

Thintri, Inc. announces the release of **Platinum Group Metals: Issues and Opportunities**, a new market study that surveys current market conditions in platinum group metals (PGMs), and analyzes emerging demand, supply constraints and price volatility. The report also explores opportunities generated by new techniques of PGM recovery from previously-unused resources, and opportunities created by development of new, much less costly substitutes.

The report separates hype from reality and assesses the dramatically changing landscape facing PGM users and suppliers. Forecasts are supplied for demand and prices under current conditions going out to 2020, as well as an analysis of the effects of new technologies for PGM replacement and recovery.



Thintri Inc.

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Contents

Background on PGMs

Sourcing and Suppliers

Applications

- Automotive and Transportation
- Electronics/Electrical
- Medical/Dental
- Industrial and Scientific
- Jewelry, Investment and Coinage

The Supply Side

- "Peak Metals"
- Supply Threats
- Response to Shortages
- Political Issues
- Long-Term Solutions

The Demand Side

- The Automotive Demand Driver

- The Jewelry and Investment Demand Drivers
- The Petroleum Demand Driver
- Industrial Demand Drivers
- Medical/Biomedical/Dental Demand Drivers
- Other Demand Drivers
- PGM Demand by element
 - Platinum
 - Palladium
 - Rhodium
 - Iridium
 - Ruthenium
 - Osmium
- Effects of Alternative Energy Schemes

Price Trends

PGM Replacement

- Precious Metals and Reduced-PGM

- PGM-Free and Reduced PGM Autocatalysts
- Alternatives Based on Conventional Chemistry
- Alternatives Based on Nanotechnology
- Electrolysis Catalyst Alternatives
- Impact of Alternatives on PGM Demand and Price

Scrap and Recovery

- Improved Recycling Schemes
- Slag and Mine Waste

Background on Platinum Group Metals

Platinum group metals (PGMs), namely platinum, palladium, rhodium, iridium, ruthenium and osmium, are rare, expensive and critical to today's economy. Up to now, there have been no other materials that can duplicate their performance in fundamental applications. Those applications include autocatalysts, the critical components in the catalytic converters found in most vehicles that reduce harmful emission; catalysts used in a broad range of industrial processes, including petroleum refining; high-temperature processing of abrasive materials such as glass; disc drives and electronic components; medical and dental implants and devices; and electrochemistry. Of course, PGMs are also highly prized in jewelry and investment.

Prices of PGMs are high and notoriously volatile. Rhodium, for example, went from slightly over \$6,000 per ounce in mid-2007, to \$10,000 per ounce in mid-2008 and then crashed to a little above \$1,000 before the end of that year. While this degree of fluctuation is exceptional, it's emblematic of the behavior of critical materials in limited supply, tied to broader economic forces like auto sales.

At this time, the limits of supply are becoming clear. Like most natural resources, PGM supplies are inherently limited. Concerns about "peak metals," the idea that availability has peaked for limited resources and future production will be reduced and/or more costly (which has already occurred for a number of important minerals), will soon be an important influence with PGMs. Already, Russia, the largest palladium producer, has announced that its supplies of palladium are dwindling.

Tightening of supplies comes at a time of accelerating demand. Growth of auto sales and industrialization in the developing world, particularly Brazil, Russia, India and China (the BRIC countries), as well as interest in PGM jewelry and investment by newly prosperous populations, will place significant stress on available supplies. In addition, tightening environmental restrictions are forcing the use of more PGMs per vehicle to meet emissions rules. Also, building of new oil refineries and industrial growth in a recovering economy will put further stress on supplies. Other demand drivers like medical and petroleum, which are functions of aging populations and global economic shifts, will place stress on PGM supplies as well. Analyses indicate that presently-known platinum reserves are sufficient for another 360 years at present rates of production and

consumption. However, that estimate drops to 15 years if growing demand, particularly from growing industrialization and automobile sales in the developing world, is taken into account.

With demand growth, inelasticity of supply will force up prices in this decade dramatically.

The response to scarcity will no doubt include reduction in PGM consumption through "thrifting," i.e. the devising of ways to use less PGMs in established applications (which has been underway for decades). Also, rising prices will mean that deposits with lower PGM content such as those in Australia, which had been too costly to exploit in the past, will now be profitably mined, to some degree mitigating that price increase.

The most significant consequences, however, will be the development of high performance, low cost alternatives, and in improved recycling and recovery. Alternatives are sometimes as simple as substituting a less expensive PGM, such as palladium, for a more expensive one, such as platinum. The more significant alternatives use nanotechnology with inexpensive materials such as nickel, to fine tune the properties of nanoparticles by controlling parameters such as diameter. Inexpensive nanomaterials can substitute for PGMs in some of the most important markets, such as catalysts in the automotive and industrial markets. PGM usage in some applications, such as jewelry and electronics, is relatively immune from substitution, but most applications are vulnerable.

Recycling will become more important as PGM prices rise. Newly available technologies are able to dramatically improve the amount of PGMs that can be captured from recycled products such as catalytic converters.

Other recently developed processes are able to extract significant quantities of PGMs from mine waste that contains much higher PGM concentrations than the best quality ores. Mountains of slag and mine waste in North America and worldwide contain enough PGMs to significantly impact the supply/demand/price picture for PGMs once exploited.

Alternatives that can capture markets directly from PGMs, and new technologies that can dramatically improve PGM recovery from recycled materials and mine waste, are already commercially available or very near commercialization and will exert a growing influence on markets now owned by PGMs and PGM prices and availability.

The confluence of growing demand, limited and/or dwindling supplies, and growing availability of alternatives and new supplies will likely create a period of extraordinary volatility before things stabilize. Most of this decade will witness the transition of established PGM markets as prices rise and users adjust to new conditions, while others take advantage of the new opportunities presented.

Understand the Opportunities

Platinum group metals are at an extraordinary intersection of market forces. Their rarity and expense has largely confined them to a limited set of markets. Those markets, in turn, are largely dependent on PGMs simply because there have been no viable, and cheaper, alternatives. The inelasticity of supply has led to occasionally extreme volatility in the past. Today, growing demand, fueled by a range of factors that include accelerating motor vehicle sales around the world, a rising industrial sector in many regions and a growing consumer preference for white metals in jewelry, while supplies are relatively fixed and in some cases declining, threatens to put PGMs in an even more volatile situation. As demand exceeds the available supplies, prices can be expected to rise significantly.

The Thintri market study, *Platinum Group Metals: Issues and Opportunities*, relies on in-depth interviews with industry executives, market development managers and government and academic researchers. The report provides a survey of the current state of the PGM markets, an assessment of viable alternatives and recovery schemes, and discussion of the effects of growing demand on availability and prices, and the effects on those prices of PGM replacement technologies and improved recovery methods.



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Report Contents

| | | | |
|--|-----------|--|--|
| Executive Summary: Platinum Group Metals | 1 | | |
| E.1 Introduction | 1 | | |
| E.2 Applications..... | 1 | | |
| E.3 Supply, Demand and Price Issues..... | 2 | | |
| Figure E-1 Source Countries of PGMs | 2 | | |
| Figure E-2 Platinum Demand Forecast, Autocatalysts | 4 | | |
| Figure E-3 Palladium Price Forecast | 4 | | |
| E.4 PGM Replacement and Improved Recovery Methods | 4 | | |
| Figure E-4 Total Rhodium Displaced by Alternatives..... | 6 | | |
| Figure E-5 Resulting Rhodium Price, After Alternatives..... | 6 | | |
| Part 1 Background | 7 | | |
| 1.1 Introduction | 7 | | |
| Table 1-1 Platinum Group Metals and Characteristics | 7 | | |
| Figure 1-1 Periodic Table of the Elements with PGMs Highlighted | 8 | | |
| Table 1-2 PGM Prices, February, 2012 | 9 | | |
| 1.2 The Elements..... | 10 | | |
| 1.2.1 Platinum | 10 | | |
| 1.2.2 Palladium..... | 11 | | |
| 1.2.3 Rhodium..... | 12 | | |
| 1.2.4 Iridium..... | 12 | | |
| 1.2.5 Ruthenium..... | 13 | | |
| 1.2.6 Osmium | 13 | | |
| 1.3 Sourcing | 14 | | |
| 1.3.1 Extraction | 14 | | |
| 1.3.2 Major Producers..... | 14 | | |
| Part 2 Applications..... | 16 | | |
| 2.1 Electronic components..... | 16 | | |
| 2.2 Medical & Dental..... | 17 | | |
| 2.3 Industrial and Scientific | 19 | | |
| 2.3.1 General Industrial..... | 19 | | |
| 2.3.2 Glass Manufacture | 20 | | |
| 2.3.3 Scientific | 21 | | |
| 2.4 Automotive: Spark Plugs and Sensors..... | 22 | | |
| 2.5 Jewelry | 23 | | |
| 2.6 Investment and Coinage..... | 24 | | |
| 2.7 Catalysts..... | 25 | | |
| 2.7.1 Catalysts: Industrial | 25 | | |
| 2.7.2 Catalysts: Petroleum..... | 27 | | |
| 2.7.3 Catalysts: Automotive | 27 | | |
| 2.7.4 Catalysts: Fuel Cells | 31 | | |
| Figure 2-1 PEMFC Fuel Cell Operation..... | 32 | | |
| Part 3 The Supply Side: Supplies, Peak Metals & Scarcity ... | 36 | | |
| 3.1 Today's PGM Sources..... | 36 | | |
| Figure 3-1 PGM Production by Country | 36 | | |
| Figure 3-2 Platinum Production by Country..... | 37 | | |
| Figure 3-3 Palladium Production by Country..... | 37 | | |
| Figure 3-4 Other PGM Production by Country | 38 | | |
| 3.2 Peak Metals & Scarcity | 38 | | |
| Table 3-1 Minerals That Have Already Peaked | 39 | | |
| 3.3 Response to Shortages..... | 40 | | |
| 3.4 Lessons from the 1970s Cobalt Crisis..... | 41 | | |
| 3.5 Today's Supply Threats: Palladium..... | 42 | | |
| 3.6 Political Issues | 43 | | |
| 3.7 Long-Term Solutions: Near-Earth Asteroid Mining | 44 | | |
| Part 4 The Demand Side: Market Growth and Price Trends | 46 | | |
| 4.1 Introduction | 46 | | |
| 4.2 The Automotive Demand Driver | 46 | | |
| Figure 4-1 Platinum Demand by Region, Autocatalysts, 2012..... | 49 | | |
| Figure 4-2 Palladium Demand by Region, Autocatalysts 2012..... | 50 | | |
| Figure 4-3 Platinum Demand Forecast, Autocatalysts | 50 | | |
| Figure 4-4 Platinum Demand Forecast by Region, Autocatalysts..... | 51 | | |
| Figure 4-5 Palladium Demand Forecast – Autocatalysts | 51 | | |
| Figure 4-6 Palladium Demand Forecast by Region, Autocatalysts..... | 52 | | |
| Figure 4-7 Rhodium Demand Forecast, Autocatalysts..... | 52 | | |
| 4.3 The Jewelry and Investment Demand Drivers..... | 52 | | |
| Figure 4-8 Platinum Demand by Region, Investment and Jewelry, 2012 | 54 | | |
| Figure 4-9 Palladium Demand by Region, Investment and Jewelry, 2012 | 54 | | |
| Figure 4-10 Platinum Demand Forecast – Investment and Jewelry | 55 | | |
| Figure 4-11 Palladium Demand Forecast – Investment and Jewelry | 55 | | |
| 4.4 The Petroleum Demand Driver | 55 | | |
| Figure 4-12 Platinum Demand by Region, Petroleum 2012..... | 56 | | |
| Figure 4-13 Platinum Demand Forecast, Petroleum | 56 | | |
| 4.5 Industrial: Chemical, Electrical, Electrochemical and Glass Demand Drivers | 56 | | |
| Figure 4-14 Platinum Demand by Region, Chemical and Glass 2012 | 57 | | |
| Figure 4-15 Palladium Demand by Region, Chemical 2012 | 57 | | |
| Figure 4-16 Platinum Demand Forecast, Chemical and Glass | 58 | | |
| Figure 4-17 Palladium Demand Forecast – Chemical..... | 58 | | |
| Figure 4-18 Rhodium Demand Forecast – Chemical and Glass | 59 | | |
| Figure 4-19 Platinum Demand Forecast, Electrical..... | 59 | | |
| Figure 4-20 Palladium Demand Forecast – Electrical..... | 60 | | |
| Figure 4-21 Rhodium Demand Forecast – Electrical..... | 60 | | |
| Figure 4-22 Iridium Demand Forecast, Chemical, Electrical and Electrochemical..... | 61 | | |
| Figure 4-23 Ruthenium Demand Forecast, Chemical, Electrical and Electrochemical..... | 61 | | |
| 4.6 Medical, Biomedical and Dental Demand Drivers.. | 61 | | |
| Figure 4-24 Platinum Demand by Region, Biomedical 2012..... | 62 | | |
| Figure 4-25 Platinum Demand Forecast – Biomedical..... | 62 | | |
| Figure 4-26 Palladium Demand by Region, Dental 2012 | 63 | | |
| Figure 4-27 Palladium Demand Forecast, Dental | 63 | | |
| 4.7 Other Market Drivers..... | 63 | | |
| Figure 4-28 Platinum Demand by Region, Other Applications 2012..... | 64 | | |
| Figure 4-29 Palladium Demand by Region, Other Applications 2012..... | 64 | | |
| Figure 4-30 Platinum Demand Forecast, Other Applications..... | 65 | | |
| Figure 4-31 Palladium Demand Forecast, Other Applications..... | 65 | | |
| Figure 4-32 Rhodium Demand Forecast, Other Applications..... | 66 | | |
| Figure 4-33 Iridium Demand Forecast, Other Applications..... | 66 | | |

| | |
|--|-----------|
| Figure 4-34 Ruthenium Demand Forecast, Other Applications..... | 67 |
| 4.8 PGM Demand by Element..... | 67 |
| 4.8.1 Platinum | 67 |
| Figure 4-35 Platinum Demand by Application, 2012 | 67 |
| Figure 4-36 Platinum Demand by Region, 2012 | 68 |
| Figure 4-37 Global Platinum Demand Forecast | 69 |
| Figure 4-38 Global Platinum Demand Forecast by Region..... | 69 |
| 4.3 Palladium | 69 |
| Figure 4-39 Palladium Demand by Application, 2012 | 70 |
| Figure 4-40 Palladium Demand by Region, 2012 | 70 |
| Figure 4-41 Global Palladium Demand Forecast | 71 |
| Figure 4-42 Global Palladium Demand Forecast by Region | 71 |
| 4.4 Rhodium..... | 71 |
| Figure 4-43 Rhodium Demand by Application, 2012..... | 72 |
| Figure 4-44 Rhodium Demand Forecast..... | 73 |
| 4.5 Iridium, Ruthenium and Osmium..... | 73 |
| Figure 4-45 Iridium Demand by Application, 2012..... | 74 |
| Figure 4-46 Iridium Demand Forecast..... | 74 |
| Figure 4-47 Ruthenium Demand by Application, 2012..... | 75 |
| Figure 4-48 Ruthenium Demand Forecast | 75 |
| Figure 4-49 Osmium Demand by Application, 2012 | 76 |
| Figure 4-50 Osmium Demand Forecast..... | 76 |
| 4.7 Effects of Alternative Energy Schemes and the Hydrogen Economy..... | 77 |
| Figure 4-51 Production of Hydrogen, Shares by Method . | 78 |
| Part 5 Price Trends..... | 80 |
| 5.1 Introduction and Methodology | 80 |
| 5.2 Demand Effects on PGM Price | 80 |
| Figure 5-1 Recent Rhodium Price History | 82 |
| 5.3 Projected Price Trends..... | 83 |
| Figure 5-2 Price Trends, Platinum..... | 83 |
| Figure 5-3 Price Trends, Palladium | 84 |
| Figure 5-4 Price Trends, Rhodium | 84 |
| Figure 5-5 Price Trends, Iridium | 85 |
| Figure 5-6 Price Trends, Ruthenium..... | 85 |
| Figure 5-7 Price Trends, Osmium | 86 |
| Part 6 PGM Replacement..... | 87 |
| 6.1 Introduction | 87 |
| 6.2 Precious Metals as Alternatives and Reduced PGM-Schemes..... | 87 |
| 6.2.1 Precious Metal-Based Substitutes in Autocatalysts..... | 88 |
| 6.2.2 Jewelry | 90 |
| 6.3 PGM-Free and Reduced PGM Autocatalysts | 91 |
| 6.3.1 Alternatives Based on Conventional Chemistry | 92 |
| 6.3.2 Alternatives Based on Nanotechnology..... | 93 |
| 6.4 Electrolysis and Fuel Cell Catalyst Alternatives | 95 |
| 6.4.1 Research Progress..... | 95 |
| 6.4.2 Nanotechnology: Catalysts Based on Nanoparticles and Nanotubes | 98 |
| 6.5 Impact of Alternatives on PGM Demand and Price..... | 101 |
| 6.5.1 Effects of Platinum Alternatives..... | 102 |
| Figure 6-1 Platinum Demand, Conventional Forecast ... | 102 |
| Figure 6-2 Platinum Demand Not Susceptible to Replacement | 103 |
| Figure 6-3 Autocatalysts: Platinum Displaced by Alternatives..... | 103 |
| Figure 6-4 Chemical: Platinum Displaced by Alternatives..... | 104 |

| | |
|--|------------|
| Figure 6-5 Petroleum: Platinum Displaced by Alternatives..... | 104 |
| Figure 6-6 Total Platinum Displaced by Alternatives..... | 105 |
| Figure 6-7 Resulting Platinum Demand After Alternatives..... | 105 |
| Figure 6-8 Resulting Platinum Price, After Alternatives ... | 106 |
| Figure 6-9 Demand for Platinum Alternatives..... | 106 |
| 6.5.2 Effects of Palladium Alternatives..... | 106 |
| Figure 6-10 Palladium Demand, Conventional Forecast | 107 |
| Figure 6-11 Palladium Demand Not Susceptible to Replacement | 107 |
| Figure 6-12 Autocatalysts: Palladium Displaced by Alternatives..... | 108 |
| Figure 6-13 Chemical: Palladium Displaced by Alternatives..... | 108 |
| Figure 6-14 Total Palladium Displaced by Alternatives... | 109 |
| Figure 6-15 Resulting Palladium Demand After Alternatives..... | 109 |
| Figure 6-16 Resulting Palladium Price, After Alternatives | 110 |
| Figure 6-17 Demand for Palladium Alternatives..... | 110 |
| 6.5.3 Effects of Rhodium Alternatives | 110 |
| Figure 6-18 Rhodium Demand, Conventional Forecast. | 111 |
| Figure 6-19 Rhodium Demand Not Susceptible to Replacement | 111 |
| Figure 6-20 Autocatalysts: Rhodium Displaced by Alternatives..... | 112 |
| Figure 6-21 Chemical: Rhodium Displaced by Alternatives..... | 112 |
| Figure 6-22 Total Rhodium Displaced by Alternatives | 113 |
| Figure 6-23 Resulting Rhodium Demand After Alternatives..... | 113 |
| Figure 6-24 Resulting Rhodium Price, After Alternatives . | 114 |
| Figure 6-25 Demand for Rhodium Alternatives..... | 114 |
| 6.5.4 Effects of Alternatives in Hydrogen Fuel Cell Catalysis | 114 |
| Figure 6-26 Effect of Alternatives on PGM Demand in Hydrogen Fuel Cells..... | 115 |
| Part 7 Opportunities in Recycling and Recovery..... | 116 |
| 7.1 Introduction | 116 |
| 7.2 Scrap & Recycling | 116 |
| Table 7-1 Energy Savings from Processing Scrap Compared with Ore | 117 |
| 7.2.1 Electronics and Electrochemistry Scrap..... | 118 |
| 7.2.2 Automotive Scrap..... | 120 |
| 7.2.3 Market Opportunities in PGM Recycling..... | 122 |
| Figure 7-1 Realized Scrap Volume: Platinum..... | 123 |
| Figure 7-2 Unrealized Scrap Volume: Platinum | 123 |
| Figure 7-3 Realized Scrap Volume: Palladium..... | 124 |
| Figure 7-4 Unrealized Scrap Volume: Palladium | 124 |
| Figure 7-5 Realized Scrap Volume: Rhodium | 125 |
| Figure 7-6 Unrealized Scrap Volume: Rhodium..... | 125 |
| Figure 7-7 Realized Scrap Volume: Iridium | 126 |
| Figure 7-8 Unrealized Scrap Volume: Iridium..... | 126 |
| Figure 7-9 Realized Scrap Volume: Ruthenium | 127 |
| Figure 7-10 Unrealized Scrap Volume: Ruthenium | 127 |
| 7.3 Slag and Mine Waste | 127 |
| Figure 7-11 PGM Slag Recovery, North America | 128 |
| Figure 7-12 Slag Recovery, North America, by Metal..... | 129 |
| Figure 7-13 PGM Slag Recovery, Rest of World | 129 |
| Figure 7-14 Slag Recovery, Rest of World, by Metal | 130 |
| Figure 7-15 New PGM Supply with Improved Recovery: Platinum, Palladium, Rhodium..... | 130 |

Figure 7-16 New PGM Supply with Improved Recovery:
Iridium, Ruthenium, Osmium 131

7.4 Effect of Improved Recycling and Slag
Recovery on PGM Prices..... 131

Figure 7-17 Conventional Price Forecast:
Platinum, Palladium, Rhodium..... 132

Figure 7-18 Conventional Price Forecast: Iridium,
Ruthenium, Osmium..... 132

Figure 7-19 Prices, with Improved Recovery: Platinum,
Palladium, Rhodium..... 133

Figure 7-20 Prices with Improved Recovery: Iridium,
Ruthenium, Osmium..... 133