

## NICKEL

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

**Domestic Production and Use:** The United States had only one active nickel mine—the underground Eagle Mine in Michigan. The new mine has been producing separate concentrates of chalcopyrite and pentlandite for export to Canadian and overseas smelters since April 2014. Three mining projects were in varying stages of development in northeastern Minnesota. The principal nickel-consuming State was Pennsylvania, followed by Kentucky, Illinois, New York, and North Carolina. Approximately 45% of the primary nickel consumed went into stainless and alloy steel production, 43% into nonferrous alloys and superalloys, 7% into electroplating, and 5% into other uses. End uses were as follows: transportation and defense, 34%; fabricated metal products, 20%; electrical equipment, 13%; chemical and petroleum industries, 7% each; construction, household appliances, and industrial machinery, 5% each; and other, 4%. The estimated value of apparent primary consumption was \$1.57 billion.

<b>Salient Statistics—United States:</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015<sup>e</sup></b>
<b>Production:</b>					
Mine	—	—	—	4,300	26,500
Refinery, byproduct	W	W	W	W	W
Shipments of purchased scrap <sup>1</sup>	132,000	130,000	125,000	114,000	142,000
<b>Imports:</b>					
Primary	138,000	133,000	126,000	156,000	134,000
Secondary	21,300	22,300	26,300	38,900	28,700
<b>Exports:</b>					
Primary	12,400	9,100	10,600	10,400	9,770
Secondary	64,800	59,800	61,200	56,400	51,500
<b>Consumption:</b>					
Reported, primary metal	110,000	114,000	114,000	141,000	148,000
Reported, secondary	88,800	92,400	89,600	93,800	102,000
Apparent, primary metal	125,000	125,000	110,000	146,000	124,000
Total <sup>2</sup>	213,000	218,000	200,000	239,000	226,000
<b>Price, average annual, London Metal Exchange:</b>					
Cash, dollars per metric ton	22,890	17,533	15,018	16,865	12,635
Cash, dollars per pound	10.383	7.953	6.812	7.650	5.731
<b>Stocks:</b>					
Consumer, yearend	18,100	16,600	18,600	17,800	17,700
Producer, yearend <sup>3</sup>	6,650	6,550	9,730	9,290	9,260
Net import reliance <sup>4</sup> as a percentage of apparent consumption	48	49	46	56	37

**Recycling:** In 2015, 101,900 tons of nickel was recovered from purchased scrap in 2015. This represented about 45% of reported secondary plus apparent primary consumption for the year.

**Import Sources (2011–14):** Canada, 40%; Australia, 10%; Russia, 10%; Norway, 8%; and other, 32%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–15</b>
Nickel ores and concentrates	2604.00.0040	Free.
Nickel oxides, chemical grade	2825.40.0000	Free.
Ferronickel	7202.60.0000	Free.
Unwrought nickel, not alloyed	7502.10.0000	Free.

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

**Government Stockpile:** The U.S. Government sold the last of the nickel in the National Defense Stockpile in 1999. The U.S. Department of Energy is holding 8,800 tons of nickel ingot contaminated by low-level radioactivity at Paducah, KY, plus 5,080 tons of contaminated shredded nickel scrap at Oak Ridge, TN. Ongoing decommissioning activities at former nuclear defense sites are expected to generate an additional 20,000 tons of nickel in scrap.

**Events, Trends, and Issues:** The U.S. steel industry produced 1.81 million tons of austenitic (nickel-bearing) stainless steel in 2015—up by 8% from 2014, and 53% greater than the output of 1.18 million tons in 2009, the last year of the recession. Stainless steel has traditionally accounted for two-thirds of primary nickel use worldwide, with more than one-half of the steel going into the construction, food processing, and transportation sectors.

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Nickel prices declined during 2015. In January, the London Metal Exchange (LME) cash mean for 99.8%-pure nickel was \$14,767 per metric ton. By September, the price had fallen to \$9,895. Decreased prices were attributed to declining growth rates for global production of austenitic stainless steel, as well as the commissioning of nickel refineries in Madagascar and Canada and the rampup of production at new ferronickel smelters in Brazil and New Caledonia. Despite weak prices and an oversupply of nickel, companies continue to bring on new mining and processing projects in anticipation of a turnaround in the global economy. Stocks in LME warehouses were at record high levels of more than 423,000 tons of nickel metal at the end of October.

In January 2014, the Government of Indonesia banned the export of direct shipping ores (DSO) of nickel. The ban was designed to encourage construction of additional ferronickel and nickel pig iron (NPI) plants in the archipelago, and also to bolster the country's foreign revenues. The ban had three immediate effects. First, several companies from China filed plans to construct NPI plants on Halmahera, Java, and Sulawesi. Second, the NPI industry in China increased its imports of DSO from the Philippines. In 2015, the Philippines was the largest exporter of DSO in the world. Third, companies from Australia, China, and Japan began showing renewed interest in the Solomon Islands after the High Court of the Islands approved a long-stalled request to develop the Isabel saprolitic deposit.

Production of austenitic stainless steel was at an alltime high in 2015, although growth rates declined; China produced a record-high 17.6 million tons, accounting for more than one-half of global output. Demand for nickel-base superalloys has been especially strong in the aerospace and power-generation sectors. Engineers are working to produce a microlattice of nickel metal that could be 100 times lighter than Styrofoam. The interwoven network of struts, which consists of 99.99% air, might be used for thermal insulation, battery electrodes, and impact protection.

**World Mine Production and Reserves:** Reserves data for Brazil, Guatemala, and New Caledonia were revised based on new information from company or Government reports.

	Mine production		Reserves <sup>5</sup>
	2014	2015 <sup>e</sup>	
United States	4,300	26,500	160,000
Australia	245,000	234,000	<sup>6</sup> 19,000,000
Brazil	102,000	110,000	10,000,000
Canada	235,000	240,000	2,900,000
China	100,000	102,000	3,000,000
Colombia	81,000	73,000	1,100,000
Cuba	50,400	57,000	5,500,000
Guatemala	38,400	50,000	1,800,000
Indonesia	177,000	170,000	4,500,000
Madagascar	40,300	49,000	1,600,000
New Caledonia	178,000	190,000	8,400,000
Philippines	523,000	530,000	3,100,000
Russia	239,000	240,000	7,900,000
South Africa	55,000	53,000	3,700,000
Other countries	377,000	410,000	6,500,000
World total (rounded)	2,450,000	2,530,000	79,000,000

**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 instead of nickel-metal hydride may be used in certain applications.

<sup>e</sup>Estimated. W Withheld to avoid disclosing company proprietary data. — Zero.

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

<sup>2</sup>Apparent primary consumption + reported secondary consumption.

<sup>3</sup>Stocks of producers, agents, and dealers held only in the United States.

<sup>4</sup>Defined as imports – exports + adjustments for industry stock changes.

<sup>5</sup>See [Appendix C](#) for resource/reserve definitions and information concerning data sources.

<sup>6</sup>For Australia, Joint Ore Reserves Committee-compliant reserves were about 7.0 million tons.