

NICKEL

(Data in metric tons of nickel content unless otherwise noted)

Domestic Production and Use: In 2018, the underground Eagle Mine in Michigan produced approximately 19,000 tons of nickel in concentrate, which was exported to smelters in Canada and overseas. The mine continued development of the Eagle East extension, with first production expected in 2020. In November, the Minnesota Department of Natural Resources announced that it had issued permits for a mining project in the northeastern part of the State. Nickel in crystalline sulfate was produced as a byproduct of smelting and refining platinum-group-metal ores mined in Montana.

Approximately 47% of the primary nickel consumed went into stainless and alloy steel products, 41% into nonferrous alloys and superalloys, 7% into electroplating, and 5% into other uses. The U.S. steel industry produced approximately 2.4 million tons of nickel-bearing stainless steel in 2018, an estimated 20% more than in 2017. Sales of nickel-base superalloys for use in jet engines also continued to increase.

Salient Statistics—United States:	2014	2015	2016	2017	2018^e
Production:					
Mine	4,300	27,200	24,100	22,100	19,000
Refinery, byproduct	W	W	W	W	W
Shipments of purchased scrap ¹	132,000	132,000	151,000	135,000	140,000
Imports:					
Ores and concentrates	92	24	(2)	64	5
Primary	156,000	130,000	111,000	150,000	150,000
Secondary	39,000	27,100	32,300	38,100	50,000
Exports:					
Ores and concentrates	3,320	25,400	22,400	20,000	19,000
Primary	10,400	9,610	10,300	11,000	10,000
Secondary	56,300	51,900	63,700	51,500	80,000
Consumption:					
Reported, primary metal	113,000	105,000	96,000	101,000	110,000
Reported, secondary	115,000	108,000	120,000	122,000	130,000
Apparent, primary metal ³	149,000	118,000	104,000	140,000	140,000
Apparent, total ⁴	264,000	226,000	224,000	262,000	270,000
Price, average annual, London Metal Exchange (LME):					
Cash, dollars per metric ton	16,865	11,831	9,594	10,403	14,000
Cash, dollars per pound	7.650	5.367	4.352	4.719	6.200
Stocks:					
Consumer, yearend	23,300	19,200	15,100	14,700	15,000
LME U.S. warehouses	1,560	4,212	5,232	3,780	2,400
Net import reliance ⁵ as a percentage of total apparent consumption	56	52	46	53	52

Recycling: Nickel in alloyed form was recovered from the processing of nickel-containing waste, including flue dust, grinding swarf, mill scale, and shot blast generated during the manufacturing of stainless steel; filter cakes, plating solutions, spent catalysts, spent pickle liquor, sludges, and all types of spent nickel-containing batteries. Nickel-containing alloys and stainless steel scrap were also melted and used to produce new alloys and stainless steel. In 2018, recycled nickel in all forms accounted for approximately 52% of apparent consumption.

Import Sources (2014–17): Nickel contained in ferronickel, metal, oxides, and salt: Canada, 41%; Norway, 11%; Australia, 8%; Russia, 8%; and other, 32%. Nickel-containing scrap, including nickel content of stainless steel scrap: Canada, 40%; Mexico, 28%; United Kingdom, 8%; and other, 24%.

Tariff: Item	Number	Normal Trade Relations
		<u>12–31–18</u>
Nickel ores and concentrates	2604.00.0040	Free.
Ferronickel	7202.60.0000	Free.
Unwrought nickel, not alloyed	7502.10.0000	Free.
Nickel waste and scrap	7503.00.0000	Free.
Unwrought nickel, powders and flakes	7504.00.0000	Free.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

NICKEL

Government Stockpile:⁶ The U.S. Department of Energy is holding nickel ingot contaminated by low-level radioactivity at Paducah, KY, and shredded nickel scrap at Oak Ridge, TN. Ongoing decommissioning activities at former nuclear defense sites were expected to generate additional nickel in scrap. See the Lithium chapter for statistics on lithium-nickel-cobalt-aluminum oxide.

Material	Inventory As of 9–30–18	FY2018		FY 2019	
		Potential Acquisitions	Potential Disposals ⁷	Potential Acquisitions	Potential Disposals ⁷
Nickel alloys, gross weight	307	—	68	—	68

Events, Trends, and Issues: In recent years, production of refined nickel decreased as stainless steel producers, primarily in Asia, preferred lower cost nickel pig iron. Mine production in countries that supply direct shipping ore to nickel pig iron operations increased, while mine production supplying refineries tended to decrease. Production of nickel chemicals, however, has increased, particularly nickel sulfate used in the production of batteries. Industry analysts project a significant increase in global nickel consumption in batteries for energy storage and electric vehicles.

World Mine Production and Reserves: Reserves for Brazil, China, Colombia, Indonesia, and the United States were revised based on new information from company or Government reports.

	Mine production		Reserves ⁸
	2017	2018 ^e	
United States	22,100	19,000	110,000
Australia	179,000	170,000	⁹ 19,000,000
Brazil	78,600	80,000	11,000,000
Canada	214,000	160,000	2,700,000
China	103,000	110,000	2,800,000
Colombia	45,500	43,000	440,000
Cuba	52,800	53,000	5,500,000
Finland	34,600	46,000	NA
Guatemala	53,700	49,000	1,800,000
Indonesia	345,000	560,000	21,000,000
Madagascar	41,700	39,000	1,600,000
New Caledonia ¹⁰	215,000	210,000	—
Philippines	366,000	340,000	4,800,000
Russia	214,000	210,000	7,600,000
South Africa	48,400	44,000	3,700,000
Other countries	146,000	180,000	6,500,000
World total (rounded)	2,160,000	2,300,000	89,000,000

World Resources: Identified land-based resources averaging 1% nickel or greater contain at least 130 million tons of nickel, with about 60% in laterites and 40% in sulfide deposits. Extensive nickel resources also are found in manganese crusts and nodules on the ocean floor. The decline in discovery of new sulfide deposits in traditional mining districts has led to exploration in more challenging locations such as east-central Africa and the subarctic.

Substitutes: Low-nickel, duplex, or ultrahigh-chromium stainless steels are being substituted for austenitic grades in construction. Nickel-free specialty steels are sometimes used in place of stainless steel in the power-generating and petrochemical industries. Titanium alloys can substitute for nickel metal or nickel-base alloys in corrosive chemical environments. Lithium-ion batteries may be used instead of nickel metal hydride batteries in certain applications.

^eEstimated. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

¹Scrap receipts – shipments by consumers + exports – imports + adjustments for consumer stock changes.

²Less than ½ unit.

³Defined as primary imports – primary exports + adjustments for industry stock changes, excluding secondary consumer stocks.

⁴Defined as apparent primary metal consumption + reported secondary consumption.

⁵Defined as imports – exports + adjustments for consumer stock changes.

⁶See Appendix B for definitions.

⁷Disposals are defined as any barter, rotation, sale, or upgrade of National Defense Stockpile stock.

⁸See Appendix C for resource and reserve definitions and information concerning data sources.

⁹For Australia, Joint Ore Reserves Committee-compliant reserves were about 6.0 million tons.

¹⁰Overseas territory of France. Although nickel-cobalt mining and processing continued, the leading producing company reported zero reserves owing to recent nickel prices.