japan, higher vehicle production as full recovery from the March 2011 disaster takes place will raise palladium demand in gasoline vehicles. China will continue to be a growth area as more gasoline autocatalysts are manufactured. In the Rest of the World region, growth in vehicle production in Brazil, India, and South Korea should benefit palladium demand, although if consumer credit becomes more restricted in these markets as a way to control inflation, there may be some negative impact on domestic sales. Overall, we anticipate that the increase in palladium demand in the automotive sector should be at least as strong as it was in 2011.

Expansion of production capacity is expected to raise demand for palladium process catalysts in China. However, we forecast overall chemical demand for palladium to remain flat due to a lack of any major capacity expansions outside China. Provided sales of electronic equipment do not drop dramatically, we expect that demand for durable passive electronic components will help drive purchases of palladium.

The prospects for palladium demand in the jewellery sector are expected to be once again limited by a lack of effective marketing and consumer awareness in China, the biggest market. Following a year in which investor sentiment has drifted away from palladium, we anticipate that 2012 will be more positive for physical palladium ETF demand.

Recovery of palladium from open loop recycling will grow, driven by higher palladium loadings on scrapped vehicle autocatalysts, together with palladium jewellery being scrapped by retailers and manufacturers in China.

On balance, we currently expect autocatalyst and industrial demand for palladium to be strong next year, although if the negative economic outlook spills over into a fall in consumer spending, the obvious reverberations through the supply chain would have some negative impact. Otherwise, even allowing for several hundred thousand ounces of supplies from Russian state stocks, and robust worldwide primary production, the palladium market is likely to be fundamentally in deficit next year. With the investment and jewellery sectors remaining positive but representing a much smaller share of palladium demand than pre-2011, the palladium market will be more industrially-driven in 2012 than it has been for many years.

OTHER PGM

The rhodium market is set to tighten somewhat in 2012 but remain in surplus as higher industrial demand offsets an increase in supplies and growth in recycling.

Supplies of rhodium are expected to increase in 2012 due to higher output in South Africa and full production levels being reached at operations in Zimbabwe. Gross demand for rhodium in autocatalysts is forecast to rise in 2012 as Japanese manufacturers, the heaviest users of rhodium in gasoline aftertreatment, will have returned to full production levels. Assuming higher vehicle output in China and North America, we also anticipate some growth there.

Provided that existing capacity is maintained, we anticipate that purchasing of rhodium for chemical applications will rise slightly in all regions driven by demand for top-up catalyst at oxo-alcohol manufacturing plants. In the glass manufacturing sector, we anticipate a softening of rhodium purchasing in line with less expansion in global melting capacities. Recycling of rhodium is set to increase by 8% as greater numbers of rhodium-rich end-of-life vehicle catalysts are scrapped.

Ruthenium demand is forecast to strengthen in 2012 as purchasing by the electrical sector increases and demand from the electrochemical sector continues at a high level.

In line with growth in purchasing in the electrical sector, ruthenium demand is predicted to rise in 2012, following a year of softer demand. Purchasing of ruthenium in the electrochemical sector is expected to remain robust as lower demand for new membrane cells in the Chinese chlor-alkali industry is offset by higher purchasing of ruthenium for that application in North America and also in the growing area of swimming pool purification.

It is anticipated that iridium demand will dampen next year mainly as a result of lower purchasing of crucibles in the manufacture of single crystal sapphire for LEDs.

With elevated prices, we anticipate lower iridium crucible purchases as manufacturers switch to alternative technologies for producing sapphire. High levels of inventory building by manufacturers in 2010 and 2011 will also affect demand. A promising growth area next year is the use of iridium in organic light emitting diodes (OLEDs), a technology finding widespread use in portable displays. Purchasing of iridium for use in spark plugs is once again expected to remain robust.

SUPPLIES, MINING & EXPLORATION

- **Global supplies of platinum, palladium and rhodium are forecast to increase in 2011.**
- **Platinum supplies from South Africa are set to rise by a modest 3% to 4.78 million ounces this year. South African palladium supplies are predicted to decline slightly.**
- **Sales of palladium from Russian state stocks are anticipated to total 750,000 oz this year, another substantial addition to palladium supplies.**
- **Shipments of platinum, palladium and rhodium from North America and Zimbabwe are forecast to rise in 2011.**

SOUTH AFRICA

Supplies of platinum from South Africa are expected to rise only modestly in 2011, with most of the growth in global supplies coming from other regions. Output in South Africa suffered from poor productivity in the first half of this year due to safety stoppages and illegal strikes. Shipments of platinum were strong overall in the first half, supported by pipeline releases and refined stock sales. Palladium supplies are expected to decline this year as sales move into line with refined output, while rhodium supplies are set to increase. Unless otherwise stated, all comparisons are with the first half of 2010.

Anglo American Platinum

At Anglo American Platinum, the first half of 2011 was punctuated by frequent safety stoppages, with the result that equivalent refined platinum production (output in concentrate adjusted for standard smelting and refining recoveries) fell by 3% to 1.16 million ounces.

Many of the group's mines recorded falls in platinum output, but those on the western limb of the Bushveld were especially hard hit. For example, production fell by 20% at Bathopele, 12% at Union, and 14% at Kroondal (the latter operates under a pool and share agreement with Aquarius Platinum). These losses were partly offset by strong performances elsewhere: Mogalakwena, the large open pit mine on the northern limb, recorded a 21% rise in platinum output.

Despite these operational difficulties, actual refined production climbed 17% to 1.17 million ounces. This was made possible by the processing of pgm concentrate built up in 2010 due to furnace maintenance at the Polokwane and Waterval smelters. Strong refined output was reflected in platinum sales, which were up 13% to 1.23 million ounces in the January to June period. Anglo American Platinum remains optimistic that it will meet its sales and refined production target of 2.6 million ounces of platinum in 2011.

PGM Supplies: South Africa
'000 oz

Supply	2009	2010	2011
Platinum	4,635	4,635	4,775
Palladium	2,370	2,640	2,610
Rhodium	663	632	650

Impala Platinum

At Impala Platinum's Rustenburg lease area, the quantity of ore processed through the mills declined by 7% to 6.25 million tonnes in the first half of 2011. The company has experienced delays in its vertical shaft-sinking programme, due to unexpected geological difficulties, engineering issues, and lower-than-planned labour productivity. As a result, the opening of 20 shaft (the first of three new deep-level mines currently in construction) has been deferred for a year.

However, refined platinum output from the Rustenburg operations was stable at 441,000 oz in the first half. It was supported by an increase in the proportion of Merensky ore mined, which resulted in improved platinum yields. There were also gains in refining recoveries, while some additional platinum was extracted from shallow low-grade sources.

In view of the delay in its new shafts, Impala has reduced its forecast of platinum production from the lease area. Annual output is expected to be maintained at around 920,000 oz for the next two years, rising to 950,000 oz thereafter – 5% lower than the company's previous target. The Two Rivers mine, a joint venture (JV) with African Rainbow Minerals, is now operating at full capacity. Platinum production in the first half of 2011 was up 5% at 72,000 oz.

Lonmin

A steady recovery at Lonmin's Marikana division continued into 2011, despite an illegal strike at the Karee mine which cost the company an estimated 258,000 tonnes of ore production. In addition, some 180,000 tonnes of output was lost to safety

stoppages during the first half of 2011.

In total, the Marikana division milled 5.53 million tonnes of ore in the January to June period; although up 8%, lower grades dampened the increase in pgm output: production of platinum in concentrate was 327,000 oz, a rise of 3%. In addition, Lonmin produced 12,000 oz of platinum from the neighbouring Pandora JV, slightly up on last year.

These modest operational gains were overshadowed by very strong refined production and sales figures. Refined platinum output was up a remarkable 44% to 392,000 oz for the six months, compared to a very weak first half of 2010 during which smelter run-outs caused a build-up in unprocessed stocks of pgm. Half year platinum sales totalled 412,000 oz, up more than 50% year-on-year.

Northam

Refined production at Northam's Zondereinde mine has been slow to recover from a six-week strike last year. In the first six months of 2011, pgm output totalled 112,000 oz, down 14.5%, reflecting lower mill throughput and a sharp fall in grade.

At the company's new Booysendal mine, underground development has begun, and surface infrastructure is under construction. Once the mine reaches steady state (scheduled for early 2014), it will extract 187,000 tonnes of UG2 a month, yielding an estimated 160,000 oz of pgm annually. Concentrator commissioning is due in early 2013, so the first pgm production from the mine should be seen towards the middle of that year.

Other Producers

At Xstrata's Eland Platinum mine an estimated 23,000 oz of platinum was produced in the first half of 2011, down by more than a third on the comparable period of last year. Production was inhibited by delays in the granting of minerals rights permitting the extension of the current open pit operations. As a result, mill throughput fell, while an increase in the mining of lower-grade oxidised ore affected recoveries.

Apart from its pool and share mines, Aquarius Platinum has two other underground operations in South Africa, both of which have concentrate offtake agreements with Impala. The Blue Ridge mine was closed for redevelopment in September 2010. The ramp-up of production at the Everest mine continued during the first half of 2011, with output of platinum in concentrate rising to 31,000 oz, from 5,000 oz in the same period last year. In May, Aquarius announced the acquisition of the Booysendal South project from Northam, at a cost of

South African producers had a poor first half in terms of underlying mined output but were able to draw on pipeline material and refined stocks.

R1.2 billion. This property is contiguous with Everest and can be mined using existing infrastructure.

Production at Eastern Platinum's Crocodile River mine was disrupted in May 2011 by illegal industrial action, during which underground infrastructure was damaged. Output of platinum fell by a quarter to 23,000 oz in the first half.

Platinum Australia's Smokey Hills project endured a difficult start to 2011. Production was disrupted by a series of illegal strikes, culminating in the death of an employee outside the mine. Underground production has been supplemented by treating chrome tailings through the plant, with the result that pgm output was flat in the first half.

The Pilanesberg open pit mine, operated by Platmin, produced 38,000 oz of pgm in the January to June period, up by more than 50%. This was despite illegal industrial action in June 2011, which resulted in some property damage and a two-week interruption of mining activities. It is likely that the stoppage will have an impact on output in the second half.

RUSSIA

In the first six months of 2011, Norilsk Nickel's Russian operations produced 1.36 million ounces of palladium (down 3%) and 347,000 oz of platinum (up 2%). These figures are in line with the company's current plan, which calls for output to total 2.7 million ounces of palladium and 670,000 oz of platinum in 2011, just slightly lower than in the previous year.

Platinum production also takes place in the Russian Far East, at the Kondjor and Korjak mines, as well as from small alluvial operations in the Urals. We expect platinum output from these

PGM Supplies: Russia '000 oz			
Supply	**2009**	**2010**	**2011**
Platinum	785	825	825
Palladium			
Primary Production	2,675	2,720	2,700
State Sales	960	1,000	750
Rhodium	70	70	68

sources in 2011 to be stable at 145,000 oz.

At the time of writing, no palladium shipments from state stocks had taken place in 2011 (we believe that a shipment of several tonnes of palladium recorded as entering Switzerland in August was a relocation of metal that had been sold previously). However, it is our belief that state stock sales will re-commence in October, and we allow for the shipment and sale of 750,000 oz of palladium this year.

NORTH AMERICA

Stillwater Mining Company reported strong first half pgm production from its mines in Montana, USA. Output of platinum and palladium rose by 13%, to 63,000 oz and 211,000 oz respectively, reflecting higher mined tonnage and ore grade. As a result, the company has slightly increased its mine production forecast for 2011, to 515,000 oz of pgm.

North American Palladium's Lac des Iles mine reopened in April 2010, after being closed due to low palladium prices. Output continued to increase during the first half of 2011, and a blend of newly-mined underground ore and material from surface stockpiles was fed to its concentrator. Palladium production this year is forecast to be 150,000 oz.

Xstrata Nickel produces pgm as by-products of its nickel mining activities in Canada. The new Nickel Rim South mine continues to ramp up, contributing to a 33% increase in the company's Sudbury nickel production in the first half of 2011. This mine exploits a polymetallic ore body containing significant quantities of platinum and palladium.

Production of by-product pgm from Vale's Sudbury operations increased dramatically in the first half of 2011, as production recovered from a year-long strike that ended in July 2010. The company reported output of 108,000 oz of platinum and 144,000 oz of palladium, compared with 7,000 oz and 18,000 oz respectively in the same period of last year.

PGM Supplies: North America '000 oz			
Supply	**2009**	**2010**	**2011**
Platinum	260	200	360
Palladium	755	590	945
Rhodium	15	10	20

ZIMBABWE

Despite uncertainty caused by the government's indigenisation programme, Zimbabwe's platinum mining industry recorded an excellent performance in the first half of 2011. Both Zimplats and Mimosa are operating stably and at full capacity, while the new Unki mine is ramping up ahead of schedule. Platinum supplies this year are expected to total 335,000 oz, up 20% on last year.

At Zimplats, output of platinum in matte was up marginally at 93,000 oz. The company's Phase I expansion is now complete, with a third portal, the Bimha mine, attaining full capacity on schedule in May 2011. Output should reach or exceed the planned 180,000 oz level this year.

A second phase of expansion got underway in August last year. This project involves the development of a fourth underground operation, known as Mupfuti mine, and a new concentrator module, to be commissioned in April 2013. This project should contribute an additional 90,000 oz of platinum annually, bringing Zimplats' total annual output to 270,000 oz.

The Mimosa mine, a JV between Impala Platinum and Aquarius Platinum, reported a strong start to 2011. Platinum production was at record levels – up 7% to 54,000 oz – despite a deterioration in ground conditions during the second quarter.

Anglo American Platinum's Unki mine came on-stream and made its first contribution to platinum supplies in the first half of 2011. Some 22,000 oz of platinum in concentrate was shipped to the company's refineries in South Africa, significantly ahead of expectations. Unki is expected to reach steady state production levels of around 60,000 oz of platinum by the end of the year.

PGM Supplies: Zimbabwe and Others '000 oz			
Supply	**2009**	**2010**	**2011**
Platinum	345	390	435
Palladium	340	405	415
Rhodium	22	22	30

RECYCLING

- **Recycling in open loop autocatalyst, electrical and jewellery applications is expected to increase again in 2011, acting as an additional secondary source of pgm.**
- **Recovery of platinum is expected to increase by 3% to 1.88 million ounces in 2011, driven by higher levels of recycling of diesel autocatalysts and old jewellery being traded in by consumers in Japan.**
- **Palladium recovery is set to rise by 19% to 2.2 million ounces as more end-of-life vehicles are scrapped, recycling of electronic waste increases, and as manufacturers and retailers in China recycle greater volumes of old palladium jewellery.**
- **Rhodium recycling from spent autocatalysts is set to rise by 8% to 260,000 oz in 2011.**

AUTOCATALYST

Recycling of platinum, palladium and rhodium from end-of-life vehicles (ELVs) is forecast to rise in 2011 due to greater numbers of scrapped vehicles as well as higher loadings of pgm. Strong growth in sales of vehicles in the first half of this year, particularly in Europe and North America, are expected to have a knock-on effect on the number of vehicles being scrapped. Elevated platinum and palladium prices, as seen for much of the year, are forecast to encourage greater levels of collection and throughput at refineries. Recycling of ELVs in Japan, however, is set to fall as lower new car sales impact scrappage rates, leading to lower pgm recoveries.

Platinum recovery from spent autocatalysts is set to increase by 95,000 oz this year to 1.18 million ounces. Many ELVs being scrapped now were manufactured around the turn of the millennium, when diesel vehicles were gaining popularity in Europe. In addition, Euro 3 legislation came in at this time requiring higher loadings of platinum on diesel vehicles. Platinum recoveries should therefore grow again this year.

Recovery of palladium in autocatalysts is anticipated to increase by 15% to 1.51 million ounces in 2011. In North America, the largest market for auto recycling where the vast majority of ELV catalysts are recovered, the palladium yield from scrap vehicles is forecast to rise by 135,000 oz to 925,000 oz. Volumes of palladium recovered are expected to be boosted by higher sales in the first half of this year, as well as higher palladium-loaded catalysts entering the refining stream.

Recovery of rhodium is also forecast to increase by 8% to 260,000 oz in line with greater numbers of rhodium-rich gasoline autocatalysts being recycled worldwide.

ELECTRICAL

Open loop recycling of palladium-containing components in the electrical sector, such as electrodes, resistors and plated parts, is expected to rise by 9% this year to 480,000 oz. Europe leads on recovery of palladium from scrap electronic items, with the Waste Electrical and Electronic Equipment (WEEE) legislation now in force in 29 countries.

JEWELLERY

Recovery of platinum from the jewellery sector is set to decline by 6% in 2010 to 690,000 oz, mainly due to a reduction in recycling in China of 20% from previously elevated levels. There is evidence that growing sales of platinum jewellery in China this year are leading to less unsold retail stock being recycled. We anticipate that levels of consumer recycling will remain high in the elevated price environment of 2011.

In Japan, the after-effects of the March disaster appear to have led many individuals to 'declutter' their homes and lives. Together with manufacturer and retail scrap, this additional consumer scrap is expected to lead to a total of 325,000 oz of old platinum jewellery entering the recycling stream. Another driver has been the rising price of gold, which tends to encourage recycling of both gold and platinum jewellery pieces by consumers.

Driven by higher prices, recycling of palladium jewellery in China is forecast to more than double this year, returning 190,000 oz of manufacturer and retail scrap. The increase in palladium recycling contrasts with platinum jewellery recycling in China, which is set to decline in 2011. It is also notable that the palladium being recycled in China is mainly unsold retailer and manufacturer inventory rather than metal from customers.

Recycling
'000 oz

	Platinum		Palladium		Rhodium	
	2010	2011	2010	2011	2010	2011
Autocatalyst	(1,085)	(1,180)	(1,310)	(1,505)	(241)	(260)
Electrical	(10)	(10)	(440)	(480)	0	0
Jewellery	(735)	(690)	(100)	(210)	0	0
Total	**(1,830)**	**(1,880)**	**(1,850)**	**(2,195)**	**(241)**	**(260)**

NON-ROAD EMISSIONS CONTROL

This special feature gives an introduction to emissions control in non-road mobile machinery (NRMM), a promising growth area for pgm demand. Regulations governing engine emissions from NRMM have been in force in various regions of the world since the late 1990s but, with a few minor exceptions, have not been sufficiently tight to require pgm aftertreatment. With the general introduction of Stage IIIB legislation in Europe and Tier 4 Interim in the USA this year, followed by Interim Tier 4 in certain engine categories in Japan next year, all that is about to change.

LEGISLATION

NRMM can be defined as any transportable industrial equipment or vehicle in which an internal combustion engine is installed and which is not intended for the use of passenger or goods transport on the road. This definition encompasses a vast range of machinery including agricultural, construction and industrial equipment, locomotive engines, non-ocean-going marine vessels, mobile generators, and pumps, although aftertreatment-enforcing legislation is largely limited to engines above 19 kW (25 hp), which puts a substantial number of engines outside our consideration. Ocean-going ships are not covered by the NRMM legislation, and fall instead under the International Maritime Organization (IMO) regulations. As ocean-going vessels are only regulated for NOx and SOx, it is unlikely that pgm in aftertreatment systems will see much demand in the foreseeable future.

There have been significant efforts to harmonise worldwide non-road emissions standards. In the main markets of Europe, North America, and Japan, the diesel engine emissions limits under each regulation and power band, as well as the test procedures, are broadly similar and engines will be designed to meet all three standards.

Legislation is being phased in according to the engine power band, and in some cases depending on the end application (e.g. for inland marine and rail engines).

Emissions limits are defined and measured in grams per kilowatt hour (g/kWh). This is the same measure as that used in the heavy duty diesel on-road sector, and in general terms the emissions allowable under the non-road Stage IIIB and Tier 4 Interims are comparable with those of on-road Euro V legislation. Likewise, Stage IV and Tier 4 Final levels, which mainly phase in from 2014, are comparable with those of on-road Euro VI, with the significant exception that there is no particulate number limit.

AFTERTREATMENT STRATEGIES AND PGM

As the range of engine applications is so wide, it is not surprising that different approaches will be adopted to tackle emissions.

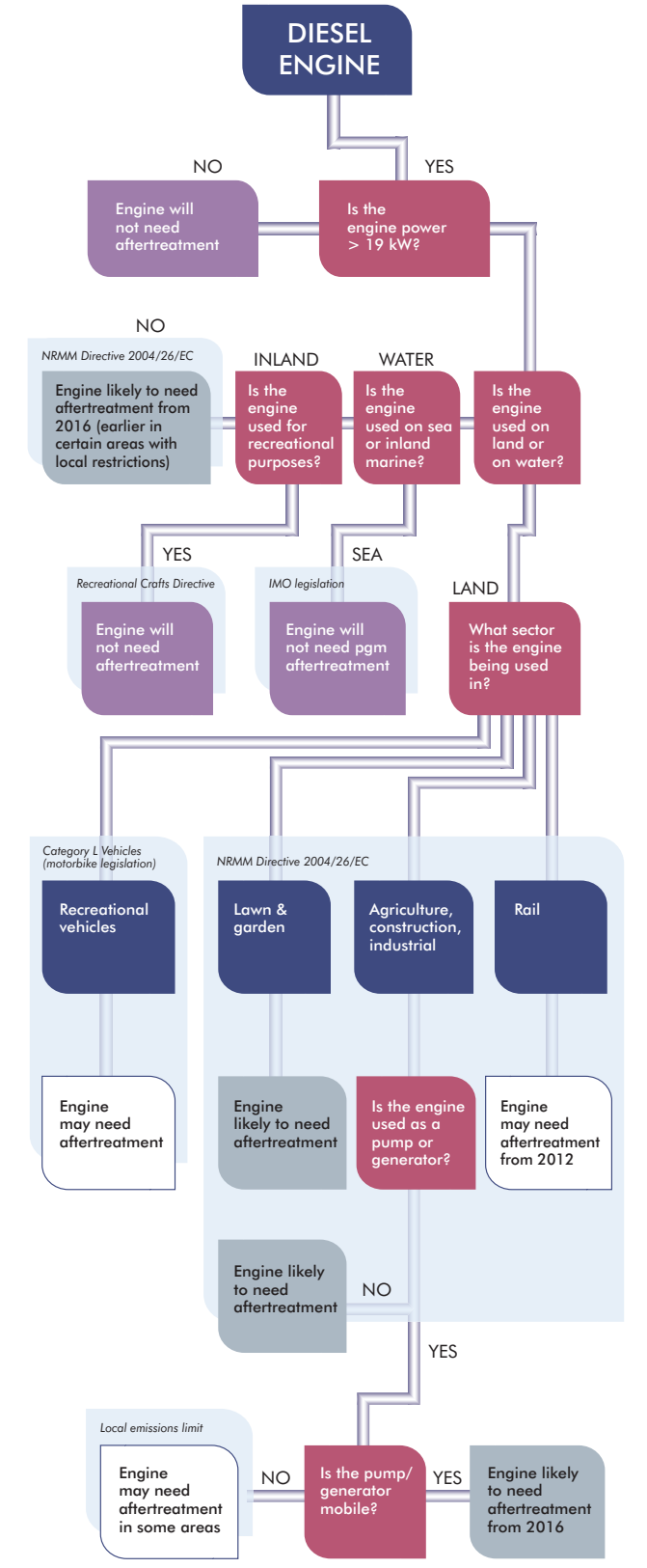
The step-change of the current legislations (i.e. Stage IIIB and Tier 4 Interim) is the reduction in allowable mass emissions of particulate matter

US Emissions Limits
g/kWh

kW	(hp)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
19-36	25-48	NOx + HC = 7.5, CO = 5.5, PM = 0.3					NOx + HC = 4.7, CO = 5.5, PM = 0.03				
37-55	49-74	NOx + HC = 4.7, CO = 5.0, PM = 0.3					NOx + HC = 4.7, CO = 5.0, PM = 0.03				
56-74	75-99	NOx + HC = 4.7, CO = 5.0, PM = 0.4				phased in:			NOx = 0.4, HC = 0.19, CO = 5.0, PM = 0.02		
75-129	100-173	NOx + HC = 4.7, CO = 5.0, PM = 0.3				NOx = 2.0, HC = 0.19, CO = 3.5, PM = 0.02					
130-560	174-751	NOx + HC = 4.7, CO = 3.5, PM = 0.2			NOx = 2.0, HC = 0.19, CO = 3.5, PM = 0.02			NOx = 0.40, HC = 0.19, CO = 3.5, PM = 0.02			
>560	>751	NOx + HC = 6.4, CO = 3.5, PM = 0.2			NOx = 3.5, HC = 0.40, CO = 3.5, PM = 0.10			NOx = 3.5, HC = 0.19, CO = 3.5, PM = 0.04			

CO – Carbon Monoxide
NOx – Oxides of nitrogen
HC – Non-methane hydrocarbons
PM – Particulate matter

TIER 2 | TIER 3 | TIER 4 INTERIM | TIER 4 FINAL



As a guide through the complexities of the NRMM legislation, the above diagram gives a snapshot of which engines will, will not, or might require aftertreatment under the European legislation.

(PM). In selecting aftertreatment strategies, there is always a 'trade-off' between engine-out emissions of PM and those of NOx: action to decrease the one increases the other and vice versa. PM can be controlled by engine calibration, generating an increase in NOx emissions which can be handled by selective catalytic reduction (SCR). Alternatively, exhaust gas recirculation (EGR) can be used to reduce NOx to a certain extent, with a corresponding increase in PM, which can, but does not always, lead to the requirement for a diesel particulate filter (DPF). DPFs use pgm, SCR uses very little.

This choice is in essence the same as that which faced the heavy duty diesel on-road sector. Just as North American heavy duty truck manufacturers largely chose to meet EPA 2007 limits using the DPF route, plus diesel oxidation catalyst (DOC), so the North American non-road engine manufacturers are adopting a similar strategy for Tier 4 Interim. Conversely, European heavy duty on-road vehicle producers have typically opted for the SCR route, and many European non-road engine makers have chosen SCR to meet Stage IIIB. However, in non-road applications the choice is further complicated by subtle differences in allowable NOx emissions between different engine power bands. These alter the relative merit of the various aftertreatment options. In addition, the broad range of applications and power bands, and the different ways in which the engines are required to perform, make the choice of aftertreatment much more individual than in the on-road sector.

Imagine a farmer, working his fields with his own tractor. His primary concern will be fuel consumption, and this will typically favour the use of SCR. Then consider a construction equipment hire company. Its equipment is run periodically at high load and periodically at idle, making engine calibration to control PM highly challenging. Its equipment may be used in an industrial area where local regulations on PM may apply. It will typically be less concerned with running costs, because fuel is normally the responsibility of the party which leases the equipment. The likely choice here will be DPF.

Aftertreatment choice is complex, but the main point is that the non-road sector is highly diverse, and to estimate pgm demand we cannot simply look at the size of the non-road market in terms of engine numbers or displacement and compare that directly with the on-road sector. We need to evaluate the individual market segments, of which there are many, and we need to understand the thinking of the engine producers, who in many cases are completely new to the world of pgm-based aftertreatment.

Whatever the individual strategies adopted, the overall impacts of the evolving legislation are good, both for the environment and for pgm demand. We estimate that pgm demand from all non-road sectors in 2011 will amount to 130,000 oz. This includes demand from all non-road engine sectors including, where applicable, small gasoline engines and stationary engines for which the legislation is not discussed here.

As non-road emissions legislation is increasingly implemented in Europe, Japan and North America, and becomes more stringent, demand for pgm in NRMM can be expected to grow over the next few years.

PLATINUM

- **Gross demand for platinum worldwide is forecast to increase by 175,000 oz to 8.08 million ounces this year, the highest since before the 2008 economic crisis.**
- **Purchasing of platinum by the automotive sector is set to increase by 3% to 3.16 million ounces in 2011, with growth mostly taking place outside of Europe.**
- **Industrial demand for platinum is anticipated to grow by 12% to 1.96 million ounces this year, a record high.**
- **Gross demand for platinum from the jewellery sector is expected to rise by 2% to 2.47 million ounces in 2011 with strong purchasing in China.**
- **Net identifiable physical investment demand for platinum is forecast to be lower this year than in 2010, but still positive at 495,000 oz.**

AUTOCATALYST

Purchases of platinum by the automotive sector are expected to increase by 3% this year to 3.16 million ounces. Despite growth in the number of diesel vehicles produced in the European market and a rise in the production of heavy duty diesel vehicles worldwide, the increase in platinum demand is predicted to be rather more modest. The impact of the Japanese disaster is expected to affect demand as is continuing substitution of platinum with palladium on diesels.

Global vehicle production is expected to grow to 80.6 million units in 2011, an increase of some 2.5 million units compared with the previous year. Light duty vehicle production in Europe and North America was strong in the first half of the year and exports of premium brand vehicles to emerging markets such as China remained healthy. While recovery from the disruption caused by the Japanese disaster was fairly rapid outside of Japan, domestic Japanese vehicle production and sales are likely to be lower this year than in 2010. Heavy duty vehicle production is expected to rise in most regions this year.

Europe

Light duty vehicle production in Europe is set to increase by half a million vehicles this year to 18.3 million units. However, despite growth in underlying production, platinum demand is expected to soften by 15,000 oz to 1.48 million ounces as further substitution of platinum by palladium takes place.

For the European region as a whole, production of vehicles in the first half of this year was well ahead of the same period in 2010. The first half was notable for the emergence of a two-speed Europe in terms of vehicle sales, with the all-important German market experiencing a surge whereas in countries like Spain and Italy, which have been affected by sovereign debt problems, sales were sharply down. Production of light duty vehicles in Europe was some way ahead of domestic sales in the first half of the year as demand for premium vehicles for export, particularly to emerging markets, remained strong.

Light duty vehicle registrations in Europe are expected to increase once again in 2011, with the share of diesel vehicles set to exceed 50%. Levels of fitment of DPFs in light duty diesel vehicles should increase this year due to Euro 5 emissions legislation that came fully into force in January 2011. However, the continued substitution of platinum by palladium in light duty diesel catalyst systems means that overall platinum demand will be down by a modest amount.

Another strong performance is anticipated this year from the heavy duty diesel (HDD) sector. In line with increased production, platinum demand in the European HDD sector is expected to increase by over 40% to almost 50,000 oz. At the moment, only around a third of HDD vehicles made in Europe use any pgm-containing aftertreatment.

Japan

The March 11th earthquake, tsunami and subsequent nuclear power crisis led to the closure of a number of vehicle manufacturing and component supply plants in Japan. Although output recovered more quickly than expected, the persistence of electricity and parts shortages has meant that

Platinum Demand: Autocatalyst
'000 oz

	Gross		Recycling		Net	
	2010	2011	2010	2011	2010	2011
Europe	1,495	1,480	(375)	(445)	1,120	1,035
Japan	550	475	(65)	(60)	485	415
North America	405	490	(580)	(605)	(175)	(115)
China	100	110	(10)	(10)	90	100
Rest of the World	525	605	(55)	(60)	470	545
Total	**3,075**	**3,160**	**(1,085)**	**(1,180)**	**1,990**	**1,980**

light duty vehicle production from domestic manufacturers is expected to slump by 14% to 7.9 million units compared with 2010 levels. With heavy duty vehicle production also down, gross platinum demand in the autocatalyst sector is set to drop by 75,000 oz to 475,000 oz this year.

North America

Gross demand for platinum in autocatalysts in North America is forecast to increase by 85,000 oz in 2011 to 490,000 oz. Economic recovery in the first half of the year, coupled with low inventory levels at the end of 2010, prompted an increase in light duty vehicle production, which is forecast to result in over 10 million units produced in the full year of 2011. More moderate gasoline prices are expected to continue to stimulate demand for larger trucks and SUVs. The share of production of such gasoline trucks is set to remain at around 62% in 2011.

In the light duty diesel sector, which is dominated by pick-up trucks purchased primarily by commercial users, platinum demand is expected to increase strongly. This is due to growth in light duty diesel truck output arising from pent-up demand.

As freight operators take advantage of better economic conditions in 2011 to renew their ageing truck fleets, we forecast a significant increase in demand for platinum in heavy duty diesel emissions control. With a strong first half of the year and impressive sales continuing through July and August, we expect to see an increase in production of heavy duty diesel vehicles of almost 50% in 2011. We anticipate an increase of similar magnitude in platinum demand.

China

Demand for platinum in Chinese autocatalysts is expected to grow by 10% to 110,000 oz in 2011 but will remain low by global standards. The double-digit rates of growth experienced in light duty vehicle production in recent years are set to slow to a much more modest 2.3% this year as the Chinese government attempts to engineer a soft landing for the economy. New vehicle restrictions in some cities will also have an impact on automotive production.

Rest of the World

Platinum demand in autocatalysts in the Rest of the World region is expected to increase by 15% to 605,000 oz this year as manufacturers, particularly in Mexico and South Korea, ramp up production to satisfy domestic and export demand.

JEWELLERY

Mainly as a result of growth in the Chinese market, we anticipate that gross platinum demand in the jewellery sector worldwide will rise by 2% to 2.47 million ounces this year. We forecast a softening of European demand, and robust demand in Japan and North America.

Europe

The number of platinum jewellery pieces hallmarked in the UK showed a year-on-year decrease in the first three quarters of this year. There was a similar story in gold which saw a greater relative decline of 14% in the first three quarters compared with platinum, which saw a 5% decline. This is perhaps testament to the continued strong position of platinum in the bridal sector as well as the high price of gold, which has encouraged consumers to choose bridal jewellery in platinum rather than white gold. In response to higher platinum prices, manufacturers have continued to offer lighter weight pieces to meet key retail price points. The trend towards lighter average weight pieces also appears to confirm reports from retailers that lower priced alternative metals are being chosen for male wedding bands, while platinum has maintained its share of the engagement ring and female wedding band market. The number of hallmarked platinum pieces in the UK fell to just over 150,000 pieces in January to September 2011, with the weight of hallmarked pieces falling by 18%.

Hallmarking statistics for platinum watch cases finished in Switzerland show a slight contraction of production between January and August 2011 compared with the same period last year, although the rate of decline is slowing in line with a return to spending on luxury items. Hallmarking of other platinum jewellery items made in Switzerland in the first eight months of this year rose by 28% to just over 30,000 pieces.

Japan

Gross platinum demand in the Japanese jewellery industry in 2011 is expected to remain fairly steady at 320,000 oz. The earthquake and tsunami in March 2011 may have had a short-term impact on consumer spending, particularly in the fashion jewellery segment, although jewellery sales are reported to have recovered since. In addition, in the aftermath of the disaster more couples are getting married, temporarily reversing a long-term trend towards later and fewer marriages and stimulating purchases of platinum wedding bands as

well as engagement rings. However, due to a continued trend towards lighter weight pieces in response to higher prices, platinum demand has remained almost flat.

North America

Consumption of platinum by the jewellery sector in North America is expected to remain flat in 2011 at 175,000 oz. The platinum jewellery market is likely to be supported this year by strong growth in production from certain high-end manufacturers. Production by these manufacturers for the domestic market as well as exports has been impressive, although middle-market manufacturers report challenging conditions. The majority of platinum jewellery sold in North America is bridal wear. As elsewhere, higher platinum prices have contributed to a trend towards lower weight pieces to meet key retail price points. The elevated gold price this year, particularly as it reached parity with platinum in August, may help platinum gain market share in the bridal sector although both face competition from alternative materials.

China

Platinum jewellery demand in China is forecast to rise by 2% to 1.69 million ounces in 2011. Purchases of platinum by the jewellery industry on the Shanghai Gold Exchange reached two-year highs in the first quarter of this year, despite platinum prices during that time being on average 12% higher than the same period in 2010 in RMB terms. This suggests that manufacturers, retailers and ultimately consumers are adjusting to higher price levels.

Plain jewellery continues to be strong and is the mainstay of the Chinese platinum jewellery market. A growing trend is for manufacturers to look for higher margins by offering gem-set platinum pieces, which appear to be popular with customers. We expect this trend to continue as increasingly affluent consumers seeking new designs are prepared to spend more on gem-set pieces.

The record high price of gold has given something of a boost to platinum recently. In rare periods of price parity, platinum is seen as a good buy in comparison with gold for manufacturers and retailers. Because of this, in recent months some stock building has been evident. Overall this year, manufacturers report that the number of platinum pieces they produce has increased, although the weight of individual items has in many cases declined, in line with attempts to target particular price points in the market.

Although gold jewellery has been popular at retail level due to consumer perception of gold being a store of value, some consumers have begun to see platinum as a bargain since gold reached parity with platinum.

Platinum Demand: Jewellery
'000 oz

	Gross[1]		Recycling[2]		Net[3]	
	2010	2011	2010	2011	2010	2011
Europe	175	165	(5)	(5)	170	160
Japan	325	320	(280)	(325)	45	(5)
North America	175	175	0	0	175	175
China	1,650	1,685	(450)	(360)	1,200	1,325
Rest of the World	95	120	0	0	95	120
Total	**2,420**	**2,465**	**(735)**	**(690)**	**1,685**	**1,775**

NOTES TO TABLE

[1] Gross demand is equivalent to the sum of platinum jewellery manufacturing volumes and any increases in unfabricated metal stocks within the industry.

[2] Recycling represents the amount of old stock and old jewellery recycled whether the metal is re-used within the jewellery industry or sold back to the market.

[3] Net demand is the sum of these figures and therefore represents the industry's net requirement for new metal.

Rest of the World

Platinum demand from the jewellery sector in the Rest of the World region is set to rise by 25,000 oz to 120,000 oz this year. The Indian platinum jewellery market continues to grow rapidly from a low base, and demand is expected to rise to over 80,000 oz in 2011.

INDUSTRIAL

Industrial demand for platinum is forecast to rise by 12% to 1.96 million ounces in 2011 with strong growth in the petroleum refining and glass manufacturing sectors.

Purchasing of platinum in the chemical sector is expected to grow by 40,000 oz to 480,000 oz. Much of this demand is from expansions to plants, mainly in China, which manufacture paraxylene. Platinum process catalysts are used in the production of paraxylene, a chemical intermediate that is ultimately used to make a range of textiles and packaging. Downstream demand for such consumer goods, particularly in Asia, is driving upstream capacity expansion and stimulating additional catalyst requirements.

The glass industry is expected to purchase 435,000 oz of platinum this year, an increase of 13% year-on-year. Expansion of production facilities that make LCD glass, used in televisions and mobile devices, should drive up demand for platinum–rhodium melting tanks and platinum coated components used in the manufacturing process. Growth in purchasing for LCD glass is anticipated to be strongest in Japan, where platinum demand is set to double as planned capacity increases take place. Demand is also expected to be up strongly in the Rest of

Platinum Demand: Industrial '000 oz	2009	2010	2011
Chemical	290	440	480
Electrical	190	230	250
Glass	10	385	435
Petroleum	210	170	210
Other	440	530	585
Total	**1,140**	**1,755**	**1,960**

the World region due to new manufacturing lines being added as well as platinum inventories being purchased this year in advance of future demand. A move towards manufacturing LCD glass in China to supply domestic display panel production resulted in more melting tanks being added there as well. In contrast, as a result of recent expansions and lacklustre economic conditions, the global glass fibre manufacturing industry currently has excess capacity. Demand for platinum in glass fibre production is likely to be depressed compared with 2010 as investment in new facilities is deferred and as returns from older marble re-melt glass fibre plants continue.

The expansion of petroleum refining capacity is also expected to create additional demand for platinum catalysts this year, with purchasing set to rise by 24% to 210,000 oz. Platinum catalysts are used to upgrade low-octane petroleum to high-quality gasoline as well as to process petrochemical feedstocks for the manufacture of polymers. Planned capacity increases in North America, which were delayed during the recession, are now beginning to be built and are expected to double platinum demand in that region. In Europe, planned capacity increases in diesel fuel production, which often involves the use of platinum promoters, will also contribute to higher demand. In addition, a large renewable diesel plant opened in the Netherlands in 2011 which uses platinum catalysts to produce diesel from waste cooking oils.

INVESTMENT

Investment demand for platinum in 2011 is forecast to be 160,000 oz lower than in 2010 but positive at 495,000 oz.

In the first nine months of 2011, the Japanese large platinum bar market showed net investment, particularly during price dips. For the year as a whole, investment in 2011 is expected to be strongly positive at around 100,000 oz.

Net identifiable physical investment in various ETF vehicles was on the whole in positive territory for the period January to mid-September 2011. Excepting a major swing in investor sentiment caused by the onset of a sovereign debt crisis or global recession, we anticipate that total ETF holdings should remain positive for the full year of 2011 at around 385,000 oz. The relatively light redemptions seen in platinum ETF holdings, even during periods of severe price falls, suggest that many investors see strength in the supply–demand fundamentals of the platinum market.

European ETF holdings are expected to continue the upward trend displayed for much of 2011 with net investment by year-end forecast to be more than double the net investment in 2010. Although there was some liquidation this year, particularly around periods of downward price movements surrounding the Japanese disaster and Middle East turmoil, the general trend has been towards net investment. All European platinum ETFs showed net investment between January and mid-September 2011. Two new platinum ETF vehicles, from iShares and Source, were launched in April 2011. The Source fund in particular attracted considerable new investment in the weeks after its launch, however it remains uncertain whether the new funds attracted genuinely new investor demand or whether investors were shifting their holdings between different vehicles.

ETF Securities' US fund is also anticipated to end the year with positive net investment for 2011, although at a much lower level than in the previous year. Redemptions in March, May and September rapidly brought down total holdings in the US fund. Holdings tended to rebound, though not always to their previous level, keeping the fund in positive territory but lower than the strong year of 2010 when there were heavy inflows into the then-new fund.

The platinum coin market has been relatively quiet this year due to the lack of production of bullion coins and a vibrant secondary market. However, there has been limited manufacturing of Platinum Eagle coins by the US Mint from late May, one-ounce 'Cougar' coins by the Royal Canadian Mint, and releases by the Perth Mint as part of the final year of their 'Discover Australia' series of coins.

Platinum Demand: Investment '000 oz	2009	2010	2011
Europe	385	140	320
Japan	160	45	105
North America	105	465	65
China	0	0	0
Rest of the World	10	5	5
Total	**660**	**655**	**495**

PALLADIUM

- **Gross demand for palladium is forecast to soften by 9% this year to 8.89 million ounces. We forecast that autocatalyst and industrial demand will remain strong, however jewellery demand will decline and net investment demand is forecast to be negative.**
- **Purchasing of palladium by the global autocatalyst sector is set to grow by 6% to a new record level of 5.92 million ounces this year.**
- **Industrial demand for palladium is anticipated to grow by 180,000 oz to 2.65 million ounces, the highest level since 2005.**
- **Gross palladium jewellery demand is set to decline by 8% to 545,000 oz in 2011.**
- **Due to redemptions in ETFs in 2011, palladium investment demand is forecast to be negative by 215,000 oz.**

AUTOCATALYST

Gross palladium demand from the global automotive sector is forecast to increase by 6% to 5.92 million ounces in 2011 as light duty vehicle production is set to rise in all regions apart from Japan. Vehicle production was strongly up in Europe and North America in the first half, although Japanese production was sharply down due to disruption from the earthquake and tsunami. Generally higher levels of vehicle production in gasoline markets as well as greater palladium use in diesels is expected to drive palladium purchasing up to new record levels this year.

Europe

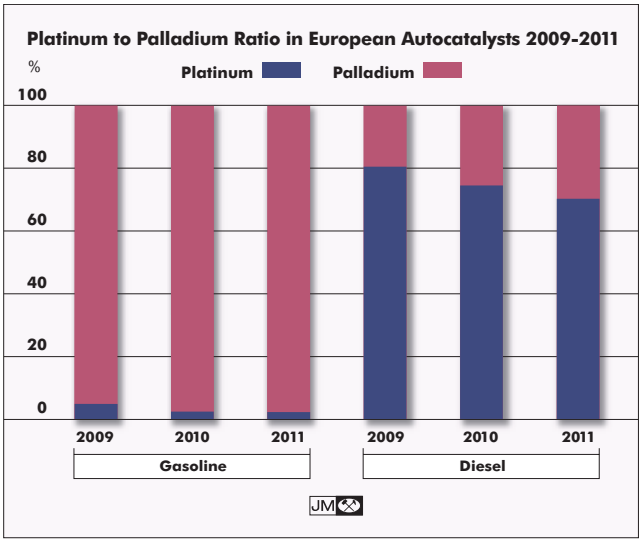
Growth in vehicle production together with continuing substitution of platinum in diesel aftertreatment systems is expected to result in gross palladium demand in European autocatalysts rising by 12% to 1.49 million ounces in 2011, the highest level for ten years. Substitution is anticipated to raise the proportion of palladium used in a typical European light duty diesel autocatalyst to 30%. Light duty diesel vehicle production, which is set to rise by almost 700,000 units to 9.4 million vehicles, is thus also expected to lift palladium demand. Despite an expected fall in light duty gasoline production in Europe this year of just under 200,000 units to 8.9 million vehicles, palladium demand is forecast to grow due to the full introduction of Euro 5 meaning higher palladium loadings on average per catalyst. Almost all European manufacturers now use palladium–rhodium three-way catalysts (TWCs) having substituted platinum with palladium over a number of years, with only a very small proportion of European gasoline vehicles now using any platinum at all.

With poor sales of passenger vehicles in European countries affected by high levels of public debt, national austerity measures and an uncertain outlook across the eurozone, total sales this year are expected to be flat or slightly down in the European region as a whole, despite some brighter spots such as Germany. However, vehicle production is anticipated to remain some way ahead of sales as exports continue to grow. Sales of premium European-made vehicles continue to be strong in China and the USA, driving up use of palladium for light duty gasoline autocatalysts.

Japan

Vehicle output in Japan was already looking set for a difficult 2011 due to declining domestic and export sales before the March earthquake and tsunami. As a result of the disaster, light duty vehicle production is anticipated to fall by at least 1.3 million units to just under 8 million vehicles in 2011, due to stoppages, parts shortages and electricity restrictions. Gross demand for palladium from the Japanese automotive sector is forecast to fall by 145,000 oz to 675,000 oz this year.

Since the Japanese vehicle market is mainly gasoline and most vehicles manufactured in Japan for export are also



Platinum has been mostly substituted out of European gasoline autocatalysts. Palladium use is growing in diesel vehicles.

Palladium Demand: Autocatalyst '000 oz	Gross		Recycling		Net	
	2010	2011	2010	2011	2010	2011
Europe	1,330	1,485	(335)	(385)	995	1,100
Japan	820	675	(80)	(70)	740	605
North America	1,355	1,480	(790)	(925)	565	555
China	1,005	1,100	(30)	(35)	975	1,065
Rest of the World	1,070	1,175	(75)	(90)	995	1,085
Total	**5,580**	**5,915**	**(1,310)**	**(1,505)**	**4,270**	**4,410**

gasoline, reduced production has impacted palladium demand more than platinum demand in relative and absolute terms. Overseas transplants operated by Japanese manufacturers have been affected by parts shortages and have cut production, which has impacted pgm demand in those regions as well.

North America

Gross demand for palladium in autocatalysts in North America is forecast to rise by 125,000 oz to 1.48 million ounces, the highest level since 2007 – before the onset of the financial crisis.

The first half of this year saw higher levels of vehicle production in a slowly improving economic climate. For the full year of 2011, we expect that North American light duty vehicle production will be around 10.6 million units, an increase of almost a million units compared with 2010. Although consumer confidence in general remained low in the USA, sales of vehicles were impressive in the first nine months due to rising dealer inventories and favourable pricing for consumers. As a result of growth in light duty production, palladium use is set to increase in light duty gasoline systems. One key factor in this is that domestic manufacturers, which tend to use only palladium–rhodium in gasoline aftertreatment, have performed strongly this year.

China

After rising at over 30% between 2009 and 2010, this year growth in vehicle production is expected to slow to single figures. The phasing out of purchase tax subsidies and vehicle scrappage incentives, which had particularly favoured sales of cheaper domestic-brand vehicles, has impacted on production levels this year. Furthermore, attempts to curb the growth of car use in cities experiencing major congestion – such as Beijing's limits on new car registrations to 20,000 per month, which became effective in January 2011 – have all had the desired effect of slowing the growth in the car market to more sustainable rates. Other contributory factors have been the impact of supply shortages on Japanese joint ventures, rising fuel prices, and tighter consumer credit.

However, despite a slower rate of growth in automotive production, more stringent China 4 gasoline emissions standards which came into force across the country in July 2011 will bolster palladium demand by requiring higher catalyst loadings. Overall, palladium demand is forecast to reach 1.1 million ounces this year, an increase of 95,000 oz.

Rest of the World

Palladium demand from the autocatalyst industry in the Rest of the World region is expected to increase by around 10% this year to 1.18 million ounces. Manufacturers in Brazil, India, Korea, Mexico and Russia have all experienced a strong year.

JEWELLERY

Gross demand for palladium in the jewellery sector is expected to contract by 50,000 oz in 2011 to 545,000 oz.

The Chinese market is sure to remain the world's largest for palladium jewellery, although demand is set to decline relative to 2010. Higher metal prices are expected to contribute to lower weights of pieces manufactured in Europe and lower sales to consumers in North America.

China

Once again, palladium jewellery demand in China is expected to decline in 2011. We forecast a fall of 30,000 oz to 330,000 oz.

Palladium retains a following in certain parts of the country but even there, lack of differentiation with other white metals and elevated prices this year have contributed to a further slowing of demand. Dollar prices in the first nine months of 2011

Palladium Demand: Jewellery '000 oz	Gross		Recycling		Net	
	2010	2011	2010	2011	2010	2011
Europe	65	65	0	0	65	65
Japan	75	75	(20)	(20)	55	55
North America	65	45	0	0	65	45
China	360	330	(80)	(190)	280	140
Rest of the World	30	30	0	0	30	30
Total	**595**	**545**	**(100)**	**(210)**	**495**	**335**

were on average 46% higher than the already elevated levels of 2010, and 41% higher in RMB terms. This has simultaneously lowered consumer demand for what was previously seen as an affordable precious metal while also helping to stimulate recycling. Some manufacturers have ceased producing palladium jewellery due to lack of consumer interest, thus lowering our net demand figure to 140,000 oz. Price rises have also damaged palladium by reducing retailer margins. In addition, the lack of effective marketing of palladium jewellery in China is expected to contribute to the fall in demand.

Other Regions

Gross palladium jewellery demand in Europe is expected to remain flat at 65,000 oz this year.

In the first nine months of 2011 around 85,000 UK-made pieces were hallmarked, 5% up on the same period in 2010. However, the weight of stamped metal declined by 21% in the first three quarters relative to 2010. One of the key reasons for this has been the higher price of palladium in 2011, which has narrowed the price differential with platinum and gold and led retailers to stock lighter weight pieces. Higher prices have also led to some rings being manufactured in lower-fineness alloys such as Pd500.

Although a new trade and consumer marketing campaign for palladium has just started, gross demand for palladium in the jewellery sector in North America in 2011 is expected to fall by 20,000 oz to 45,000 oz. Over recent years, palladium has gained ground in the male wedding band sector. As the price has increased, palladium's positioning as a men's jewellery metal has been increasingly challenged by cheaper alternatives including base metals. Palladium is also used to enhance the colour of white gold jewellery in some higher-end pieces, for which demand has been resilient. Demand for palladium in Japan, where it is used as an alloying agent, will remain robust.

ELECTRICAL

Gross demand for palladium in the electrical sector is forecast to rise by 5% this year to 1.49 million ounces.

Production of electronics items continues to grow, driven by consumer demand and the need for businesses to upgrade computer hardware. In multi-layer ceramic capacitors (MLCCs), palladium demand has been stable, particularly in applications where cost is less important than performance. The increasing complexity of electrical devices means that more MLCCs as well as more palladium-containing resistors and other passive components are required per device, helping drive up demand. Use of palladium connectors, which are required to be both conductive and highly durable, is expected to show a similar trend this year as the number of components per device grows. The use of gold, traditionally the metal preferred for connector applications, has suffered recently due to the high gold price compared with palladium and the fact that palladium has a much lower density so less of it is needed to coat the same thickness.

Palladium Demand: Electrical
'000 oz

	Gross		Recycling		Net	
	2010	2011	2010	2011	2010	2011
Europe	195	200	(175)	(195)	20	5
Japan	295	340	(55)	(55)	240	285
North America	160	150	(80)	(85)	80	65
China	360	375	(35)	(40)	325	335
Rest of the World	400	420	(95)	(105)	305	315
Total	**1,410**	**1,485**	**(440)**	**(480)**	**970**	**1,005**

DENTAL

Demand for palladium in the dental sector is set to remain flat this year at 595,000 oz.

Production of palladium-containing Kinpala alloy in Japan is expected to soften once again in 2011, reducing palladium demand to 245,000 oz. This is in line with long-term trends in improved dental health as well as competition from resin and ceramic based cosmetic dental treatments. In North America, although porcelain-fused-to-metal (PFM) dental treatments are generally in decline due to the rising market share of metal-free restorations, the elevated price of gold is expected to result in use of PFM alloys with higher palladium contents. Similarly, palladium demand in the European dental industry is anticipated to hold up well as there is a move away from high gold alloys to palladium based systems on cost grounds.

Palladium Demand: Dental
'000 oz

	2009	2010	2011
Europe	65	80	80
Japan	295	250	245
North America	260	250	255
China	0	0	0
Rest of the World	15	15	15
Total	**635**	**595**	**595**

CHEMICAL

Demand for palladium in the chemical industry is set to increase by 23% this year to 455,000 oz as a result of capacity expansions driven by downstream consumer demand. Purchasing in Asia is anticipated to stimulate demand in the chemical sector again this year, whereas capacity overhangs in developed markets are expected to leave demand largely flat.

Palladium catalysts are utilised in the manufacture of purified terephthalic acid (PTA), a chemical feedstock used to produce polyester and polyethylene terephthalate (PET). Demand for PET in consumer products such as textiles and packaging is growing rapidly in the developing world and remains high in developed markets. Expansion of capacity for PET manufacture has put pressure on upstream manufacturers of PTA. As a result, there has been expansion of PTA manufacturing capacity this year, particularly in China, India and Pakistan. Construction and expansion of plant in China is expected to contribute to a doubling of demand for palladium in process catalysts in 2011.

Palladium Demand: Chemical
'000 oz

	2009	2010	2011
Europe	85	105	80
Japan	20	20	20
North America	50	65	80
China	75	65	150
Rest of the World	95	115	125
Total	**325**	**370**	**455**

INVESTMENT

This year has seen a major shift of investor sentiment away from palladium. This contrasts with the situation in 2010 when the rise in gross demand for palladium from ETFs was second only to growth in the automotive sector. As of early October 2011, palladium ETF holdings stood starkly in negative territory with net redemptions in the year to date. In comparison, in terms of ounces, liquidation in palladium ETFs was almost exactly matched by new investment in platinum ETFs.

In the aftermath of the Japanese earthquake in March, at a time of political turmoil in the Middle East and North Africa and uncertainty about the world economy, there were sizable redemptions in palladium ETF holdings across various investment vehicles. Physical palladium investment holdings were more severely affected than those for platinum, perhaps reflecting palladium's greater use in automotive and industrial applications. At other times during the year when investors feared that industrial recovery would stall, such as in May as eurozone debt concerns once again emerged, and in August following the US credit rating downgrade, there were bouts of liquidation in palladium ETFs.

Holdings of palladium in the US fund were on a generally downwards trend between May and September. Following the heavy investment inflows into the US ETF just after its launch in January 2010, and the subsequent doubling in palladium's price last year, many investors would have been in a position to take profit during 2011. Palladium has traded on average 61% higher in the first nine months of 2011 than the same period last year, with periods of rising price generating further opportunities for profit-taking. Despite positive underlying fundamentals, a perception that palladium may not repeat its previous price performance may have led some holders to redeem ETF investments. There may also have been some distressed selling during wider commodity market sell-offs this year. The US fund remains by far the largest palladium ETF vehicle and the fact that so much palladium remains in the fund, almost 800,000 oz at the time of writing, may indicate that there is a body of core, long-term investors who hold their positions during temporary market uncertainty.

Palladium demand in European ETFs fared somewhat better this year, with net investment in some of the newer funds offsetting redemptions in the more established vehicles. We anticipate that net palladium demand in the investment sector in Europe will be positive for the full year.

Weak economic conditions and negative market sentiment imply further volatility in the ETF market before the end of 2011. For the year as a whole, we forecast that redemptions in palladium ETFs will keep overall investment demand in negative territory. Liquidation is also expected in the coin and small bar investment market in North America again this year.

Palladium Demand: Investment
'000 oz

	2009	2010	2011
Europe	525	(5)	60
Japan	0	10	10
North America	95	1,090	(285)
China	0	0	0
Rest of the World	5	0	0
Total	**625**	**1,095**	**(215)**

OTHER PLATINUM GROUP METALS

- **Gross rhodium demand is forecast to rise by 18,000 oz to 905,000 oz in 2011. Strong purchasing in the glass sector and new physical investment demand is set to more than offset a decline in demand in autocatalysts.**
- **Supplies of rhodium are predicted to rise by 5% to 768,000 oz while recycling is set to increase by 8%.**
- **Demand for ruthenium is forecast to soften by 14% to 811,000 oz due to lower levels of purchasing by the electrical sector this year.**
- **Iridium demand is set to remain robust at 342,000 oz in 2011 with continued strong purchasing of crucibles in the electrical sector.**

RHODIUM

The rhodium market is forecast to remain in surplus this year by 123,000 oz as growth in supplies and recycling offsets a rise in gross demand. Due to thrifting and the disruption to Japanese vehicle production caused by the March disaster, automotive demand for rhodium is set to soften. This is expected to be more than made up for by an increase in demand from the glass industry, plus some additional demand from a new rhodium ETF.

Autocatalyst

Gross demand for rhodium in the autocatalyst sector is set to decline by 22,000 oz to 705,000 oz in 2011. A long-term trend towards thrifting rhodium from palladium–rhodium gasoline autocatalyst formulations in response to previously high prices will lead to flat or reduced demand in most regions this year.

Japan is expected to remain the largest market for rhodium in autocatalysts but demand is forecast to fall in the light duty gasoline sector, the principal area of rhodium use, by almost 27,000 oz this year to 171,000 oz. This is mainly due to lower vehicle output in the aftermath of the earthquake, tsunami and ongoing power restrictions that are expected to affect the car industry this year. Continued thrifting by manufacturers should also play a part in lowering demand in Japan.

In Europe, demand is forecast to decline due to thrifting as well as a fall in the number of gasoline vehicles produced as diesel output picks up. In North America and the Rest of the World region, rhodium demand will remain flat.

Other Demand

Demand for rhodium in the glass sector is forecast to increase by 25% this year to 85,000 oz. Rhodium is used in platinum–rhodium alloys to increase the strength and durability of melting tanks and components in the manufacture of LCD glass and glass fibre. In LCD glass manufacturing, strong consumer demand for TVs and computer displays is expected to drive purchases of rhodium for new and expanded glass substrate manufacturing facilities in China, Japan, South Korea and Taiwan. Falling rhodium prices and rising platinum prices recently have encouraged glass fibre manufacturers to switch alloys from 10% rhodium–platinum to 20% rhodium–platinum with the extended lifetime of the latter justifying the higher capital investment. Therefore, though the glass fibre manufacturing sector currently has overcapacity and platinum demand is subdued, some additional demand for rhodium is anticipated to come from alloy switching this year.

Consumption of rhodium in the chemical sector is set to rise by 5,000 oz to 72,000 oz this year mainly due to expansion of capacity for oxo-alcohol and acetic acid production, particularly in China.

With the launch of a rhodium ETF by Deutsche Bank in May this year, a new demand area for rhodium is identifiable physically-backed investment. Perhaps due to rhodium's subdued price performance in 2011, as well as rhodium being largely an industrial metal, additions to the new ETF were modest in the first few months of its operation, with only around 14,000 oz of net inflows in the period to late September. Although the physically-backed rhodium investment market is likely to remain a relatively small part of the overall rhodium market, purchases of rhodium for the ETF account for most of the growth in our 'Other' category this year.

Rhodium Demand by Application
'000 oz

	2009	2010	2011
Autocatalyst	619	727	705
Chemical	54	67	72
Electrical	3	4	6
Glass	19	68	85
Other	21	21	37
Total Gross Demand	**716**	**887**	**905**
Autocatalyst Recycling	**(187)**	**(241)**	**(260)**
Total Net Demand	**529**	**646**	**645**

Supplies

Rhodium supplies are forecast to increase by 34,000 oz in 2011 to 768,000 oz as refined output by South African producers recovers following pipeline build-ups in 2010. We anticipate a continued ramp-up to full production by North American miners following strikes and shutdowns in 2009 to 2010. Additional supplies will come from Zimbabwe in line with rhodium beginning to be produced from Unki. Overall, the rhodium market is forecast to remain oversupplied this year as higher refined output, as well as increased recycling, overshadows the increase in industrial demand.

RUTHENIUM & IRIDIUM

Due to a contraction of purchasing by the electrical sector, ruthenium demand is forecast to soften to 811,000 oz this year, a reduction of 14%. In the iridium market, demand is set to remain robust at 342,000 oz, a rise of 4,000 oz compared with 2010.

Demand

Total demand for ruthenium is anticipated to fall this year, mainly due to a reduction in purchasing by the hard disk sector. Following the filling of manufacturing pipelines in early 2010 to support growth in demand for hard disk drives with higher storage capacity, purchasing of ruthenium sputtering targets is expected to return to more normal levels this year. However, despite lower purchasing of ruthenium by manufacturers, demand for hard disks for computers and digital recording devices is set to remain strong from the consumer electronics industry. Not all of the new demand can be satisfied from manufacturer inventories and net demand for ruthenium in this segment is forecast to be 250,000 oz. In addition, increased sales of electronic goods should drive manufacturer purchases of ruthenium pastes for use in components such as chip resistors.

Demand for ruthenium from the chemical industry is again forecast to increase with higher levels of purchasing of ruthenium catalysts for production of ammonia and acetic acid. In the electrochemical sector, a continuing move towards more environmentally friendly membrane cell technology to replace older mercury and diaphragm technology in the chlor-alkali industry is expected to account for some demand, though at a lower level than in previous years. Ruthenium demand is set to increase for salt water chlorination of swimming pools. This process uses ruthenium-coated electrodes in the electrolysis of salt water to generate sanitising agents to clean the water.

Ruthenium Demand by Application
'000 oz

	2009	2010	2011
Chemical	89	100	109
Electrical	336	679	514
Electrochemical	95	124	131
Other	54	42	57
Total Demand	**574**	**945**	**811**

Iridium demand is expected to rise slightly this year to 342,000 oz in line with higher consumption in the electrical sector. The use of iridium in phosphorescent emitter materials in organic light emitting diode (OLED) displays is a new and interesting area of demand. OLED displays are increasingly used in mobile devices such as smart phones and tablet computers where they offer improved image quality over LCD technology and are more energy efficient.

The exceptional levels of purchases of iridium crucibles by the electrical sector last year are unlikely to be repeated in 2011, but demand should remain high by historical standards. The rapid rise in demand for iridium crucibles, particularly in Japan, came as manufacturers built capacity to produce single crystal sapphire, used as a substrate in the manufacture of LEDs. Driven by strong consumer purchasing of LED backlit televisions, further expansion of sapphire production is expected this year in Asia, although as higher iridium prices encourage a shift to alternative technology for crystal growing, overall demand will be lower.

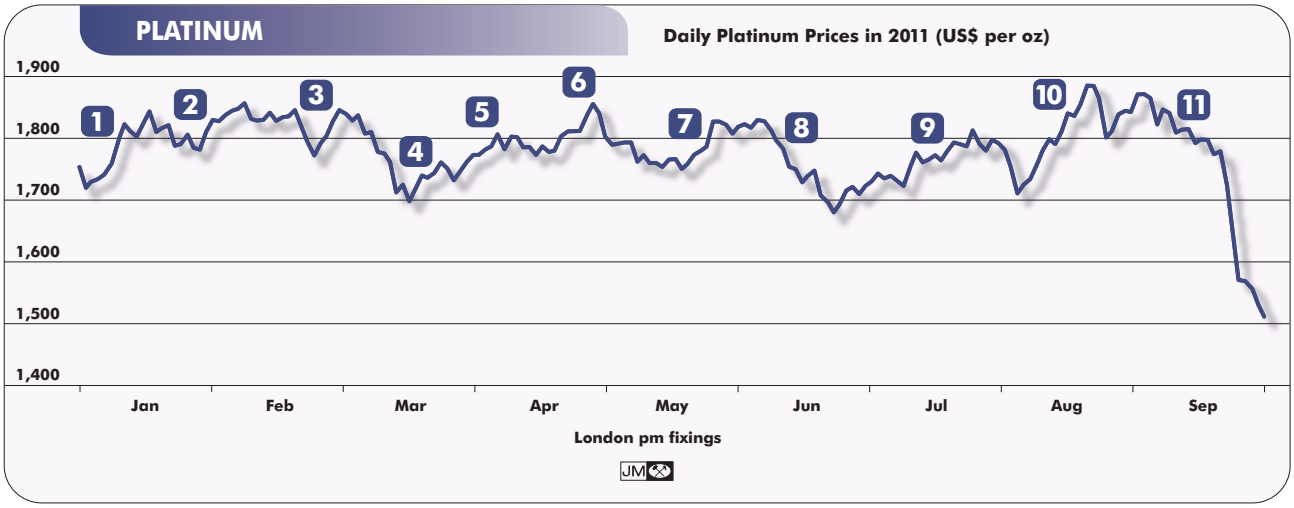
Supplies

Underlying mine production of ruthenium and iridium is forecast to fall this year in line with lower production of platinum. However, ruthenium output is expected to be above the level of demand this year. In the iridium market, sales from producer stocks were required in the first half of 2011 in order to balance the market.

Iridium Demand by Application
'000 oz

	2009	2010	2011
Chemical	11	18	19
Electrical	7	201	204
Electrochemical	33	79	74
Other	30	40	45
Total Demand	**81**	**338**	**342**

PRICES



Platinum traded on average at $1,782 in the first nine months of 2011, some 13% above the average price in the equivalent period last year. The price fixed at a three-year high of $1,887 in August and remained generally above $1,700 until September, when there was a substantial sell-off. Platinum fell to a low for the year to date of $1,511 on 30th September.

1 Platinum's opening pm fix of $1,753 was sharply higher than it had traded for much of the previous month. The first week of 2011 saw platinum's price drop as liquidation in the gold market dragged the precious metals complex down. The fall was relatively short-lived as, by the second week of **January**, physical demand from Asia began to lift the price. A successful auction of Portuguese, Spanish and Italian debt tempered fears of eurozone debt, and also helped boost pgm prices. The price rose to over $1,800 on the 13th, a level not seen since July 2008. Cumulative ETF fund holdings exceeded 1.3 million ounces for the first time in early January, before dropping back slightly.

2 Escalating political tensions in various Middle East and North African countries, notably Egypt and Libya, brought mixed fortunes for platinum prices in **February**. With protests in Egypt creating concern about the security of oil supplies through the Suez Canal, crude oil prices rose above $100 for the first time since 2008, which helped to boost other industrial commodities. Driven by buying on NYMEX, total net long futures positions rose to almost 2.3 million ounces during the week commencing 8th February, a record high.

3 With increasing unrest in the Middle East and North Africa, crude oil continued to track higher in the second half of February, bringing fears of a slowdown to the world economy caused by rising prices. This helped weaken confidence in industrial commodities. Platinum began to appear overbought in late February and corrected sharply downwards to $1,772 on the 24th, giving up most of its gains for the year.

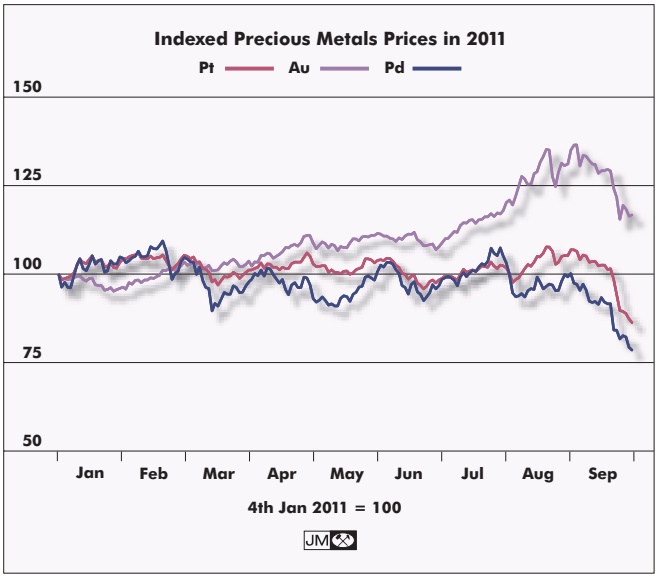
4 Platinum's price was already falling in the week of 7th **March** when a severe earthquake followed by a tsunami hit eastern Japan on the 11th. These twin disasters, plus a resulting meltdown at the Fukushima Daiichi Nuclear Power Plant, caused the closure of much of Japan's industrial capacity for several days. Fears of severely reduced demand from Japan dragged the platinum price down – between the 7th March, just before the disaster, and the 17th March, platinum lost $141, or 7.7%. The steepest falls occurred in the two trading days immediately following the earthquake. There was a major sell-off in equities and commodities alike as investors sought to cover their losses. Platinum positions on TOCOM declined by 374,000 oz between 8th and 29th March, while on NYMEX 479,000 oz of platinum were liquidated; unsurprisingly the relative decline was greater on the Japanese exchange.

Average PGM Prices
in $ per oz (Jan-Sep)

	2010	2011	Change
Platinum	1,581	1,782	13%
Palladium	477	768	61%
Rhodium	2,494	2,163	(13%)
Ruthenium	204	178	(13%)
Iridium	606	1,020	68%

Platinum and palladium prices are averages of London am and pm fixings. Other pgm prices are averages of Johnson Matthey European Base Prices.

The gold price achieved parity with platinum in August and traded at a premium to platinum during September.



5 After fixing at a three-month low of $1,697 on the 17th March, physical demand in Asia predictably increased, with the Shanghai Gold Exchange registering a sharp upswing in purchases of platinum. This helped to move the price upwards, and platinum regained the $1,800 level on the 6th **April**. News of the implementation of a mining indigenisation law in Zimbabwe in late March also helped give platinum some upwards momentum from the supply side.

6 In late April and early **May**, platinum made further gains as the dollar slid on the back of news that the US Federal Reserve would continue its loose monetary policy. Anglo American Platinum announced a 5% year-on-year fall in production in the first quarter, adding to upside pressure on the platinum price. With thin trading around various public holidays, platinum fixed at $1,858 on the 3rd May – its highest level since February. Later that week, platinum's price fell in a wider liquidation.

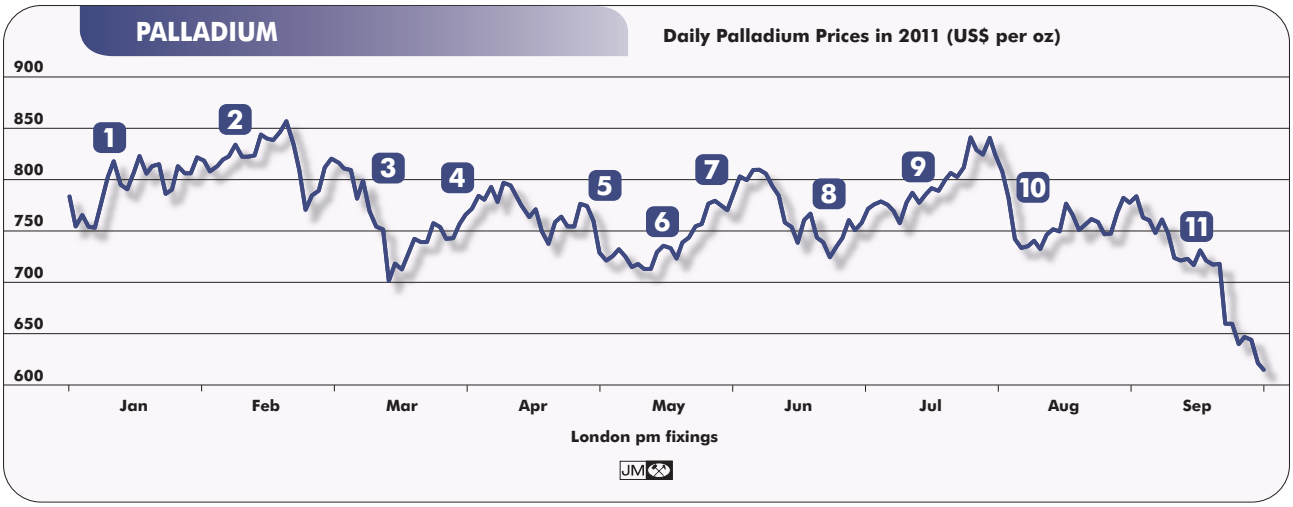
7 News of slower growth in China, and that Japan's economy had moved into recession in the first quarter, led platinum's price to dip. However, in late May, concerns over South African supplies gave some momentum to the platinum price: Lonmin announced the dismissal of 9,000 mineworkers after an unofficial strike at its Karee mine, while Impala Platinum announced it would miss its 2011 output target.

8 When it was announced that the US government would not be engaging in a third round of quantitative easing, the dollar staged a brief rally, which put some pressure on commodities. The platinum price also came under pressure as Greece's credit rating was downgraded by Standard and Poor's. With a stronger dollar and weaker euro, commodity prices plunged. Net long positions fell by 11% in the week commencing 28th **June** to their lowest level since April.

9 Sovereign debt was again a watchword in **July** as policymakers in the USA wrangled over a proposed raising of the national debt ceiling amidst concerns that the country might default on its debt. As the deadline for a decision approached, the dollar was on a downward trend and gold, so often a safe haven in times of crisis, rose to historic highs. Platinum followed gold upwards for much of the month, aided by the uncertainty around tense labour negotiations in South Africa. Late in July, ETF investment holdings climbed to a new record high of almost 1.55 million ounces.

10 Following a last-minute agreement on the debt ceiling, in an unsurprising move, rating agencies downgraded the USA's credit rating. Platinum slumped as investors sought to reduce their losses and as the prospects for lower industrial demand were digested. With high levels of uncertainty in the markets, gold traded briefly at a premium to platinum for the first time since December 2008 and remained at near-parity for much of the month. With platinum consequently representing a good buying opportunity, physical demand re-emerged in Asia and was supported by some fund buying which lifted the price to a high for the year of $1,887 in the pm fix of the 22nd **August**.

11 Platinum came off its recent highs in early **September**, while continuing to trade at near-parity with gold. Dropping through the $1,800 level on the 15th, the price continued downwards. The fall slowed somewhat with good physical demand from Europe and Asia at the sub-$1,800 level. Following the Fed's announcement of Operation Twist, a plan to increase bank lending, the dollar strengthened considerably and investors fled from any assets considered risky, including pgm. Platinum was helpless in the ensuing flight from risk, plunging through $1,600 on the 26th with spot platinum trading below $1,500, although there was a modest recovery as European leaders appeared confident in finding a solution to the eurozone debt crisis. The price fell further with a generally negative economic outlook and lost all its gains in the year to date, fixing at $1,511 on the 30th. By the end of the nine-month period, net long positioning was overall 247,000 oz lower than it had been at the start of the year, with the largest redemptions on TOCOM. In contrast, ETF holdings showed net investment of almost 300,000 oz in the same period.



While palladium's performance was subdued compared with 2010, the price nonetheless traded on average 61% higher, at $768, in the first nine months of 2011 compared with the same period in 2010. Palladium's price was arguably more strongly affected by fluctuations in market sentiment regarding industrial demand than platinum, and the price did not experience the same level of support from ETF buying as in 2010. Nonetheless, it was underpinned by positive supply–demand fundamentals throughout.

1 Palladium began **January** at $784, marginally higher than its level at the end of 2010, and quickly followed the platinum price downwards. As the dollar weakened, palladium's price surged to over $800, a level last seen in early 2001. Aggregate ETF volumes also increased to a new record high of 2.4 million ounces. Palladium net longs dropped to just under 1.7 million ounces, in contrast to platinum net longs, which grew.

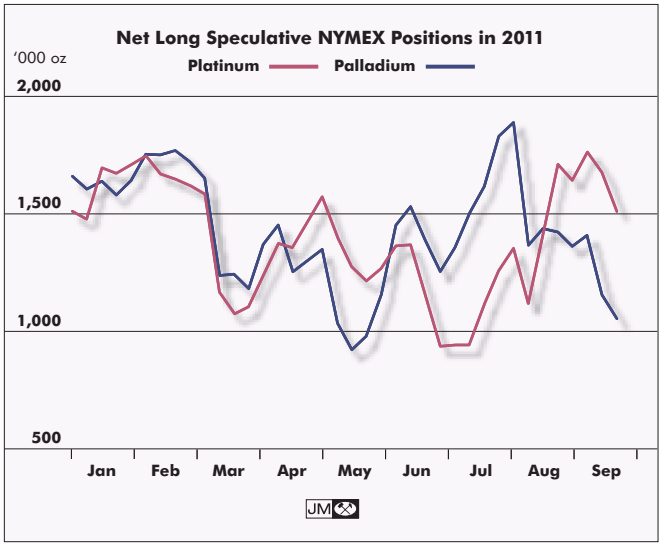
2 Buoyed by strong US auto figures released in **February**, which revealed that sales had increased by 17% the previous month, palladium continued to trade at ten-year highs of above $800, reaching a peak for the year of $858 on the 21st February. Thereafter, the support from steadily increasing industrial commodity prices fell away as oil tracked rapidly downwards in the wake of investor fears surrounding the ongoing political turmoil in Egypt.

3 In early **March**, palladium regained the $800 level with some buying interest only to drop back again with investor nervousness over unrest in the Middle East. Like platinum, palladium's downward price trend was exacerbated by news of the Japanese disaster, with palladium arguably more affected than its sister metal due to its widespread use in gasoline autocatalysts in Japan and in electronic components. Palladium's price lost 12.1% in the period 7th to 17th March, compared with platinum's 7.7% fall. As the price fell during this period, there was a good deal of liquidation in ETFs, led by the London and US funds. There was also an unwinding of net speculative positions in palladium, with the relative decline greatest on TOCOM.

4 Palladium's price recovered well into mid-**April**, although disruption to vehicle production emanating from the Japanese earthquake appeared to dampen investor confidence in palladium's short-term prospects. In addition, Chinese vehicle sales figures for March came in below many analysts' expectations. Although car sales grew overall, the slowdown in the rate of growth was attributed to the end of government subsidies and to higher oil prices. All of this added to the negative sentiment around palladium and the price softened in mid-April. Two new physically-backed palladium ETFs were launched, by iShares and Source, at the same time as two platinum ETFs in April. Initial interest in these products was strong; over 50,000 oz of palladium were purchased in the first few weeks, with the vast majority in the Source vehicle.

5 Palladium was relatively subdued in early **May,** reflecting the mood of investors. With a general sell-off in commodities caused by fears of economic slowdown in Europe, palladium tumbled. As the price fell, there was also a large sell-off in the palladium futures market, with net long positions declining by nearly a third between the weeks commencing 3rd and 17th May. This sell-off was deeper than that experienced by the platinum futures market. Combined palladium net longs fell to below a million ounces for the first time in two years.

Net long speculative positions underwent major liquidation in September as part of a general commodity sell-off.



6 Palladium regained some lost ground in the second half of May as the earlier selling began to appear overdone. Through the remainder of the month, palladium's price movement outperformed that of platinum in relative terms. ETF holdings remained fairly steady for the whole of May as new investment in the Source ETF was largely offset by liquidation in the US and Swiss funds. Like platinum, palladium's price was supported somewhat by concerns over industrial action in South Africa.

7 The price continued to track upwards into early **June**, exceeding the $800 level for the first time in three months on the 7th. Although the Chinese auto industry reported a drop in sales for May 2011, the first such drop in over two years, the subsequent announcement of a recycling incentive plan was generally supportive of the palladium price. Accompanying the rising price, net long positions increased to over 1.5 million ounces by mid-June.

8 The high price ultimately triggered some profit-taking in ETFs and the futures market alike. As with platinum futures, the second half of June saw liquidation in palladium net long positions. Speculative positions declined by 9% in each of the weeks commencing 21st and 28th June, while the palladium price fell beneath $750 for the first time since late May.

9 In **July**, there was mixed news from the global auto industry: disappointing European car sales but healthy growth in export markets, and higher output from a recovering Japanese automotive industry. However, market sentiment was generally bullish for palladium and the price tracked upwards. As the wrangle over the US debt ceiling continued, palladium also benefited from a weakening dollar.

10 The fall in price, which came in early **August**, was more precipitous for palladium than for platinum as palladium lost $107 between the 1st and the 9th August. Palladium was dragged down by the general dive in industrial commodity prices that followed the US credit rating downgrade, as well as continued concerns over the prospects for economic recovery in the eurozone. During this period, the palladium ETF market suffered major liquidation, bringing total holdings down to the lowest level for eight months.

11 Palladium began **September** buoyed by news of higher year-on-year vehicle production in Europe and the USA and news that in Japan vehicle production was returning to normal levels more quickly than anticipated. Despite this initial positive news, palladium soon fell victim to the chaos in the commodities markets, although it gained some benefit from being less closely linked with the gold price than platinum. Palladium came under heavy selling pressure from investors as the economic outlook became ever gloomier, although there was some industrial buying in Europe and Asia. Palladium dropped through the $700 level on the 22nd, for the first time since March. Further selling pressure pushed the price down further to a low for 2011 of $614 on 30th September. By this date all the gains of 2011 had been erased. As with platinum, net long positioning for the year to date was negative and, unlike platinum, ETF holdings showed around 260,000 oz of net disinvestment for the year.

OTHER PGM

Rhodium prices continued to soften in the first nine months of 2011, following a trend seen in 2010. The average price for January to September was $2,163, 13% lower than the same period in 2010.

Rhodium's price firmed slightly in **January**, gaining $75 to reach its high for the year of $2,500 by the end of January, where it remained until mid-**February** as Chinese buying was balanced by selling elsewhere. With uncertainty in the market surrounding turmoil in the Middle East, sustained European selling pushed the market steadily lower through the remainder of February. In early **March**, fresh buying demand in Asia helped support the price at $2,425. The Japanese disaster saw an easing of buying interest later on in March, and the price softened to $2,375. Rhodium, despite being an industrial metal, did not see the same fall in price in the aftermath of the

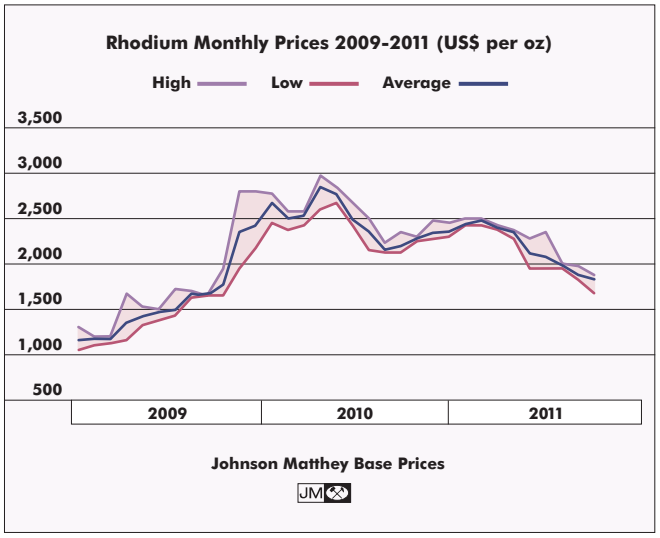
disaster as platinum and palladium did.

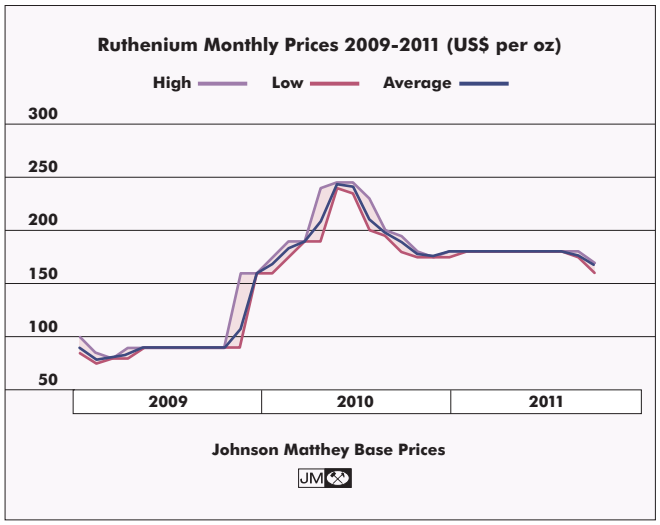
Further selling pressure saw the price fall to $2,350 in mid-**April**. New buying emerged and the price held at this level until the 19th, when speculative selling saw it drift downwards into **May**. In late May, Deutsche Bank launched a physically-backed rhodium exchange traded fund. This, the first such rhodium ETF, tracks the price of rhodium and is backed by physically allocated rhodium sponge. News of the new investment vehicle led to a price spike as investors and industrial consumers alike moved to cover their needs – the price increased by 20%, or $400, between 25th May and 1st **June**. As normality returned to the typically thinly-traded rhodium market, the price shed all of its recent gains to fall to $1,950 again by mid-June. By late June after just over a month of operation, total rhodium ETF holdings stood at the relatively modest level of around 8,000 oz.

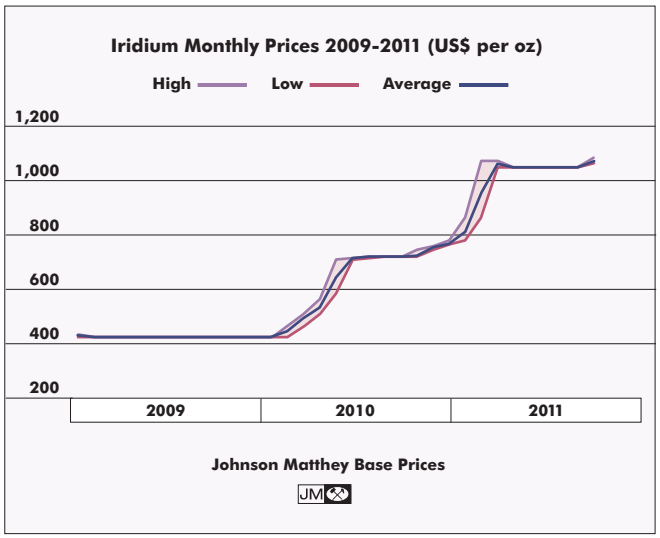
With the downward price movement being seen as a buying opportunity for some industrial users, the price moved up again before easing and flatlining at $2,000 into mid-**July** as selling was met by a steady stream of buyers. Rhodium lost $150 in the first half of **August** as buying interest was outweighed by offers in the market. The price held firm at $1,825 before gaining in the second half of the month with steady demand from buyers taking advantage of the lowest prices since late 2009. Rhodium was not immune to the turmoil in the market in **September**; under selling pressure the price plunged ever lower, reaching $1,675 on the last day of the nine-month period, like platinum and palladium wiping out the gains for the year to date.

Ruthenium remained at the Johnson Matthey base price of $180 for the first seven months of 2011, having been becalmed at that price since December 2010. Light selling pressure moved the price downwards by $5 in **August** to $175, before the price softened by a further $15 in **September** to $160 with light industrial demand.

Iridium's price performed remarkably in the first two months of 2011 and reached record highs. From an opening Johnson Matthey base price in **January** of $780, the price moved steadily upwards with strong demand from the electrical and electrochemical sectors. Iridium broke through the $1,000 level on 17th **February** as heavy buying in a small, illiquid market moved the price steeply higher, although the market remained adequately supplied. The price eventually peaked at $1,075 in late February and into early **March**. With little sustained buying demand for iridium at this level, the price eased by $25 to $1,050. It remained at $1,050 until late **August**, when renewed buying interest caused the price to increase to $1,085 by the end of **September**.







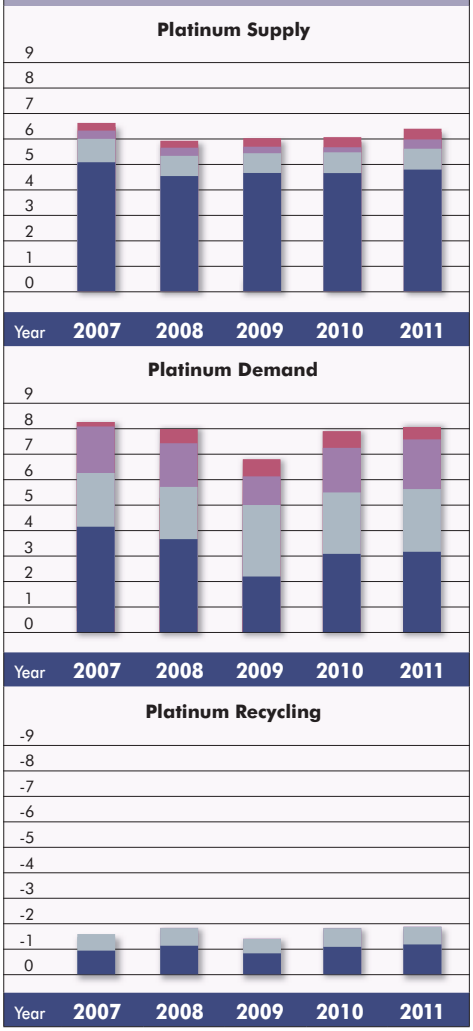
SUPPLY AND DEMAND TABLES

Platinum Supply and Demand

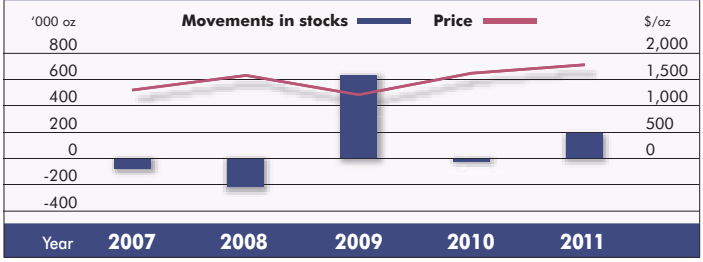
	'000 oz	2007	2008	2009	2010	2011
Supply[1]	South Africa	5,070	4,515	4,635	4,635	4,775
	Russia[2]	915	805	785	825	825
	North America	325	325	260	200	360
	Zimbabwe[3]	170	180	230	280	335
	Others[3]	120	115	115	110	100
	Total Supply	**6,600**	**5,940**	**6,025**	**6,050**	**6,395**
Gross Demand by Application[4]	Autocatalyst[4]	4,145	3,655	2,185	3,075	3,160
	Chemical	420	400	290	440	480
	Electrical[4]	255	230	190	230	250
	Glass	470	315	10	385	435
	Investment	170	555	660	655	495
	Jewellery[4]	2,110	2,060	2,810	2,420	2,465
	Medical & Biomedical[5]	230	245	250	230	235
	Petroleum	205	240	210	170	210
	Other[5]	265	290	190	300	350
	Total Gross Demand	**8,270**	**7,990**	**6,795**	**7,905**	**8,080**
Recycling[6]	Autocatalyst	(935)	(1,130)	(830)	(1,085)	(1,180)
	Electrical	0	(5)	(10)	(10)	(10)
	Jewellery	(655)	(695)	(565)	(735)	(690)
	Total Recycling	**(1,590)**	**(1,830)**	**(1,405)**	**(1,830)**	**(1,880)**
	Total Net Demand[7]	**6,680**	**6,160**	**5,390**	**6,075**	**6,200**
	Movements in Stocks[8]	**(80)**	**(220)**	**635**	**(25)**	**195**

At a glance

million oz



Prices and Movements in Stocks



Supply	Demand / Recycling
Others	Investment
North America	Industrial
Russia	Jewellery
South Africa	Autocatalyst

Average Price (US$ per oz)[9]

2007	2008	2009	2010	2011
1,304	1,576	1,205	1,611	1,782

Gross Platinum Demand by Region

	'000 oz	2007	2008	2009	2010	2011
Europe	Autocatalyst	2,055	1,970	970	1,495	1,480
	Chemical	110	105	70	110	120
	Electrical	15	20	20	15	20
	Glass	15	(25)	5	10	10
	Investment	195	105	385	140	320
	Jewellery	200	205	185	175	165
	Medical & Biomedical	110	115	115	90	90
	Petroleum	25	30	25	20	35
	Other	75	85	55	100	110
	Total	**2,800**	**2,610**	**1,830**	**2,155**	**2,350**
Japan	Autocatalyst	610	610	395	550	475
	Chemical	55	55	45	50	35
	Electrical	35	35	30	30	30
	Glass	85	65	40	90	180
	Investment	(60)	385	160	45	105
	Jewellery	540	530	335	325	320
	Medical & Biomedical	15	20	20	20	20
	Petroleum	5	10	10	5	5
	Other	30	25	15	40	40
	Total	**1,315**	**1,735**	**1,050**	**1,155**	**1,210**
North America	Autocatalyst	850	505	370	405	490
	Chemical	95	95	65	100	105
	Electrical	55	30	25	25	30
	Glass	25	(5)	(35)	10	(10)
	Investment	30	60	105	465	65
	Jewellery	225	200	135	175	175
	Medical & Biomedical	80	85	90	90	90
	Petroleum	30	25	15	25	50
	Other	135	150	90	105	130
	Total	**1,525**	**1,145**	**860**	**1,400**	**1,125**
China	Autocatalyst	175	145	85	100	110
	Chemical	70	60	40	80	115
	Electrical	20	30	20	30	30
	Glass	180	85	(90)	130	75
	Investment	0	0	0	0	0
	Jewellery	1,070	1,060	2,080	1,650	1,685
	Medical & Biomedical	10	10	10	10	15
	Petroleum	10	10	10	15	15
	Other	5	10	10	25	30
	Total	**1,540**	**1,410**	**2,165**	**2,040**	**2,075**
Rest of the World	Autocatalyst	455	425	365	525	605
	Chemical	90	85	70	100	105
	Electrical	130	115	95	130	140
	Glass	165	195	90	145	180
	Investment	5	5	10	5	5
	Jewellery	75	65	75	95	120
	Medical & Biomedical	15	15	15	20	20
	Petroleum	135	165	150	105	105
	Other	20	20	20	30	40
	Total	**1,090**	**1,090**	**890**	**1,155**	**1,320**
	Total Gross Demand	**8,270**	**7,990**	**6,795**	**7,905**	**8,080**

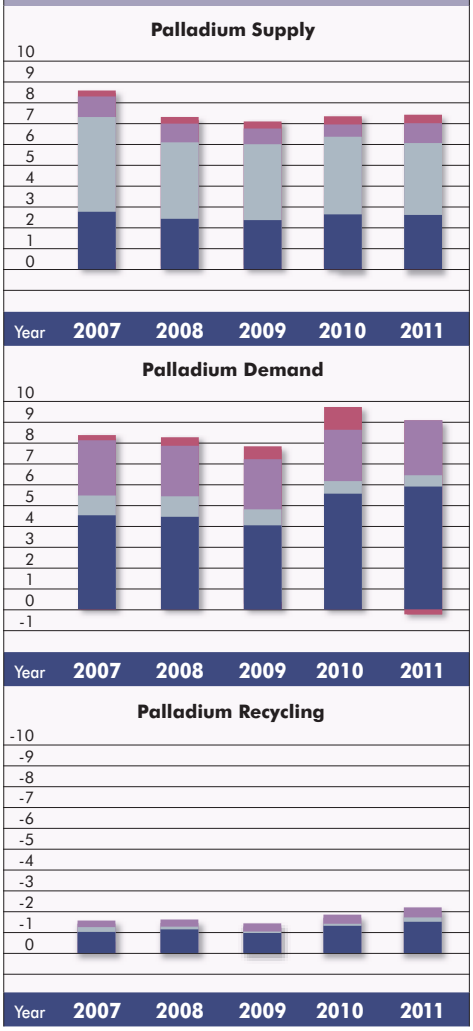
At a glance

Palladium Supply and Demand

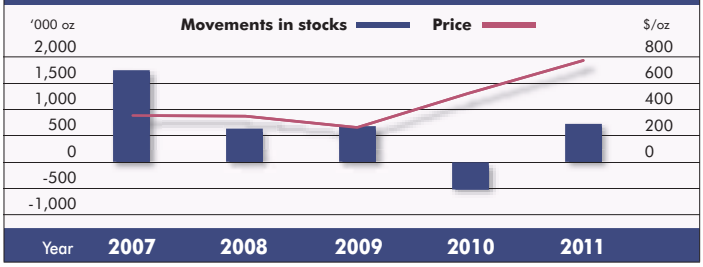
	'000 oz	2007	2008	2009	2010	2011
Supply[1]	South Africa	2,765	2,430	2,370	2,640	2,610
	Russia[2]					
	Primary	3,050	2,700	2,675	2,720	2,700
	Stock Sales	1,490	960	960	1,000	750
	North America	990	910	755	590	945
	Zimbabwe[3]	135	140	180	220	260
	Others[3]	150	170	160	185	155
	Total Supply	**8,580**	**7,310**	**7,100**	**7,355**	**7,420**
Gross Demand by Application[4]	Autocatalyst[4]	4,545	4,465	4,050	5,580	5,915
	Chemical	375	350	325	370	455
	Dental	630	625	635	595	595
	Electrical[4]	1,550	1,370	1,370	1,410	1,485
	Investment	260	420	625	1,095	(215)
	Jewellery[4]	950	985	775	595	545
	Other	85	75	70	90	110
	Total Gross Demand	**8,395**	**8,290**	**7,850**	**9,735**	**8,890**
Recycling[6]	Autocatalyst	(1,015)	(1,140)	(965)	(1,310)	(1,505)
	Electrical	(315)	(345)	(395)	(440)	(480)
	Jewellery	(235)	(130)	(70)	(100)	(210)
	Total Recycling	**(1,565)**	**(1,615)**	**(1,430)**	**(1,850)**	**(2,195)**
	Total Net Demand[7]	**6,830**	**6,675**	**6,420**	**7,885**	**6,695**
	Movements in Stocks[8]	**1,750**	**635**	**680**	**(530)**	**725**

At a glance

million oz



Prices and Movements in Stocks



Supply	Demand / Recycling
Others	Investment
North America	Industrial
Russia	Jewellery
South Africa	Autocatalyst

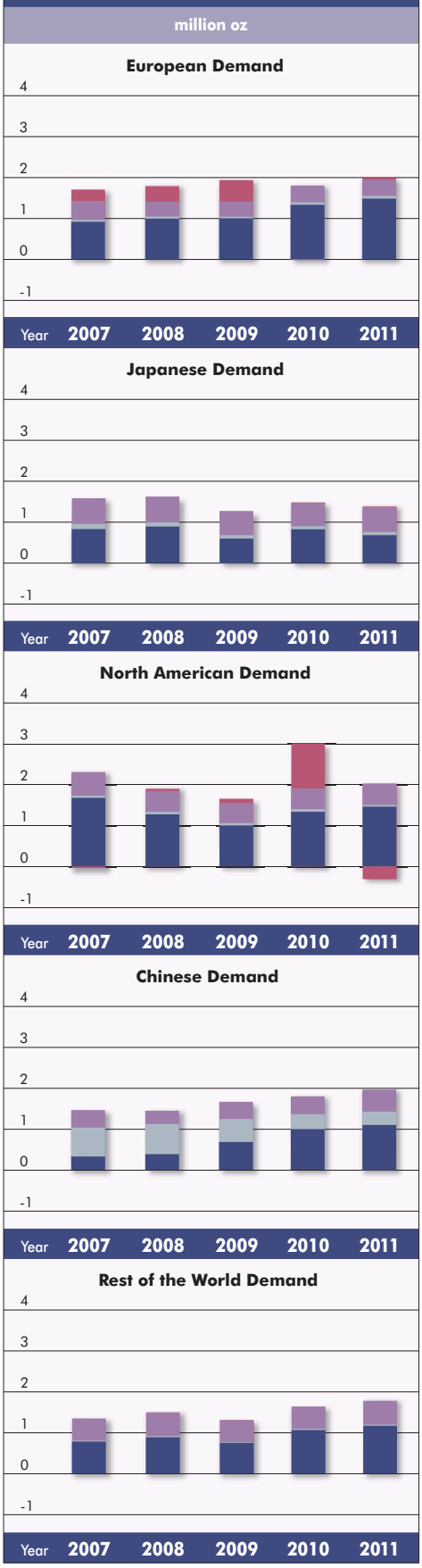
Average Price (US$ per oz)[9]

2007	2008	2009	2010	2011
355	352	264	526	768

Gross Palladium Demand by Region

	'000 oz	2007	2008	2009	2010	2011
Europe	Autocatalyst	920	1,005	995	1,330	1,485
	Chemical	95	100	85	105	80
	Dental	70	65	65	80	80
	Electrical	280	190	195	195	200
	Investment	280	370	525	(5)	60
	Jewellery	40	45	50	65	65
	Other	20	20	20	30	40
	Total	**1,705**	**1,795**	**1,935**	**1,800**	**2,010**
Japan	Autocatalyst	820	885	590	820	675
	Chemical	25	20	20	20	20
	Dental	275	275	295	250	245
	Electrical	325	320	270	295	340
	Investment	0	0	0	10	10
	Jewellery	125	115	80	75	75
	Other	10	10	10	10	10
	Total	**1,580**	**1,625**	**1,265**	**1,480**	**1,375**
North America	Autocatalyst	1,695	1,290	1,020	1,355	1,480
	Chemical	75	55	50	65	80
	Dental	265	270	260	250	255
	Electrical	195	170	170	160	150
	Investment	(20)	50	95	1,090	(285)
	Jewellery	55	60	60	65	45
	Other	30	20	15	25	30
	Total	**2,295**	**1,915**	**1,670**	**3,010**	**1,755**
China	Autocatalyst	325	390	685	1,005	1,100
	Chemical	80	55	75	65	150
	Dental	5	0	0	0	0
	Electrical	340	255	335	360	375
	Investment	0	0	0	0	0
	Jewellery	705	740	560	360	330
	Other	10	10	10	10	10
	Total	**1,465**	**1,450**	**1,665**	**1,800**	**1,965**
Rest of the World	Autocatalyst	785	895	760	1,070	1,175
	Chemical	100	120	95	115	125
	Dental	15	15	15	15	15
	Electrical	410	435	400	400	420
	Investment	0	0	5	0	0
	Jewellery	25	25	25	30	30
	Other	15	15	15	15	20
	Total	**1,350**	**1,505**	**1,315**	**1,645**	**1,785**
	Total Gross Demand	**8,395**	**8,290**	**7,850**	**9,735**	**8,890**

At a glance



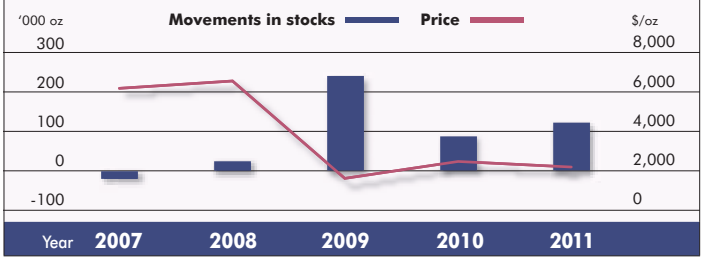
Rhodium Supply and Demand

	'000 oz	2007	2008	2009	2010	2011
Supply[1]	South Africa	696	574	663	632	650
	Russia[2]	90	85	70	70	68
	North America	20	18	15	10	20
	Zimbabwe[3]	14	15	19	19	28
	Others[3]	4	3	3	3	2
	Total Supply	**824**	**695**	**770**	**734**	**768**
Gross Demand by Application[4]	Autocatalyst[4]	887	768	619	727	705
	Chemical	63	68	54	67	72
	Electrical[4]	3	3	3	4	6
	Glass	59	34	19	68	85
	Other	24	24	21	21	37
	Total Gross Demand	**1,036**	**897**	**716**	**887**	**905**
Recycling[6]	Autocatalyst	(192)	(227)	(187)	(241)	(260)
	Total Recycling	**(192)**	**(227)**	**(187)**	**(241)**	**(260)**
	Total Net Demand[7]	**844**	**670**	**529**	**646**	**645**
	Movements in Stocks[8]	**(20)**	**25**	**241**	**88**	**123**

At a glance

'000 oz

Prices and Movements in Stocks



Supply	Demand / Recycling
Others	Other
North America	Glass
Russia	Chemical
South Africa	Autocatalyst

Average Price (US$ per oz)[9]

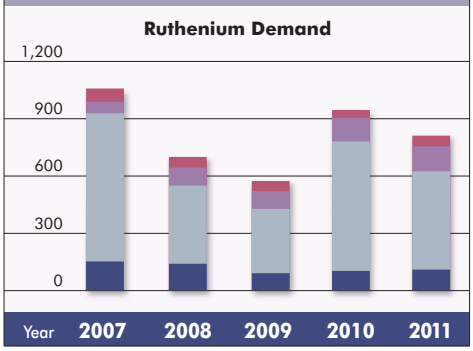
2007	2008	2009	2010	2011
6,191	6,564	1,592	2,458	2,163

Ruthenium Demand

	'000 oz	2007	2008	2009	2010	2011
Demand by Application	Chemical	151	139	89	100	109
	Electrical	776	410	336	679	514
	Electrochemical	62	95	95	124	131
	Other	69	55	54	42	57
	Total Demand	**1,058**	**699**	**574**	**945**	**811**

At a glance

'000 oz



Average Price (US$ per oz)[9]

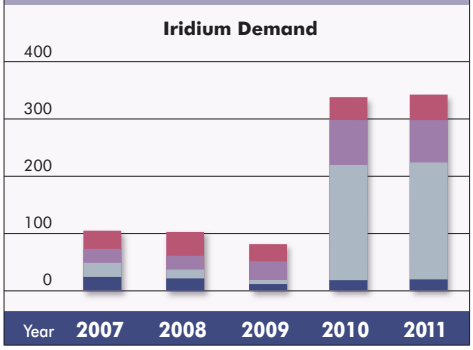
2007	2008	2009	2010	2011
580	323	95	197	178

Iridium Demand

	'000 oz	2007	2008	2009	2010	2011
Demand by Application	Chemical	23	21	11	18	19
	Electrical	25	15	7	201	204
	Electrochemical	24	25	33	79	74
	Other	32	41	30	40	45
	Total Demand	**104**	**102**	**81**	**338**	**342**

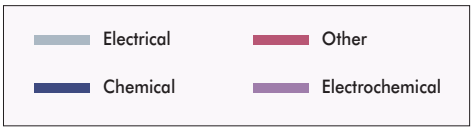
At a glance

'000 oz



Average Price (US$ per oz)[9]

2007	2008	2009	2010	2011
447	450	425	642	1,020



NOTES TO TABLES

[1]**Supply** figures represent estimates of sales by the mines of primary pgm and are allocated to where the initial mining took place rather than the location of refining. Additionally, we continue to report sales of metal which we believe has not previously been priced, principally sales of Russian state stocks, as supplies.

[2]Our **Russian supply** figures represent the total pgm sold in all regions, including Russia and the ex-CIS. Demand in Russia and the ex-CIS states is included in the Rest of the World region. **Russian supply** figures for palladium have been split into sales from primary mining and sales of stocks.

[3]Supplies from **Zimbabwe** have been split from **Others' supplies**. Platinum group metals mined in Zimbabwe are currently refined in South Africa, and our supply figures represent shipments of pgm in concentrate or matte, adjusted for typical refining recoveries.

[4]**Gross demand** figures for any given application represent the sum of manufacturer demand for metal in that application and any changes in unrefined metal stocks in that sector. Increases in unrefined stocks lead to additional demand, reductions in stock lead to a lower demand figure.

[5]Our **Medical and Biomedical** category represents combined metal demand in the medical, biomedical and dental sectors.

[6]**Recycling** figures represent estimates of the quantity of metal recovered from open loop recycling (i.e. where the original purchaser does not retain control of the metal throughout). For instance, autocatalyst recycling represents the weight of metal recovered from end-of-life vehicles and aftermarket scrap in an individual region, allocated to where the car is scrapped rather than where the metal is finally recovered. These figures do not include warranty or production scrap. Where no recycling figures are given, open loop recycling is negligible. In our recycling charts, we label recovery of electrical scrap as 'industrial' recycling.

[7]**Net demand** figures are equivalent to the sum of gross demand in an application less any metal recovery from open loop scrap in that application, whether the recycled metal is reused in that industry or sold into another application. Where no recycling figure is given for an application, gross and net demand are identical.

[8]**Movements in stocks** in any given year reflect changes in stocks held by fabricators, dealers, banks and depositories but excluding stocks held by primary refiners and final consumers. A positive figure (sometimes referred to as a 'surplus') reflects an increase in market stocks. A negative value (or 'deficit') indicates a decrease in market stocks.

[9]**Average price** figures for platinum and palladium are the mean of all daily fixing values in a given year except for 2011 which cover the period January to September inclusive. Average price figures for rhodium, ruthenium and iridium are based on Johnson Matthey European Base Prices.

GLOSSARY

ASC	Ammonia Slip Catalyst
CIS	Commonwealth of Independent States
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRT	Cathode Ray Tube
CSF	Catalysed Soot Filter
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
EGR	Exhaust Gas Recirculation
ELV	End-of-Life Vehicle
ETF	Exchange Traded Fund
g	Gram
g/kWh	Grams per Kilowatt Hour
GDP	Gross Domestic Product
HC	Hydrocarbons
HDD	Heavy Duty Diesel
hp	Horsepower
IMO	International Maritime Organization
JV	Joint Venture
kg	Kilogram
kW	Kilowatt
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LNT	Lean NOx Trap
LPG	Liquefied Petroleum Gas
Merensky	A platiniferous ore body in South Africa
MLCC	Multi-Layer Ceramic Capacitor
NOx	Oxides of Nitrogen
NRMM	Non-Road Mobile Machinery
NYMEX	New York Mercantile Exchange
OLED	Organic Light Emitting Diode
oz	Ounces Troy
PET	Polyethylene Terephthalate
PFM	Porcelain-Fused-to-Metal
pgm	Platinum Group Metal(s)
Platreef	A platiniferous ore body in South Africa
PM	Particulate Matter
PMR	Perpendicular Magnetic Recording
ppm	Parts Per Million
ppt	Parts Per Thousand
PTA	Purified Terephthalic Acid
SCR	Selective Catalytic Reduction
SOx	Oxides of Sulphur
SUV	Sports Utility Vehicle
TOCOM	Tokyo Commodity Exchange
tonne	1,000 kg
TWC	Three-Way Catalyst
UG2	A platiniferous ore body in South Africa
VAM	Vinyl Acetate Monomer

NOTE ON PRICES

All prices are quoted per oz unless otherwise stated.

R	South African Rand
£	UK Pound
$	US Dollar
¥	Japanese Yen
€	Euro
RMB	Chinese Renminbi

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