

## NICKEL

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

**Domestic Production and Use:** The United States did not have any active nickel mines in 2010. Limited amounts of byproduct nickel were recovered from copper and palladium-platinum ores mined in the Western United States. Six sulfide mining projects were in varying stages of development in the Lake Superior region. On a monthly or annual basis, 105 facilities reported nickel consumption. The principal consuming State was Pennsylvania, followed by Kentucky, North Carolina, and Indiana. Approximately 44% of the primary nickel consumed went into stainless and alloy steel production, 42% into nonferrous alloys and superalloys, 9% into electroplating, and 5% into other uses. End uses were as follows: transportation, 32%; chemical industry, 14%; electrical equipment, 10%; construction, fabricated metal products, and petroleum industry, 8% each; household appliances and industrial machinery, 6% each; and other, 8%. The estimated value of apparent primary consumption was \$2.81 billion.

| <b>Salient Statistics—United States:</b>                                    | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010<sup>e</sup></b> |
|---|-------------|-------------|-------------|-------------|-------------------------|
| Production, refinery byproduct  | W           | W           | W           | W           | W                       |
| Shipments of purchased scrap <sup>1</sup>                                   | 142,000     | 186,000     | 160,000     | 152,000     | 152,000                 |
| Imports:  |             |             |             |             |                         |
| Primary   | 153,000     | 125,000     | 129,000     | 99,900      | 144,000                 |
| Secondary   | 20,300      | 16,200      | 20,100      | 17,700      | 24,300                  |
| Exports:  |             |             |             |             |                         |
| Primary   | 8,050       | 13,100      | 11,600      | 7,020       | 11,700                  |
| Secondary   | 59,300      | 103,000     | 94,600      | 90,000      | 75,300                  |
| Consumption:  |             |             |             |             |                         |
| Reported, primary   | 105,000     | 101,000     | 102,000     | 81,200      | 116,000                 |
| Reported, secondary   | 103,000     | 98,900      | 85,200      | 79,400      | 100,000                 |
| Apparent, primary   | 143,000     | 112,000     | 115,000     | 94,500      | 129,000                 |
| Total <sup>2</sup>  | 247,000     | 211,000     | 200,000     | 174,000     | 229,000                 |
| Price, average annual, London Metal Exchange:                               |             |             |             |             |                         |
| Cash, dollars per metric ton  | 24,244      | 37,216      | 21,104      | 14,649      | 21,710                  |
| Cash, dollars per pound   | 10.997      | 16.881      | 9.572       | 6.645       | 9.847                   |
| Stocks:   |             |             |             |             |                         |
| Consumer, yearend   | 14,000      | 19,100      | 19,200      | 16,600      | 22,200                  |
| Producer, yearend <sup>3</sup>  | 6,450       | 5,690       | 5,860       | 6,150       | 6,620                   |
| Net import reliance <sup>4</sup> as a percentage of<br>apparent consumption | 50          | 17          | 33          | 22          | 43                      |

**Recycling:** About 100,000 tons of nickel was recovered from purchased scrap in 2010. This represented about 44% of reported secondary plus apparent primary consumption for the year.

**Import Sources (2006–09):** Canada, 44%; Russia, 16%; Australia, 10%; Norway, 8%; and other, 22%.

| <b>Tariff: Item</b>               | <b>Number</b> | <b>Normal Trade Relations<br/>12-31-10</b> |
|-----------------------------------|---------------|--|
| Nickel oxide, chemical grade      | 2825.40.0000  | Free.                                      |
| Ferronickel                       | 7202.60.0000  | Free.                                      |
| Nickel oxide, metallurgical grade | 7501.20.0000  | 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 plus 5,080 tons of contaminated shredded nickel scrap. Ongoing decommissioning activities at former nuclear defense sites are expected to generate an additional 20,000 tons of nickel in shredded scrap.

**Events, Trends, and Issues:** In 2010, the U.S. economy began to recover from recessionary conditions, but the recovery remained weak. Prior to the recovery, U.S. production of austenitic (nickel-bearing) stainless steel had declined in 2009 to 1.16 million tons—10% less than the reduced output of 1.29 million tons in 2008. 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. China produced 7.72 million tons of austenitic stainless steel in 2010, followed by the European Union with 5.41 million tons.

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Nickel prices were adversely affected by the global economic recession in 2008 and 2009. In March 2009, the London Metal Exchange (LME) cash mean for 99.8%-pure nickel bottomed out at \$9,693 per metric ton after a 22-month decline. The cash price gradually recovered and returned to above \$19,000 per metric ton in March 2010. The average monthly LME cash price for November 2010 was \$22,905 per ton. In July, a multinational joint venture began mining the large Ambatovy laterite deposit in east-central Madagascar. The ore was being slurried and piped to the venture's pressure leach plant and refinery near Toamasina. The Toamasina complex was designed to produce 60,000 tons per year of nickel and was expected to be in the early stages of commissioning at the beginning of 2011. New mines also were being developed at several locations in Brazil, Southeast Asia, and the Pacific. In August, the \$4.5 billion Goro laterite project in New Caledonia began producing a nickel-cobalt intermediate for export. Goro was scheduled to reach full production in 2013 with a production capacity of 60,000 tons per year of nickel. The Onca Puma project in Brazil's Para State began producing ferronickel from laterite in December. Enhancement work continued at the new Ravensthorpe Mine in Western Australia at a cost of \$190 million. The global automotive industry is using more and more nickel as the popularity and familiarity of electric and hybrid vehicles increase. Collaboration between battery manufacturers and the U.S. Department of Energy has enabled the startup of at least three facilities designed to mass produce advanced cathode materials, several of which contain nickel.

**World Mine Production and Reserves:** Estimates of reserves for Brazil, China, Indonesia, and 18 other countries were revised based on new mining industry information from published sources.

|                            | Mine production |                   | Reserves <sup>5</sup>   |
|----------------------------|-----------------|-------------------|-------------------------|
|                            | 2009            | 2010 <sup>e</sup> |                         |
| United States              | —               | —                 | —                       |
| Australia                  | 165,000         | 139,000           | <sup>6</sup> 24,000,000 |
| Botswana                   | 28,600          | 32,400            | 490,000                 |
| Brazil                     | 54,100          | 66,200            | 8,700,000               |
| Canada                     | 137,000         | 155,000           | 3,800,000               |
| China                      | 79,400          | 77,000            | 3,000,000               |
| Colombia                   | 72,000          | 70,200            | 1,600,000               |
| Cuba                       | 67,300          | 74,000            | 5,500,000               |
| Dominican Republic         | —               | 3,100             | 960,000                 |
| Indonesia                  | 203,000         | 232,000           | 3,900,000               |
| Madagascar                 | —               | 7,500             | 1,300,000               |
| New Caledonia <sup>7</sup> | 92,800          | 138,000           | 7,100,000               |
| Philippines                | 137,000         | 156,000           | 1,100,000               |
| Russia                     | 262,000         | 265,000           | 6,000,000               |
| South Africa               | 34,600          | 41,800            | 3,700,000               |
| Venezuela                  | 13,200          | 14,300            | 490,000                 |
| Other countries            | 51,700          | 77,800            | 4,500,000               |
| World total (rounded)      | 1,400,000       | 1,550,000         | 76,000,000              |

**World Resources:** Identified land-based resources averaging 1% nickel or greater contain at least 130 million tons of nickel. About 60% is in laterites and 40% is in sulfide deposits. In addition, extensive deep-sea resources of nickel are in manganese crusts and nodules covering large areas of the ocean floor, particularly in the Pacific Ocean. The long-term decline in discovery of new sulfide deposits in traditional mining districts has forced companies to shift exploration efforts to more challenging locations like the Arabian Peninsula, east-central Africa, and the Subarctic.

**Substitutes:** To offset high and fluctuating nickel prices, engineers have been substituting low-nickel, duplex, or ultrahigh-chromium stainless steels for austenitic grades in construction applications. Nickel-free specialty steels are sometimes used in place of stainless steel within the power-generating and petrochemical industries. Titanium alloys can substitute for nickel metal or nickel-based alloys in corrosive chemical environments. Cost savings in manufacturing lithium-ion batteries allow them to compete against nickel-metal hydride 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 Government and 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 (JORC) compliant reserves were only 4.7 million tons.

<sup>7</sup>Overseas territory of France.