

PLATINUM 2011



Johnson Matthey

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Background image: Autocatalyst scrap being recycled.

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by **Jonathan Butler**

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EXECUTIVE SUMMARY

The platinum market in 2010 was in a very small surplus of just 20,000 oz. As the world economy improved, gross demand increased by 16% to 7.88 million ounces, with growth in the automotive and industrial sectors. Supplies were up by 0.6% at 6.06 million ounces. Recycling of platinum rose by almost a third to 1.84 million ounces.



Global supplies of platinum rose by just 35,000 oz in 2010 to 6.06 million ounces. Although refined production in South Africa rose last year, not all of this metal was shipped by the year-end, leading to sales of platinum from South Africa remaining flat at 4.64 million ounces. Russian platinum shipments climbed by 5% to 825,000 oz, while supplies from Zimbabwe grew by almost a quarter to 280,000 oz.

Gross demand for platinum in autocatalysts rose by 43% to 3.13 million ounces. The global automotive sector recovered strongly in 2010, with vehicle production higher in all regions. The largest increase in platinum demand was in Europe, due to a sharp rise in demand for light duty diesel vehicles.



Gross demand for platinum from the jewellery sector declined by 14% to 2.42 million ounces in 2010. Although purchasing of platinum by the Chinese jewellery sector remained robust, at 1.65 million ounces, overall demand levels were lower than in the exceptional year of 2009.

Gross industrial demand for platinum jumped by 48% to 1.69 million ounces in 2010. Economic recovery in developed markets, and strong growth in emerging ones, drove purchasing of consumer products. Platinum demand in the manufacture of electrical items, glass and chemicals therefore increased.



Net physical investment demand for platinum remained almost flat at 650,000 oz. There was a good deal of investor interest in physically-backed platinum exchange traded funds (ETFs) in the US. Demand in the more mature European funds declined due to profit-taking.

The rhodium market tightened in 2010 but remained in oversupply by 114,000 oz. Gross demand for rhodium increased by 22% in 2010 to 873,000 oz as automotive and industrial markets recovered. Supplies of rhodium declined slightly to 751,000 oz. Recycling of rhodium from autocatalysts increased to 236,000 oz.





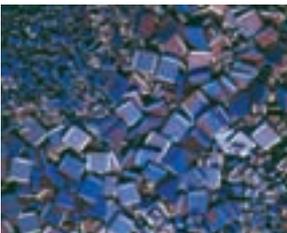
The palladium market was in a deficit of 490,000 oz in 2010. Gross demand increased by 23% to a record 9.63 million ounces due to strong purchasing by the automotive and physical investment sectors. Supplies of palladium climbed by 3% to 7.29 million ounces as South African mines raised output.

Supplies of palladium rose by 190,000 oz to 7.29 million ounces. Supplies of palladium from Russian mining increased by 2% to 2.72 million ounces. Sales of palladium from Russian state stocks were once again at around 1 million ounces. South African sales of palladium climbed by 9% to 2.58 million ounces.



Gross demand for palladium in autocatalysts increased by 35% to 5.45 million ounces last year. Higher global production in the light duty passenger vehicle sector, together with tightening emissions legislation in some markets, helped raise demand. Rapid growth in the light duty sector lifted automotive palladium demand in China by 42% to a new level of 975,000 oz.

Net physical investment demand for palladium grew by 74% to 1.09 million ounces. Heavy buying of palladium exchange traded funds helped lift demand to unprecedented levels. Investment interest was underpinned by positive supply–demand fundamentals.



Gross industrial demand for palladium was 70,000 oz higher in 2010 at 2.47 million ounces. Use of palladium in the chemical industry rose by 22% as consumer demand for plastics and other products raised rates of factory utilisation. Dental demand for palladium softened in line with long-term health trends, while electrical demand rose moderately compared with 2009.

Gross palladium demand in the jewellery sector fell by 20% to 620,000 oz. A decline in the manufacture of palladium jewellery in China was responsible for much of this fall. Demand in China went down by around a third to 380,000 oz, more than offsetting a small increase in manufacture of palladium jewellery in Europe and North America.

Recycling of palladium increased by 29% to 1.85 million ounces. Higher rates of end-of-life vehicles being processed through the recycling chain helped push up returns of metal from this source. Jewellery and electrical recycling levels were also up, stimulated by elevated metal prices in 2010.



SUMMARY

PLATINUM

- The platinum market was close to balance in 2010, with a surplus of just 20,000 oz. Supplies remained almost flat at 6.06 million ounces, while gross demand increased by 16% to 7.88 million ounces. Recycling of platinum increased by almost a third to 1.84 million ounces.
- Gross demand for platinum in autocatalysts increased by 43% to 3.13 million ounces in 2010 as the global automotive sector bounced back from a poor 2009. Increased vehicle production in Europe in particular benefited platinum.
- Gross industrial demand for platinum increased by 48% to 1.69 million ounces in 2010, led by growth in the glass and chemical sectors.
- Gross demand for platinum from the jewellery sector fell by 14% to 2.42 million ounces in 2010 mainly due to softer Chinese demand. Purchasing of platinum by the jewellery industry in other regions remained fairly stable.
- Identifiable physical investment demand for platinum remained almost flat in 2010 at 650,000 oz.

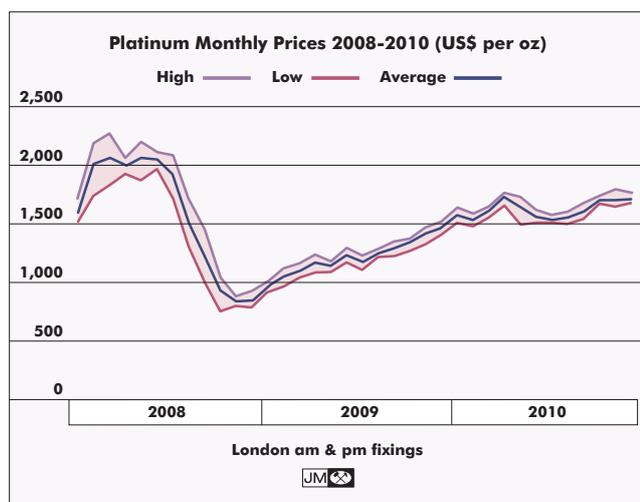
The recovery of the global economy in 2010 helped drive gross demand for platinum up by 16% to 7.88 million ounces, its highest level since 2008. Supplies remained largely flat at 6.06 million ounces while open loop recycling of platinum increased to 1.84 million ounces. The platinum market tightened in 2010 and ended the year very close to balance, with a 20,000 oz surplus. Platinum's average price for 2010 was an all-time high in dollar terms, at \$1,611.

Supplies of platinum from mining operations increased by just 35,000 oz to reach 6.06 million ounces in 2010. Shipments from South Africa remained flat at 4.64 million ounces while increases in supply from Russia and Zimbabwe were largely offset by decreases in North America and elsewhere. Due to a production profile that was heavily loaded towards the end of the year, some of the metal refined in South Africa in 2010 was not shipped by the year-end, therefore supplies fell below the level of refined output. There was some improvement in underlying mine production, which rose by around 3%, reflecting recovery at Lonmin's Marikana operations and at the Impala lease area.

Total supplies of platinum from Russia increased by 40,000 oz in 2010. Although pgm grades have fallen in recent years at Norilsk's Taimyr operation, in 2009 the company increased the processing of above-ground materials to compensate. Production of platinum in North America fell by 50,000 oz in 2010. Despite increases in output in some operations, others were affected by strikes and reduced mill throughput. Platinum supplies from Zimbabwe grew by 50,000 oz in 2010 as Zimplats increased output following the commissioning of the Phase I expansion at its Ngezi mine.

A rise in vehicle production across all regions in 2010 helped drive up demand for platinum in autocatalysts. With an improved global economic outlook, manufacturing of vehicles worldwide reached 78 million units in 2010, an increase of almost 16 million compared with 2009. Gross platinum demand in the autocatalyst sector rose by 43% in 2010 to 3.13 million ounces, a considerable

improvement compared with the previous year but still some way off pre-2009 levels of demand. Driving much of this increase was the use of platinum in diesel autocatalyst formulations in Europe. Diesel passenger vehicle production recovered strongly in 2010 as the overall vehicle market grew and scrappage incentives, which had favoured small gasoline cars, came to an end. This meant there was a recovery in the market share of diesels to around 48%, which helped boost demand for platinum in autocatalysts in Europe by 51% to 1.47 million ounces. Higher production of heavy duty diesels worldwide accelerated platinum demand, as did more stringent heavy duty diesel emissions regulations in the US which generally meant an increase in platinum catalyst loadings. Although usage of platinum in autocatalysts has fallen from its peak in 2007 as partial substitution with palladium has occurred, platinum



Platinum's price traded higher in 2010 than in the previous year, reaching levels not seen since 2008. The price was supported by strong supply-demand fundamentals.

remains the dominant component of diesel emissions control systems.

In 2010, gross industrial demand for platinum increased by 550,000 oz to 1.69 million ounces. Resurgent demand for platinum from the electrical, chemical and glass sectors came as a result of economic recovery in traditional markets such as Europe and North America, and substantial new demand as manufacturing capacity was constructed in China and elsewhere in Asia. The glass sector in particular saw remarkable growth in demand for platinum in 2010 as production of thin-film transistor liquid crystal display (TFT-LCD) glass for use in electronic displays increased, as did output of glass fibre for construction materials. This stimulated purchases of platinum for glass manufacturing lines, which exceeded returns from older decommissioned facilities.

Demand for platinum in the chemical sector increased by 53% in 2010 to 445,000 oz as manufacturing plants boosted capacity utilisation. Growth was fastest in emerging markets where demand for polymers is increasing rapidly. In traditional markets, a cautious approach to investing in new production capacity tempered the growth in platinum demand. Gross platinum demand from the global electrical sector increased by 30,000 oz to 220,000 oz as higher sales of electronic equipment increased the demand for platinum in hard disk drives, as well as in plating and thermocouples.

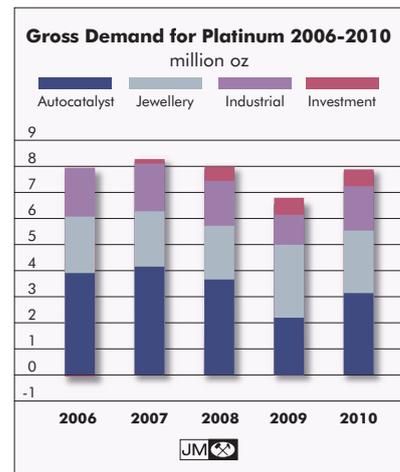
Gross demand for platinum in the jewellery sector was 2.42 million ounces in 2010, 14% lower than in 2009. Demand from the Chinese jewellery industry remained relatively robust at 1.65 million ounces. Although this represented a fall of 21% compared with 2009 when lower prices encouraged exceptional levels of stock building and sales, this was a healthy figure given that platinum traded on average 34% higher in 2010 than 2009. The Chinese jewellery sector remained strong compared with historical levels: demand was around 600,000 oz higher in 2010 than in 2008.

A key feature of 2010, as in recent years, was the size of the investment market for platinum. Over the past three years, growth in investment has had an increasing influence on the metal's price, while the price has in turn influenced investment levels. The total cumulative volume of platinum allocated in various physically-backed exchange traded funds (ETFs) around the world exceeded 1.2 million ounces in December 2010, an historic high. Similarly, total combined net long platinum positions on NYMEX and TOCOM reached record levels of over 2 million ounces by the end of 2010. The dynamics of the investment market operate on a wholly different timescale from the supply of platinum. The volume of platinum that went into ETFs in 2010 was larger than the year-on-year increase in global supplies of platinum in any year apart from 1993.

However, the platinum market remains very different from the gold and silver markets in that it still remains primarily industrial, not speculative. The rationale for platinum as an investment metal can be traced to the fundamentals of supply and demand, as well as the low opportunity cost of investing in ETFs in a low interest rate environment. Investors appear to remain convinced that, in the longer term, demand will outstrip supply. The strong increase in demand for platinum in 2010 undoubtedly drove physical investment in platinum, which in turn added 650,000 oz of new demand, mainly in the form of ETFs.

Open loop recycling of platinum returned 1.84 million ounces to the market in 2010. A resurgence in the automotive sector meant rates of platinum recovery from end-of-life vehicles increased to 1.09 million ounces. This was boosted by the returns from car scrapping schemes which increased the volume of platinum from older vehicles processed through the recycling system. The high metal price in 2010 also helped incentivise recycling in the jewellery sector, lifting the total jewellery scrap figure to 745,000 oz.

Platinum Supply and Demand '000 oz			
Supply	2008	2009	2010
South Africa	4,515	4,635	4,635
Russia	805	785	825
Others	620	605	600
Total Supply	5,940	6,025	6,060
Gross Demand			
Autocatalyst	3,655	2,185	3,125
Jewellery	2,060	2,810	2,415
Industrial	1,720	1,140	1,690
Investment	555	660	650
Total Gross Demand	7,990	6,795	7,880
Recycling	(1,830)	(1,405)	(1,840)
Total Net Demand	6,160	5,390	6,040
Movements in Stocks	(220)	635	20



PALLADIUM

- The palladium market was in a fundamental deficit of 490,000 oz in 2010. Supplies of palladium increased by a modest 3% to 7.29 million ounces. Gross demand increased by 23% to 9.63 million ounces, its highest ever level. Open loop recycling of palladium increased by 29% to 1.85 million ounces.
- A strongly performing automotive sector in all regions pushed up gross demand for palladium in autocatalysts by 35% to 5.45 million ounces in 2010.
- Net identifiable physical investment demand for palladium increased by a remarkable 74% in 2010 due to strong demand for various palladium exchange traded funds (ETFs).
- Gross industrial demand for palladium increased by 70,000 oz in 2010 to 2.47 million ounces.
- Gross palladium demand in the jewellery sector softened by 20% in 2010 to 620,000 oz.

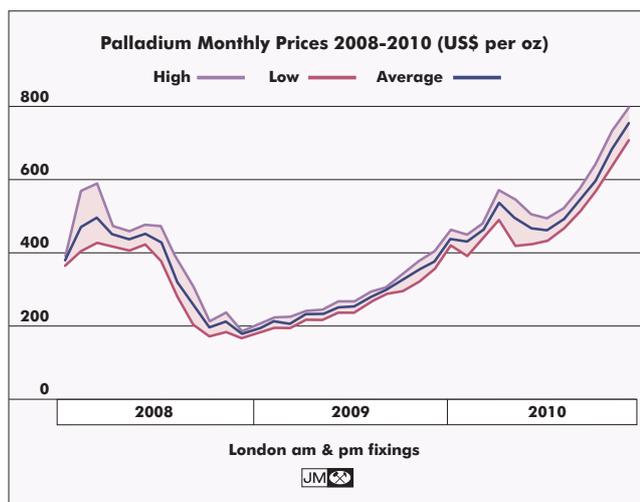
The palladium market was in a substantial deficit of 490,000 oz in 2010 as a surge in demand from the rebounding automotive industry, and growth in the physical investment sector, outweighed rising supplies. Gross palladium demand reached a record high level of 9.63 million ounces in 2010 reflecting a better economic outlook in most regions. Driven by the strong supply-demand fundamentals, palladium proved to be popular with investors in ETFs. Physical investment holdings of palladium were larger than those of platinum in 2010 and reached record high volumes. With a tight market underpinning investment demand, palladium's price performed strongly, trading at an annual average of \$526, twice as high as in 2009 and at its third highest ever level.

Worldwide supplies of palladium in 2010 increased by 3% to 7.29 million ounces. Supplies from South Africa increased by 205,000 oz due to pipeline releases of palladium, as well as increased production from palladium-rich ore bodies by the two largest producers. Russian supplies of palladium increased by 45,000 oz through the greater exploitation of above-ground reserves, while sales of Russian state stock continued at around a million ounces, roughly the same level as the previous two years. Although North American supplies reduced by 22% to 590,000 oz following lower production at Stillwater and Vale, this was insufficient to offset net growth in supplies worldwide.

On the demand side, palladium was very strong. Gross demand increased by 1.78 million ounces in 2010 to reach a record 9.63 million ounces with recovery in almost all sectors. Growth in automotive demand was impressive, increasing by 1.40 million ounces in 2010 to reach 5.45 million ounces. With developed markets recovering from recession, there was an increase in vehicle production, which drove automotive palladium demand up by 33% in Europe and North America and 38% in Japan. Rapid expansion of light duty gasoline vehicle production helped lift palladium demand by 42% in the Chinese automotive market, while high rates of growth of vehicle production in other developing markets created new demand. Palladium also benefited

from increasing levels of substitution for platinum in gasoline autocatalyst formulations, which continued despite a narrowing of the price difference between the two metals.

Industrial demand for palladium strengthened overall, increasing by 70,000 oz to 2.47 million ounces, lifted by expansion of manufacturing capacity. Purchasing of palladium by the electrical sector increased by 40,000 oz to 1.41 million ounces as improved economic conditions stimulated consumer and business demand for various electronic products. Demand for palladium from the chemical industry, particularly in downstream uses of polymers, increased by 70,000 oz in 2010 to 395,000 oz as higher rates of chemical plant utilisation stimulated demand for process catalysts. There was especially strong growth in China, where significant new capacity is being constructed to supply the domestic market.



Palladium's price performed remarkably in 2010, particularly in the second half when it reached its highest level in almost a decade.

Purchasing of palladium by the dental sector worldwide weakened in 2010 to 580,000 oz. Palladium demand in dentistry continued to be affected by the long-term effects of improved dental health and preventative measures worldwide and the greater use of resin-based, all-ceramic and base metal dental treatments.

Demand for palladium in the jewellery sector also fell in 2010, by 20% to 620,000 oz. Consumer purchases of palladium jewellery continued to grow in Europe and North America, particularly in the men's wedding band market. However, demand declined in China, reducing by around a third to 380,000 oz, as elevated prices and adequate manufacturer and retail stock levels affected new purchasing of palladium.

Investment demand for palladium grew by 74% compared with 2009: the highest rate of growth in any of our demand sectors. The ETF market was responsible for most of this; specifically, the US-based palladium ETF registered heavy investment inflows throughout much of the year. With strong fundamentals in the palladium market, including high levels of new demand coming from emerging markets and recovery in developed markets, there was net purchasing of ETF investments, which further drove up physical palladium demand levels. Investors piled into ETFs as the palladium price climbed rapidly at the end of 2010: between the end of November and the end of December, palladium's price increased by around \$100, and total ETF holdings increased by 200,000 oz. Although it is difficult to disentangle the cause and effect of the appreciating price and the growth in ETF holdings, price and demand clearly acted in tandem.

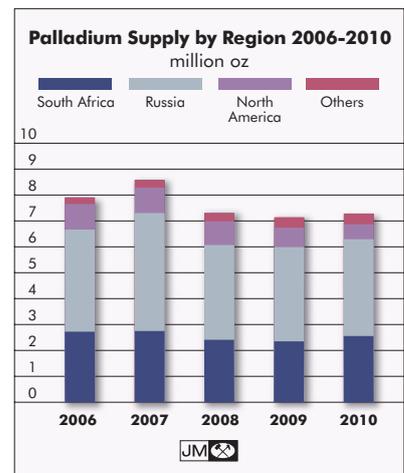
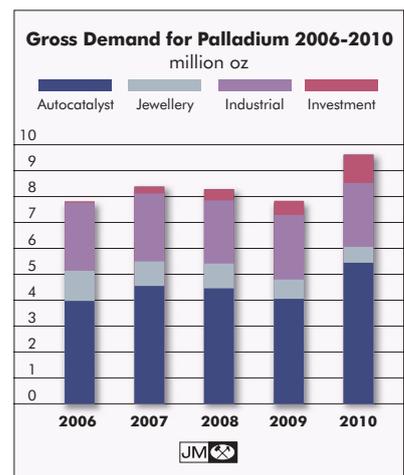
A feature of investor sentiment for palladium in 2010 was the anticipation of potential future supply shortfalls. This, together with strong demand throughout the year, underpinned the dynamics of the palladium market, accounted for much investor interest and also partly explained the price performance. Prompted by comments in the second half from Norilsk Nickel, the largest Russian producer, investors became increasingly convinced that 2010 could be the last year of significant sales from Russian state stocks. The pricing in of that potential shortfall, and the evidently rising level of demand, helped underpin the price rally towards the end of the year and added to the positive fundamentals.

New investment demand for palladium totalled 1.09 million ounces in 2010, its highest ever level, of which over 1 million ounces were in ETFs. The cumulative ETF total fund volume stood at 2.2 million ounces at the end of 2010, another record high. To put this into context: the growth in palladium demand in ETFs last year was larger than the year-on-year growth in net demand (excluding investment) at any time in the past decade. Growth in palladium ETF investments exceeded the percentage growth in all other demand sectors and in 2010 was roughly equal to total supplies from Russian state stocks.

Underpinned by strong fundamentals, the palladium price performed extremely strongly in 2010, doubling over the course of the year and reaching levels not seen since 2000 and 2001. The price of palladium was more volatile than that of platinum; palladium's price outperformed that of platinum in both upward and downward movements, with a notably sharp rally for palladium towards the end of the year.

Recycling of palladium from the open loop sources of automotive, electrical and jewellery sectors totalled 1.85 million ounces in 2010, an increase of almost a third compared with the previous year. The majority of this metal, 1.33 million ounces, came from scrapped autocatalysts. This sector saw a substantial increase in the amount of palladium recycled in 2010 as higher numbers of end-of-life vehicles were returned for recycling. Recycling of electrical components also increased as did recycling of old, broken, and unsold palladium jewellery, largely driven by higher prices.

Palladium Supply and Demand '000 oz			
Supply	2008	2009	2010
South Africa	2,430	2,370	2,575
Russia	3,660	3,635	3,720
Others	1,220	1,095	995
Total Supply	7,310	7,100	7,290
Gross Demand			
Autocatalyst	4,465	4,050	5,450
Jewellery	985	775	620
Industrial	2,420	2,400	2,470
Investment	420	625	1,085
Total Gross Demand	8,290	7,850	9,625
Recycling	(1,615)	(1,430)	(1,845)
Total Net Demand	6,675	6,420	7,780
Movements in Stocks	635	680	(490)



OTHER PGM

- Rhodium was in oversupply by 114,000 oz in 2010, although the market was tighter than in 2009.
- Gross rhodium demand increased by 22% in 2010, mainly due to higher levels of purchasing by the automotive and glass industries.
- Recycling of rhodium from autocatalyst scrap increased by 26% to 236,000 oz in 2010 due to higher returns of end-of-life vehicles.
- Supplies of rhodium fell by around 3% to 751,000 oz in 2010 with lower sales from South Africa.
- Demand for ruthenium increased by 79% to 1.03 million ounces in 2010, stimulated by purchases from the hard disk drive sector.
- Iridium demand increased to 334,000 oz in 2010 from 81,000 oz the previous year. Much of this demand was for iridium crucibles in the electrical sector.

Rhodium

The rhodium market tightened in 2010, still in oversupply but with the surplus of 241,000 oz in 2009 falling to 114,000 oz in 2010. Higher levels of purchasing by the global automotive sector underpinned a rise in gross demand for rhodium. Increased capacity utilisation and construction of new plants in the chemical and glass sectors also stimulated purchasing. Supplies of rhodium fell slightly, mainly due to reduced pipeline movements in South Africa. Supplies were augmented by greater levels of recycling, particularly in the autocatalyst sector.

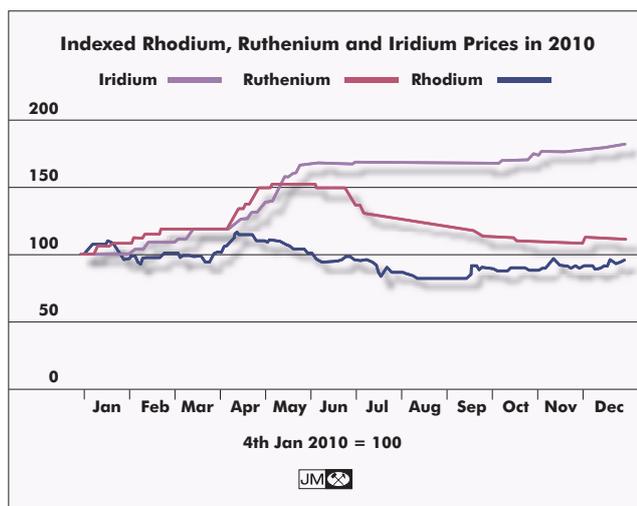
Supplies of rhodium fell by around 3% to 751,000 oz in 2010. Despite mine output increasing in South Africa in late 2010, a build-up of pipeline and refined metal stocks resulted in total shipments falling by 3% to 642,000 oz. Production of rhodium in North America declined by 23% to 12,000 oz, due to labour disputes and lower grades. The Zimbabwean mining sector produced an additional 5,000 oz of rhodium, bringing its 2010 total to 24,000 oz.

The increase in worldwide vehicle production in 2010 benefited rhodium in autocatalysts, the largest demand sector. Gross purchasing strengthened by 17% to reach 724,000 oz. Due to the recent trend to thrift rhodium this was still some way short of the 2008 level. The largest share of demand came from use of rhodium in gasoline three way catalyst (TWC) formulations. Most vehicles produced worldwide are gasoline, and therefore use palladium–rhodium catalysts.

All markets apart from Europe saw an increase in demand for rhodium in autocatalysts. In Europe, rhodium demand softened due to continuing efforts to reduce loadings in gasoline catalysts in response to previous high prices. Although overall production grew in 2010, manufacturing of gasoline vehicles in Europe fell slightly relative to 2009. In the biggest market for automotive rhodium demand, Japan, higher levels of gasoline vehicle production helped drive up demand. Purchasing of rhodium also

increased strongly in North America, mainly for use in gasoline vehicles but also in some light duty diesel vehicles. Chinese demand rose to 141,000 oz with good sales of domestically-produced gasoline vehicles.

Industrial demand for rhodium increased with better economic conditions worldwide in 2010. The glass industry increased purchases by 200% compared with 2009 as new demand for TFT-LCD glass in electronic goods and for glass fibre in the construction industry prompted the building of new and replacement manufacturing capacity. Although some rhodium was returned to the market through closure of redundant plant, unlike in 2009 this did not offset new demand significantly. Demand for rhodium from the chemical sector increased by 25% to 68,000 oz as plants were run at higher capacity and new oxo-alcohol plants were constructed.



Iridium's price performed strongly in the first half of 2010. Ruthenium also performed well in early 2010, but corrected downwards as purchasing by the electrical sector slowed.

Recycling of rhodium in the autocatalyst sector increased by 26% to 236,000 oz, driven by higher metal prices which encouraged greater recovery from scrap. Levels of recycling were also boosted by end-of-life vehicles from car scrappage schemes which worked their way through the recycling chain during 2010.

With strong recovery in the automotive sector, the rhodium price traded on average 54% higher than in 2009, at \$2,458, supported by good physical purchasing in early 2010.

Ruthenium

Demand for ruthenium increased by 79% to 1.03 million ounces in 2010 with a resurgence in purchasing for use in hard disk drives as well as high levels of purchasing in the electrochemical sector for chlor-alkali plants. Chemical demand for ruthenium was also strong. Ruthenium demand exceeded supplies from mined output in 2010, however the shortfall was met from above-ground stocks and some release of speculative holdings.

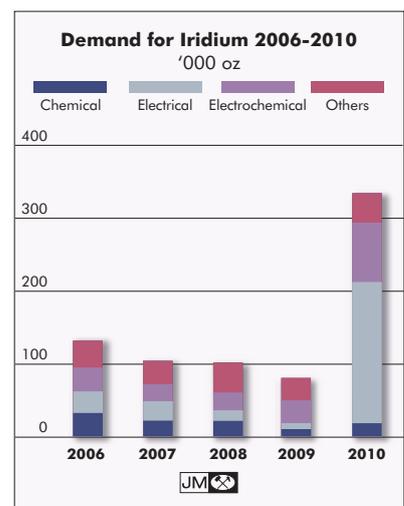
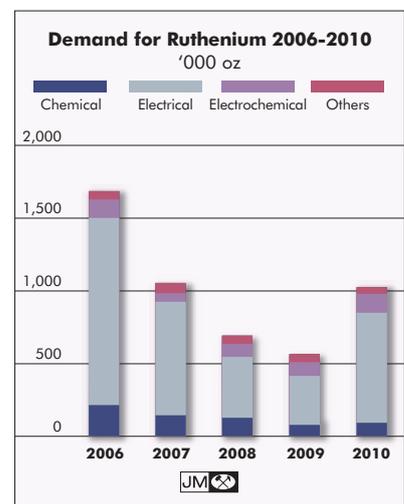
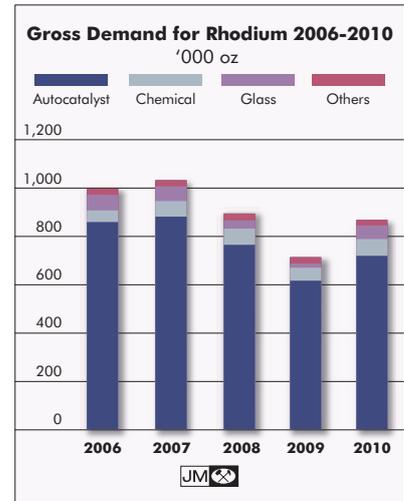
Strong purchasing of ruthenium from the hard disk drive sector in the first half of the year helped drive up demand and also the price. Ruthenium is used along with platinum in perpendicular magnetic recording hard disk drives, which are ubiquitous in computer equipment. Improved economic conditions compared with 2009 led many individuals and businesses to upgrade IT equipment, boosting sales of computers and stimulating demand for ruthenium by producers of hard drives. The magnitude of the increase was reminiscent of the first wave of stock building of ruthenium in the hard disk drive sector in 2006 and 2007 and had a similar effect on the price. Electrical purchases of ruthenium for the full year of 2010, most of which were for use in hard disk drives, more than doubled to 754,000 oz. The average annual price for ruthenium in 2010 was \$197, an increase of 107% compared with 2009. Much of the price rise came in the first half of the year, supported by strong buying.

Demand for ruthenium increased from the electrochemical sector as a result of replacing mercury-based chlor-alkali plants in China with ruthenium-iridium membrane cells. Demand from the chemical sector for replacement ruthenium catalysts and promoters increased by 12% as chemical plants were run at higher capacity.

Iridium

Iridium demand increased to 334,000 oz in 2010 from 81,000 oz in 2009 as a number of factors coincided: improved general economic conditions, technology changes, and stock building in certain sectors. The biggest increase in iridium demand came from the electrical sector. This was principally for use in crucibles designed for the manufacture of single crystal sapphire, used in the manufacture of LEDs. Supplies of iridium expanded to meet higher levels of demand by drawing down refined stocks.

Iridium demand increased suddenly and rapidly in 2010, adding an extra 253,000 oz to demand mainly from the electrical sector. A rise in consumer purchasing of backlit LED televisions stimulated demand for single crystal sapphire, which uses iridium crucibles in manufacturing. The re-fitting of the Chinese chlor-alkali industry generated additional demand for iridium. Growth in the worldwide automotive sector in 2010 also led to increased demand for iridium-tipped spark plugs. The sharp increase in demand in the small, relatively illiquid market of iridium had a significant impact on the price, which traded on average 51% higher than in 2009 at \$642.



OUTLOOK

- **Platinum is expected to remain close to balance in 2011.**
- **A modest increase in platinum supplies, with strong underlying production in South Africa and North America, is anticipated this year.**
- **Gross automotive and industrial demand for platinum should increase as economic growth continues worldwide. Jewellery demand should remain steady.**
- **Palladium is anticipated to be in deficit again in 2011.**
- **Supplies of palladium are forecast to decrease overall with sales from Russian state stocks much lower than in the previous three years.**
- **Palladium demand is expected to grow in line with higher purchasing by the automotive and chemical sectors, particularly in emerging markets.**

OVERVIEW

Despite fears of a 'double dip' recession during 2010, most countries continued on a path to economic recovery. Moderate GDP growth is widely expected this year, with the US policy of 'quantitative easing' credited with increasing liquidity and lifting American consumers' confidence, although unemployment remains high. In Europe, the outcomes of various national austerity measures are still uncertain, with the potential for a slowdown in consumer spending that might negatively affect near-term economic performance. Growth in emerging markets such as China and India continues to be strong, although there are signs that high commodity prices and inflationary pressures may impact future prospects.

The global economy remains vulnerable to external factors which have the potential to impact pgm demand. As in 2010, it is possible that a sovereign debt crisis in Europe, concerns over sluggish recovery in the US, or further interest rate rises in China may undermine growth. Recent events in Japan, and in the Middle East and North Africa have highlighted that external shocks can have a substantial impact on the pgm markets, at least in the short term.

The earthquake and tsunami which affected Japan in March 2011 had the immediate effect of slowing demand for pgm as vehicle and other industrial production stopped for several days. A consequent lack of components also affected some overseas factories. Japan accounted for 15% of worldwide platinum and palladium demand in 2010, with both metals mainly used in the autocatalyst sector. In the short term, purchases of vehicles and electronics in the domestic market will be delayed while exports from Japan will also be affected. The disaster may have longer-term effects on pgm demand caused by shortages of Japanese electrical components, which would have a global impact on vehicle production. Eventually, there will clearly be potential for a recovery in domestic demand.

Political uncertainty in the Middle East and North Africa has weighed on pgm because of the potential impact on oil supply and commodity price inflation, although to date this has affected pgm prices rather than demand. Political unrest, beginning in Tunisia and Egypt in January 2011 and spreading to other countries in the region, initially had the effect of driving up industrial commodity prices alongside crude oil and safe haven investments such as gold. PGM prices fell as fears emerged that oil price rises could precipitate a slowdown in the world economy through inflationary effects, reducing consumption and affecting demand for pgm.

However, despite these downward pressures, continuing economic growth across the world is driving demand for platinum in industrial uses, particularly glass and chemical catalyst manufacture and in diesel autocatalysts; and for palladium in electronics manufacturing and in emissions control catalysts for gasoline vehicles, especially in China. The growth of new consumer-driven technologies and applications such as LED backlit televisions is expected to result in acceleration of demand for the minor pgm. Promising new growth areas also beckon: for example the use of pgm in fuel cell technologies and in non-road emissions control, although these markets are in their infancy and the full impact of their growth will be felt beyond 2011. These good prospects should continue to support pgm demand and also pgm prices.

The jewellery sector will continue to be an important area of demand for platinum but will be less so for palladium. Platinum jewellery demand remains robust in China and there has been improvement in North America and Europe. Palladium has a niche as a jewellery metal in the UK and US. Demand in China, although significant, is not growing at present.

In April 2011, it was announced that two physically-backed exchange traded funds (ETFs) in platinum and palladium would be launched in London. The investment market for physically-backed platinum and palladium should continue to be a substantial area of demand this year.

PLATINUM

The outlook for platinum supplies is cautiously optimistic. In South Africa, mine output is expected to increase through a combination of ramp-up from new or expanded operations, improvement of underperforming operations and additional output from reopened shafts. On the demand side, we believe that there will be steadily increasing purchases from the auto and industrial sectors this year. We expect the platinum market will therefore remain close to balance in 2011.

In total, the South African platinum industry has the potential to increase production by around 5% in 2011, due to recovery at underperforming mines and the reopening of operations previously closed due to low prices or geological issues. However, strikes and stoppages are factors which have impeded expansion in recent years and could do so again in 2011. In the longer term, the strong rand, inflation and availability of electricity could threaten future expansion.

In Zimbabwe, we expect production to increase this year. From a low base, pgm production has ramped up steadily over the past six years due to new investment by South African producers. Anglo American Platinum's newly commissioned Unki East mine is forecast to contribute up to 30,000 oz of production in 2011; metal from this operation will be refined in South Africa but included in our estimates of Zimbabwean supplies. Output from Zimplats and Mimosa is not set to change significantly this year, with recent expansions now operating at full capacity. However, construction of a second phase of expansion at Zimplats is now underway: this will involve the construction of a third underground mine and another concentrator module at Ngezi, increasing the company's annual platinum output to 270,000 oz by 2014.

Zimbabwe has large pgm resources but there is significant uncertainty about the eventual impact of measures to increase indigenous investment in the Zimbabwean mining industry. Regulations published in March 2011 called for all foreign-owned mines to submit plans to the government within 45 days on how they intend to transfer 51% of equity to local owners, and to implement those plans within six months of approval. These regulations seek to implement the Indigenisation and Economic Empowerment Act, first published in 2007. Mining companies with operations in Zimbabwe are currently engaged in discussions with the authorities to establish how they will comply with the Act, and at the time of writing it was too early to say whether this will affect investment in the mining sector in the longer term. Some companies have

already earned empowerment credits in Zimbabwe through infrastructure development and the transfer of mineral rights.

Platinum production in Russia is expected to remain flat. In 2011, Norilsk Nickel intends to increase output of ore in order to maintain primary metal production from lower grade deposits. Above-ground sources of pgm, for example tailings and stored pyrrhotite concentrate, should continue to augment supplies. Alluvial material from operations in the Russian Far East should also contribute to supplies again this year.

North American platinum production should rise this year. Output from Xstrata's Sudbury operations should increase with additional metal coming from the new Nickel Rim South mine, which exploits a pgm-rich ore body. Production of pgm from Vale's Sudbury mines, which was badly affected by a year-long strike during 2009 to 2010, is expected to recover in 2011. Stillwater Mining Company plans to increase output slightly by reopening the east side of the operation at the Stillwater mine, which closed previously due to high costs.

Recycling of platinum is forecast to increase once again in 2011, with much of that growth being apparent in the automotive recycling sector as more end-of-life vehicles with highly loaded catalysts are returned.

We expect gross demand for platinum will increase in 2011. Platinum in autocatalysts is forecast to continue to benefit from recovery in the automotive sector, albeit at a slower rate than in 2010. Barring a major decline in consumer confidence, global vehicle production is expected to rise again in 2011. Substitution of platinum with palladium in diesel autocatalysts is likely to continue, with its effects being felt most in Europe, although platinum will remain the largest constituent. Without the distorting effects of car scrappage schemes in most countries in Europe, diesels should continue to represent a high proportion of the total vehicle market, thus benefiting platinum. We believe there will continue to be good growth in platinum demand from the diesel vehicle sector in North America, with expansion of the light duty diesel market and higher production of heavy duty trucks. Expansion of production of light duty vehicles in the Rest of the World region is also expected to continue, boosting platinum as well as palladium demand.

Gross demand for platinum jewellery in 2011 is likely to be at least at the 2010 level. The introduction of lighter weight platinum jewellery products in North America to meet key retail price points, which began in late 2010, is an interesting area for potential future consumer demand. The European jewellery sector is expected to be healthy with firm demand for women's bridal jewellery, although economic uncertainty

could depress demand for fashion jewellery. Economic growth, which gives consumers the spending power to buy platinum jewellery as well as other discretionary luxury items, is key to the Chinese jewellery sector, and this should remain strong in 2011. Purchasing of platinum in the first quarter of 2011 by jewellery manufacturers was at similar levels to the same period in 2010 despite the firm price. The jewellery outlook for Japan is less certain, especially given recent events, but we do expect some slowing of demand this year.

Industrial demand for platinum will benefit from economic growth and improving consumer confidence in many markets this year. Unemployment in Europe declined in the first quarter of 2011, although problems persist in the countries most severely affected by the eurozone crisis. In the US, although unemployment is high overall, recovery in the labour market was beginning to be apparent in early 2011.

In the opening months of the year, manufacturing output in China grew despite government measures to curb high inflation. These positive trends are expected to result in higher levels of consumer demand for a range of products, from plastics to electrical goods, that will increase capacity utilisation in chemical and electrical manufacturing. This should help drive higher manufacturing levels in the electrical and chemical sectors. A number of plant expansions are already underway in China, and this will continue to support pgm demand in 2011.

In the glass industry, there could be a slowing of platinum demand in 2011 as less new glass fibre capacity is installed and returns from older facilities are used to meet some of the industry's requirements. The building of new petroleum refining capacity, for example to satisfy growing demand for transport fuel in India, should add new platinum demand in 2011 after several years in which plant was under-utilised.

Physical platinum investment is expected to continue to influence the price in 2011, with the price in turn largely determining the dynamics of investment. One sensitivity is if, when, and how much profit-taking in platinum ETFs will take place this year given that ETF holdings in early 2011 stood at near-record levels. Significant buying during the period of rising prices at the end of 2010 suggests that ETFs are likely to be a significant part of overall platinum demand. There was relatively little profit-taking in the first three months of 2011, despite a downward correction in the price. Overall, with a low interest rate environment and strong fundamentals, physical investment demand for platinum should remain strong, with perhaps some profit-taking occurring in the more mature funds, as was seen last year.

PALLADIUM

Palladium supplies are forecast to decline slightly in 2011 as a reduction in the sales of Russian state stocks is partly offset by an increase in production elsewhere. With demand from the automotive and industrial sectors expected to remain strong in 2011, the palladium market should again be in fundamental deficit in 2011.

Supplies of newly-mined palladium from South Africa are anticipated to increase in 2011, reflecting continued recovery at some larger operations, and a ramp-up at the palladium-rich Mogalakwena mine. There will also be further gains in palladium output in Zimbabwe, as the Unki mine comes on stream; Zimbabwean pgm ores contain a relatively high proportion of palladium.

Russian primary supplies are forecast to remain steady in 2011. Norilsk plans to increase disseminated ore production to compensate for lower production from richer ore bodies. Sales of palladium from Russian state stocks are expected to total several hundred thousand ounces, a substantial addition to supplies in 2011, but will fall short of the million or so ounces which were sold from state stocks in each of the last three years.

Supplies of palladium from North America are anticipated to increase this year due to higher mined output. We anticipate a substantial increase in sales from North American Palladium. Although the mine reopened in April 2010, it has a long refining pipeline and only small amounts of metal were sold in 2010. Higher output from Xstrata in 2011 is expected mainly due to the first full year of production from Nickel Rim South. This mine has high grades for the Sudbury area, and its opening has increased the overall grade of ore mined in Sudbury.

We believe recycling of palladium will increase once again in 2011 as growth in new car sales has a commensurate impact on the number of end-of-life vehicles being scrapped. Recycling of palladium from the electrical sector is also expected to rise as old electronic items are scrapped.

Palladium demand should be strong again in 2011, but rates of growth may slow compared with last year. Automotive demand for palladium is set to rise in line with increased car production, particularly in emerging markets such as China. The spectacular recovery seen in the automotive industry in 2010 is unlikely to be matched in 2011 but there should be another increase in production, driven by strong underlying sales. Growth in the use of palladium in Europe will be enhanced by further substitution of palladium for some platinum in diesel aftertreatment formulations.

Industrial purchasing of palladium should continue to benefit from economic growth around the world, as demand for consumer products increases and palladium use in manufacturing of chemical and electrical products rises. Demand for palladium in the chemical sector is expected to grow in China, India and Saudi Arabia as new upstream purified terephthalic acid (PTA) manufacturing plants employing palladium process catalysts are built. Elsewhere, higher rates of plant utilisation should increase demand for top-up catalyst. In the high end of the electrical sector, the long-term trend of increasing loadings of palladium in multi-layer ceramic capacitors (MLCCs) is expected to continue. The increasing complexity of electronic devices also means that generally more MLCCs per device will be needed. This, together with strong consumer purchasing, should help increase demand for palladium in electrical applications.

We cannot be as confident about the prospects for demand for palladium in jewellery. Demand in China, though still meaningful, has lost impetus because of a historic lack of marketing and a change in trade profitability as the price rises. However, palladium should maintain a niche position in European and North American markets as an alternative to white gold in men's wedding bands.

Physical investment demand for palladium continued to be popular in the opening weeks of 2011 with total ETF volumes standing at 2.2 million ounces at the end of March 2011. ETFs are likely to continue to attract investor interest but profit-taking may again net off some new demand, particularly in the more mature funds.

OTHER PGM

We anticipate the rhodium market will be in surplus in 2011. Supplies of rhodium are expected to increase as underlying mine output improves in South Africa due to a combination of recovery of production at older operations, ramping-up at newer mines, and the reopening of some UG2 shafts. Production in Russia and other regions is forecast to be flat. Demand for rhodium will remain strong.

With another strong year forecast in the auto sector, demand for rhodium in autocatalysts will grow in 2011. China and the Rest of the World region are expected to lead this increase with rapid rises in vehicle production and thus in demand for rhodium in TWCs. Elsewhere, rhodium autocatalyst demand is forecast to be flat as automakers continue to introduce lower rhodium loadings in aftertreatment systems.

Demand for rhodium in the glass industry is expected to

remain buoyant in 2011 as manufacturers continue to use high rhodium content alloy in TFT-LCD glass manufacturing facilities. Strong growth in consumer demand for electronic devices including TVs, in which TFT-LCD display glass is used, is expected to drive this. Glass producers continue to increase the rhodium content of their alloys in order to improve the durability of components and extend the working lifetime of plants. Regionally, demand will be highest in China and the Rest of the World region where new manufacturing capacity is due to be installed. Demand for rhodium in process catalysts is also anticipated to increase in 2011 as higher rates of plant utilisation stimulate top-up demand.

Ruthenium demand is forecast to enjoy another strong year as purchases from the electrical and electrochemical sectors continue at a high level. Some dampening of demand for ruthenium in hard disk drives is likely in 2011 given the exceptional level of stock building in 2010. Overall, demand is likely to be slightly lower than in 2010 but considerably higher than in 2009.

Continued economic growth around the world is anticipated to result in higher consumer and business demand for electrical equipment, particularly hard disk drives. Ruthenium benefited from an exceptional year of sales across the hard disk industry in 2010 as manufacturers rebuilt their inventories. Although there is unlikely to be a repeat of the significant increase in working stocks of ruthenium amongst manufacturers as seen last year, demand for hard disk drives in various consumer electronic devices is forecast to sustain ruthenium purchasing at a high level.

Electrochemical demand for ruthenium should continue to increase in 2011. Slightly softer demand in China will be offset by rises in other regions as new and replacement capacity is built in the chlor-alkali industry. Purchasing of ruthenium for the chemical sector will also continue to increase with higher rates of capacity utilisation, driven by downstream demand, stimulating the need to top-up process catalysts.

Iridium demand is forecast to be lower in 2011 than the exceptional level seen last year. Purchases of iridium crucibles for use in the production of LEDs are expected to weaken as manufacturer inventories are high following a good deal of stock building in 2010. Electrochemical demand is anticipated to soften slightly as the modernisation of the Chinese chlor-alkali industry nears completion. Demand for iridium-tipped spark plugs should continue to grow in line with the increase in global vehicle production. Although total demand will be lower than in 2010, it is likely to be significantly higher than in 2009.

FUEL CELLS: THE FUTURE IS NOW



FUEL CELLS: AN INTRODUCTION

A fuel cell is a device which generates electricity directly from electrochemical oxidation, usually of a hydrogen-rich fuel. The fuel cell structure separates the reaction into two distinct steps and it is this separation that allows the electrons to be captured and used to drive an outside circuit. Although the specific technology used in a fuel cell may vary, all are based around this fundamental design. Fuel cells can be used to power any device that requires electricity, from a mobile phone to a power grid, and have the advantage of operating with zero emissions, low noise and high efficiency. The electrochemical reaction in a fuel cell also produces heat which can be captured and used in heating buildings or generating hot water.

Although the first fuel cell was demonstrated in 1842 by Sir William Grove, it was not until the 1960s that fuel cells came to wider prominence, through their use as generators on board the Apollo spacecraft. Since then, and particularly in the last 20 years, substantial developments have increased the efficiency of fuel cell units, successfully demonstrated their use in a variety of applications and lowered their cost, making them commercially available in a variety of everyday applications.

Although fuel cells have long promised clean, efficient power generation, it is only in the last five years that the first applications have become truly commercialised. While light duty vehicles represent the largest single market for many fuel cell developers, it is in the immediate opportunities for stationary power generation and niche vehicles that fuel cells are seeing the most commercial traction. Most of the fuel cells sold to date contain pgm, which are used to give unique durability, power density and efficiency. Total demand for platinum in fuel cells reached 20,000 oz for the first time in 2010.

PGM IN FUEL CELLS

Fuel cells typically consist of two electrodes, a negative anode and a positive cathode separated by a solid or liquid electrolyte. Platinum group metals are frequently used at the electrodes to catalyse the electrochemical reactions that, overall, convert hydrogen and oxygen into water. Almost all of the fuel cells sold to date use platinum, with smaller amounts of ruthenium, and the use of pgm in fuel cells gives unique characteristics of durability, power density and efficiency.

The most commercially successful type of fuel cell in use today is the proton exchange membrane (PEM) fuel cell, which uses a polymer membrane as the electrolyte, with platinum coated electrodes. To date, this type of fuel cell has mainly been used in small stationary applications such as providing back-up power to buildings or infrastructure, in forklift trucks, and in demonstration fleets of fuel cell cars.

A variation on the PEM fuel cell is the direct methanol fuel cell (DMFC) which uses a polymer electrolyte membrane and a platinum or platinum-ruthenium catalyst, and is fuelled directly with liquid methanol. DMFCs have been miniaturised for use in powering small portable devices such as mobile phones and laptop computers.

THE CURRENT MARKET – AUXILIARY POWER

The camping and boating market has seen tens of thousands of units sold to date: mainly as DMFCs in luxury camper vans. A fuel cell can run continuously and independently of an electrical grid for as long as it is provided with fuel, and has the additional environmental benefits of low noise, low emissions and high efficiency.

Another current market for fuel cells is that of auxiliary or back-up power for stationary installations where the fuel cell offers a unique combination of high efficiency, low pollution and autonomous operation over long periods of time. Such units typically use PEM technology fuelled by hydrogen, LPG, methanol or natural gas. Cellular telephone operators are beginning to take advantage of fuel cell technology by installing the units for emergency back-up power at sites vulnerable to grid failure, or for primary power where the grid is not available. There are significant opportunities for fuel cell units in developing countries, where grid security is not guaranteed, and in places prone to natural hazards, where a reliable telecommunications infrastructure can aid relief efforts.

COMBINED HEAT AND POWER (CHP)

Fuel cells are being deployed around the world in CHP applications where the advantages of high electrical efficiency, low emissions and the co-generation of electricity and heat are an attractive proposition. Over 13,000 small PEM units have been installed to date in Japanese homes, where the government-supported large-scale residential fuel cell demonstration programme has encouraged their uptake.

A number of electronics and gas utility companies have joined forces to sell residential fuel cell CHP in Japan under the brand name of 'Ene-Farm'. These PEM units use natural gas or town gas and typically reduce household energy consumption by a third, and CO₂ emissions by half, compared with supplying electricity from a power station and heat from a gas fuelled boiler. Outside Japan, residential fuel cell CHP is also growing in popularity, with thousands of units currently installed in Europe and North America.

MATERIALS HANDLING VEHICLES

Many of the world's major car manufacturers are looking to release fuel cell cars commercially on a limited scale in 2015. Thereafter, these will form an important part of the world's vehicle pool. However, niche vehicles such as materials handling vehicles, including forklift trucks, are already commercial with thousands of vehicles deployed in warehouses, factories and airports around the world.

Forklift trucks powered by PEM or DMFC technology enable zero emissions and silent operation – often important in a warehouse environment. The crucial advantage that fuel cell materials handling vehicles have over their battery powered equivalent is that the vehicles can go on running over extended periods of time and do not require prolonged recharging. Fuel cells can be refuelled by hydrogen or methanol in minutes, rather than the hours required for batteries. Furthermore, operating a fleet of fuel cell materials handling vehicles eliminates the need for recharging infrastructure and the capex and storage space for multiple battery packs. This 'value proposition' of fuel cell materials handling vehicles has been realised by operators around the world, although further cost reduction is needed to make them truly competitive with battery or combustion engine vehicles.

FUEL CELLS ARE COMMERCIAL

Fuel cells offer genuine advantages over incumbent technologies, and their use in a number of commercial applications over the last five years has demonstrated their unique characteristics. Commercialisation in a number of niche early markets has been successful, and fuel cells are becoming increasingly mainstream. The implications for pgm demand are significant: many of the unique characteristics of fuel cells come from the nature of pgm catalysed reactions and, as the global market for fuel cells grows, they will form an increasingly important part of industrial demand for platinum.



SUPPLIES, MINING & EXPLORATION

- Global supplies of platinum increased by just 35,000 oz to 6.06 million ounces in 2010. Total worldwide shipments of palladium increased to 7.29 million ounces. Global supplies of rhodium fell to 751,000 oz.
- Supplies of platinum from South Africa remained flat at 4.64 million ounces last year. South African sales of palladium increased by 9% to 2.58 million ounces, while supplies of rhodium fell by 3% to 642,000 oz.
- Supplies of palladium from current Russian mining increased by 2% to 2.72 million ounces. Sales of palladium from state stocks were once again at around 1 million ounces. Platinum supplies climbed by 5% to 825,000 oz.
- Palladium supplies in North America dropped by 22% to 590,000 oz. Platinum supplies fell by 19% to 210,000 oz.
- Supplies from Zimbabwe rose by nearly a quarter to 280,000 oz of platinum and 220,000 oz of palladium.

SOUTH AFRICA

South African platinum supplies remained flat overall at 4.64 million ounces in 2010. Although refined production rose by 2%, due to a production profile that was heavily loaded towards the end of the year not all of this metal had been shipped by the year-end, leading to an increase in refined stocks. Palladium sales rose by 205,000 oz, with the two largest producers recording significant increases in production, and also some pipeline releases. In contrast, sales of rhodium fell by 3% to 642,000 oz, due to a build-up of pipeline and refined metal stocks.

Anglo American Platinum

Platinum output from Anglo American Platinum's mining operations rose marginally in 2010. Equivalent refined platinum production (production in concentrate adjusted for standard smelting and refining recoveries) totalled 2.48 million ounces, as higher output from the Kroondal Pool and Share operation and the Mogalakwena open pit offset the impact of shaft closures at some of the group's Rustenburg mines.

In contrast, refined production rose by 120,000 oz, or 5%, to 2.57 million ounces, due to reductions in pipeline stocks at the group's smelting and refining operations. Refined output was particularly strong in the final quarter and, as a result, there was a build-up in unsold inventory of refined platinum at the year-end. Platinum shipments in 2010 totalled 2.52 million ounces, down 2% compared with the previous year when some 124,000 oz were sold from stocks.

The company's older western limb operations had a difficult year. Production from the Khuseleka and Siphumelele mines (formerly part of Rustenburg Section) fell sharply due to the closure of uneconomic shafts, while geological difficulties affected output at Khomanani (Rustenburg) and Union Mine.

Production at Tumela and Dishaba (formerly Amandelbult Section) was stable, but remained well below pre-2008 levels.

However, these losses were outweighed by increases at some of the newer operations. Anglo American Platinum's share of equivalent refined production from Kroondal and Marikana, operated under Pool and Share Agreements by Aquarius Platinum, rose by 12%, or over 30,000 oz. This was despite a major fall of ground at Marikana's 4 shaft in July 2010 which resulted in the loss of two weeks' production, and the closure on economic grounds of the Number 1 shaft at the same operation.

Production continued to ramp up at the expanded Mogalakwena open pit mine, which produced 260,000 oz of platinum in 2010 (up 10%). Platinum output from the Bafokeng Rasimone joint venture (operated by Royal Bafokeng Platinum) rose by 7% to 185,000 oz, with the mining of some UG2 ore supplementing production from the Merensky Reef.

In 2011, Anglo American Platinum expects to produce and sell 2.60 million ounces of platinum. The company has reopened Khuseleka 2 shaft, which was mothballed in 2009, while additional ounces will come from Khomanani, Tumela and Mogalakwena. The newly commissioned Unki mine in Zimbabwe will contribute up to 30,000 oz of production; metal from this operation will be included in our estimates of Zimbabwean supplies, discussed on page 22. Going forward, the company intends to grow its output annually in order to meet expected demand.

PGM Supplies: South Africa '000 oz			
Supply	2008	2009	2010
Platinum	4,515	4,635	4,635
Palladium	2,430	2,370	2,575
Rhodium	574	663	642

Ore from Aquarius Platinum's Everest Mine is conveyed to a silo ahead of the processing plant.



Impala Platinum

After a difficult year in 2009, the year 2010 saw a significant recovery in output from the Impala lease area. Refined platinum production from Impala's Rustenburg shafts rose by 8% to 940,000 oz, mainly due to a very strong performance in the second half when 7.8 million tonnes of ore were treated, compared with the first half of the year. Platinum sales from the lease area totalled 864,000 oz.

At Impala's Marula mine on the eastern Bushveld, the objective is to expand output to 100,000 oz of platinum in concentrate annually by 2013, but progress towards this target has been slow. In 2010, the operation milled 1.62 million tonnes of UG2 ore yielding 73,000 oz of platinum; these figures were little changed compared with the previous year.

The Two Rivers mine, a joint venture with African Rainbow Minerals, recorded another strong performance. Production of platinum in concentrate rose 7% to 142,000 oz, reflecting an increase in plant throughput to nearly 3 million tonnes. Improvements in concentrator recoveries are expected to lift annual output towards 150,000 oz by 2013.

Impala's Zimbabwean operations also had another excellent year; these operations are discussed separately on page 22.

Impala intends to expand platinum production from its lease area to 1 million ounces annually from 2014, as three major replacement shaft projects are brought on line. The first of these, 20 shaft, began to produce ore in January 2011, while 16 and 17 shafts are planned to come on-stream during the 2013 and 2017 financial years, respectively. Together, these three deep-level shafts will ultimately be capable of producing over half a million ounces of platinum annually.

Lonmin

Output from Lonmin's Marikana operations continued to recover during 2010, with the new Saffy and Hossy shafts continuing their ramp-up, and a sharp fall in the amount of production lost to safety stoppages. In addition, Lonmin restarted the open cast Merensky operations in mid-year. Mill throughput (including ore mined from the Pandora joint venture area) rose by 4% to 11.6 million tonnes, while grades and recoveries also improved; production of platinum in concentrate totalled 713,000 oz, a gain of 9%.

Refinery output for the year was once again affected by incidents at the Number One furnace, which experienced run-outs in March and May. The furnace was also taken off-line for a scheduled rebuild between late October and mid-December

2010. Despite the use of back-up smelting capacity at its three Pyromet furnaces, Lonmin was unable to smelt and refine all its concentrate. To avoid an excessive build-up in unprocessed stocks, some 87,000 oz of platinum were toll-refined at Impala Refining Services, while a further 25,000 oz of platinum were sold in concentrate form.

Sales by Lonmin during the 2010 calendar year totalled 664,000 oz of platinum; the company expects the figure to rise to 750,000 oz during its financial year to September 2011. Going forward, output from the Marikana operations is planned to rise to 850,000 oz from 2013, including production at Pandora. It is not yet clear to what extent the Pandora joint venture could increase output in future: deepening of the E3 shaft will enable mining to continue at current rates, but a feasibility study of a 180,000 tonne per month operation was not conclusive, and the joint venture partners are reviewing alternative options.

Lonmin has made progress towards its target of producing 850,000 oz by 2013 and is expected to show growth in output due to replacement shafts ramping up, better efficiencies, and the reopening of the Merensky open cast operations.

Northam

After a steady first six months, in which production was slightly up on the same period of 2009, Northam's Zondereinde mine had an exceptionally difficult second half of 2010. A six-week strike, a slow post-strike start-up and a series of safety stoppages all impacted output; in total, the company lost nearly a third of available production days between July and December. As a result, pgn output for the year fell by 15% to 264,000 oz.

Looking ahead, the company continues to progress a



Milling ore at Northam's Zondereinde mine.

deepening project which will give access to additional Merensky Reef reserves, and which will enable the mine to sustain production at around 300,000 oz of pgm annually over its remaining eighteen-year life.

Development of the Booyssendal project on the eastern limb of the Bushveld complex got underway in 2010: Northam spent R378 million on an 'early works programme', including the establishment of access roads and temporary power and water supplies. The project's planned start-up date is January 2013. Once complete, it is forecast to produce approximately 160,000 oz of pgm each year.

During 2010, Northam signed a Memorandum of Understanding with Jubilee Platinum plc. Together, the companies will assess the viability of establishing a ConRoast smelter facility in Middelburg; this could be used to process all or part of the output from Booyssendal.

Output from Zondereinde should improve modestly in 2011, as the mine recovers from last year's strike. Operating conditions remain difficult, with ore reserve availability a problem on the Merensky Reef. However, Northam's overall output should increase in 2011, reflecting the ramp-up at Platmin's Pilanesberg mine, from which it receives concentrate.

Other Producers

In this section we discuss mines which are not owned (or part-owned) by the four major producers described above, although almost all pgm from these mines is refined in South Africa under concentrate off-take agreements by Anglo American Platinum, Impala Refining Services (IRS) or Northam Platinum.

Xstrata's Eland Platinum mine produced around 60,000 oz of platinum in 2010, down around 20% compared with the previous year. The operation is in the process of transitioning from open cast to underground mining: output from the Kukama (western) decline shaft began in early 2011, with the Nyala (eastern) decline shaft set to follow suit during the second quarter. Xstrata forecasts that underground operations will produce 150,000 oz of platinum per year by the end of 2013. By late 2015, the company expects to process 500,000 tonnes of ore per month, at which point platinum output should total some 300,000 oz per annum. Platinum group metals from Eland are refined by Anglo American Platinum.

Apart from its Pool and Share mines, Aquarius Platinum operates two other underground operations in South Africa. Concentrate from these is refined by IRS. At the Everest mine, the re-establishment project proceeded ahead of schedule,

The deepening project at Northam Platinum is due to give the company access to additional Merensky reserves.



with milling operations resuming in May 2010. This project involves the construction of new declines to replace the original shaft, which was abandoned due to subsidence in December 2009. Mill throughput at Everest yielded around 32,000 oz of platinum in 2010; output in 2011 should be significantly higher, as production from the new declines ramps up. Steady-state output of around 120,000 to 130,000 oz of platinum annually is expected to be achieved from 2013.

Production of platinum in concentrate from Aquarius' Blue Ridge mine totalled 20,000 oz in 2010. Since its acquisition from Ridge Mining in July 2009, this operation has struggled to achieve planned volumes; as a result, a decision was taken in September 2010 to close the mine temporarily for redevelopment. Ore mined during the shutdown will be stockpiled ahead of the restarting of the mill which is currently scheduled to take place in July 2011. Following redevelopment, Aquarius estimates that Blue Ridge will be capable of mining and processing 160,000 tonnes of ore per month, yielding 130,000 to 140,000 oz of pgm annually once it reaches steady-state production levels in 2014.

At Eastern Platinum's Crocodile River mine, platinum output was stable at around 65,000 oz, this metal being purchased and refined by IRS. Over the next two to three years, the company plans to increase mill throughput to 175,000 tonnes per month (a 65% increase on current levels), which would lift platinum production to over 110,000 oz annually. Part of this will come from the new Crocette section, development of which was restarted in April 2010 having been put on hold during 2009.

Platinum Australia's Smokey Hills operation also sends concentrate to IRS. The mine encountered both geological and labour difficulties during the year, restricting pgm production

Refined platinum output at Anglo American Platinum was strong in the final quarter of 2010.



to just 31,000 oz. Early in the year, potholes forced some changes in mine design, slowing the ramp-up in production. The company also lost production to industrial action both in the first quarter, and again in October following the dismissal of the mining contractor. These losses were partly offset by the decision to process chrome tailings through the plant, which added approximately 4,000 oz of pgm production in the second half of the year.

A feasibility study of the Kalahari Platinum (Kalplats) project was completed in 2010, and is under review by Platinum Australia's joint venture partner, African Rainbow Minerals (ARM). This study envisages an open pit operation mining and treating 1.5 million tonnes of ore, yielding 105,000 oz of platinum, palladium and gold annually over a nine year life. The initial capital cost is projected to be around R1.42 billion.

The build-up of production at Platmin's Pilanesberg Platinum Mine has been slow. In 2010, this operation milled 2.9 million tonnes of ore at a grade of 1.75 grams of pgm per tonne, yielding around 60,000 oz of pgm in concentrate, most of which was despatched to Northam for refining. Output should rise significantly in 2011: Platmin expects to produce and sell between 100,000 and 120,000 oz of pgm.

During 2010, Wesizwe Platinum signed a transaction with Jinchuan Group and the China Africa Development (CAD) Fund, under which it will receive an equity injection of \$227 million in return for Wesizwe shares. Jinchuan and the CAD Fund have also undertaken to secure project finance of \$650 million. Once the outstanding conditions of the agreement have been fulfilled, Wesizwe will have access to the funds necessary for the development of its Frisch-Ledig project, which is adjacent to Royal Bafokeng Platinum's Styldrift project. A feasibility study,

conducted in 2008, envisaged a project mining and processing some 2.76 million tonnes of ore annually, yielding 350,000 oz of pgm per year.

At the Nkomati Nickel mine, a joint venture between African Rainbow Minerals and Norilsk Nickel, a large-scale expansion programme is close to completion. In 2010, pgm production doubled to 14,000 oz of platinum and 46,000 oz of palladium; this metal was refined outside South Africa, but is included in our estimates of South African supplies.

RUSSIA

Production of pgm from Norilsk Nickel's Russian mines rose modestly in 2010, exceeding the company's production plans. Supplies of palladium totalled 2.72 million ounces last year, up 2% compared with 2009. Platinum supplies increased by 5% to 825,000 oz. Nickel and copper mining in Russia are the key drivers of pgm output: pgm production largely comes as a by-product of these operations.

As discussed in our Platinum 2010 Interim Review, we believe that recent increases in pgm output at Norilsk are the result of greater processing of surface materials, including stored pyrrhotite concentrates, old flotation tailings, and a variety of pgm-bearing materials from the smelters. In contrast, production of pgm from underground ore has declined in recent years: between 2007 and 2009, the volume of ore extracted at the Taimyr operations (the principal source of Norilsk's pgm) was relatively stable at around 15 million tonnes, while pgm grades declined by 10% as richer ore was depleted. Norilsk Nickel intends to increase mining of disseminated ore to compensate for lower grades.

In 2011, Norilsk Nickel intends to increase ore output in order to maintain primary metal production at 2010 levels. Production of pgm this year is expected to total 21 tonnes (675,000 oz) of platinum and 84 tonnes (2.7 million ounces) of palladium.

Platinum production also occurs in the Russian Far East from alluvial mines in the Khabarovsk and Kamchatka regions.

PGM Supplies: Russia			
	'000 oz		
Supply	2008	2009	2010
Platinum	805	785	825
Palladium			
Primary Production	2,700	2,675	2,720
State Sales	960	960	1,000
Rhodium	85	70	70

Russian supplies of platinum increased to 825,000 oz in 2010.



Norilsk Nickel has also developed the Severny Gluboky mine on the Kola peninsula. We believe that output in 2010 from these mines amounted to some 145,000 oz of platinum, slightly down on the previous year's level.

Substantial sales of palladium from state stocks occurred once again in 2010 – the remaining one-third of the large volumes of metal shipped by Gokhran into Switzerland in 2007 to 2008. In early 2010, several tonnes of palladium were shipped from Russia into Switzerland. We believe that this was simply a relocation of metal that had already been sold and therefore we do not include this in our 2010 Russian supply figures.

NORTH AMERICA

Supplies of platinum in North America declined by 50,000 oz in 2010 to 210,000 oz, while supplies of palladium reduced by 165,000 oz to 590,000 oz. Rhodium supplies also declined, to 12,000 oz. Despite increases in output from North American Palladium and Xstrata's operations, overall production suffered as Vale's Sudbury operations were affected by a year-long strike and production of platinum at Stillwater declined due to lower pgm grades and reduced mill throughput.

Canada

A rise in palladium prices led to the reopening of North American Palladium's Lac des Isles mine in April 2010. During the year, the mine processed some 650,000 tonnes of ore at a grade of 6.06 grams of palladium per tonne, with production totalling 95,000 oz of palladium and 5,000 oz of platinum.

Lac des Isles is currently exploiting the Roby Zone, with a remaining mine life of one to two years. The company is extending mining infrastructure in order to access the Offset Zone, from which commercial production is planned to commence during the second half of 2012. According to a scoping study published in August 2010, this ore body will initially be mined at a rate of 3,500 tonnes a day, rising to 5,500 tonnes per day by late 2014. At full capacity, annual palladium output is planned to reach around 250,000 oz.

Xstrata's Nickel Rim South mine attained nameplate capacity in October 2010, six months ahead of schedule. As a result, production from the company's Sudbury operations rose by 69% in 2010, to 15,472 tonnes of nickel in concentrate. Xstrata does not disclose pgm production in Canada, but Nickel Rim South exploits an ore body which contains unusually high grades of pgm for the Sudbury area, and we estimate that output from this mine in 2010 exceeded 60,000 oz of platinum plus similar quantities of palladium.

Raglan, Xstrata's nickel-copper mine in northern Quebec, reported a 3% decrease in production of nickel in concentrate in 2010, reflecting lower grades. This mine produces significant quantities of pgm, particularly palladium, as by-products.

Production of pgm from Vale's Sudbury mine fell by over 60% last year, to just 35,000 oz of platinum and 60,000 oz of palladium, of which we estimate that around half came from ore purchased from QuadraFNX Mining. Output from Vale's own mines was severely hit by a year-long strike which ended in July 2010.

USA

Production of pgm by Stillwater Mining Company from its Montana mining operations fell by 9% in 2010, to 112,000 oz of platinum and 377,000 oz of palladium. The decline was primarily due to a combination of reduced mill throughput and the mining of lower grade areas at the Stillwater Mine, where the pgm content of ore processed last year fell 9% to 0.53 oz per ton (18 grams per tonne). Output from the East Boulder mine was little changed.

PGM Supplies: North America			
	'000 oz		
Supply	2008	2009	2010
Platinum	325	260	210
Palladium	910	755	590
Rhodium	18	15	12

In 2011, output is expected to increase slightly to 500,000 oz of combined platinum and palladium. In order to compensate for reduced pgm grades at the Stillwater mine, the company intends to reopen the east side of the operation, which was shut down in 2008 due to low pgm prices. Grades in this area are typically higher than average, but ground conditions are difficult, leading to high mining costs.

Going forward, higher pgm prices have encouraged Stillwater to investigate the potential to expand its Montana operations. During 2010, the company undertook a programme to assess undeveloped areas adjacent to its existing mines. It has identified two potential projects, the Blitz project which would extend mining infrastructure eastwards from the existing Stillwater mine, and the Graham Creek project, a westwards extension of the East Boulder mine. It will take five years to develop these projects, although Stillwater believes that it may be possible to bring on additional production more quickly.

In November 2010, Stillwater spent \$173 million to acquire the pgm assets of the Canadian exploration company Marathon PGM Corporation. The latter's Marathon pgm-copper project is located near the town of Marathon, Ontario in Canada; a feasibility study envisaged annual production of around 37 million pounds (around 17,000 tonnes) of copper and 200,000 oz of combined palladium and platinum, over a twelve-year life. The project is currently in the permitting phase and Stillwater hopes to commence construction in 2013.

In December 2010, Norilsk Nickel completed a secondary offering, selling its controlling stake in Stillwater. The offer was oversubscribed, reflecting continuing interest in the North American pgm mining sector.

ZIMBABWE

Supplies from Zimbabwe increased in 2010 following a ramp-up of expansion projects. Total platinum sales from Zimbabwe increased by 22% in 2010 to 280,000 oz, while supplies of palladium rose by 40,000 oz to 220,000 oz.

After a rapid ramp-up of its Phase I expansion, Zimplats operated at close to full capacity in 2010, milling 4.2 million tonnes of ore and despatching 180,000 oz of platinum in matte for final refining by Impala Refining Services in South Africa. This was despite an unscheduled eleven-day shutdown at the older of the two concentrators, at the Selous Metallurgical Complex, during the final quarter of the year.

A second phase of expansion at Zimplats is now underway. This \$450 million project will involve the construction of a third underground mine plus a second concentrator at Ngezi, lifting

PGM Supplies: Zimbabwe
'000 oz

Supply	2008	2009	2010
Platinum	180	230	280
Palladium	140	180	220
Rhodium	15	19	24

the mine's overall capacity to 6.1 million tonnes of ore annually. Once Phase 2 reaches steady-state production levels in 2014, annual platinum output from Zimplats will reach 270,000 oz. Impala is now conducting a feasibility study for a third stage of expansion, which would require investment in new smelting and base metals refining capacity alongside the development of a fourth underground portal and associated concentrator.

The Mimosa mine, a joint venture between Impala Platinum and Aquarius Platinum, enjoyed another excellent year. Production of platinum in concentrate increased by 3% to 101,000 oz, despite operations being hampered by poor ground conditions during the final quarter. After a series of incremental expansions over the last few years, Mimosa is now operating at steady-state throughput and no further expansions are envisaged in the next five years. However, in the longer term, there may be potential to increase output from the southern portion of the South Hill deposit (the site of current operations) and by developing the North Hill area.

Construction of Anglo American Platinum's Unki East mine continued during 2010. Some 392,000 tonnes of ore were mined from underground development during the year, with this material being stockpiled ahead of the commissioning of the concentrator in late November. Anglo American Platinum expects to refine up to 30,000 oz of platinum from Unki in 2011; at steady-state production levels – expected to be achieved in the second half of 2013 – the operation will process 120,000 tonnes of ore each month, yielding around 70,000 oz of platinum annually. Concentrate from the mine, located near Gweru in central Zimbabwe, will be transported by road to the group's Polokwane smelter in South Africa.

The Unki East mine is a first stage in the development of Anglo American Platinum's Zimbabwean mineral assets. The company is undertaking initial evaluation of further phases of development, and believes that the Unki project area could ultimately support production of up to 5.8 million tonnes of ore per annum (280,000 oz of platinum annually).

In March 2011, the Zimbabwean government published regulations stipulating that foreign-owned mines must submit plans on how they plan to transfer 51% ownership to indigenous

investors and enact those plans within six months of approval. At the time of writing, there is considerable uncertainty about the eventual impact of these measures and it remains too early to say how this will affect future production levels.

OTHER PRODUCING COUNTRIES

Platinum group metals produced as by-products of mining in other countries such as China and Columbia remained relatively flat overall in 2010. Approximately 110,000 oz of platinum, 185,000 oz of palladium and 3,000 oz of rhodium were produced, with palladium showing the biggest increase in output.

Small amounts of pgm are mined in many other countries, mainly as a by-product of nickel mining, with China and Botswana the largest producers. Some platinum is also extracted from alluvial deposits (notably in Colombia), while minor quantities of pgm (mainly palladium) are refined from anode sludges produced during electrolytic copper refining at numerous locations around the world.

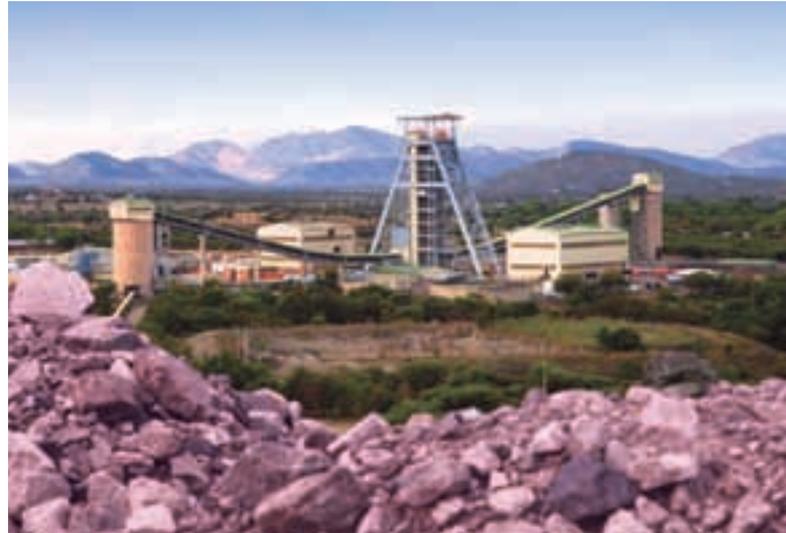
The Tati Nickel mine in Botswana is part of Norilsk Nickel's African operations, with Norilsk holding an 85% share in the mine and the Botswana government the remaining 15%. The operation consists of an open pit (the Phoenix mine), located about 35 km from Francistown, and a mothballed underground mine at nearby Selkirk. In 2010, Tati produced 107,000 oz of palladium and 18,000 oz of platinum.

Production of pgm at the Jinchuan Non-Ferrous Metals Company in Gansu province, China, is estimated to total around 70,000 oz per annum. Of this, approximately two thirds comes from the mining of nickel ores at Jinchuan itself. These ores contain small amounts of pgm (less than 0.5 grams per tonne) with a platinum to palladium ratio of around 2:1.

The remaining pgm refined at Jinchuan comes from nickel concentrates purchased from nickel mining operations in other countries, including Australia, Spain and Zambia. Jinchuan holds a 50.4% stake in Albidon Limited, owner of the Munali nickel project in Zambia. This project was put on hold in March 2009, but restarted in December that year, and in 2010

PGM Supplies: Other Producing Countries			
	'000 oz		
Supply	2008	2009	2010
Platinum	115	115	110
Palladium	170	160	185
Rhodium	3	3	3

Production at Anglo American Platinum's Tumela mine in South Africa was stable but remained below pre-2008 levels.



produced some 2,800 tonnes of contained nickel along with small quantities of pgm.

Concentrate from Lundin Mining's Aguablanca nickel mine in Spain is also refined at Jinchuan. This operation, located in the Badajoz province about 80 km from Seville, consists of an open pit mine and associated processing facility. In 2010, Aguablanca milled 1.4 million tonnes of ore (down from 1.9 million tonnes the previous year), yielding some 6,300 tonnes of contained nickel and an estimated 12,000 oz of pgm. In December 2010, very heavy rains resulted in a slope failure in the pit, and operations were curtailed; they are unlikely to restart until 2012.

A new nickel-copper-pgm project in Finland is currently being developed by the Toronto-listed company First Quantum Minerals. The \$400 million Kevitsa project is located approximately 140 km north-northeast of the town of Rovaniemi in northern Finland and is expected to enter production in 2012. It is planned to mine 5 million tonnes of ore annually from an open pit, which we estimate will yield approximately 30,000 oz of pgm. It is not yet known where this metal will be refined.

There are a number of exploration-stage projects investigating platinum group metal deposits in Finland. The most advanced of these is Gold Fields' Arctic Platinum Project, located 60 km south of Rovaniemi, which was the subject of a scoping study (conducted by former joint venture partner North American Palladium) in 2007, but which was not considered sufficiently attractive at then-prevailing pgm prices. In 2010, it was reported that Gold Fields was investigating hydro-metallurgical processing options to recover copper, nickel and pgm from the deposit. The company plans to process metallurgical samples through a pilot plant facility.

RECYCLING

- **Platinum recycling increased by 31% to 1.84 million ounces in 2010. 1.85 million ounces of palladium were recycled in 2010, an increase of 29%, while 236,000 oz of rhodium were recycled; 49,000 oz more than in 2009.**
- **Recycling of spent automotive catalysts climbed in 2010. Recovery of palladium from end-of-life vehicles showed the biggest rise, of 37% to 1.33 million ounces.**
- **Platinum reclaimed from recycled jewellery went up by 180,000 oz to 745,000 oz. Palladium jewellery recycling increased to 80,000 oz.**
- **Recycling of palladium from electrical scrap rose to 440,000 oz in 2010.**

Recycling in ‘open loop’ applications – autocatalyst, electrical and jewellery – rose once again in 2010. PGM from these applications, where the metal is sold back into the market after refining, acts as an additional source of metal, supplementing metal from primary mining. This contrasts with ‘closed loop’ applications where metal in a spent product does not change ownership but is recycled and reused in the same application, such as pgm gauze in the nitric acid industry.

AUTOCATALYST

The impact of national car scrappage schemes continued to be felt last year as catalyst systems collected during the schemes of 2009 were processed through the recycling system. Recycling of platinum, palladium and rhodium from autocatalysts each rose by around a third in 2010, resulting in 1.09 million ounces of platinum, 1.33 million ounces of palladium and 236,000 oz of rhodium being reclaimed.

In North America, the largest market for autocatalyst recycling, improved vehicle sales in 2010 led to a greater number of vehicles being scrapped. Of these, many were relatively recent models with high pgm loadings, particularly of palladium. Rising pgm prices in 2010 also stimulated scrap collectors to return metal to the market.

In Europe, as well as higher overall metal output as catalysts returned under scrappage schemes were processed, there was a particular increase in the amount of platinum being recycled. This was mainly from end-of-life diesels, as the first diesel vehicles to be fitted with catalysts started to become an important part of the scrap vehicle profile.

ELECTRICAL

Recycling of pgm from waste electrical equipment amounted to 10,000 oz of platinum and 440,000 oz of palladium. Levels of returned platinum in electrical equipment were flat compared with 2009, with most of the recycling arising from scrap

materials collected in Europe. Palladium recycling increased by 11%, driven by higher metal prices, improved consumer awareness and ongoing legislation. The Waste Electrical and Electronic Equipment Directive, which mandates that electrical scrap is collected and not sent to landfill, is the main driver for recycling in Europe. It contributed to 175,000 oz of palladium being recycled in the electrical sector in 2010 in Europe, mainly from computer equipment. Improved consumer and business confidence worldwide also led to higher levels of new electrical purchases and the scrapping of older equipment, driving levels of palladium recycling worldwide. Recycling of palladium from old electrical goods in China was around 35,000 oz.

JEWELLERY

Recycling of jewellery was higher than in 2009 as consumers and retailers took advantage of elevated metal prices to trade in old and broken jewellery. Platinum jewellery recycling increased to 745,000 oz in 2010 while palladium jewellery recycling went up by 14% to 80,000 oz.

Platinum jewellery recycling levels were highest in China where, in a rising price environment, consumers traded in old platinum pieces for other platinum jewellery or cash. Palladium jewellery recycling also increased in China in 2010, stimulated by higher prices.

Platinum jewellery recycling in Japan grew to 290,000 oz in 2010 as consumers there traded in jewellery in the rising price environment. Outside Japan and China, platinum and palladium jewellery recycling was minimal.

	Recycling '000 oz					
	Platinum		Palladium		Rhodium	
	2009	2010	2009	2010	2009	2010
Autocatalyst	(830)	(1,085)	(965)	(1,325)	(187)	(236)
Electrical	(10)	(10)	(395)	(440)	0	0
Jewellery	(565)	(745)	(70)	(80)	0	0
Total	(1,405)	(1,840)	(1,430)	(1,845)	(187)	(236)

PLATINUM

- In 2010 gross demand for platinum strengthened by 16% to 7.88 million ounces with an increase in automotive and industrial purchasing.
- Recycling of platinum increased by 31% to 1.84 million ounces in 2010.
- Autocatalyst demand for platinum rose by 43% in 2010 to 3.13 million ounces led by a recovery in the market share of diesel vehicles in Europe.
- Gross industrial demand for platinum increased by 48% to 1.69 million ounces in 2010 with an upswing in purchasing by the glass and chemical sectors.
- Gross platinum jewellery demand fell by 14% in 2010 to 2.42 million ounces as Chinese manufacturing demand softened somewhat.
- Net identifiable physical investment demand for platinum remained almost flat at 650,000 oz in 2010.

AUTOCATALYST

Total worldwide vehicle production was 78 million units in 2010, some 25% higher than in 2009. Higher production stemmed from stronger consumer and fleet sales, which in turn were driven by improved credit and various government stimulus measures. Output in some regions also benefited from a rebound in exports. A recovery in the market share of diesel vehicles, especially in Europe, greatly favoured platinum, while more stringent diesel emissions legislation in various markets also helped drive up demand. There was however decreased use of platinum in gasoline autocatalyst formulations and continuing substitution of platinum by palladium in diesel aftertreatment systems. Overall, gross purchases of platinum for autocatalysts strengthened by 43% to 3.13 million ounces in 2010.

Europe

Gross demand for platinum in autocatalyst manufacturing in Europe rose by 51% to 1.47 million ounces in 2010 as production levels moved higher compared with the previous year. An increase in the share of diesel vehicles produced in Europe provided the main fillip to platinum demand. Also important was the introduction of Euro 5 emissions legislation, which has applied to new models since September 2009. Despite the strong recovery in automotive platinum purchasing in Europe, overall demand levels remained lower than in 2008, suggesting that there is some upside potential for platinum in the European automotive sector.

Production of light duty vehicles in Europe rebounded strongly in 2010 to almost 18 million units, an increase of around 2 million compared with 2009. European production remained some way short of its record 20.5 million units in

Platinum Demand: Autocatalyst '000 oz						
	Gross		Recycling		Net	
	2009	2010	2009	2010	2009	2010
Europe	970	1,465	(290)	(375)	680	1,090
Japan	395	545	(50)	(60)	345	485
North America	370	485	(425)	(580)	(55)	(95)
China	85	105	(20)	(20)	65	85
Rest of the World	365	525	(45)	(50)	320	475
Total	2,185	3,125	(830)	(1,085)	1,355	2,040

2008, however. The picture on sales was less encouraging. After a good start in the first half of 2010, registrations of light duty vehicles in Europe fell in the final three months of the year, compared with the same period in 2009, with overall sales for 2010 actually lower than in the previous year. Despite a shortfall between European sales and production, car manufacturers remained extremely busy supplying export markets.

An increase in the market share of diesel cars produced in Europe, to around 48%, also boosted platinum demand. This was partly as a result of higher levels of business fleet purchasing, which tends to be of diesel passenger cars. Several national car scrappage incentives, which had supported private purchases of smaller gasoline cars, came to an end in 2010. Once the schemes were over, diesels took a more normal share of an expanding market, increasing platinum demand. With more credit available for businesses and better economic conditions in some European countries, the rate of growth in sales of light commercial vehicles exceeded the rate of growth in passenger cars, again favouring diesel and therefore platinum. At the same time, strong expansion in production of large premium vehicles, with relatively high catalyst loadings, for export also helped increase platinum demand.

Some additional demand came from the fitment of pgm coated diesel particulate filters (DPFs) to new diesel passenger

cars and smaller light commercial vehicles in order to meet Euro 5 light duty emissions regulations, which were due to come fully into force for most light duty vehicles in January 2011. Overall platinum purchasing for use in light duty gasoline vehicles declined in 2010 as the market share swung against gasoline and as long-term trends in thrifting and substitution with palladium were felt. Substitution over several years has resulted in few European gasoline autocatalysts having any platinum content. In diesel, the proportion of platinum is around three quarters to one quarter palladium, although platinum's share in diesel has also fallen incrementally in recent years.

Heavy duty vehicle production in Europe increased substantially in 2010 to 470,000 units compared with just 333,000 in 2009. This was largely due to an improved economic outlook worldwide, which stimulated replacement purchases of trucks and buses, although production did not regain the high levels seen in 2008. Full implementation of Euro V heavy duty emissions legislation, which came into force in the last quarter of 2009, began to be felt with greater use of pgm-based oxidation catalysts and particulate filters.

Japan

Production of light duty vehicles in Japan strengthened to 8.7 million units in 2010, up from 7.2 million the year before. Domestic sales of vehicles increased modestly; however, export growth was strong and accounted for almost half of light duty vehicle production. Sales to Europe and North America bounced back, although exports remained lower than their historic levels. Under domestic social and political pressure, there was some retrenchment at overseas transplants in order to avoid job losses in Japan. This had the effect of raising the number of diesel vehicles made in Japan, although the proportion of diesel light duty vehicles manufactured in Japan remained fairly low. The recovery of the light duty vehicle sector in general led to greater total platinum use in both diesel and gasoline aftertreatment. Gross automotive platinum demand in Japan therefore grew by close to 40% in 2010 to 545,000 oz, a considerable improvement compared with 2009 but still some way from the 2008 demand level.

Heavy duty vehicle production in Japan rose by around half in 2010. Strong demand for trucks and buses increased manufacturing and associated platinum demand. The Post New Long Term Regulations on heavy duty diesel vehicle emissions came into force in October 2010. These focus on reducing NOx and particulate matter emissions, and require increased average platinum loadings on heavy duty vehicles.

North America

Production of light duty vehicles in North America strengthened by 2.7 million units from 2009 levels, reaching 9.7 million units in 2010. This raised total demand for platinum in light duty vehicles by around 31%. Following a year of crisis in 2009 and associated restructuring, General Motors and Chrysler, two of the three largest US-owned domestic manufacturers, saw a return to profitability. Ford, the other large domestic manufacturer, saw strong sales during 2010 after they had weakened severely during the downturn of 2008 to 2009. Foreign-owned manufacturers in North America also had a better year than in 2009 as confidence amongst the car-buying public returned to some extent. However, a weak employment market, high levels of consumer debt and relatively tight credit continued to drag on consumption of 'big ticket' items such as cars. Light duty vehicle production therefore remained subdued compared with pre-2009 levels.

Sales of trucks and SUVs staged a comeback in 2010, regaining a 50% market share as consumer preference once again moved to larger vehicles as gasoline prices eased. Domestic sales of diesel vehicles improved, particularly of larger SUVs and pick-up trucks, which helped light duty diesel demand. Fleet purchases of light duty vehicles by businesses, primarily delivery trucks, also increased in 2010, which benefited demand for diesels, therefore platinum.

The heavy duty diesel sector, linked to the fortunes of the wider economy, recovered modestly in 2010 with higher sales of new medium and heavy duty trucks. The ratio of trucking capacity to freight increased during 2010, and used truck prices, an indication of the strength of demand for vehicles, rose steadily. Heavy duty diesel production therefore increased for the full year of 2010. With tighter emissions standards fully in effect from January 2010, platinum demand in heavy duty diesel rose by around 25,000 oz.

Although signs of stagnation in the economy and slower growth emerged in the second half of 2010, better year-on-year performance in the North American automotive sector as a whole saw overall purchases of platinum expand by around a third to 485,000 oz.

China

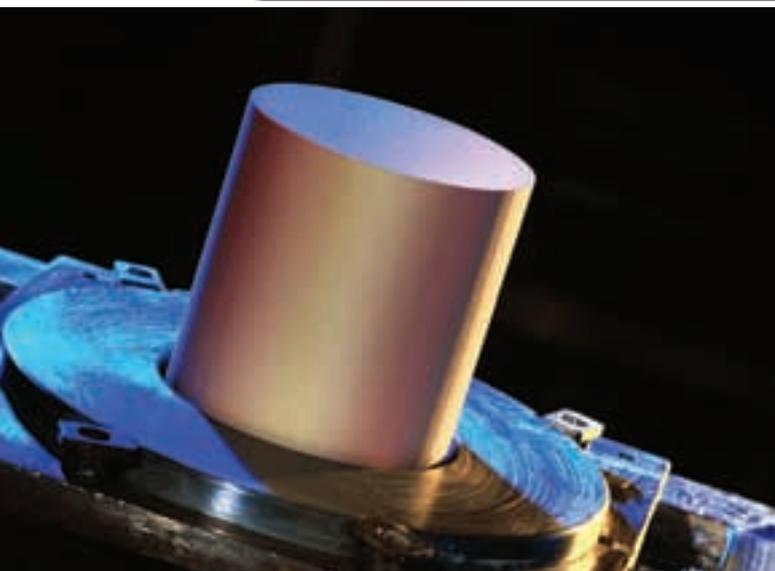
Production of light duty vehicles in China reached a new record of 16.5 million units in 2010, a 28% increase over 2009. Together with sales of imported vehicles, China maintained its position as the world's largest car market by sales volume.

A close-up photograph of a car's hood, which is dark blue and covered in numerous water droplets. The letters 'CDI' are prominently displayed in a silver, three-dimensional font. Below the hood, the red taillights of the car are visible, also showing some water droplets. The background is slightly blurred, suggesting an outdoor setting.

CDI

Production of diesel
vehicles in Europe
recovered strongly in
2010.

A better-performing global automotive industry lifted demand for platinum in emissions control.



Being primarily a gasoline market, China's expansion mainly impacted palladium demand, however platinum demand also benefited, with purchasing by the Chinese auto sector adding 20,000 oz of demand to reach 105,000 oz.

Overall use of platinum in Chinese autocatalysts remains fairly low, being used only by a small number of manufacturers in gasoline TWCs. Substitution has further eroded platinum's market share amongst these manufacturers in recent years. Most manufacturers use palladium–rhodium formulations for passenger cars. Even so, platinum demand received a boost in 2010 with the introduction of Euro 4 equivalent gasoline emissions standards (China 4) in Beijing and Shanghai, which are amongst the fastest expanding car markets in China. Nationwide, the majority of manufacturers were producing vehicles compliant with China 4 emissions standards in 2010.

As the transport and logistics sector in China continued to benefit from strong growth in the economy as a whole, production of heavy duty diesel vehicles in 2010 increased by almost 50%. Some platinum is beginning to be used in heavy duty diesel vehicles in China in anticipation of Euro IV equivalent regulations.

Rest of the World

Platinum demand from the automotive sector in the Rest of the World region reached its highest level to date of 525,000 oz as several countries shook off the effects of recession.

South Korea's light duty vehicle sector had a remarkable year, increasing production by over 18% as domestic sales picked up and as production for overseas markets saw a

substantial rise. Platinum demand was strengthened by higher exports of diesel vehicles for the European market and also by better conditions domestically, where diesel has a share of around a third of the vehicle market.

The Indian automotive sector performed well, with double-digit increases in production of vehicles of all types, including two- and three-wheelers. The introduction of Bharat Stage IV emissions legislation in thirteen major cities in April helped drive platinum use, while a move to Bharat Stage III took place in the second half of 2010 across the rest of the country.

JEWELLERY

Gross demand for platinum in the jewellery sector was 2.42 million ounces in 2010, a 14% fall compared with 2009. Gross demand for platinum from the Chinese jewellery industry was robust at 1.65 million ounces, although it fell by 21% compared with 2009 when lower prices encouraged exceptional levels of stock building.

Europe

Demand for platinum in the European jewellery sector softened by 10,000 oz to 175,000 oz in 2010. Economic uncertainty in the eurozone had a marked effect on consumer confidence. Elevated prices and the lingering effects of recession also affected total volumes of platinum jewellery purchases.

Demand was most robust in countries where platinum jewellery purchases have traditionally been strong. Numbers of hallmarked jewellery pieces produced in the UK showed a small increase in 2010, demonstrating some underlying growth in consumer demand. However, the total weight of hallmarked platinum declined, suggesting that consumers were choosing smaller, lighter pieces in response to price. According to retail jewellers in the UK, consumers are choosing wedding band sets that include the bride's rings in platinum and the groom's in palladium or white gold. The total weight of platinum jewellery manufactured outside the UK but hallmarked and sold in the UK dropped slightly.

Production of platinum jewellery in continental Europe suffered as a result of higher metal prices and limited demand, with consumers beginning to feel the effects of national austerity measures. Swiss platinum watch production declined by almost 40% in 2010 as sales of luxury goods fell. Hallmarking data showed that total production of Swiss jewellery items increased by a third in 2010, but this gave little support to overall platinum demand due to the lower weight of these items.

Japan

The Japanese jewellery industry benefited from better consumer confidence in 2010 following a poor 2009. Spending on discretionary items appeared to be returning to a limited extent in 2010. However, the gross weight of platinum purchased by the Japanese jewellery industry softened by 10,000 oz in 2010 to 325,000 oz, as a trend towards offering lighter weight pieces continued. With slow growth in the domestic market, China is still a focus for Japanese jewellery manufacturers and retailers, with some manufacturers moving production overseas to meet demand for their products.

Platinum remains popular in the bridal jewellery segment, however the long-term downward trend in marriage rates, and therefore purchasing of rings, continues. In addition, average weights of individual rings reduced in 2010 as the trade responded to elevated prices.

The platinum fashion jewellery segment remained subdued, partly due to price and also due to the tendency of younger consumers to view fashion jewellery as a more disposable commodity than previous generations did.

North America

The platinum jewellery sector in North America was positive in the middle to upper segment of the market as the economy recovered somewhat and consumer confidence began to return. Some larger manufacturers raised production levels and medium- to high-end retailers introduced new platinum product lines in stores. Other retailers saw increased sales, although much of this was from existing stocks. In the middle segment of the market, there was relatively little new manufacturing demand for platinum. In late 2010 some retailers in the US began to introduce lighter weight platinum products to meet key retail price points. Overall, demand for platinum in the North American jewellery sector strengthened by 30% in 2010 to reach 175,000 oz.

The number of marriages taking place in the US declined between 2005 and 2010 as higher birth rates were more than offset by a trend towards deferring marriage until later in life. This long-term trend continued to affect platinum demand in the bridal sector in 2010. Competition from cheaper wedding bands, such as those made from base metals, also carried on as high prices and economic uncertainty influenced consumer choices. However, a narrowing of the price difference between platinum and gold helped lift purchases of platinum at the high end of the market.

Purchasing of platinum on the Shanghai Gold Exchange was slightly lower in 2010 than in the previous year. Strong buying demand generally emerged during price dips.



China

The Chinese jewellery sector performed solidly in 2010, with gross platinum demand of 1.65 million ounces. However this represented a fall of some 430,000 oz compared with the exceptional year of 2009, when a combination of lower prices and low stock levels led to large amounts of metal being purchased by manufacturers and retailers alike. Adjusted for increased levels of recycling, total net platinum jewellery demand in China was 1.20 million ounces, 550,000 oz lower than the record high achieved in 2009.

While consumer demand remained good throughout 2010, manufacturers were faced with an elevated and rising platinum price. Purchasing patterns reflected this with strong buying whenever the price dipped. Rising costs of manufacturing, including labour, also eroded margins for many producers. Together with the cost of financing platinum stocks, this led a number of manufacturers to diversify into gem-set jewellery. Yellow gold has also proved lucrative, and some manufacturers have moved their workforce into gold jewellery production.

Platinum Demand: Jewellery						
'000 oz						
	Gross ¹		Recycling ²		Net ³	
	2009	2010	2009	2010	2009	2010
Europe	185	175	(5)	(5)	180	170
Japan	335	325	(230)	(290)	105	35
North America	135	175	0	0	135	175
China	2,080	1,650	(330)	(450)	1,750	1,200
Rest of the World	75	90	0	0	75	90
Total	2,810	2,415	(565)	(745)	2,245	1,670

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 reused 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.

Demand for platinum jewellery fell overall, but remained relatively robust in Europe.



Consumer interest in platinum has remained high overall, but gold's price performance has made it attractive to those consumers looking to buy jewellery in part as an investment. Some consumers see gold as holding its value better than platinum, which has been perceived as more volatile than gold over the past three years, leading to stronger sales of gold despite high prices.

Purchases of platinum in first tier cities such as Beijing and Shanghai remained strong in 2010, although plain platinum jewellery seemed to be shrinking in terms of counter space relative to platinum gem-set jewellery, particularly in department stores where margins on gem-set jewellery are higher. Second tier cities such as Dalian saw higher sales of platinum thanks to their increasingly affluent populations, as well as concerted marketing efforts. These new regional markets for platinum are proving to be attractive for manufacturers and retailers alike. However, platinum jewellery in both first and second tier cities increasingly faces competition from non-jewellery branded luxury goods.

The wedding band market continues to perform well in China and has recently been augmented by sales of platinum in the so-called 'life journey' market, where typically young females self-purchase jewellery pieces to mark milestones such as special birthdays or career developments.

Rest of the World

Platinum demand in jewellery manufacturing in the Rest of the World region increased by 20% to 90,000 oz in 2010 as platinum jewellery continued to gain popularity in India. Sales

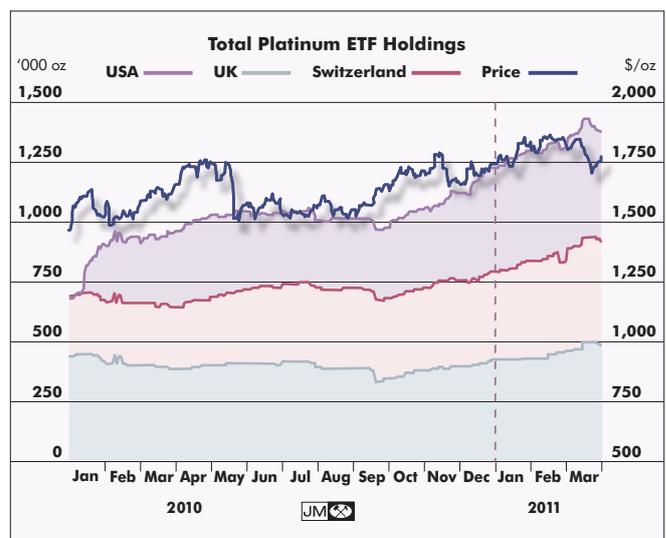
of platinum rings in India for the relationship segment were also complemented by sales of platinum pendants, chains and bangles. Platinum continues to gain acceptance among young, urban consumers, assisted by targeted marketing.

INVESTMENT

With positive supply-demand fundamentals, and a rising price throughout much of the year, physical investment demand for platinum remained robust during 2010. Lower demand in Europe and Japan was offset by growth in purchases of platinum for investment purposes in North America. Total net investment demand for platinum was 650,000 oz in 2010, just 10,000 oz lower than in 2009.

Investment demand for platinum in 2010 was largely a story of physically-backed ETFs, with total net fund holdings reaching over 1.2 million ounces for the first time in 2010. The unique combination of worldwide economic circumstances in 2010, a time of low interest rates and rising commodity prices, led to a flood of investment in ETFs.

Net new demand for platinum in the European ETFs was around 120,000 oz. This was less than in 2009 when there was much buying into funds, but indicative of the level of interest that remains in ETFs in Europe, even taking into account a good deal of profit-taking in the more mature funds during 2010. The launch of a new platinum ETF in the US in January brought a surge of new investment. In late 2010, two new ETF basket funds were also launched, which contained physical platinum, though volumes were considerably lower than the platinum ETF. Total net ETF demand for platinum in the US was around 440,000 oz for the full year of 2010.



Demand for physically-backed platinum exchange traded funds reached unprecedented levels in 2010.

Platinum Demand: Investment '000 oz			
	2008	2009	2010
Europe	105	385	120
Japan	385	160	45
North America	60	105	480
China	0	0	0
Rest of the World	5	10	5
Total	555	660	650

Purchasing of platinum bars in the Japanese retail market saw net investment in 2010, albeit at a lower level than in 2009. Demand for metal in Japanese platinum accumulation plans (PAPs) was also positive, and exceeded that of retail bars. In the retail market, investment during months of declining price outweighed the disinvestment during rising prices.

In the coin market, the US Mint released a limited number of 2010 Proof Platinum Eagle coins. No further releases of platinum bullion coins were made by the US Mint, making 2010 the second year in a row that bullion coins have been unavailable. This is largely attributed to the legal requirement for the US Mint to produce gold coins to satisfy market demand. Demand for gold coins was high in 2010, however no legal mandate exists for platinum coins to be produced. Production of platinum Maple Leaf coins by the Royal Canadian Mint was low in 2010 due to high liquidity in the secondary market restricting demand in the primary market.

CHEMICAL

Demand for platinum in the chemical sector increased by 53% to 445,000 oz as improved economic conditions boosted capacity utilisation in chemical plants last year. Demand for platinum in the chemical sector was at its highest level since 1975. In India and China, where high rates of economic growth are stimulating the need for lightweight polymer materials in the automotive and packaging sectors, the picture was even more positive. China's chemical manufacturing industry remained the world's largest and fastest-growing in 2010.

Expansion in the silicones market in 2010 was positive for platinum, with demand for platinum curing catalysts expanding in line with greater production of silicones. Use of silicone elastomers, in automotive seals and gaskets as well as in adhesive medical dressings for wound healing, saw strong rises in Europe and North America. Silicone release liners, which are used as a backing for paper and film adhesives, saw

Platinum Demand: Chemical '000 oz			
	2008	2009	2010
Europe	105	70	110
Japan	55	45	50
North America	95	65	100
China	60	40	80
Rest of the World	85	70	105
Total	400	290	445

solid demand in developed markets, and good expansion in developing ones.

Demand for platinum in the production of process catalysts grew strongly in 2010 as demand for polyethylene terephthalate (PET) helped increase demand for paraxylene, and therefore platinum as a catalyst to produce it. The rapidly growing middle classes in both India and China which are moving towards western patterns of consumption are ultimately driving new demand for platinum in production of chemical intermediates for downstream consumer goods. Capital investment in new production capacity in India and China is helping to meet this new demand, and driving up requirements for platinum process catalysts.

Purchases of gauze for the production of nitric acid, used in the manufacture of nitrate-based fertilisers and explosives, increased markedly in 2010. With improved economic conditions and demand for the end-products, nitric acid facilities were run at higher capacity, prompting greater top-up metal requirements. Higher demand for agricultural fertilisers was due to long-term trends of increasing population, a move towards western style diets in the developing world, the expansion of biofuels in the US, and loss of agricultural land. Conditions unique to 2010 also contributed to higher fertiliser use, such as high prices for a range of agricultural commodities, which provided farmers with an incentive to produce more. Adding to this, disappointing agricultural yields related to climatic events led to greater use of nitrogen-based fertilisers.

Platinum Demand: Petroleum Refining '000 oz			
	2008	2009	2010
Europe	30	25	20
Japan	10	10	5
North America	25	15	25
China	10	10	15
Rest of the World	165	150	105
Total	240	210	170

PETROLEUM REFINING

Demand for platinum in petroleum refining softened by 40,000 oz in 2010 as the global petroleum industry continued to feel the lingering effects of recession. Although demand for transport fuel recovered along with economic conditions, there remained a good deal of spare production capacity in Europe and North America, meaning that little new refining plant was built in those regions. Increases in new capacity were stronger elsewhere, particularly in large refineries in the Middle East.

The steady expansion in demand seen in other industrial sectors was absent from petroleum refining. Refinery demand for catalysts remained low in Europe overall, with low rates of capacity utilisation depressing new demand and plant closures returning metal to the market. In North America, new capacity was installed, leading to overall growth in the region, although plant closures on the east coast of the US netted off some of that new demand. China's rapidly expanding transport sector stimulated increases in domestic refining capacity, which partly offset the closure of excess capacity in other regions.

ELECTRICAL

Gross platinum demand from the global electrical sector increased by 30,000 oz to 220,000 oz as an improved economic situation in many markets led to more sales of consumer electronic items and higher levels of business purchasing of computer equipment, continuing a trend that began in late 2009. Platinum demand was aided by higher production levels of hard disk drives, all of which contain platinum.

Consumers and businesses which deferred buying electronic equipment and IT infrastructure in 2009 during the economic downturn resumed purchasing in 2010, giving a boost to the electronics sector. Aided by a better credit environment and the

Platinum Demand: Electrical '000 oz						
	Gross		Recycling		Net	
	2009	2010	2009	2010	2009	2010
Europe	20	15	(5)	(5)	15	10
Japan	30	30	0	0	30	30
North America	25	25	0	0	25	25
China	20	25	0	0	20	25
Rest of the World	95	125	(5)	(5)	90	120
Total	190	220	(10)	(10)	180	210

**Platinum Demand: Glass
'000 oz**

	2008	2009	2010
Europe	(25)	5	10
Japan	65	40	105
North America	(5)	(35)	10
China	85	(90)	90
Rest of the World	195	90	130
Total	315	10	345

availability of new hardware and software on the market, sales of personal computers and digital video recorders both registered increases globally, adding to demand for platinum in hard disk drives. The popularity of notebook and tablet computers has also benefited hard disk drives by expanding the market into new segments. Although some of these computers use flash memory, hard disk drives are also frequently used. However, platinum demand in hard disk drives faced some headwinds from excess inventories in manufacturers' pipelines.

GLASS

Net platinum demand in the glass industry grew by 335,000 oz in 2010 as purchasing of metal for new and replacement glass manufacturing facilities exceeded returns from old and decommissioned facilities; a contrasting scenario to that which prevailed during 2009 when net demand was just 10,000 oz. Consumer demand for flat-panel displays and a recovery in the construction sector helped reinvigorate demand for glass and glass fibre, and therefore platinum fabrications and components.



Better sales of consumer electronics drove up platinum demand in the electrical and glass sectors.

Construction of new manufacturing capacity for the production of glass fibre and thin-film transistor liquid crystal display (TFT-LCD) glass was responsible for substantial new purchasing of platinum. Worldwide, this more than offset the sell-back from old marble re-melt glass fibre plants and old cathode ray tube (CRT) glass manufacturing plants, which returned platinum from redundant manufacturing lines.

Growth in demand for platinum was highest in China, where new TFT-LCD plants were commissioned to keep up with consumer purchases of TFT-LCD TVs. A recovery of the glass fibre market to pre-2008 production levels to meet demand from the construction sector required new capacity addition worldwide. This was most significant in China, where it stimulated new purchases of platinum. The Rest of the World region was responsible for the highest net demand for platinum in glass manufacturing as new TFT-LCD glass facilities were constructed. The Japanese glass manufacturing industry also benefited from accelerated demand for TFT-LCD glass, especially from the fast-expanding mobile device sector, and added new capacity which necessitated relatively large metal purchases. Europe, which struggles to compete on cost with Asia, saw some new capacity additions, but much of the arising demand was netted off by closure of old facilities.

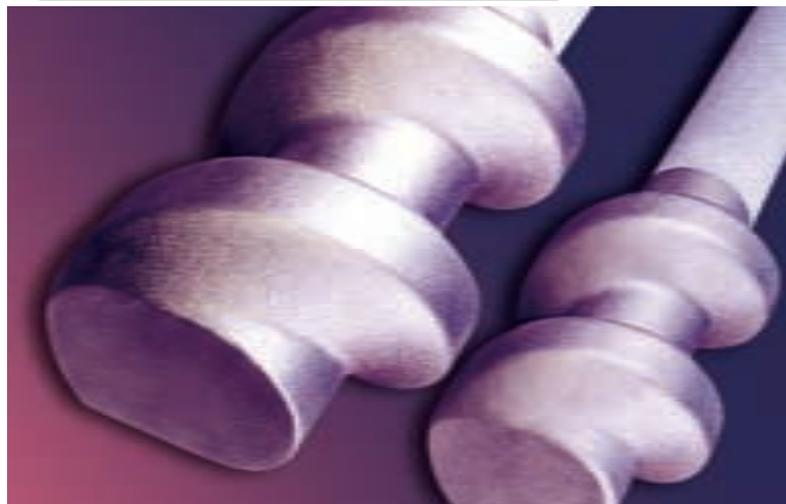
MEDICAL & BIOMEDICAL

Use of platinum in the medical, biomedical and dental sectors remained solid in 2010 at 255,000 oz. This continued the long-term upward trend resulting from better diagnosis and treatment of various conditions, an ageing population in the developed world and improving health care in the populations of the developing world.

Platinum demand in biomedical components increased steadily in 2010. New demand came from the introduction of a cardiac stent made from a platinum-chromium alloy, while there was growth in the use of electrophysiology catheters to treat atrial fibrillation, and neuromodulation devices to address

Platinum Demand: Medical & Biomedical '000 oz			
	2008	2009	2010
Europe	115	115	115
Japan	20	20	20
North America	85	90	90
China	10	10	10
Rest of the World	15	15	20
Total	245	250	255

There was heavy purchasing of platinum by the glass industry for use in coated components such as stirrers.



a range of neurological disorders.

Demand for platinum in anti-cancer drugs remained robust in all regions. Use of platinum in dental alloys in North America and Europe softened very slightly as a result of long-term trends in preventative dental care and competition from resin-based and ceramic crowns and bridgework.

OTHER

Demand for platinum in all other applications increased by around a third in 2010 to 255,000 oz. As the world economy recovered, demand re-emerged from the automotive and aerospace sectors.

Higher vehicle production worldwide drove purchasing of automotive oxygen sensors and spark plugs, helping lift platinum demand in those applications following a poor year in 2009. Better economic conditions relieved pressure on the aerospace sector, driving up demand for platinum in turbine blade coatings for new and refurbished aircraft engines, and pinning wire in new turbine blades. This followed a year in which many airlines had reduced aircraft utilisation, negatively affecting platinum demand.

Platinum Demand: Other '000 oz			
	2008	2009	2010
Europe	85	55	80
Japan	25	15	30
North America	150	90	115
China	10	10	10
Rest of the World	20	20	20
Total	290	190	255

PGM IN GLASS MANUFACTURING



Glass manufacturing represents one of the largest industrial demand areas for platinum group metals. With high melting points and corrosion resistance, pgm have long been essential in the manufacture of high-purity optical glass, glass fibre and, more recently, TFT-LCD panels. The market for pgm in glass manufacture tends to be cyclic; a large amount of demand comes from new glass plants, driven by technology choices, consumer trends and economic growth. Recycling periodically returns metal from older manufacturing facilities, lending interesting dynamics to the glass market.

PGM IN GLASS

The glass industry has been a major user of platinum and platinum-rhodium alloys for many years. Platinum and pgm alloys are used in the linings of vessels that contain, channel, and form molten glass, as well as in self-supporting fabricated parts and in coatings on surfaces such as ceramics. Platinum's high melting point and resistance to corrosion make it suitable for use in the aggressive environment of molten glass. The alloying of platinum with rhodium, and the micro-alloying of platinum with zirconia, further increase the material's mechanical strength when used in linings and fabrications. Use of pgm helps extend the durability and lifetime of equipment, improve return on investment, lower total energy requirements and ensure that the end-product is free of defects. A crucial advantage of pgm is that they are recyclable: typically 95 to 98% of the metal used can be recovered and it is mostly reused in similar glass applications; recovery of metal in the glass industry is an example of 'closed loop' recycling.

TYPES OF GLASS MANUFACTURING

One of the largest uses for pgm in glass manufacture is in the production of **glass fibre**, a component of glass-reinforced

plastics and construction materials. In this process, molten glass is drawn through a platinum-rhodium bushing, a vessel with hundreds of precisely dimensioned holes in its base, allowing extremely fine fibres of glass to be consistently produced. The resurgence in industrial demand for glass fibre in 2010 meant that around 150,000 oz of platinum went into that application.

In the manufacture of glass used in active-matrix thin-film transistor liquid crystal display (**TFT-LCD**) panels, used in most television and computer displays on the market at present, pgm components are essential. The substrate in TFT-LCD panels is a thin sheet of non-alkali ion-free glass on which the TFT structure is fabricated. The glass substrate must be extremely smooth, of uniform thickness and not contain any charge-carrying particles that could migrate into the TFT structure and reduce image quality in the finished product. Platinum and rhodium linings are therefore used to channel the molten glass throughout the manufacturing process, making TFT-LCD glass production the most intensive user of pgm per unit of glass manufactured. Different technologies use varying amounts of pgm, but some latest-generation tanks contain up to a tonne of platinum. Melting tanks,

refining channels and stirring cells, where the raw materials are mixed and the glass is homogenised, have to be capable of withstanding temperatures of up to 1,650°C, while remaining inert in order to ensure the finished product is defect-free.

Cathode Ray Tube (CRT) glass manufacture has historically been a strong demand area for pgm. Platinum–rhodium fabrications or coatings are used in the glass forming part of the process to protect bowls, stirrers and orifice rings.

Like TFT–LCD glass, **optical glass** requires platinum components throughout the manufacturing process in order to produce flawless lenses. In this case, pure platinum components are preferred for melting, conditioning and forming, as rhodium alloys can cause unwanted colouration of the glass.

A new and growing area is in glass for solar photovoltaic panels. This **solar glass** needs to be highly transmissive and free of blemishes. In this, as in other applications, pgm coatings and fabrications are required to protect and extend the lifetime of individual process components.

THE CURRENT MARKET

In 2010, new purchasing of platinum and rhodium was driven by two main technology trends: a move by consumers away from older CRT technology in televisions, monitors and other display units and the growth in consumer demand for TFT–LCD panels, particularly in mobile devices such as handheld ‘tablet’ computers. A third trend was the resurgence of the glass fibre manufacturing industry in 2010, as the construction sector picked up in better economic conditions. Overall, pgm usage in the glass manufacturing sector was in an upswing in 2010 as demand from new facilities outweighed the return of metal from older ones. This was precisely the opposite situation to 2009 when returns from older, decommissioned plants outweighed new and top-up demand.

CRT display technology has been in decline for several years. Devices which have achieved mass-market uptake in the last twenty years, such as mobile phones and laptops, require flat-panel display technology, usually TFT–LCD panels. Consumer preference has also moved towards TFT–LCD technology in televisions and monitors, and it is expected that all CRT production will cease by 2015. This trend has meant that a large amount of pgm has been recovered from CRT factories, which has effectively netted off new demand elsewhere.

Unit sales of TFT–LCD technology for flat-panel displays and mobile devices have grown rapidly over the past few years with the introduction of inexpensive and ever-larger panels. Most TFT–LCD panels use two sets of high-quality display glass

coated with electrodes between which the liquid crystals lie. Some devices use a third layer of thin, high-strength sheet glass as a protective cover, which offers greater durability and scratch resistance to handheld devices with touch screens. The rapid uptake of such devices represents considerable new demand for pgm in the production of multiple layers of blemish-free glass.

The recovery of the world economy during 2010 led to increased glass fibre manufacturing. Growth in demand for platinum bushings from both new capacity and replacement of older equipment has therefore taken place. Strong, lightweight glass fibre composites are increasingly required in the aerospace, automotive and construction industries. Considerable new capacity is being installed for glass fibre manufacture, although some of the pgm requirements are being met from metal already in manufacturers’ inventory.

OUTLOOK

Demand for increasingly sophisticated electronic displays, solar panels and lightweight, durable glass fibre composite materials looks set to grow in the next few years. PGM use in manufacturing glass for these various applications offers unique operational characteristics. The glass industry is an example of a sustainable application of pgm: in addition to the high proportion of metal that is recovered from closed loop recycling, pgm also offer benefits in terms of extending component lifetimes and reducing expenditure.



PALLADIUM

- Gross demand for palladium increased by 23% to 9.63 million ounces in 2010, its highest ever level.
- Open loop recycling of palladium returned 1.85 million ounces to the market in 2010.
- Gross demand for palladium from the autocatalyst sector in 2010 increased by 35% to 5.45 million ounces as economic recovery drove vehicle production higher in all regions.
- Net identifiable physical investment demand for palladium grew by a remarkable 74% in 2010 to reach 1.09 million ounces on the back of heavy buying of exchange traded funds.
- Gross industrial demand for palladium rose by 70,000 oz to 2.47 million ounces in 2010.
- Purchases of palladium by the jewellery sector declined by 20% in 2010 to a total of 620,000 oz.

AUTOCATALYST

Palladium purchasing by the automotive sector increased by 1.40 million ounces to 5.45 million ounces in 2010, the highest since 1999, as vehicle markets in all regions fared better than in the previous year. Higher global production of light duty passenger vehicles, principally gasoline cars, benefited palladium demand, as did tightening emissions legislation in various markets. Substitution of platinum with palladium in autocatalyst formulations showed no signs of abating despite a narrowing of the price differential between the two metals.

Europe

The light duty vehicle sector continued to see some recovery in the opening months of 2010 as ongoing car scrappage schemes and generous discounts in European markets tempted the car buying public back to showrooms. Small, inexpensive gasoline vehicles tended to be the main beneficiaries of such schemes aimed at reviving car sales, which led to an associated increase in palladium demand. Markets such as Spain, Portugal and Ireland, which were beset by economic problems later in the year, registered strong gains in the first half of 2010.

The second half of the year saw decreasing monthly sales in western Europe as scrappage schemes in major markets came to an end and the effects of sovereign debt crises and austerity measures began to be felt in several countries. New car sales declined in the second half in Greece and Spain, due to the financial crises there, while monthly sales in usually robust markets such as the UK and Germany also shrank. An interesting dynamic of this slump was that it tended to affect gasoline vehicles more than diesels with sales of diesels in Germany, for example, continuing to rise even as gasoline sales declined. This can be partly attributed to the end of 2009's

market-distorting car scrappage schemes, which had favoured gasoline cars. It also marked the return of fleet buyers to the market and renewed interest by consumers in fuel efficient diesel vehicles.

Although diesel vehicles regained much of their market share in Europe in 2010, with diesels representing almost half of the total light duty market, the effect of this on palladium demand was far from negative. The introduction of tougher Euro 5 emissions standards for new models in late 2009 resulted in higher palladium loadings as automakers took the opportunity to further substitute platinum with palladium in both diesel and gasoline catalysts. In 2010 only a few manufacturers still used platinum in gasoline autocatalysts. Substitution of platinum in both gasoline and diesel formulations grew incrementally in 2010, as in previous years. The typical proportion of palladium used in a European diesel catalyst rose to around 25%. Despite much higher palladium prices during 2010, platinum still traded at more than twice the price of palladium throughout the year, giving manufacturers an incentive to continue the substitution of platinum with palladium.

One of the biggest drivers of the rise in palladium demand in the European automotive sector was the rebound in the export market. Export destinations tended to be gasoline markets such as China, thereby favouring palladium.

Palladium Demand: Autocatalyst						
'000 oz						
	Gross		Recycling		Net	
	2009	2010	2009	2010	2009	2010
Europe	995	1,325	(280)	(335)	715	990
Japan	590	815	(50)	(75)	540	740
North America	1,020	1,360	(540)	(790)	480	570
China	685	975	(35)	(50)	650	925
Rest of the World	760	975	(60)	(75)	700	900
Total	4,050	5,450	(965)	(1,325)	3,085	4,125

Gross demand for palladium in European autocatalysts increased by 33% in 2010 to 1.33 million ounces, a pronounced rise compared with the sector's depressed state in 2009. Although vehicle production in 2010 was at its second lowest level of the past decade, palladium autocatalyst demand in Europe was at its highest since 2002.

Japan

Gross demand for palladium in the Japanese automotive sector rose by 38% in 2010 to 815,000 oz as production of vehicles recovered from recession.

As the Japanese economy improved, light duty vehicle sales increased, driving up demand for gasoline cars in the domestic market, and therefore palladium demand. Full-year auto production data reveal that vehicle production grew overall, including production of diesels. Although the domestic light duty vehicle market performed strongly in 2010, the export sector showed the biggest rise. In terms of vehicles manufactured for overseas markets, production of gasoline vehicles remained larger than production of diesels. Continuing substitution for platinum in domestic and export models also helped increase palladium demand.

North America

Purchasing of palladium in the North American automotive sector rose by 33% in 2010 to 1.36 million ounces. Following a desperate year for many auto manufacturers in the US in 2009 when production lagged behind weak sales, 2010 marked a strengthening of production levels. Higher levels of consumer confidence resulted in car sales growing from 11.9 million vehicles in 2009 to 13.1 million in 2010. This was further augmented by an easing of gasoline prices which helped drive purchasing of larger vehicles such as trucks and SUVs, with higher palladium loadings per vehicle.

While the North American market made some gains in 2010, a combination of high personal debt levels, limited credit and stubbornly high levels of unemployment in the US continued to weigh on new car sales.

China

Production of vehicles in China rose sharply in 2010 as economic growth enabled an increasingly affluent population to buy vehicles. This was aided by government intervention in the form of tax breaks for small vehicles, making car purchases

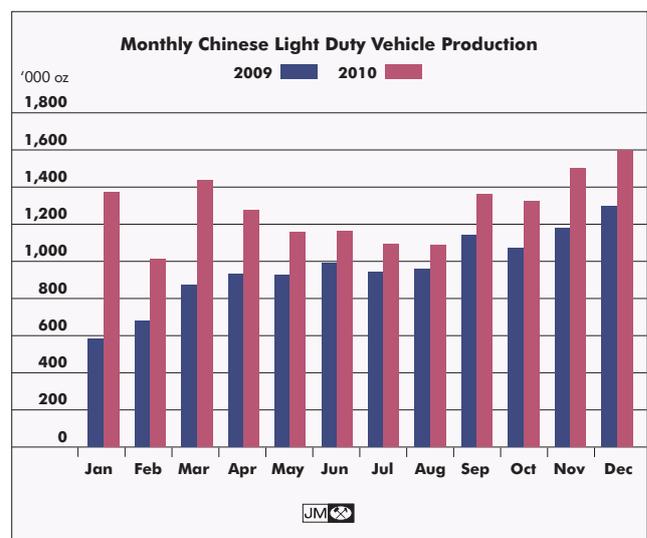
Growth of the light duty vehicle market in China helped boost palladium demand.



more affordable for consumers. Total vehicle production in China was 16.5 million units in 2010, with the majority of these gasoline fuelled. The rise in car sales was greatest in the SUV and crossover sectors; these larger vehicles require more pgm per vehicle to control emissions. Sales of smaller vehicles also grew strongly.

In anticipation of China 4 emissions standards coming into force across the country in mid-2011, some automakers raised pgm loadings in vehicles made in China. This tended to favour palladium-rhodium catalyst formulations, which are used by the majority of manufacturers. High production levels in China saw palladium demand reach 975,000 oz in 2010, a gain of 290,000 oz compared with 2009.

Despite some signs of a cooling of the auto market in cities such as Beijing and Shanghai, partly as a result of measures

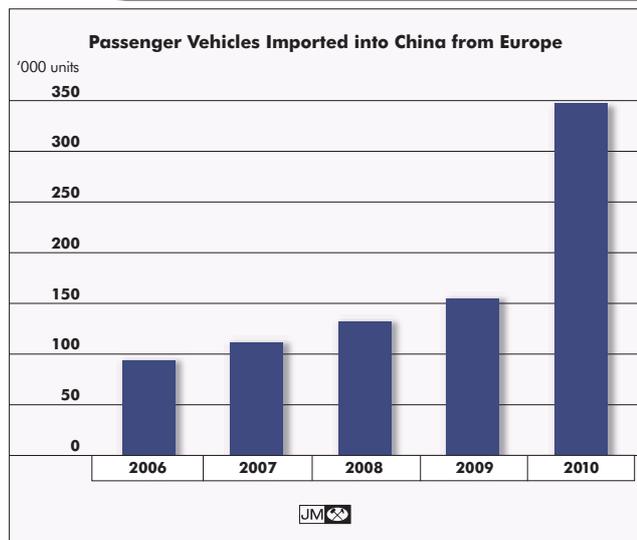


Chinese light duty vehicle production was higher in every month of 2010 than the previous year, supporting demand for palladium.

Physically-backed
palladium exchange
traded funds grew to
record levels in 2010.



Imports of European-manufactured vehicles into China strengthened in 2010, boosting palladium demand in Europe.



to control inflation and manage congestion, car ownership remains a key aspiration of the increasingly affluent Chinese public. Growth remains strong in second and third tier cities where road infrastructure is being rapidly developed to keep pace with car sales.

Rest of the World

In Russia, the early part of 2010 saw vehicle sales continue their downward trend, prompting the introduction of a scrappage scheme in March for vehicles produced in Russia. The scheme immediately provided a boost to the Russian market and by the end of April, year-on-year sales had grown for the first time in 18 months. Within three months the original quota of 200,000 certificates towards the purchase of a new vehicle had all been allocated. The scheme was therefore extended with the addition of a further 300,000 certificates. The Russian government announced in April 2011 that it may provide another extension to the scheme. By the end of 2010, Russian production had grown by 29% year-on-year. Sales of inexpensive Russian-brand vehicles saw the biggest rise, but western brands assembled locally also expanded production. Since Russia is mainly a gasoline market, this overwhelmingly benefited palladium.

Manufacturers in South Korea also had a strong year, with higher production levels for both domestic and export markets. Both at home and abroad, small gasoline vehicles sold well, driving up palladium demand. Raised production levels of larger gasoline vehicles with higher catalyst loadings also helped to boost palladium.

Passenger car production in Mexico rose by almost 51% to

reach 2.3 million units in 2010 due to an increase in confidence of domestic consumers and also better conditions in the US, the principal export destination for Mexican-produced cars. Demand in the domestic market was aided by loan guarantees from the state development bank to auto financing institutions, which helped increase the number of cars bought on finance.

JEWELLERY

Gross demand for palladium in the worldwide jewellery sector reduced by 20% in 2010 to 620,000 oz. Although purchases of palladium jewellery continued to grow in Europe and North America, albeit from a low level, there was a tailing off in demand in China, the largest market for palladium jewellery. Elevated palladium prices and adequate retail and manufacturer stock levels proved to be a drag on uptake of palladium for jewellery overall.

Europe

Palladium demand in the European jewellery sector reached 70,000 oz in 2010, a 40% rise over the previous year. Much of this came from raised production of palladium jewellery in the UK market. Between July 2009 when hallmarking of palladium in the UK began and the end of 2009, 40,000 palladium pieces received a hallmark. Data for the full year of 2010 show that 102,000 British-made palladium pieces were hallmarked. The increase in demand was also evident in the weight of palladium hallmarked in 2010, with an average weight per piece of 8.4 grams in 2010 compared with 7.5 grams in 2009. A good deal of interest in palladium jewellery has been



Non-road emissions control is a promising future market, covered in our 'Other' category.

See notes to table on page 29.

Palladium Demand: Jewellery '000 oz						
	Gross ¹		Recycling ²		Net ³	
	2009	2010	2009	2010	2009	2010
Europe	50	70	0	0	50	70
Japan	80	75	(20)	(20)	60	55
North America	60	65	0	0	60	65
China	560	380	(50)	(60)	510	320
Rest of the World	25	30	0	0	25	30
Total	775	620	(70)	(80)	705	540

generated by the trade in the UK recently, with manufacturers adding to their product ranges and retailers augmenting their stock levels. Palladium continues to gain popularity as a metal for men's wedding bands, where larger, chunkier designs can be made at a price competitive with white gold. Growth in palladium demand in the UK partly offset declines elsewhere, particularly in the use of palladium in white gold alloys, and in Swiss watches.

Japan

Gross demand for palladium jewellery in Japan was higher than in most regions in 2010, but softened by 5,000 oz. Since palladium is used as an alloying agent in Japanese platinum alloys, the downward trend in platinum also affected palladium. Use of palladium in white gold alloys also suffered as white gold sales dropped, mainly due to high gold prices.

Several manufacturers are testing the market for palladium jewellery in Japan and for export overseas, including chains and wedding bands. Overall however manufacture of palladium jewellery, as opposed to its use in alloys, remains minimal.

North America

Gross demand for palladium in North American jewellery increased by 5,000 oz in 2010 to 65,000 oz. This followed a number of manufacturers and retailers adding palladium to their product offerings in 2009. The popularity of men's palladium rings in the wedding band market was robust in the first half of 2010. However, the elevated palladium price and competition from non-precious metal alternatives moderated its progress later in the year.

Some demand came from the use of palladium in certain white gold alloys, where it is used to enhance the look and finish, and also in a number of new sterling silver formulations where it adds cachet to a lower-end product.

China

Gross palladium purchasing by the Chinese jewellery sector reduced by around a third in 2010 to 380,000 oz. Elevated palladium prices combined with sufficient levels of stock were mainly responsible for this fall. The rising palladium price also had the effect of reducing previously high margins and adding to the funding cost to retailers, thus reducing the attractiveness of stocking palladium.

In first tier cities such as Beijing, many retailers have ceased selling palladium due to poor consumer demand and competition from gold, which many customers perceive as retaining its value to a greater degree. Some manufacturers in Shenzhen, many of whom supply other cities in China, stopped manufacturing palladium in 2010 due to low retail demand. In addition to a lack of awareness amongst consumers, a key challenge in retailing palladium is that, unlike gold and platinum, it is not traded on the Shanghai Gold Exchange. This means the metal lacks credibility as an investment for the Chinese jewellery-buying public, who typically view jewellery items in part as investments that can be traded.

Palladium jewellery continued to sell in certain second and third tier cities and outlying metropolitan and rural areas. However, demand even in these areas faces competition from other luxury goods as the population there becomes more affluent. In late 2010, marketing campaigns aimed at promoting palladium to consumers restarted, but it remains too early to judge their effectiveness.

The rising price throughout most of 2010 encouraged the return of old palladium jewellery by consumers, reducing net palladium demand. Unlike in other markets, low manufacturing margins in China increased the attractiveness of recycling jewellery. The recycling of palladium is covered in our recycling chapter on page 24.

CHEMICAL

Demand for palladium from the chemical industry increased by 70,000 oz in 2010 to 395,000 oz as consumer demand for a variety of downstream products worldwide drove up rates of chemical plant throughput, therefore stimulating demand for top-up catalysts. Considerable new capacity also came on-stream, especially in China.

In the improved global economic climate of 2010, demand for consumer products such as packaging and clothing expanded. In many of these products, polyethylene terephthalate (PET) is a key component. PET is made from purified terephthalic acid

Palladium Demand: Chemical '000 oz			
	2008	2009	2010
Europe	100	85	105
Japan	20	20	20
North America	55	50	65
China	55	75	90
Rest of the World	120	95	115
Total	350	325	395

(PTA), a petrochemical intermediate which is manufactured from paraxylene using palladium process catalysts. Greater demand for the end-use consumer products drove the need for top-up catalyst in upstream chemical plants. Some new capacity was built in Europe in 2010, requiring palladium process catalysts. In Saudi Arabia, new capacity was also being built to serve the fast-growing Indian and Chinese markets, where PET is required in the textile and construction sectors. China continued to see strong domestic demand for PET, and high levels of purchasing of palladium process catalysts for new plant during 2010.

The production of vinyl acetate monomer (VAM), used in adhesives, paints, paper and textiles, increased during 2010 in line with the recovery in the global economy. VAM uses a supported palladium catalyst in its manufacture. Purchases of palladium therefore grew, particularly in Asia where expansion of production is currently strongest.

DENTAL

Purchasing of palladium by the dental sector worldwide amounted to 580,000 oz in 2010. Demand for palladium in dentistry continued to feel the long-term effects of improved dental health worldwide and the greater use of resin-based, all-ceramic and base metal dental treatments. In Japan, the largest market for palladium dental alloys, demand fell mainly due to these long-term trends.

Statistics published by the Japanese Ministry of Health, Labour and Welfare suggest that use of Kinpala alloy, which has a palladium content of 20%, is declining, thus reducing palladium demand. We have adjusted our 2010 demand figure downwards to 250,000 oz to take into account this development. For most of last year subsidies for Kinpala alloy were lower than they were previously, but they increased once again in late 2010. Other trends were also felt such as better preventative care and a declining population as well as higher costs to patients.

Palladium demand in electronic components rose during 2010.



The worldwide trend towards base metal and all-ceramic treatments for crowns and bridgework continued in 2010 as patients and dentists elected these treatments for aesthetic reasons, further impacting palladium demand. The one bright spot was the high price of gold in 2010, which led to greater substitution with palladium. However, the cost saving of using palladium is relatively small compared with the total cost of the treatment. Consequently, the additional palladium demand from substituting gold was more than offset by the move to non-precious metal procedures.

ELECTRICAL

Gross purchasing of palladium by the electrical sector increased by 40,000 oz to 1.41 million ounces as improved economic conditions prompted consumer and business demand for downstream electronic products. As manufacturing of palladium-containing electronic components climbed, there was heavy buying of palladium by manufacturers. This continued the stock building that began in late 2009.

Palladium Demand: Dental '000 oz			
	2008	2009	2010
Europe	65	65	65
Japan	275	295	250
North America	270	260	250
China	0	0	0
Rest of the World	15	15	15
Total	625	635	580

The recovery of the global economy and stimulus measures introduced by various national governments helped the electrical sector in late 2009 and into 2010. Higher sales, particularly in emerging markets, and stock building helped raise demand levels. Production of silicon for semiconductor manufacture, a proxy for general electrical sector growth, reached pre-2009 levels. However, lingering economic uncertainty and high unemployment in developed markets started to weaken consumer demand in the second half of 2010. With high retail and manufacturer stock levels, sales of electrical items slowed, although they remained positive on a year-on-year basis.

Demand for palladium resistors and passive components such as multi-layer ceramic capacitors (MLCCs) continued to grow as production of circuit boards increased in line with consumer demand. Although nickel components have threatened palladium's market share for some time, nickel remains less durable than palladium in MLCCs, and palladium-based MLCCs remain the technology of choice in higher-end applications. The increasing complexity of electronic devices also means that, generally, more MLCCs per device are needed. Growth of palladium in MLCCs was strongest in Japan and China in 2010, highlighting the importance of these markets in electrical production.

The use of palladium in plating applications also saw a rise during 2010. With an upswing in the number of components produced worldwide, there was a consequent expansion in demand for palladium in lead frames and connectors. Palladium competes with gold in plating applications, and the high price of gold relative to palladium during 2010 continued to act as an incentive for substitution with palladium.

Recovery of palladium from open loop recycling of electronics increased in 2010, reaching 440,000 oz. Elevated palladium prices helped drive greater levels of recycling, as did the continuing effects of legislation and consumer awareness. Recycling of electronic scrap was particularly high in Europe, where the Waste Electrical and Electronic Equipment legislation continued to drive greater levels of collection and recycling of end-of-life electronic goods.

INVESTMENT

Physical investment demand for palladium increased by a remarkable 74% to reach 1.09 million ounces last year. ETFs were responsible for most of this; specifically, ETF Securities' US-based palladium ETF registered heavy investment inflows throughout much of 2010.

Palladium Demand: Electrical						
'000 oz						
	Gross		Recycling		Net	
	2009	2010	2009	2010	2009	2010
Europe	195	195	(160)	(175)	35	20
Japan	270	295	(55)	(55)	215	240
North America	170	160	(70)	(80)	100	80
China	335	360	(25)	(35)	310	325
Rest of the World	400	400	(85)	(95)	315	305
Total	1,370	1,410	(395)	(440)	975	970

Although overshadowed by the rise in automotive demand in 2010, increased sales of palladium investment products made an important contribution to the palladium market moving into substantial deficit for the full year of 2010.

Changes in investor sentiment can lead to swings in the physical investment market which do not necessarily reflect the underlying supply-demand fundamentals. This makes the investment market one of the most interesting to analyse. Although the fundamentals for palladium were positive throughout 2010, the second half of the year saw palladium's price track upwards as part of a wider commodity rally. This was spurred by eurozone uncertainty, the fluctuating fortunes of the dollar and continuing concerns over the strength of the worldwide economic recovery. These same factors also help explain some of the volatility seen in the palladium market over the same period. Although the price rose, investors continued to see palladium as undervalued and ETFs continued to attract investment. There was also perhaps some pricing-in of perceived future supply shortfalls due to possible lower palladium sales from Russian stock. Interestingly, given that palladium reached its highest price for a decade in late 2010, all fund holdings effectively had the potential for investors to take profit. Apart from some profit-taking in the relatively mature ZKB fund and ETF Securities' London fund, there was not much selling of positions, suggesting that palladium investments may be relatively long-term. Profit-taking in the younger US fund was certainly limited, and investors continued to see considerable upside to palladium.

Total palladium ETF investments reached a record high of around 2.2 million ounces on 31st December 2010, increasing from approximately 1.2 million ounces at the end of 2009. In late 2010, palladium's price stood at a ten-year high approaching \$800, the rising price having accompanied higher levels of investment. Most of the rise in ETF holdings was a result of additions to the US fund, which grew by 1.1 million ounces between its launch at the beginning of 2010 to the end of the

year. Growth of the US fund was fastest in the opening weeks of its launch, before declining in late April as the price softened. However, US fund holdings initially rose by 20,000 oz during palladium's price correction in mid-May, while platinum's holdings remained flat in the US fund, although eventually a period of profit-taking occurred as the price recovered. A quieter phase with few additions to the fund followed in the middle of the year, before a renewed wave of buying into the fund occurred from October onwards. Another period of heavy buying occurred in early December. The launch of two new ETF basket funds containing palladium by ETF Securities also added some demand, although holdings of palladium in these funds were relatively small.

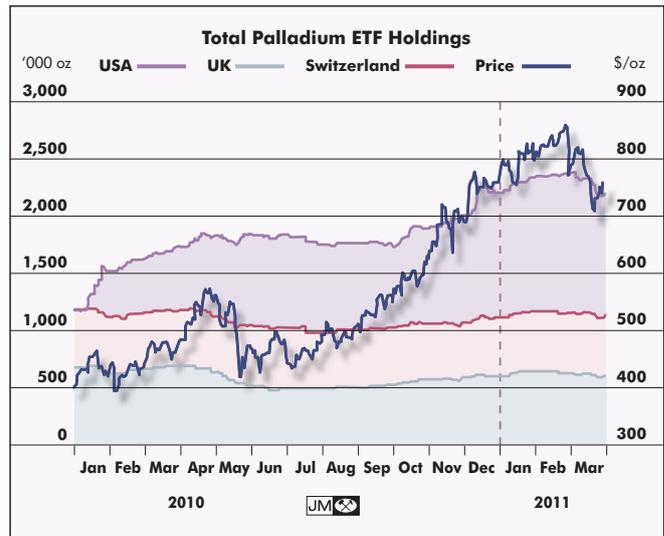
In the European ETFs, the overall trend was one of profit-taking, in contrast to the situation in 2009. Last year marked the third full year that the London and Swiss funds had been in operation. As investors looked to close positions in the higher price environment, net profit-taking took place, bringing our net European investment figure to minus 55,000 oz. Investors started to take profit before the price correction, and continued to do so after it; although the London fund showed investment during times of rising palladium prices and disinvestment during dips, liquidation in this fund was stronger than new investment. The Swiss ZKB fund saw steady profit-taking throughout the year with a net 61,000 oz of holdings being liquidated, not surprisingly since in the higher price environment of 2010 many investors would have been able to yield profit from positions bought the previous year. However, unlike in the London fund, there was steady investment during palladium's downward price correction in May.

In January 2010, a palladium ETF was launched by the Swiss bank Julius Baer. Although initial buying into this fund was high, it moderated towards the middle of the year, only to pick up in the final months, adding a total of 75,000 oz of demand by year-end. In 2010, Deutsche Bank also launched a palladium ETF, which saw some investment interest.

In July 2010, a new physically-backed palladium ETF,

Palladium Demand: Investment '000 oz			
	2008	2009	2010
Europe	370	525	(55)
Japan	0	0	10
North America	50	95	1,130
China	0	0	0
Rest of the World	0	5	0
Total	420	625	1,085

Palladium exchange traded funds proved popular with investors, supported by strong supply-demand fundamentals.



managed by Mitsubishi, together with ETFs in platinum, silver and gold was launched on the Tokyo stock exchange (TSE). This marked the first time a physical palladium investment vehicle achieved primary listing on the TSE, and was responsible for an additional 10,000 oz of palladium demand in 2010.

In terms of coin production, few palladium coins were produced in 2010, although consumer demand for those that were released was strong. The Royal Canadian Mint once again issued palladium Maple Leaf coins, albeit at a lower level than in 2009. The elevated palladium price in 2010 triggered healthy secondary market activity, reducing primary demand to around 25,000 oz. Production and sale of small palladium bars was minimal in 2010.

OTHER

Demand for palladium in all other applications increased by 15,000 oz to 85,000 oz in 2010 as the global economy improved. There was rising demand for palladium in pollution control devices for non-road engines, driven by forthcoming legislation, especially in Europe.

Palladium Demand: Other '000 oz			
	2008	2009	2010
Europe	20	20	25
Japan	10	10	10
North America	20	15	25
China	10	10	10
Rest of the World	15	15	15
Total	75	70	85

OTHER PLATINUM GROUP METALS

- Gross demand for rhodium increased by 22% last year to 873,000 oz. Supplies of rhodium declined slightly to 751,000 oz. Overall, the rhodium market tightened but remained in surplus by 114,000 oz.
- Recycling of rhodium rose by 26% to 236,000 oz in 2010.
- Net demand for ruthenium was 79% higher in 2010 at 1.03 million ounces.
- Net iridium demand strengthened from 81,000 oz in 2009 to 334,000 oz last year. The iridium market, like that of ruthenium, remained adequately supplied.

RHODIUM

The rhodium market tightened in 2010, although it remained in surplus by 114,000 oz. Global supplies of rhodium declined by 19,000 oz to 751,000 oz, mainly due to a build-up of pipeline stocks in South Africa. Gross demand for rhodium increased by 22% to 873,000 oz, led by a strong recovery in purchasing of rhodium by the automotive industry and an impressive performance by the glass and chemical sectors. Recycling of rhodium from spent autocatalysts totalled 236,000 oz last year, a rise of 26% compared with 2009.

Autocatalyst Demand

Gross purchasing of rhodium for use in autocatalysts strengthened by 105,000 oz to reach 724,000 oz in 2010 as vehicle production worldwide picked up compared with the depressed level of 2009.

Higher consumer and business confidence in many countries as the world economy recovered from recession drove production of vehicles, boosting rhodium purchases. The largest share of demand came from the light duty gasoline sector, where rhodium is used together with palladium, and to a lesser extent platinum, in three-way catalyst (TWC) formulations. However, continued thrifting of rhodium in autocatalysts, a knock-on effect from previous high prices, meant that automotive rhodium demand remained below the level of 2008 despite higher levels of vehicle production.

Gross demand for rhodium in autocatalysts was highest in Japan in 2010, with 204,000 oz of rhodium purchased for use in the light duty vehicle sector, compared with 164,000 oz in 2009. There was a strong increase in production for both the domestic and export markets as the world economy fared better than in 2009. North America accounted for 152,000 oz of demand for rhodium. This was mainly for gasoline vehicles, but there was also some demand in light duty diesel vehicles such as pick-up trucks and SUVs as production of these recovered in line with total automotive production.

Purchasing of rhodium for use in the Chinese autocatalyst sector increased to 141,000 oz in 2010. With strong sales of domestically-produced gasoline vehicles, rhodium demand continued to grow despite efforts to reduce rhodium content on cost grounds. Rhodium thrifting was most evident in the European market, where gross rhodium demand dropped slightly to 106,000 oz despite higher vehicle production than in the previous year. This was due to automakers using the enforcement of Euro 5 emissions standards, beginning in late 2009 for new models, as an opportunity to reduce rhodium content in gasoline autocatalyst formulations.

Other Demand

Demand for rhodium in other applications increased in 2010 in line with economic recovery, which lifted industrial purchasing. This was most marked in the glass sector, where purchases of rhodium rose by 200% to 57,000 oz. There was strong demand from the TFT-LCD and glass fibre manufacturing sectors as construction of new and replacement capacity took place. The large year-on-year rise, however, was partly a function of depressed demand in 2009 when closure of old facilities returned large amounts of rhodium to the market.

The chemical sector saw a substantial rise in rhodium demand, to 68,000 oz. Higher rates of capacity utilisation in chemical plants, as well as the construction of new oxo-alcohol manufacturing plants in Asia, helped lift demand.

Rhodium Demand by Application '000 oz			
	2008	2009	2010
Autocatalyst	768	619	724
Chemical	68	54	68
Electrical	3	3	4
Glass	34	19	57
Other	24	21	20
Total Gross Demand	897	716	873
Autocatalyst Recycling	(227)	(187)	(236)
Total Net Demand	670	529	637

Supplies

Supplies of rhodium fell by 19,000 oz in 2010 to 751,000 oz. Despite higher mine output in South Africa in late 2010, a build-up of pipeline metal stocks resulted in supplies falling by 3% to 642,000 in 2010. Production of rhodium in North America declined slightly but Zimbabwean rhodium output grew by 5,000 oz to 24,000 oz.

RUTHENIUM & IRIIDIUM

2010 saw a large increase in demand for both ruthenium and iridium due to technology changes, stock building in certain sectors and better economic conditions. Total ruthenium demand strengthened by 79% to 1.03 million ounces on the back of strong purchasing by the electrical and electrochemical sectors. Iridium demand increased more than fourfold during 2010, reaching 334,000 oz as purchases of iridium crucibles attained record levels.

Demand

The electrical sector remained the biggest demand area for **ruthenium**, and also the fastest-growing, in 2010. Electrical demand for ruthenium increased by 418,000 oz to 754,000 oz, mainly driven by purchasing from the hard disk drive sector, where it is used together with platinum in now-ubiquitous perpendicular magnetic recording (PMR) hard disk drives. Improved economic conditions led to a surge in sales of computer equipment to consumers and businesses. This in turn drove target and disk drive producers to raise production levels and build pipeline stocks of ruthenium. The hard disk drive sector in the first half of 2010 was therefore in one of its periodic upswings, where new demand for ruthenium greatly exceeded the amount of metal being recovered from the refining of old sputtering targets and associated scrap. The second half was a different story as full stock levels and higher prices, which had been driven by strong purchasing in the first half, led to a softening of demand. The second half of 2010 was therefore similar to the year 2009 when overall demand was limited by full stock levels and returns from recycling.

Ruthenium demand from the electrochemical sector rose by 39% in 2010 to 132,000 oz, mainly as a result of replacement of mercury-based chlor-alkali plants in China with higher-loading membrane cells, driven by environmental policies. New capacity for the production of chlorine and sodium hydroxide in this way added significant new demand in 2010. Ruthenium

Ruthenium Demand by Application

	'000 oz		
	2008	2009	2010
Chemical	139	89	100
Electrical	410	336	754
Electrochemical	95	95	132
Other	55	54	43
Total Demand	699	574	1,029

purchasing in the chemical sector also grew as plants were run at higher capacity to satisfy downstream demand, stimulating replacement of ruthenium catalysts and promoters.

Iridium demand increased more than fourfold, adding an extra 253,000 oz to reach 334,000 oz in 2010. Much of this came from the sudden and rapid expansion of demand for iridium crucibles by the electrical sector. The recent rise in purchasing of backlit LED televisions stimulated demand for single crystal sapphire, which is used as a substrate in LEDs. The use of iridium crucibles is amongst the various methods used to make sapphire crystal, therefore 2010 saw a surge in demand for iridium in this application.

The refitting of the Chinese chlor-alkali industry also generated extra demand for iridium in the electrode coating of membrane electrolytic cells. In addition, growth in the worldwide automotive sector last year led to higher demand for iridium in spark plugs.

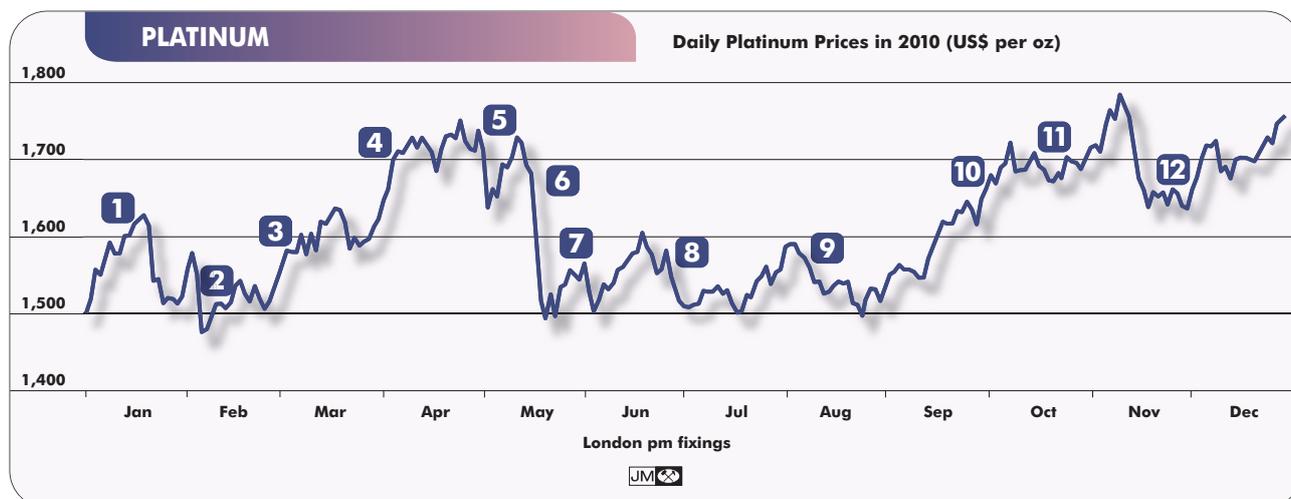
Supplies

Ruthenium demand exceeded supplies from mined output in 2010, however the shortfall was met from movement of above-ground stocks and some release of speculative holdings. Strong demand from the hard disk sector in the first half of the year helped drive up the average annual price by 107%, although the price remained well below the level seen in 2007 when the first wave of stock building in the hard disk drive sector took place. Supplies of iridium expanded, largely drawing down refined stocks, to meet new demand in 2010.

Iridium Demand by Application

	'000 oz		
	2008	2009	2010
Chemical	21	11	18
Electrical	15	7	194
Electrochemical	25	33	82
Other	41	30	40
Total Demand	102	81	334

PRICES



Supported by positive supply–demand fundamentals, platinum gained 17% in 2010 and the average annual price was an all-time record high in dollar terms. This followed a steadily rising price throughout 2009. The recovery of automotive and industrial demand in the early part of 2010, as well as demand for physically-backed platinum ETFs, saw prices return to over \$1,700 from an opening price of \$1,500; levels last seen in mid-2008. Concerns over European sovereign debt contributed to a substantial price correction across the commodities sector in mid-May, during which time platinum’s price lost all the gains it had made in the early part of the year. Platinum traded generally below \$1,600 for the subsequent four months, with periods of heavy physical buying emerging during price dips, which helped to somewhat cushion the fall. From September onwards, platinum’s price staged a remarkable recovery, reaching a year-high of \$1,786 in the fix of 9th November. This rally during the second half of the year was largely on the back of solid physical investment demand and general speculative fund buying, led by gold, across the precious metals complex.

1 Opening 2010 at \$1,500, and appreciating rapidly, platinum breached \$1,600 for the first time in eighteen months on 14th **January**. Platinum was to revisit this level for a number of sustained periods throughout the year. Heavy investment inflows into the new US-based platinum ETF suggested a good deal of latent demand, and investor confidence in platinum grew as the price strengthened. The launch of a second Swiss-based ETF also helped boost demand. After peaking at \$1,627 on the 20th, platinum trended downwards for the remainder of January as the dollar gained on the back of concern over fiscal tightening in China. Limits on bank proprietary trading announced by the US government also served to dent investor confidence, affecting precious metals.

2 After a brief fillip in early February as platinum tracked the rising gold price, a mounting sense of crisis over Greek sovereign debt saw investors flock to the perceived safety of the US dollar. In consequence, the platinum price briefly plunged to \$1,475 on 5th **February**, its low point for 2010, before recovering the \$1,500 level as Germany indicated fiscal support for ailing European economies. With limited physical demand from China during their New Year holiday, platinum was buffeted by a resilient dollar as the Federal Reserve tightened the US discount rate.

3 Early **March** saw the start of a price rally for platinum, which was to last until mid-May. A second rally was to take place between September and November. Underlying both of these rallies was robust industrial and automotive demand due to the global economy continuing to recover, albeit with some setbacks, a good deal of physically-backed and speculative investment demand, and a weak dollar. With a well-received

Average PGM Prices in \$ per oz			
	2009	2010	Change
Platinum	1,205	1,611	(34%)
Palladium	264	526	(99%)
Rhodium	1,592	2,458	(54%)
Ruthenium	95	197	(107%)
Iridium	425	642	(51%)

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

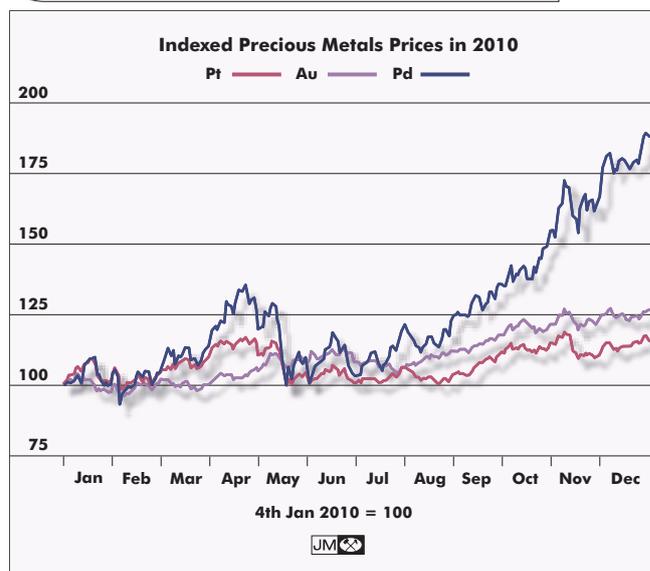
Greek eurobond offer and improved auto sales data, platinum broke through \$1,600 on 8th March then fluctuated around this level in response to variations in the US dollar, rather than supply–demand fundamentals. Physical demand emerged on the Shanghai Gold Exchange (SGE) during platinum’s dips beneath \$1,600. News of the failure of Lonmin’s No. 1 furnace, initially shrugged off by the market, reinforced negative sentiment about the South African supply side and provided a background for further price rises.

4 Rising through the \$1,700 level in early **April**, as part of a general rise across the commodity sector, platinum’s price initially followed that of gold. However, a noticeable disconnect emerged: gold resumed its ‘safe haven’ role as the Greek debt crisis and fears of its contagion unfolded. Platinum, on the other hand, faltered as the implications of the crisis for recovering industrial demand across Europe was factored into the price. Nonetheless, investors continued to pile into platinum, with total physically-backed ETF holdings exceeding 1 million ounces for the first time in mid-April. Platinum resumed its upwards trend on 19th April, peaking at \$1,752 on 26th April, its highest level since August 2008 and a level that would not be reached again until November.

5 Further fears of European debt contagion contributed to a stronger dollar, fragile stock markets and limited physical demand. This led investors to liquidate positions at the end of April and the price corrected sharply downwards into the first week of **May**, fixing at \$1,651 on the 7th. With plans by the European Union to support Greece and austerity measures being announced to aid Spain’s ailing economy, gold resumed its ‘safe haven’ status and this gave some support to the precious metals complex. However, a large degree of volatility remained in the market, with price swings of almost \$100 within just a few days.

6 The following week, the speculative bubble that had been building since March finally burst, prompted by the external shock of a German ban on ‘naked’ short selling of financial products and government bonds, which triggered a substantial market sell-off in both equities and commodities. Although by itself the German ban was a fairly minor event, the response to it reflected continuing nervousness surrounding the euro economies, particularly regarding sovereign debt. Platinum plunged from \$1,728 on 13th May to \$1,492 on the 21st, the most significant downward correction since July 2008. Despite the supply–demand fundamentals for platinum remaining

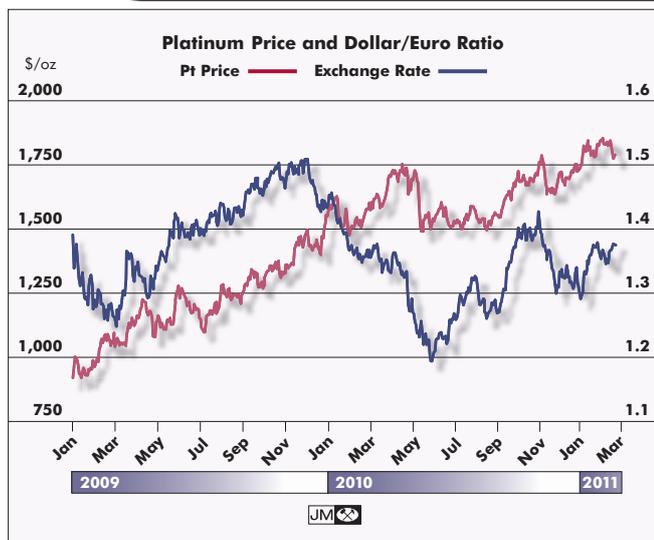
Overall, palladium’s price outperformed both that of gold and platinum during 2010.



strong, and signs of a recovering global economy helping to lift the demand outlook, the failure of investor confidence in mid-May affected the whole precious metals complex. Futures markets fell, with net long platinum positions on NYMEX reducing by a third between the 18th and 25th May. However, physically-backed ETF investments remained fairly sticky, with net platinum ETF holdings actually increasing by around 10,000 oz during the same period. This suggested that ETF investors were perhaps more confident of the underlying fundamentals for platinum and that those who had bought into funds earlier in the year were willing to weather temporary price corrections to make longer-term gains.

7 At the sub-\$1,500 level, physical demand re-emerged from China, enabling the platinum price to gain some ground. Platinum’s recovery was also boosted by news of another smelter run-out at Lonmin, raising South African supply-side concerns once more. A wage dispute at the South African utility Eskom, together with rumours of South African power supply restrictions during the imminent football World Cup helped boost platinum later in **June**, although these supply concerns ultimately turned out to be overstated. A modest rally was staged by platinum during June as heavy physical demand in Asia was augmented by positive reports of new car sales in emerging markets, particularly BRIC countries. Although a number of discouraging signs of faltering global economic growth emerged in June, such as poorer than expected US employment data and low UK business confidence, the rising gold price and the removal of the Chinese renminbi / US dollar peg helped boost platinum, which fixed at \$1,605 on the 21st.

The dollar strengthened in early 2010 as the European debt crisis took hold; this led to a correction in platinum's price in May. July to October saw a weakening of the dollar and a boost to platinum.



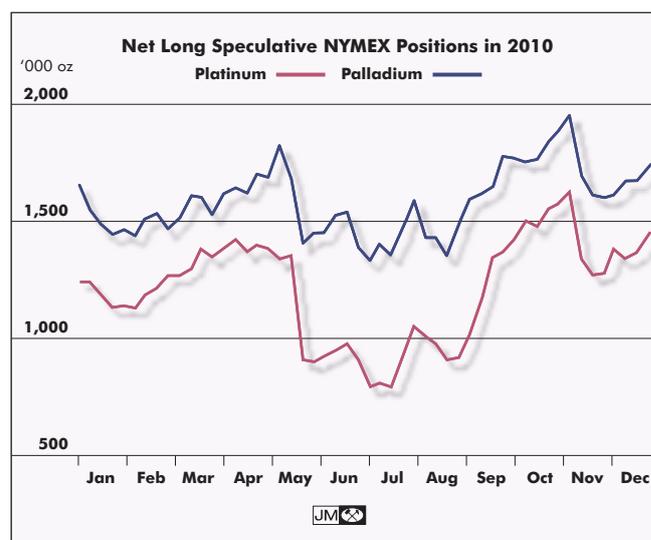
8 Platinum's price softened once again in late June as a lack of confidence in the strength of the global recovery undermined all commodity prices. The downward drift continued into early **July** as eurozone debt concerns persisted and US unemployment remained at stubbornly high levels, raising concerns about the strength of the economic recovery in key markets. An associated liquidation of speculative futures positions also added to the downward pressure. Reasonable physical demand from Asia helped to lift the price as July wore on; this was supported by concerns on the supply side. In particular, news of a production suspension at Aquarius's Marikana mine following a fatal accident and a wage dispute between Impala and the National Union of Mineworkers led to nervousness about supplies. This and thin trading conditions helped give a boost to the price in early **August**.

9 The threat of strike action in South Africa was insufficient to maintain upward momentum in the price during August. Amid light trading, platinum softened to \$1,494 on the 24th with news of wage settlements. Visiting the sub-\$1,500 level for the last time in 2010, platinum recovered well, driven by physical demand on the SGE, and embarked on its second rally of 2010. After its subdued August performance, platinum trended upwards, reaching \$1,550 by 2nd **September** as investors returned to the market after the August holiday. There was further mixed news from the automotive sector, with car production in Asia reportedly up but European car sales continuing to be sluggish. A strike at Northam Platinum helped keep the price fairly firm into mid-September even as the dollar regained some strength due to sovereign debt concerns in Europe. As the gold price reached nominal record highs in

mid-September, platinum pushed through \$1,600 on the 16th, and remained above this level for the rest of the year.

10 In **October**, platinum continued to gain ground, breaking through the \$1,700 level on the 7th for the first time in over four months. Signs that the Federal Open Market Committee would loosen monetary policy with a further round of quantitative easing put downward pressure on the dollar. Platinum regained some momentum but struggled to sustain the \$1,700 level. An interest rate rise in China on 20th October, designed to constrain domestic inflation, caused some turmoil in equity markets, but had a relatively minor effect on platinum, with the price returning to an upward trend the following day, and little discernible effect on either ETF investments or net long speculative positions. Although the Chinese interest rate rise, and consequent strengthening of the renminbi at the expense of the dollar, would nominally make imports of platinum into China cheaper, there remained some uncertainty over its effect on economic growth, and therefore on commodity demand.

As the US dollar continued to slide against a basket of currencies, concerns about a stronger rand and its negative impact on pgm producer earnings began to re-emerge. These concerns were seemingly justified when Aquarius Platinum reported it was closing its Number One shaft at the Marikana mine, citing the strengthening rand. Although this had the immediate effect of strengthening the platinum price, it further emphasised the knock-on effects of the rand basket price, and also the currently high levels of price and wage inflation for South African producers. In the last week of October, platinum flirted once again with the \$1,700 level, finally fixing at \$1,700 on the last trading day of October.

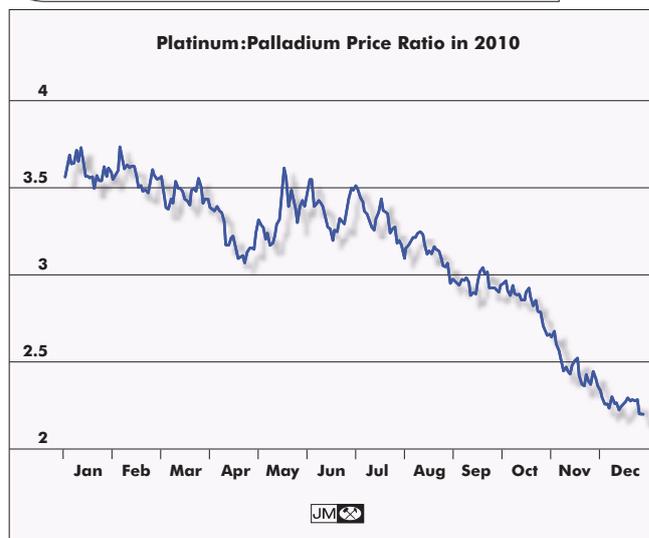


Net long speculative positions on NYMEX reached record levels for both platinum and palladium during 2010.

11 Platinum moved higher in early **November** as the Federal Reserve announced that it would pump \$600bn into the US economy by the end of June 2011. Although this second round of quantitative easing was widely anticipated, it did have the effect of depressing the dollar and raising commodity prices, particularly that of gold. The platinum price was also boosted by data showing increased US light truck sales, reported for October. Platinum reached its pinnacle of \$1,786 on 9th November, its highest level since 2008 and the high point of 2010. The steady march towards \$1,800 faltered as news emerged of the Chinese government's strategy to combat domestic inflation, which would ultimately mean raising interest rates further, thereby possibly slowing down consumption. Adding to the downward pressure was an announcement from the Chicago Mercantile Exchange that margins on precious metals would be raised, affecting platinum. Concerns over debt in peripheral eurozone economies also came to a head as it became clear that Ireland would seek emergency loans to save its stricken economy. The sovereign debt concerns that had lingered since the early part of 2010 came back in full force and platinum suffered its most severe downward correction since May, losing \$149 between 9th and 17th November.

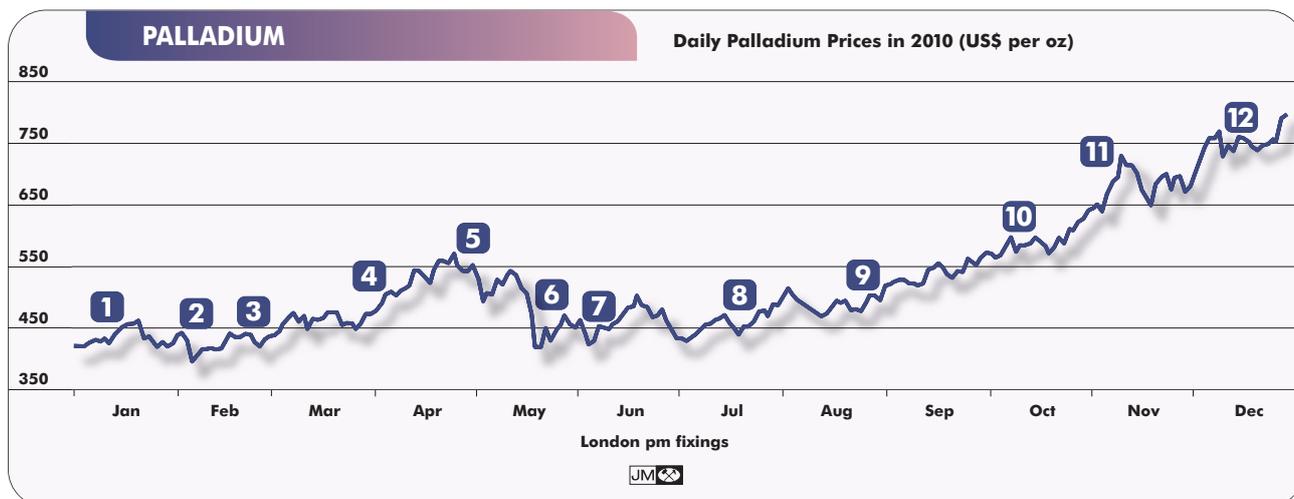
12 With platinum stuck around \$1,650 in late November, the breakthrough came in early **December** when continuing tension and the threat of conflict between North and South Korea helped push up precious metal prices. A generally well-received aid package for Ireland, as well as plans to establish a procedure for bailing out debt-laden European economies,

Although platinum performed well in 2010, the price differential with palladium narrowed.



helped lift market sentiment. With platinum touching \$1,724 on 7th December, the price again dipped beneath \$1,700 as disappointing news on the Japanese and European auto industries and a strengthening dollar affected pgm. This strengthening came partly as a result of further concerns over European economic recovery after an announcement by Moody's credit rating agency that Spain's debt may be downgraded and also an increase in unemployment in the UK. Platinum's price exceeded the \$1,700 level once again mid-month following heavy demand from Asia. Amid thin trading in the run-up to the holiday period, platinum fixed ever higher, on an upward trend led by gold. The year-end exuberance reached its zenith when platinum fixed at \$1,755 on 30th December.

Platinum Prices in 2010 London am and pm fixings, \$ per oz				Palladium Prices in 2010 London am and pm fixings, \$ per oz				Rhodium Prices in 2010 Johnson Matthey Base Prices, \$ per oz			
	High	Low	Average		High	Low	Average		High	Low	Average
January	1,641.00	1,496.00	1,563.28	January	462.00	418.00	434.16	January	2,775.00	2,450.00	2,673.75
February	1,586.00	1,475.00	1,520.68	February	446.00	387.00	424.98	February	2,575.00	2,375.00	2,500.00
March	1,645.00	1,548.00	1,599.74	March	479.00	437.00	461.33	March	2,575.00	2,425.00	2,530.22
April	1,752.00	1,659.00	1,716.53	April	571.00	489.00	533.50	April	2,975.00	2,600.00	2,847.50
May	1,731.00	1,492.00	1,626.37	May	543.00	416.00	489.66	May	2,850.00	2,675.00	2,770.24
June	1,605.00	1,495.00	1,552.84	June	502.00	421.00	461.84	June	2,675.00	2,425.00	2,488.64
July	1,560.00	1,499.00	1,526.18	July	491.00	429.00	455.90	July	2,500.00	2,150.00	2,357.95
August	1,590.00	1,494.00	1,541.11	August	514.00	465.00	488.17	August	2,225.00	2,125.00	2,152.27
September	1,662.00	1,528.00	1,591.56	September	573.00	508.00	538.69	September	2,350.00	2,125.00	2,195.45
October	1,723.00	1,661.00	1,688.61	October	640.00	565.00	591.74	October	2,300.00	2,250.00	2,279.76
November	1,786.00	1,636.00	1,694.51	November	730.00	638.00	683.07	November	2,475.00	2,275.00	2,342.05
December	1,760.00	1,673.00	1,709.88	December	797.00	707.00	754.01	December	2,450.00	2,300.00	2,355.68
Annual	1,786.00	1,475.00	1,610.94	Annual	797.00	387.00	526.42	Annual	2,975.00	2,125.00	2,457.79



Palladium was the star performer of the precious metals complex in 2010, almost doubling in price between its opening and closing fixes of the year and trading at levels last seen a decade ago. Palladium's average price in 2010 at \$526 was 99% higher than in 2009 and reflected robust supply-demand fundamentals, with resurgent demand from the recovering automotive sector, and a good deal of investment interest. The price averaged at its third highest ever level, beaten only in 2000 and 2001. Holdings of physically-backed ETFs and net long speculative positions, both of which reached record highs in 2010, helped provide further support to the price. As palladium followed the price of gold on an upward trend for much of the year, palladium's price appreciated relative to platinum, and it considerably outperformed its sister metal.

1 Palladium's price started the year at \$421 in the afternoon fix of 4th January, higher than the metal had traded at any time in 2009, and moved quickly upwards. Pent-up demand for the long-awaited US-based palladium ETF, launched in **January**, helped drive up the price in the opening days of 2010. Net investment inflows into the US palladium ETF were around 400,000 oz by 31st January and went on to reach 1.1 million ounces by year-end, bringing the cumulative amount of palladium in ETF investments to 2.2 million ounces. Upbeat news on car sales from US, German and Chinese manufacturers also helped provide some support to the price in January.

2 Concerns about sovereign debt in the eurozone, which were to become a persistent feature of 2010, became widespread in late January as the extent of Greece's structural debt problems was made clear. Similar problems were to

plague the euro in the months to come as the economies of Ireland, Spain and Portugal, as well as non-euro economies such as Hungary, underwent scrutiny. A common feature of these successive debt crises was a weakening of the euro and a consequent strengthening of the US dollar, which generally had the effect of softening commodity prices. This was evident in early February when, in the wake of Greece's structural reforms, the euro reached a seven-month low against the dollar and palladium tumbled to its lowest price of 2010, fixing at \$395 on 5th **February**.

3 With thin trading conditions around the Chinese New Year holiday in mid-February, palladium's price held up reasonably well. It continued to be influenced by fluctuations in the US dollar, rather than supply-demand fundamentals, throughout February and **March**. A tightening of the US Federal discount rate on 17th February provided some support to the dollar, and led to a consequent dip in palladium's price and that of commodities in general. The confident response to Greece's bond offer in early March and a weaker dollar lent some support to palladium, which reached a two-year high of \$475 on 8th **March**.

4 Palladium's price remained subdued throughout March, and additions to physically-backed ETFs slowed compared with the earlier part of the year. Towards the end of the month, comments that US interest rates would remain unchanged, together with a weakening of the dollar, helped precious metal commodities embark on the first of their two major rallies of 2010. This first rally was relatively short-lived and saw palladium gain \$123, or 27%, from 25th March to 26th **April**. The second, much longer rally saw palladium track gold on an upward trend between mid-July and mid-December and increase by

almost \$300, or 60%. In addition to speculative interest and a weaker dollar, supply concerns helped support the price of palladium during both March and April. The failure of Lonmin's No. 1 furnace on 30th March had persistent knock-on effects on the processing pipeline which were reflected in rising pgm prices.

5 Throughout April, palladium strengthened and generally outperformed platinum, reaching a thirteen-month high of \$571 on 26th April. Much of this was due to speculative investments as NYMEX palladium positions approached 1.7 million ounces. With promising fundamentals for both platinum and palladium as signs of automotive and industrial recovery became clearer, investors continued to see palladium as undervalued and bought into the rising price. After its peak on 26th, some profit-taking in funds occurred, leading palladium to retreat briefly below \$500. A weakening of the dollar saw palladium make some gains in the first two weeks of **May**, regaining the \$500 level and peaking again at \$543 on 13th May as increased Japanese auto sales were reported.

6 A precipitous drop in price was experienced in the week of 17th May as fragile confidence in the global economic recovery was replaced by a low-risk mentality exacerbated by proposals to restrict short selling in Germany. Amid a crisis of confidence in the European economic recovery, palladium lost 19% of its value between 17th and 21st May, but did not breach the \$400 'floor' established since February. Platinum, on the other hand, lost just 12% of its value during this seven-day price correction; however palladium had risen much more than platinum since the start of 2010. Interestingly, speculative futures positions proved to be more sticky for palladium: although there was a sell-off in the futures markets, positions on NYMEX only reduced by 17% between 18th and 25th May, half that for platinum. As with platinum, there was some net palladium ETF buying during the price correction.

7 Palladium made a modest recovery in late May and early **June**, but failed to regain the \$500 level. Palladium did not consistently trade above \$500 again until September. Some support for palladium's price came from industrial buyers, as well as a more confident outlook for the US economy – with improved new homes sales and car sales up 20% year-on-year. However, countering this optimistic sentiment was a stubbornly high level of US unemployment, warnings on the fragile state of Japan's economy from its new government, and continuing concerns about European economies such as Hungary.

8 **July** saw the start of the long trend upwards for palladium that was to continue for the remainder of the year. Announcements on increased car production in China and South America helped lift the price as did some solid physical demand. Although palladium ETF holdings reached a two-month low in July, the middle of the month saw a re-emergence of speculative investor interest which helped lift the price. At around this time, the palladium price began to outperform that of platinum in periods of rising prices, while palladium prices generally fell by more than platinum during dips. All this was against a backdrop of rising gold and other commodity prices, which mostly continued for the remainder of the year. The price ratio between platinum and palladium decreased from around 3.4 in July to around 2.3 in December. Although palladium got off to a good start in **August**, with investor interest pushing the price through the \$500 level for the first time in three months, the price suffered as downgraded Chinese car sales projections added to negative sentiment.

9 After a subdued performance throughout much of June, and some recovery in July and August, palladium regained the \$500 level on 1st **September** and remained on a rising trend throughout the month – gaining 16% compared with the close of August. The palladium price strengthened as increases in car sales were reported for Asian markets, primarily for gasoline cars, while both platinum and palladium made gains after a strike began at Northam Platinum. By the end of September, spot prices of palladium were reaching levels not seen for two and a half years. This reflected a great deal of speculative interest in palladium and perhaps some early pricing-in of possible future supply shortfalls from Russia.

10 A weak US dollar continued to give support to the commodities sector in general, and precious metals in particular, throughout **October**. Proposals from the US Federal Open Market Committee on the second round of quantitative easing saw the dollar weaken and commodities make gains mid-month. Later resurgence in the US dollar did not appear to affect palladium in the same way as it did gold and platinum – palladium continued to experience a high level of demand, while concerns over Russian supplies caught the attention of speculative investors. Even as gold reached nominal record highs, palladium continued to outperform the other precious metals, reaching new nine-year highs and testing the \$600 level. The launch of a precious metals basket ETF (GLTR) in October, comprising physically-backed gold, silver, platinum and palladium in a single vehicle, helped boost market

sentiment for investment, although it had a relatively small impact on net new palladium or platinum demand between its launch and the end of 2010. Despite Northam Platinum returning to work in October following a strike, longer-term supply concerns and concerns over escalating wage inflation had the effect of raising palladium's price. A statement from Norilsk Nickel, the world's largest supplier of palladium, that Russian state stocks of the metal would likely 'be finished' next year appeared to lend support to the metal as supply shortages became widely anticipated. The Chinese interest rate rise was largely shrugged off by palladium and the price consolidated its upward move towards the end of the month as the NYMEX net long position reached near-record levels of 1.8 million ounces with fund purchasing dominating the market.

11 Fresh nine-year highs above \$700 were seen in the second week of **November** and, although platinum also reached new highs, palladium continued to outperform its sister metal in relative terms amid rapidly rising prices for precious metal commodities. Chinese inflation and eurozone sovereign debt concerns contributed to a fall in palladium's price after its high of \$730 on the 9th. The general flight from risk in the commodities sector sent palladium into a steep decline around the 11th and 12th as news of Ireland's sovereign debt crisis reached markets. The prevailing negative sentiment in the market helped drag palladium down, even as supply-demand fundamentals remained strong, although there was some profit-taking in speculative positions.

12 Palladium continued to outperform platinum throughout **December**, supported by good year-on-year production data from the auto sector and investor interest. Like platinum, palladium had a solid start to December, reaching \$769 on the 7th before consolidating at around \$750. Driving palladium's price was eurozone uncertainty and continuing interest in palladium ETF investments, boosted by the launch of another ETF, the White Metals ETF (WITE), consisting of physically-backed fixed weights of silver, platinum and palladium. As with the GLTR ETF, the launch generated some positive sentiment, but the overall effect on investment demand was limited, with GLTR and WITE collectively responsible for just 5% of the increase in palladium ETF demand between their launches and year-end. As the Christmas holiday approached, palladium experienced some of the year-end exuberance seen across the wider commodities sector as it tested the \$800 level, reaching prices not seen since 2001. Palladium finally ended 2010 at \$797 – up \$376, or 89% in dollar terms.

OTHER PGM

Rhodium prices softened overall during 2010, from an opening Johnson Matthey base price of \$2,550 in January to \$2,425 by the end of December. Highs of \$2,975 were experienced along the way – levels last seen in 2008. Rhodium was not set below \$2,125 during 2010 and, on average, traded some 54% higher in 2010 than in 2009, reflecting a robust recovery in demand from the automotive and glass sectors.

Continuing its upward trend from late 2009, rhodium strengthened into **January**, reaching \$2,775 by the 18th. Thereafter, with offers dominating the market, the price slid, reaching \$2,450 at the start of **February**. After benefiting from the rising gold price in early February, negative sentiment surrounding eurozone debt caused commodity prices to soften, with rhodium falling to \$2,375 on the 9th. With physical demand re-emerging at this level, the price was lifted to \$2,575 on the 24th, where it remained until 5th **March**.

The price drifted once again in March, picking up only towards the end of the month. With modest buying demand and an upward trend across the precious metals complex, the price pushed towards \$2,600, a level which was finally reached on 1st **April**. Rhodium moved higher throughout April, gaining more than \$300 in the month, to reach its high for the year of \$2,975 on the 16th. Driving this price rise was strong industrial demand, as well as some speculative fund buying. Despite increased automotive sales, supply concerns and a buoyant commodities sector, rhodium failed to break through the \$3,000 level. The rhodium price drifted downwards during **May**, but did not suffer the major price correction seen for platinum and palladium – illustrating the relative lack of liquidity of rhodium and its absence from most investment portfolios.

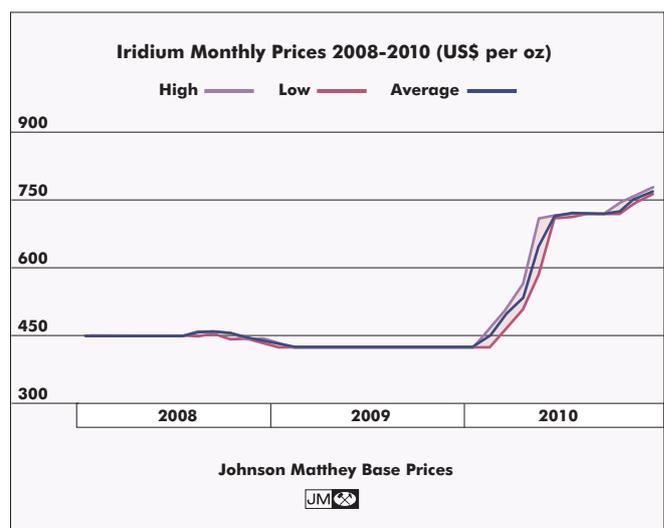
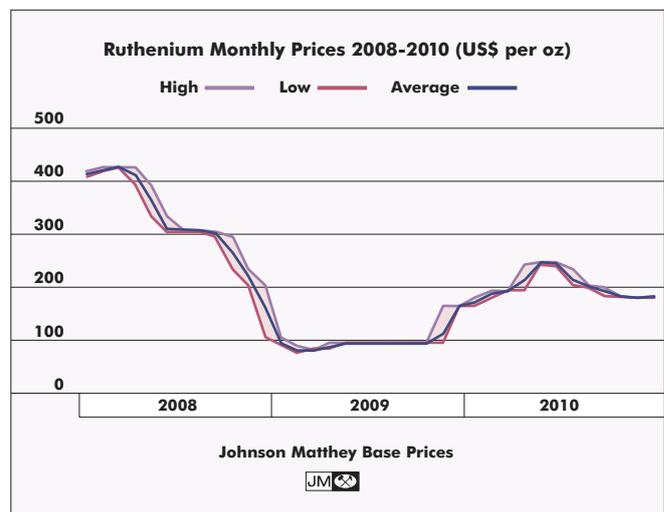
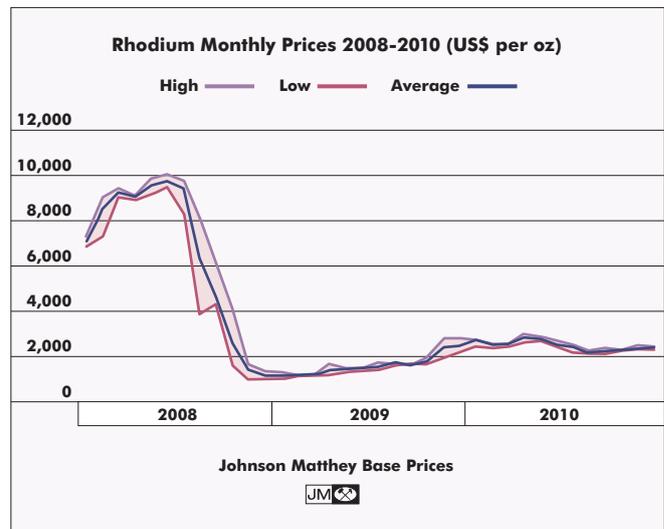
Light selling continued into **June**, bringing the price back to \$2,425 by the 11th. However, there was no large-scale liquidation and the price recovered to \$2,500 by month-end as demand from Asia picked up. The price declined again in **July** with sustained selling pressure and a lack of buying interest. This continued in thin trading during **August** where, under downward pressure on commodities, rhodium reached its low for 2010 of \$2,125 on 13th August and was becalmed at that level until 20th **September**. Rhodium then regained some lost ground in September with solid Asian demand emerging, although it struggled to push beyond \$2,300.

Although platinum and palladium were both buoyant in **October**, the rhodium price fell on the 7th to \$2,250, but Asian industrial demand prevented further sliding, and the price

picked up to \$2,300 in the second half of the month, only to lose \$25 by month-end. The rhodium market was quiet in the early days of **November**; the price was initially unchanged at the JM Base Price of \$2,275, but rose on the back of industrial demand and the general positive sentiment that affected the precious metal complex in the first half of that month. The price then rose steeply with news of increased Chinese car sales. An increase in offers put rhodium under some further pressure in the remainder of the month; however, a move downwards helped stimulate buying in Asia, which was balanced by selling in Europe and helped keep prices fairly stable. Rhodium benefited from renewed buying interest from the Far East in **December** with good two-way business in Europe and Asia and upbeat sentiment in the precious metal commodities sector as a whole, leading rhodium to end the year at \$2,425, down \$125 in the year.

Ruthenium started **January** at the Johnson Matthey Base Price of \$160, which was to be the low for the year, unchanged since November 2009. Purchases by the electronics sector helped lift the price through January and into **February**. Despite solid demand from the electronics sector, ruthenium remained at \$190 throughout **March** and until early **April** when the price pushed through \$200 and reached the high for the year of \$245 on 11th **May** with strong physical demand. The price remained at this level until 9th **June**, when it eased in \$5 increments to begin **August** at \$200. In the quiet trading conditions of August and into **September**, demand scaled back and ruthenium fell still further, going into **October** at \$180. As solid industrial demand slid further, ruthenium spent **November** at \$175, before gaining \$5 to end **December** at \$180.

Iridium performed well during 2010, starting the year at the Johnson Matthey Base Price of \$425 and ending it at \$780 as buying demand from the electrochemical and electronics sector drove the price to a 30-year high. The price movements in **February** through to **June**, the first for many months, reflected strong purchasing by the Chinese chlor-alkali industry as old technology was replaced, as well as by manufacturers of iridium crucibles used in the production of LEDs. Iridium crucible manufacture expanded suddenly and rapidly during 2010, driving up demand. The small size of the iridium market helped amplify movements in the price as industrial buyers built their stocks of working metal in response to technology changes. While industrial demand was very strong, there was very little speculative investment in iridium. The price reached a plateau between **July** and **October**, with relatively subdued demand becalming the price at \$720. Demand picked up again towards the end of the year, raising the price to \$780.



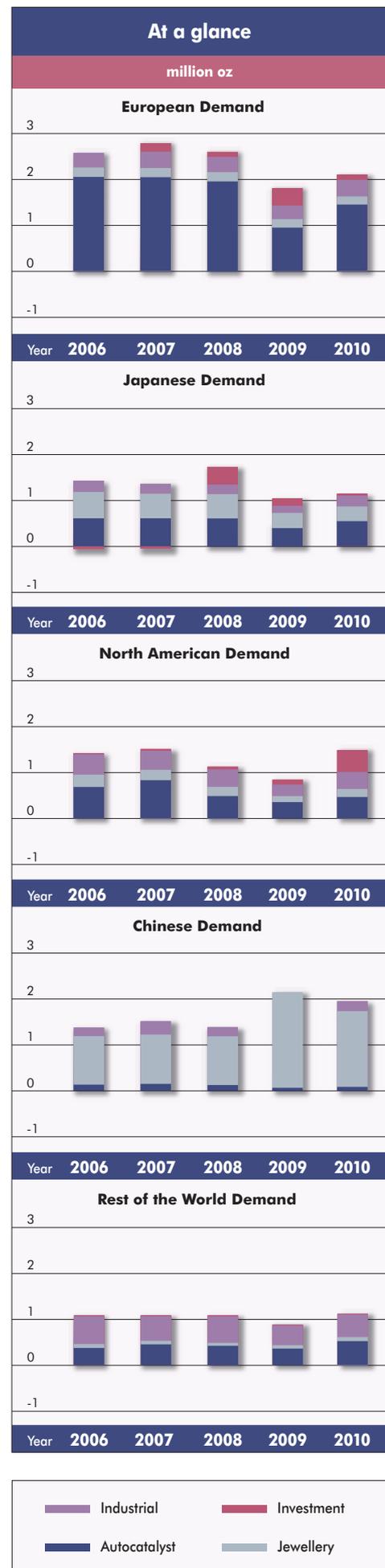
SUPPLY AND DEMAND TABLES

Platinum Supply and Demand							
		'000 oz	2006	2007	2008	2009	2010
Supply	South Africa		5,295	5,070	4,515	4,635	4,635
	Russia ²		920	915	805	785	825
	North America		345	325	325	260	210
	Zimbabwe ³		165	170	180	230	280
	Others ³		105	120	115	115	110
Total Supply			6,830	6,600	5,940	6,025	6,060
Gross Demand by Application⁴	Autocatalyst ⁴		3,905	4,145	3,655	2,185	3,125
	Chemical		395	420	400	290	445
	Electrical ⁴		360	255	230	190	220
	Glass		405	470	315	10	345
	Investment		(40)	170	555	660	650
	Jewellery ⁴		2,195	2,110	2,060	2,810	2,415
	Medical & Biomedical ⁵		250	230	245	250	255
	Petroleum		180	205	240	210	170
	Other ⁵		240	265	290	190	255
	Total Gross Demand			7,890	8,270	7,990	6,795
Recycling⁶	Autocatalyst		(860)	(935)	(1,130)	(830)	(1,085)
	Electrical		0	0	(5)	(10)	(10)
	Jewellery		(555)	(655)	(695)	(565)	(745)
Total Recycling			(1,415)	(1,590)	(1,830)	(1,405)	(1,840)
Total Net Demand⁷			6,475	6,680	6,160	5,390	6,040
Movements in Stocks⁸			355	(80)	(220)	635	20

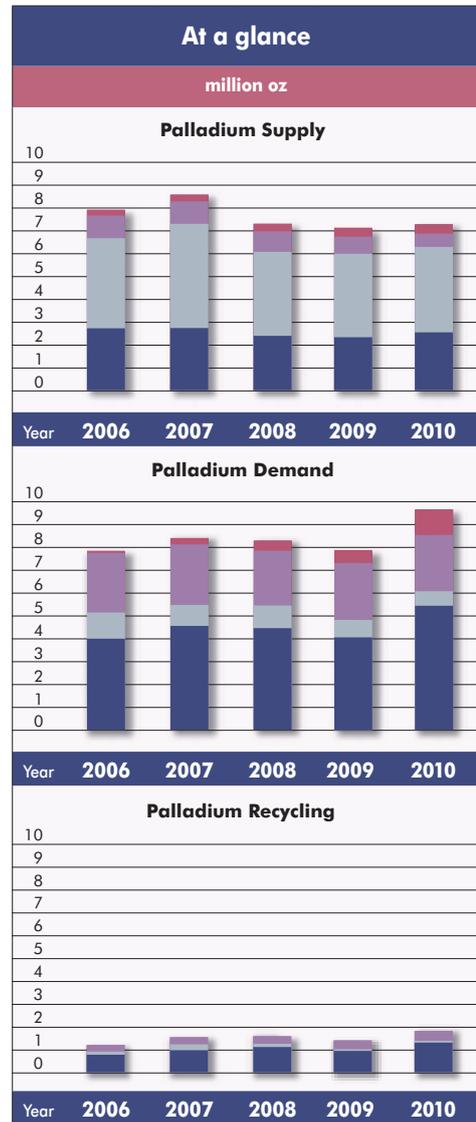


Average Price (US\$ per oz) ⁹				
2006	2007	2008	2009	2010
1,143	1,304	1,576	1,205	1,611

Gross Platinum Demand by Region							
		'000 oz	2006	2007	2008	2009	2010
Europe	Autocatalyst		2,060	2,055	1,970	970	1,465
	Chemical		100	110	105	70	110
	Electrical		25	15	20	20	15
	Glass		10	15	(25)	5	10
	Investment		0	195	105	385	120
	Jewellery		200	200	205	185	175
	Medical & Biomedical		110	110	115	115	115
	Petroleum		20	25	30	25	20
	Other		65	75	85	55	80
	Total		2,590	2,800	2,610	1,830	2,110
Japan	Autocatalyst		605	610	610	395	545
	Chemical		50	55	55	45	50
	Electrical		55	35	35	30	30
	Glass		100	85	65	40	105
	Investment		(65)	(60)	385	160	45
	Jewellery		585	540	530	335	325
	Medical & Biomedical		20	15	20	20	20
	Petroleum		5	5	10	10	5
	Other		20	30	25	15	30
	Total		1,375	1,315	1,735	1,050	1,155
North America	Autocatalyst		705	850	505	370	485
	Chemical		100	95	95	65	100
	Electrical		75	55	30	25	25
	Glass		10	25	(5)	(35)	10
	Investment		20	30	60	105	480
	Jewellery		270	225	200	135	175
	Medical & Biomedical		105	80	85	90	90
	Petroleum		35	30	25	15	25
	Other		120	135	150	90	115
	Total		1,440	1,525	1,145	860	1,505
China	Autocatalyst		155	175	145	85	105
	Chemical		65	70	60	40	80
	Electrical		45	20	30	20	25
	Glass		50	180	85	(90)	90
	Investment		0	0	0	0	0
	Jewellery		1,060	1,070	1,060	2,080	1,650
	Medical & Biomedical		0	10	10	10	10
	Petroleum		10	10	10	10	15
	Other		10	5	10	10	10
	Total		1,395	1,540	1,410	2,165	1,985
Rest of the World	Autocatalyst		380	455	425	365	525
	Chemical		80	90	85	70	105
	Electrical		160	130	115	95	125
	Glass		235	165	195	90	130
	Investment		5	5	5	10	5
	Jewellery		80	75	65	75	90
	Medical & Biomedical		15	15	15	15	20
	Petroleum		110	135	165	150	105
	Other		25	20	20	20	20
	Total		1,090	1,090	1,090	890	1,125
Total Gross Demand		7,890	8,270	7,990	6,795	7,880	

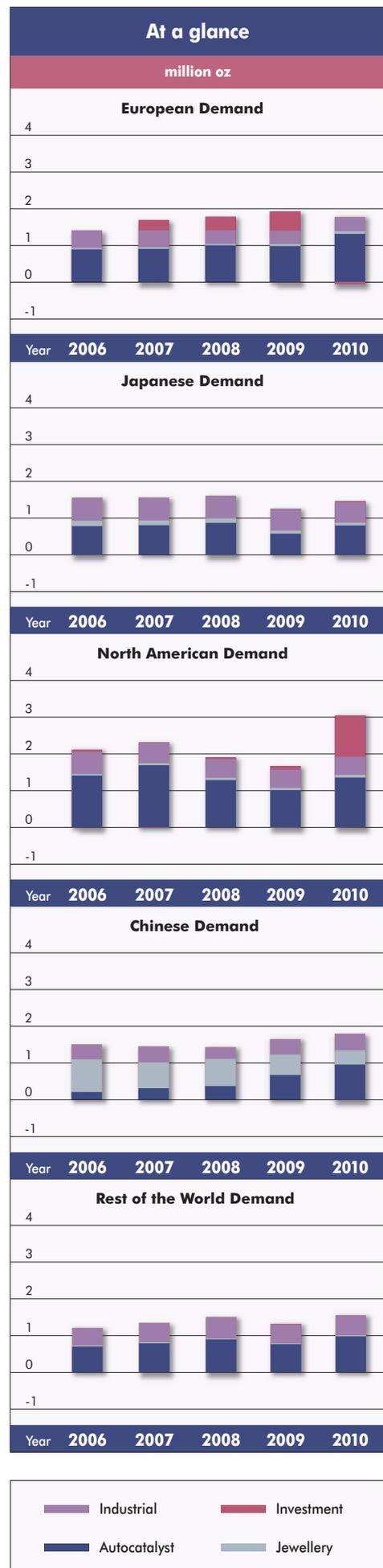


Palladium Supply and Demand							
		'000 oz	2006	2007	2008	2009	2010
Supply ¹	South Africa		2,775	2,765	2,430	2,370	2,575
	Russia ²						
	Primary		3,220	3,050	2,700	2,675	2,720
	Stock Sales		700	1,490	960	960	1,000
	North America		985	990	910	755	590
	Zimbabwe ³		135	135	140	180	220
	Others ³		135	150	170	160	185
	Total Supply		7,950	8,580	7,310	7,100	7,290
Gross Demand by Application ⁴	Autocatalyst ⁴		4,015	4,545	4,465	4,050	5,450
	Chemical		440	375	350	325	395
	Dental		620	630	625	635	580
	Electrical ⁴		1,495	1,550	1,370	1,370	1,410
	Investment		50	260	420	625	1,085
	Jewellery ⁴		1,140	950	985	775	620
	Other		85	85	75	70	85
	Total Gross Demand		7,845	8,395	8,290	7,850	9,625
Recycling ⁶	Autocatalyst		(805)	(1,015)	(1,140)	(965)	(1,325)
	Electrical		(290)	(315)	(345)	(395)	(440)
	Jewellery		(135)	(235)	(130)	(70)	(80)
	Total Recycling		(1,230)	(1,565)	(1,615)	(1,430)	(1,845)
Total Net Demand⁷		6,615	6,830	6,675	6,420	7,780	
Movements in Stocks⁸		1,335	1,750	635	680	(490)	

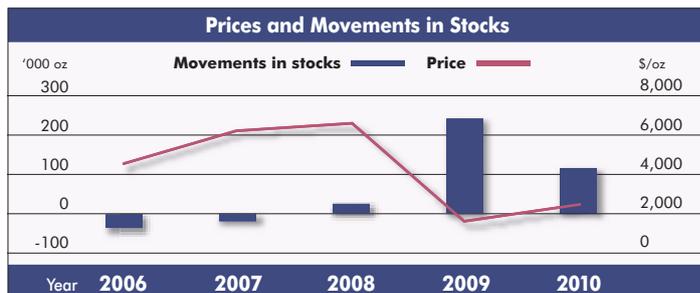
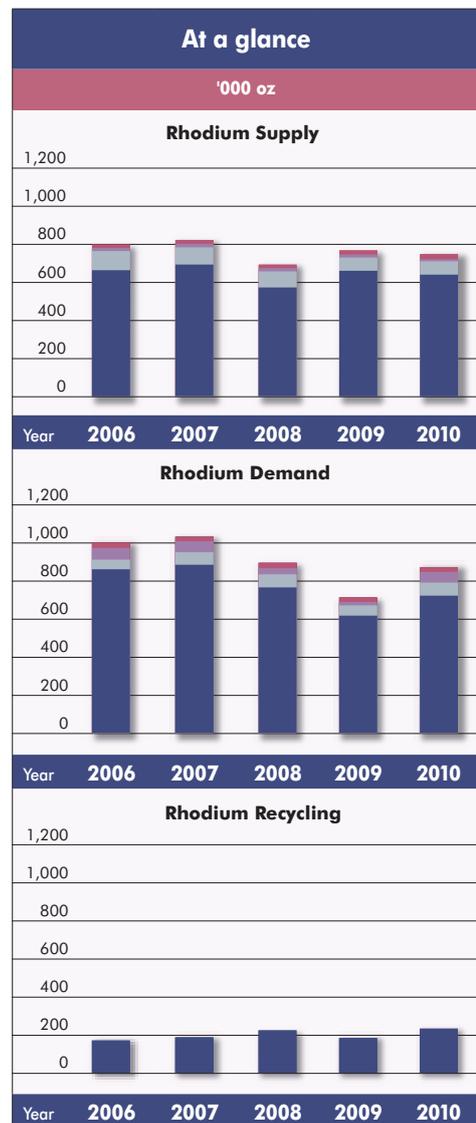


Average Price (US\$ per oz) ⁹				
2006	2007	2008	2009	2010
320	355	352	264	526

Gross Palladium Demand by Region							
		'000 oz	2006	2007	2008	2009	2010
Europe	Autocatalyst		890	920	1,005	995	1,325
	Chemical		175	95	100	85	105
	Dental		75	70	65	65	65
	Electrical		210	280	190	195	195
	Investment		0	280	370	525	(55)
	Jewellery		40	40	45	50	70
	Other		25	20	20	20	25
	Total		1,415	1,705	1,795	1,935	1,730
Japan	Autocatalyst		795	820	885	590	815
	Chemical		25	25	20	20	20
	Dental		270	275	275	295	250
	Electrical		330	325	320	270	295
	Investment		0	0	0	0	10
	Jewellery		145	125	115	80	75
	Other		10	10	10	10	10
	Total		1,575	1,580	1,625	1,265	1,475
North America	Autocatalyst		1,415	1,695	1,290	1,020	1,360
	Chemical		80	75	55	50	65
	Dental		260	265	270	260	250
	Electrical		240	195	170	170	160
	Investment		50	(20)	50	95	1,130
	Jewellery		40	55	60	60	65
	Other		30	30	20	15	25
	Total		2,115	2,295	1,915	1,670	3,055
China	Autocatalyst		220	325	390	685	975
	Chemical		65	80	55	75	90
	Dental		5	5	0	0	0
	Electrical		330	340	255	335	360
	Investment		0	0	0	0	0
	Jewellery		890	705	740	560	380
	Other		10	10	10	10	10
	Total		1,520	1,465	1,450	1,665	1,815
Rest of the World	Autocatalyst		695	785	895	760	975
	Chemical		95	100	120	95	115
	Dental		10	15	15	15	15
	Electrical		385	410	435	400	400
	Investment		0	0	0	5	0
	Jewellery		25	25	25	25	30
	Other		10	15	15	15	15
	Total		1,220	1,350	1,505	1,315	1,550
Total Gross Demand		7,845	8,395	8,290	7,850	9,625	

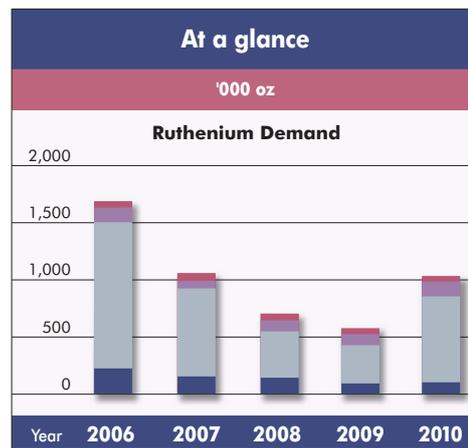


Rhodium Supply and Demand							
		'000 oz	2006	2007	2008	2009	2010
Supply ¹	South Africa		666	696	574	663	642
	Russia ²		100	90	85	70	70
	North America		17	20	18	15	12
	Zimbabwe ³		14	14	15	19	24
	Others ³		5	4	3	3	3
Total Supply			802	824	695	770	751
Gross Demand by Application ⁴	Autocatalyst ⁴		863	887	768	619	724
	Chemical		49	63	68	54	68
	Electrical ⁴		9	3	3	3	4
	Glass		65	59	34	19	57
	Other		23	24	24	21	20
Total Gross Demand			1,009	1,036	897	716	873
Recycling ⁶	Autocatalyst		(171)	(192)	(227)	(187)	(236)
	Total Recycling		(171)	(192)	(227)	(187)	(236)
Total Net Demand⁷			838	844	670	529	637
Movements in Stocks⁸			(36)	(20)	25	241	114



Average Price (US\$ per oz) ⁹				
2006	2007	2008	2009	2010
4,552	6,191	6,564	1,592	2,458

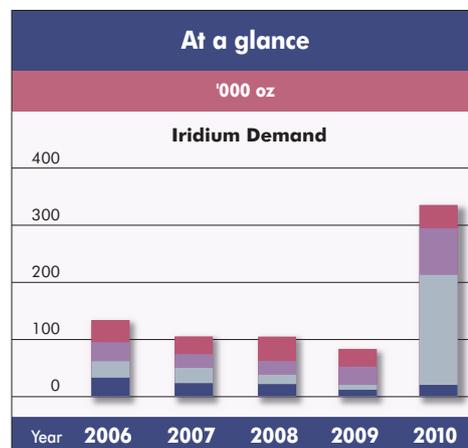
Ruthenium Demand		'000 oz				
		2006	2007	2008	2009	2010
Demand by Application	Chemical	223	151	139	89	100
	Electrical	1,272	776	410	336	754
	Electrochemical	137	62	95	95	132
	Other	54	69	55	54	43
Total Demand		1,686	1,058	699	574	1,029



Average Price (US\$ per oz)⁹

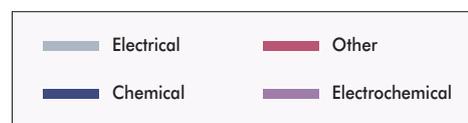
2006	2007	2008	2009	2010
192	580	323	95	197

Iridium Demand		'000 oz				
		2006	2007	2008	2009	2010
Demand by Application	Chemical	33	23	21	11	18
	Electrical	28	25	15	7	194
	Electrochemical	34	24	25	33	82
	Other	36	32	41	30	40
Total Demand		131	104	102	81	334



Average Price (US\$ per oz)⁹

2006	2007	2008	2009	2010
350	447	450	425	642



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.

²From 2006 onwards, **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 from 2006 onwards. **Russian supply** figures for palladium have been split into sales from primary mining and sales of stocks.

³Supplies from **Zimbabwe** have been split from **Others' supplies** throughout the 2006-2010 period. 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.

⁵Our **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. Average price figures for rhodium, ruthenium and iridium are based on Johnson Matthey European Base Prices.

GLOSSARY

BEE	Black Economic Empowerment	PET	PolyEthylene Terephthalate
CHP	Combined Heat and Power	pgm	Platinum Group Metal(s)
CIS	Commonwealth of Independent States	Platreef	A platiniferous ore body in South Africa
CO	Carbon Monoxide	PM	Particulate Matter
CO ₂	Carbon Dioxide	PMR	Perpendicular Magnetic Recording
CRT	Cathode Ray Tube	ppm	Parts Per Million
CSF	Catalysed Soot Filter	ppt	Parts Per Thousand
DMFC	Direct Methanol Fuel Cell	PTA	Purified Terephthalic Acid
DOC	Diesel Oxidation Catalyst	SCR	Selective Catalytic Reduction
DPF	Diesel Particulate Filter	SUV	Sports Utility Vehicle
ETF	Exchange Traded Fund	TFT	Thin Film Transistor
g	Gram	TOCOM	Tokyo Commodity Exchange
HDD	Heavy Duty Diesel	ton	Short ton (2,000 pounds or 907 kg)
JV	Joint Venture	tonne	1,000 kg
kg	Kilograms	TWC	Three-Way Catalyst
LCD	Liquid Crystal Display	UG2	A platiniferous ore body in South Africa
LED	Light Emitting Diode	VAM	Vinyl Acetate Monomer
LPG	Liquefied Petroleum Gas		
Merensky	A platiniferous ore body in South Africa		
MLCC	Multi-Layer Ceramic Capacitor		
NO _x	Oxides of nitrogen		
NYMEX	New York Mercantile Exchange		
OBD	On-Board Diagnostics		
OTC	Over the Counter		
oz	Ounces troy		
PEMFC	Proton Exchange Membrane Fuel Cell		

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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PGM coated stirring rods, front cover, p2 and p33
Non-road emissions control, front cover and p39
Autocatalyst scrap, inside cover and p3
Autocatalyst in production, p2 and p28
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