

PLATINUM-GROUP METALS

(Palladium, platinum, iridium, osmium, rhodium, and ruthenium)

[Data in kilograms of contained platinum-group metals (PGMs) unless otherwise noted]

Domestic Production and Use: One company in Montana produced approximately 18,000 kilograms of PGMs with an estimated value of about \$1.4 billion. Small quantities of primary PGMs also were recovered as byproducts of copper-nickel mining in Michigan; however, this material was sold to foreign companies for refining. The leading domestic use for PGMs was in catalytic converters to decrease harmful emissions from automobiles. PGMs are also used in catalysts for bulk-chemical production and petroleum refining; dental and medical devices; electronic applications, such as in computer hard disks, hybridized integrated circuits, and multilayer ceramic capacitors; glass manufacturing; investment; jewelry; and laboratory equipment.

<u>Salient Statistics—United States:</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021^e</u>
Mine production: ¹					
Palladium	14,000	14,300	14,300	14,600	14,000
Platinum	4,000	4,160	4,150	4,200	4,200
Imports for consumption: ²					
Palladium	86,000	92,900	84,300	76,400	76,000
Platinum	53,200	58,500	42,300	64,800	56,000
PGM waste and scrap	354,000	40,700	35,200	188,000	210,000
Iridium	1,420	1,020	875	1,620	2,500
Osmium	856	25	(3)	1	1
Rhodium	11,600	14,500	15,000	20,700	17,000
Ruthenium	14,600	17,900	11,200	13,900	23,000
Exports: ⁴					
Palladium	52,300	52,900	55,500	48,600	43,000
Platinum	16,700	18,900	17,400	28,900	30,000
PGM waste and scrap	37,200	31,700	20,800	33,200	42,000
Rhodium	844	2,010	1,210	1,470	1,300
Other PGMs	939	2,500	1,330	1,440	2,800
Consumption, apparent: ^{5,6}					
Palladium	89,700	96,300	85,100	80,400	90,000
Platinum	51,600	53,700	37,000	47,200	37,000
Price, dollars per troy ounce: ⁷					
Palladium	874.30	1,036.43	1,544.31	2,205.27	2,600.00
Platinum	951.23	882.66	866.94	886.02	1,200.00
Iridium	908.35	1,293.27	1,485.80	1,633.51	5,400.00
Rhodium	1,112.59	2,225.30	3,918.78	11,205.06	24,000.00
Ruthenium	76.86	244.41	262.59	271.83	510.00
Employment, mine, number	1,513	1,628	1,789	1,881	1,700
Net import reliance ^{6,8} as a percentage of apparent consumption:					
Palladium	38	42	34	35	37
Platinum	71	74	67	77	70

Recycling: About 115,000 kilograms of palladium and platinum was recovered globally from new and old scrap in 2021, including about 53,000 kilograms recovered from automobile catalytic converters in the United States.

Import Sources (2017–20): Palladium: Russia, 35%; South Africa, 31%; Germany, 9%; and other, 25%.
Platinum: South Africa, 38%; Germany, 20%; Switzerland, 12%; Italy, 6%; and other, 24%.

Tariff: All unwrought and semimanufactured forms of PGMs are imported duty free. See footnotes for specific Harmonized Tariff Schedule of the United States codes.

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Depletion Allowance: 22% (domestic), 14% (foreign).

Government Stockpile:⁹

Material	Inventory as of 9–30–21	FY 2021		FY 2022	
		Potential acquisitions	Potential disposals	Potential acquisitions	Potential disposals
Iridium	15	—	15	—	15
Platinum	261	—	261	—	261

Events, Trends, and Issues: Progress continued at a domestic mine expansion project, but full production was delayed to 2024 owing to disruptions from the COVID-19 pandemic and operational challenges associated with ventilation and ground conditions. Production of PGMs in South Africa, the world's leading supplier of mined material, increased by 13% compared with that in 2020 owing to increased mining in the UG2 orebody of the Bushveld Complex.

The estimated annual average prices of palladium, platinum, and ruthenium increased by 18%, 35%, and 88%, respectively, compared with those in 2020, and the estimated prices for rhodium doubled and iridium more than tripled. In addition, the prices of iridium, rhodium, and ruthenium all reached record highs in 2021.

Constrained automobile production owing to semiconductor chip shortages and a decline in diesel passenger vehicle production are expected to result in decreased demand for palladium, platinum, and rhodium used in catalytic converters.

World Mine Production and Reserves: Reserves for Russia were revised based on Government reports.

	Mine production				PGM reserves¹⁰
	Palladium		Platinum		
	2020	2021^e	2020	2021^e	
United States	14,600	14,000	4,200	4,200	900,000
Canada	20,000	17,000	7,000	6,000	310,000
Russia	93,000	74,000	23,000	19,000	4,500,000
South Africa	73,500	80,000	112,000	130,000	63,000,000
Zimbabwe	12,900	13,000	15,000	15,000	1,200,000
Other countries	2,670	2,800	4,320	4,300	NA
World total (rounded)	217,000	200,000	166,000	180,000	70,000,000

World Resources:¹⁰ World resources of PGMs are estimated to total more than 100 million kilograms. The largest reserves are in the Bushveld Complex in South Africa.

Substitutes: Palladium has been substituted for platinum in most gasoline-engine catalytic converters because of the historically lower price for palladium relative to that of platinum. About 25% of palladium can routinely be substituted for platinum in diesel catalytic converters; the proportion can be as much as 50% in some applications. For some industrial end uses, one PGM can substitute for another, but with losses in efficiency.

^eEstimated. NA Not available. — Zero.

¹Estimated from published sources.

²Includes data for the following Harmonized Tariff Schedule of the United States codes: 7110.11.0010, 7110.11.0020, 7110.11.0050, 7110.19.0000, 7110.21.0000, 7110.29.0000, 7110.31.0000, 7110.39.0000, 7110.41.0010, 7110.41.0020, 7110.41.0030, 7110.49.0010, 7112.92.0000, and 7118.90.0020.

³Less than ½ unit.

⁴Includes data for the following Schedule B codes: 7110.11.0000, 7110.19.0000, 7110.21.0000, 7110.29.0000, 7110.31.0000, 7110.39.0000, 7110.41.0000, 7110.49.0000, and 7112.92.0000.

⁵Defined as primary production + secondary production + imports – exports.

⁶Excludes imports and (or) exports of waste and scrap.

⁷Engelhard Corp. unfabricated metal.

⁸Defined as imports – exports.

⁹See Appendix B for definitions.

¹⁰See Appendix C for resource and reserve definitions and information concerning data sources.