

## INDIUM

(Data in metric tons unless otherwise noted)

**Domestic Production and Use:** Indium was not recovered from ores in the United States in 2015. Several companies produced indium products—including alloys, compounds, high-purity metal, and solders—from imported indium metal. Production of indium tin oxide (ITO) continued to account for most of global indium consumption. ITO thin-film coatings were primarily used for electrical conductive purposes in a variety of flat-panel displays—most commonly liquid crystal displays (LCDs). Other indium end uses included alloys and solders, compounds, electrical components and semiconductors, and research. Based on an average of recent annual import levels, estimated domestic consumption of refined indium was 124 tons in 2015. The estimated value of refined indium consumed domestically in 2015, based on the average New York dealer price, was about \$67 million.

<b>Salient Statistics—United States:</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015<sup>e</sup></b>
Production, refinery	—	—	—	—	—
Imports for consumption	146	109	97	123	145
Exports	NA	NA	NA	NA	NA
Price, annual average, dollars per kilogram:					
New York dealer <sup>1</sup>	685	540	570	705	540
Free market <sup>2</sup>	NA	NA	NA	NA	460
U.S. producer <sup>3</sup>	720	650	615	735	NA
99.99% c.i.f. Japan <sup>4</sup>	680	510	575	700	NA
Net import reliance <sup>5</sup> as a percentage of estimated consumption	100	100	100	100	100

**Recycling:** Data on the quantity of secondary indium recovered from scrap were not available. Indium is most commonly recovered from ITO scrap in Japan and the Republic of Korea. A small quantity of scrap was recycled domestically.

**Import Sources (2011–14):** Canada, 21%; China, 16%; Belgium, 15%; Republic of Korea, 10%; and other, 38%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations</b>
			<b>12–31–15</b>
	Unwrought indium, including powders	8112.92.3000	Free.

**Depletion Allowance:** 14% (Domestic and foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** The 2015 estimated average free market price of indium was \$460 per kilogram. Free market prices for indium declined significantly during the year, having an average range of about \$545 per kilogram to \$625 per kilogram in the first quarter, \$450 per kilogram to \$510 per kilogram in the second quarter, and \$295 per kilogram to \$365 per kilogram in the third quarter. Decreasing prices were attributed to an absence of investor demand in China coincident with the Fanya Metal Exchange halting indium deliveries in or out of exchange warehouses in June and the reported freezing of funds invested in the Ri Jin Bao—Fanya's main investment product that guaranteed annual returns of more than 13%—in July. In August, Fanya entered into a debt-restructuring plan, and investors reportedly met with the China Securities Regulatory Commission (China's stock market regulator) and provincial-level authorities to protest Fanya's actions. At the time Fanya halted delivery of indium into its warehouses, exchange warehouses held 3,600 tons of indium, equivalent to about 4.5 years of primary production, and the listed price of indium on the exchange was \$1,190 per kilogram, significantly more than prevailing domestic market prices.

According to market reports, indium production in China declined by 15% to 30% in the first half of 2015 compared with that during the same period of the previous year. Decreasing prices resulted in large state-owned zinc smelters reducing their indium production by at least 10%, small-scale zinc smelters suspending their indium production, and stand-alone indium producers reducing output by 30% to 40%.

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China returned to being a net exporter of indium in 2015, owing mostly to a lack of domestic investor demand, as well as to higher international prices compared with domestic market prices in the second half of the year and an elimination of the domestic export tariff on indium.

China's ITO production capacity has increased notably in the past few years, along with the country's expanding flat-screen display industry. Within the past year, a China-based company commissioned an ITO production plant in Henan Province, and a Belgium-based ITO producer, in a joint venture with a China-based materials company, constructed a 200-metric-ton-per-year ITO plant in Guangdong, China, which could be commissioned by the end of 2015, at the earliest.

### World Refinery Production and Reserves:

	Refinery production <sup>e</sup>		Reserves <sup>6</sup>
	2014	2015	
United States	—	—	Quantitative estimates of reserves are not available.
Belgium	25	25	
Canada	65	65	
China	460	370	
France	43	38	
Germany	10	10	
Japan	72	72	
Korea, Republic of	150	150	
Peru	14	15	
Russia	5	10	
World total (rounded)	844	755	

**World Resources:** Indium is most commonly recovered from the zinc-sulfide ore mineral sphalerite. The indium content of zinc deposits from which it is recovered ranges from less than 1 part per million to 100 parts per million. Although the geochemical properties of indium are such that it occurs in trace amounts in other base-metal sulfides—particularly chalcopyrite and stannite—most deposits of these metals are subeconomic for indium.

**Substitutes:** Antimony tin oxide coatings have been developed as an alternative to ITO coatings in LCDs and have been successfully annealed to LCD glass; carbon nanotube coatings have been developed as an alternative to ITO coatings in flexible displays, solar cells, and touch screens; PEDOT [poly(3,4-ethylene dioxythiophene)] has also been developed as a substitute for ITO in flexible displays and organic light-emitting diodes; and silver nanowires have been explored as a substitute for ITO in touch screens. Graphene has been developed to replace ITO electrodes in solar cells and also has been explored as a replacement for ITO in flexible touch screens. Researchers have developed a more adhesive zinc oxide nanopowder to replace ITO in LCDs. Gallium arsenide can substitute for indium phosphide in solar cells and in many semiconductor applications. Hafnium can replace indium in nuclear reactor control rod alloys.

<sup>e</sup>Estimated. NA Not available. — Zero.

<sup>1</sup>Price is based on 99.99%-minimum-purity indium at warehouse (Rotterdam); cost, insurance, and freight (in minimum lots of 50 kilograms). Source: Platts Metals Week.

<sup>2</sup>Price is based on 99.99%-minimum-purity indium at warehouse (Rotterdam). Source: Metal Bulletin.

<sup>3</sup>Indium Corp.'s price for 99.97%-purity metal, free on board. Price discontinued in 2015. Source: Platts Metals Week, Metal Bulletin.

<sup>4</sup>Price is based on 99.99%-purity indium, primary or secondary, shipped to Japan. Price discontinued in 2015. Source: Platts Metals Week.

<sup>5</sup>Defined as imports – exports.

<sup>6</sup>See [Appendix C](#) for resource/reserve definitions and information concerning data sources.