



# 2008 Minerals Yearbook

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## INDIUM [ADVANCE RELEASE]

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# INDIUM

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All refined indium produced in the United States during 2008 came from the refining of lower grade imported indium metal and from refining of scrap. Two refineries, one in New York and the other in Rhode Island, produced the majority of indium metal and indium compounds in 2008. A number of smaller companies produced specialty indium alloys and other indium products.

## Production

Though zinc was mined domestically, primary indium was not recovered as a byproduct in the United States. Production of indium consisted of upgrading imported indium metal and powder. Lower grade (99.97%) and standard-grade (99.99%) imported indium was refined to purities of up to 99.99999%. Indium Corp. of America, Utica, NY, and Umicore Indium Products, Providence, RI (a division of n.v. Umicore, s.a., Olen, Belgium), accounted for the major share of U.S. production of indium metal and products. Indium metal was sold in various forms (foil, ingot, powder, ribbon, wire, and others) and grades. Many smaller companies produced compounds, high-purity indium alloys, indium tin oxide (ITO) coatings, solders, and other indium products.

## Recycling

A large portion of global secondary indium was produced from ITO recycling. Sputtering, the process in which ITO is deposited as a thin-film coating onto a substrate, is highly inefficient; only about 30% of an ITO target is deposited onto the substrate. The remaining 70% resides in the spent ITO target, the grinding sludge, and the after-processing residue left on the walls of the sputtering chamber. It was estimated that 60% to 65% of the indium in a new ITO target will be recovered, and research was underway to improve this rate further. A short recycling process time for used ITO targets is critical, as a recycler may have millions of dollars worth of indium in the recycling loop at any one time, and a large increase in ITO scrap could be problematic owing to increased capital costs, environmental restrictions, and a lack of storage space. It was reported that the ITO recycling process—from collection of scrap to production of secondary materials—now takes less than 30 days. Spent ITO target recycling was concentrated in China, Japan, and the Republic of Korea—the countries where ITO production and sputtering takes place (Phipps and others, 2007; Stevens, 2007, p. 1–16).

A liquid crystal display (LCD) manufacturer has developed a process to reclaim indium directly from old LCD panels. The panels are crushed to millimeter-sized particles and then soaked in an acid solution to dissolve the ITO from which the indium is recovered.

Indium recovery from tailings was thought to have been insignificant, as these wastes contain small percentages of

the metal and can be difficult to process. However, recent improvements to the process technology have made indium recovery from tailings feasible when the price of indium is high.

## Consumption

*Indium Tin Oxide.*—Production of ITO was the leading end use of indium, accounting for more than three-quarters of global indium consumption. ITO is used for electrically conductive purposes in a variety of flat-panel display devices—most commonly, LCDs. The majority of ITO production took place in Japan. Significant amounts of ITO were also produced in China, the Republic of Korea, and Taiwan.

Indium consumption remained strong from yearend 2007 through mid-2008 owing to ITO demand for flat-panel displays and equipment in Asia prior to the Olympic Games in Beijing. Consumption of the metal began to decline towards the end of summer and through yearend 2008 owing to a slowdown in demand for flat-panel devices. As a result, LCD producers began cutting output at panel production plants in late 2008. Panasonic Corp. announced that its subsidiary (IPS Alpha Technology), which produces LCD televisions, would begin a production cutback at its Mobara, Japan, panel plant in mid-December owing to declining LCD demand. Sharp Corp. announced that it would adjust production of LCD screens at its Kameyama, Japan, plant also beginning in mid-December. The company still planned to move forward with the construction of an additional panel production plant in Sakai by March 2010. Mitsui Mining & Smelting Co., Ltd. reduced its work staff at two of its panel manufacturing plants, although a company source said its ITO production would not be affected. Corning, Inc. announced that its LCD television sales in China and the United States rose less than anticipated late in 2008; however, sales were higher than expected in Europe and Japan (Platts Metals Week, 2008e, g, h; Ryan's Notes, 2008c, d, f).

Touch-screen applications may be a developing market for ITO films. Two Taiwan-based optical film makers, Efun Technology Co., Ltd. and Gamma Optical Co., Ltd., planned to begin producing ITO films in 2009 for touch-screen applications. Efun's ITO film production capacity would be 360,000 square meters per year. The company planned to initially produce ITO films for touch panels and then expand their production for use in flexible displays once the technology reaches maturity. Gamma Optical expected to produce up to 1 million square meters of ITO films in 2009. The company would initially focus on producing ITO films for small- to medium-sized touch-screen applications. Then, Gamma Optical planned to develop ITO films for larger applications, such as touch-screen computer notebooks and car displays, two touch-screen applications that were expected to grow in the future (Kuo and Yu, 2008).

**Alloys and Solders.**—Alloys and solders were the second leading end use of indium. Indium-containing solders have lower crack propagation and improved resistance to thermal fatigue when compared to tin-lead solders. They also inhibit the leaching of gold components in electronic apparatus. Low-melting-point indium alloys are used as fuses or plugs for sprinkler systems. In the optical industry, low-melting-point alloys are applied to lenses and act as a surface for machine tools to grip during the polishing process. Certain types of indium alloys can also be used as a bonding agent between nonmetallic materials, such as glass, glazed ceramics, and quartz. Indium has also been used in dental alloys and in white gold alloys.

**Other.**—Another important use of indium was for III-V semiconductor materials for light-emitting diodes (LEDs) and laser diodes. In indium-based semiconductors, indium antimonide, indium arsenide, or indium phosphide can be used as the substrate, and several indium-containing compounds can be used as the epitaxial layer (or substrate coating), such as indium gallium arsenide. Indium-based LEDs are used predominantly for communication purposes to optically transmit data and, to a lesser extent, in LED displays. Indium-based laser diodes are used in fiber-optic communications.

Photovoltaic applications could become another large market opportunity for indium. Thin-film photovoltaic technologies—including cadmium telluride and copper indium gallium diselenide (CIGS)—accounted for a small share of the global solar market. Silicon-based technologies continued to dominate. However, a shortage of high-purity polysilicon has prompted the development of thin-film photovoltaic technology, which is less efficient but more economical than the silicon-based counterparts. Flexible CIGS solar cells could be used in roofing materials and in various applications in the aerospace, military, and recreational industries. In the United States, at least 15 CIGS thin-film photovoltaic companies were in operation; however, at yearend, only Nanosolar, Inc. (San Jose, CA) and Global Solar Energy, Inc. (Tucson, AZ) were considered to be out of the pilot stage and commercially producing CIGS solar cells. Currently, CIGS solar conversion efficiencies were thought to average nearly 10%. Yet, IBM Corp. (Armonk, NY) and Tokyo Ohka Kogyo Co., Ltd. (Japan) recently developed a CIGS solar cell production process that would reduce the energy required for their production and possibly raise their solar conversion efficiency to 15%. Once the two companies have finalized their technology, they would likely license it to existing CIGS manufacturing companies. In May, Solyndra, Inc. (Freemont, CA) filed an application to build a manufacturing facility that may have the capacity to produce 450 megawatts worth of solar equipment. The project was expected to be completed by second quarter 2010. Solyndra's existing Freemont CIGS production facility has between a 70- and 120-megawatt-per-year capacity. In October, HelioVolt Corp. (Austin, TX) announced that it had opened its flagship thin-film CIGS solar cell manufacturing plant in Austin. The solar cells, which are more than 12% efficient, would be produced for conventional modules and next-generation building-integrated photovoltaic (BIPV) systems. In BIPV systems, the solar cells are embedded onto the building materials (for example, cladding

and glass, roofing materials, and skylights), thereby reducing operating costs and improving the aesthetics of structures outfitted with solar modules (HelioVolt Corp., 2008; PV News, 2008a, b, c).

Other uses of indium included electrode-less lamps, mercury alloy replacements, and nuclear control rods. Alkaline batteries use indium to prevent buildup of hydrogen gas within sealed battery casings.

## Foreign Trade

During 2008, U.S. imports for consumption of unwrought indium and indium powders totaled 144 metric tons (t), a slight decrease from the 147 t imported in 2007. Leading suppliers included China (36%), Canada (19%), and Japan (18%) (table 1). Belgium and the United Kingdom also were significant sources for imports. There was no exclusive domestic export classification code for unwrought indium and indium powders.

## Prices

Platts Metals Week published a weekly New York dealer price range for indium [99.99% minimum purity in minimum lots of 50 kilograms (kg)]. The 2008 average annual New York dealer price range was \$488 to \$549 per kilogram. Indium prices began the year ranging from \$470 to \$540 per kilogram and then declined through March, dipping to \$400 to \$450 per kilogram. Prices then quickly rose until early May, reaching an annual high of \$670 to \$720 per kilogram. Subsequently, prices generally declined through yearend, at which time the price ranged from \$350 to \$400 per kilogram.

According to Platts Metals Week, the Indium Corp. of America producer price for indium (99.97% purity, 1-kilogram bar in lots of 10,000 troy ounces) began the year at \$685 per kilogram and remained unchanged for the entire year.

## World Review

**Argentina.**—Silver Standard Resources, Inc. (Vancouver, British Columbia, Canada) announced that development of its Pirquitas silver project in Jujuy continued on track during the year. The mine would produce silver, tin, and potentially zinc concentrate along with the possible production and sale of gallium and indium. Mine commissioning was underway during the fourth quarter, and ore delivery to the mill was expected to begin in first quarter 2009 (Silver Standard Resources, Inc., 2009).

Minerals exploration company Argentex Mining Corp. (Vancouver) continued a drilling program to define the mineral resources at its Pinguino property in Santa Cruz. Drilling results at Pinguino revealed the presence of numerous veins containing silver-gold and indium-enriched base-metal mineralization. The company expected to have a resource calculation for the property in the first quarter of 2009 (Argentex Mining Corp., 2008).

**Australia.**—North Queensland Metals, Ltd. (Fortitude Valley) completed a feasibility study for its Herberton Project, which is the site of the Baal Gammon copper-silver-tin-indium deposit, and decided to move forward with the project's development. The mine would yield 20,000 metric tons per year (t/yr) of

concentrate during a 6-year mine life. North Queensland Metals initially planned to produce concentrates at a test facility that could produce separate copper and indium-tin products. Estimated probable ore reserves at Baal Gammon reportedly were 3.1 million metric tons (Mt) of ore grading 29.6 grams per metric ton of indium. North Queensland Metals also purchased EPM 14016, a tenement adjoining the Baal Gammon deposit, with the objective of securing additional ore stocks. EPM 14016 contained five advanced copper-silver-indium and lead-zinc-indium projects (North Queensland Metals, Ltd., 2008, p. 9).

**Belgium.**—Indium metal (foil and ingots) was produced at Umicore's precious metals refinery at Hoboken. A special metals plant at the refinery recovered indium from dusts and residues generated by the facility's lead refinery. Production capacity was 30 t/yr of indium.

**Bolivia.**—Several mines in Bolivia produced indium-bearing concentrates, which were thought to be exported and processed elsewhere. State-owned Vinto tin smelter and refinery complex in Oruro considered expanding production to include additional byproducts, including indium metal. The state-owned Huanuni tin mine supplied 60% to 80% of Vinto's concentrates.

Minerals exploration company South American Silver Corp. (Vancouver) continued exploring and developing the Malku Khota silver-indium-gold property in Potosi. Mineralized zones on the property consisted of disseminated silver associated with indium. Indicated resources at the deposit measured 845 t of indium, and inferred resources contained 968 t of indium. In October, South American Silver announced that it had successfully recovered more than 99% of the indium contained in an acid chloride leach solution from Malku Khota into a salable indium product (South American Silver Corp., 2008).

**Brazil.**—Votorantim Metais (a unit of Grupo Votorantim, Sao Paulo) planned to start producing indium metal at its refinery in Juiz de Fora as part of its Polymetallic Project. The two-stage project entailed expanding the existing zinc refinery to produce additional metals and products. The first stage, scheduled for completion in 2008 to 2009, included the construction of a 15-t/yr indium plant and increasing its existing zinc production. During the second phase, a facility would be built that would produce gold-silver alloy, lead metal, polypropylene, and sulfuric acid from lead concentrates and recycled automotive batteries and other lead-bearing scrap (Australia-Latin America Business Council, 2006, p. 13; Votorantim Metais, 2007).

Minerals exploration company Crusader Holdings NL (West Perth, Australia) began a drill program at its Manga tin-indium prospect, which was part of the company's larger Ouro Belo tin-indium-gold project in Goias State. The drill program was initiated with the intention of locating a shallow surface body containing indium-tin mineralization. Drilling results discounted the potential of a shallow body containing mineralization of economic value at the tested area; however, anomalous amounts of tin and indium discovered in an area called the Main Zone supported further exploration at Manga (Crusader Holdings NL, 2008).

**Canada.**—Refined indium was produced at Teck Cominco Ltd.'s (Vancouver) lead-zinc metallurgical complex at Trail, British Columbia, and at Xstrata plc's (Zug, Switzerland) Kidd

Creek copper-zinc metallurgical operations at Timmins, Ontario. Indium production capacity at Trail was about 75 t/yr. Actual production would be determined by the availability of indium-bearing concentrates. Xstrata produced 8 t of refined indium at Kidd Creek in 2008 (Xstrata Copper Canada, 2009, p. 16).

Adex Mining, Inc. (Toronto, Ontario) completed a drill program at its Mount Pleasant property in southwestern New Brunswick in order to prepare an updated resource estimate. The property was the site of the former Mount Pleasant tungsten mine, which operated from 1983 until 1985, when it closed owing to low tungsten prices. The site contained two main ore zones—the Fire Tower Zone, which contained tungsten-molybdenum mineralization, and the North Zone, which contained indium-tin mineralization. Adex planned to complete a resource estimate for the North Zone by early January 2009 (Adex Mining, Inc., 2008).

**China.**—China was a major global producer of indium. Many primary producers were located in the indium-bearing regions of Guangxi and Yunnan Provinces. In 2008, China reportedly produced 210 t of primary indium. It was reported that in 2007, China produced 441 t of indium, of which 281 t was primary metal. According to Antaiko, sources of high-grade indium in China have decreased during the past few years; as a result, only the larger lead and zinc smelters were able to recover primary indium from lower-grade sources owing to their more sophisticated recovery technology (China Metal Market—Precious & Minor Metals Monthly 2008b, 2009c).

Several producers in China suspended spot exports of indium in April. Liuzhou China Tin Group Co., Ltd. (30 t/yr indium production capacity) halted exports and sales late in the month. Hunan Zhuye Torch Metals Co., Ltd. suspended indium production (30 t/yr capacity) in late January owing to power shortages taking place in the Hunan Province. Hunan Zhuye later ceased spot exports in April owing to dwindling stock levels. Two other producers in Hunan Province, each with a 10-t/yr indium production capacity, also reduced exports. The supply cuts were thought to have happened at a time when spot demand was starting to pick up. ITO manufacturers in Japan were reported to be buffered from the sudden supply reduction in China because most ITO manufacturers in Japan were sourcing indium on long-term contracts from domestic sources, Canada, and China. Smaller spot buyers, mostly solder and metal fabricators, were reported to be the most affected by the supply cuts. Most of the indium producers in China restarted exporting in May. Later, two producers in China confirmed that they had suspended indium production at yearend 2008, and several producers reduced their production rates at yearend as a result of cuts in zinc production and falling indium prices (Platts Metals Week, 2008d, i; Watanabe, 2008b).

On December 17, China's State Reserve Bureau (SRB), which manages China's stockpile of strategic reserves, announced plans to purchase 30 t of indium metal. Leading indium producers Hunan Zhuye, Huludao Zinc Industry, Ltd., and Liuzhou China Tin convened in Beijing to compete for the bid. Reportedly, SRB purchased the indium from Huludao Zinc, though the transaction price was not released (China Metal Market—Precious & Minor Metals Monthly 2009a).



The first set of indium export quotas for 2009 was set to 139,800 kg, down from the 168,000 kg in 2008. Twenty-one companies received a quota. Producers with the highest export quotas were Hunan Zhuye (26,335 kg), Liuzhou China Tin (17,983 kg), and Huludao Zinc (12,026 kg). Trading company Nanjing Foreign Economic & Trade Development Co., Ltd. received an export quota of 17,188 kg. The total export quota for 2009 was set to 233 t, a decrease from the 240 t set in 2008 (China Metal Market—Precious & Minor Metals Monthly, 2008a, 2009b).

**France.**—Nyrstar's Auby zinc smelter recovered 36.7 t of indium in concentrate in 2008, an increase from the 15.8 t recovered in 2007 as production continued to ramp up to full capacity during the year. The company commissioned an indium recovery plant at Auby in late 2006 that produced a concentrate grading 20% indium, which was sold to third parties for further processing (Nyrstar NV, 2009, p. 15).

**Germany.**—Indium was produced at PPM Pure Metals GmbH (Langelsheim) and Norddeutsche Affinerie AG (Hamburg). PPM recovered indium from indium-containing materials at its special metals production facility in Langelsheim. The company produced high-purity indium ingot, semifinished products, and indium compounds. Norddeutsche Affinerie AG also produced high-purity indium, which it consumed for the development of solar cells.

**Japan.**—In addition to China, Japan was a significant producer of indium. Indium-producing companies included Asahi Pretec Corp., Dowa Metals & Mining Co., Ltd., Nikko Metals, Mitsui Mining & Smelting, Sumitomo Metal Mining Co., Ltd., and Toho Zinc Co., Ltd. Dowa Metals & Mining operated an indium recycling facility in Akita Prefecture. Production capacity at the facility was 150 t/yr of secondary indium. Dowa also had the capacity to produce 70 t/yr of primary indium. All production was sold to consumers in Japan. Asahi Pretec had the capacity to produce 200 t/yr of secondary indium at its ITO target recycling plant in Fukuoka. Toho Zinc was thought to have significantly cut its production of indium since spring 2008 in light of declining indium prices. The company produced about 12 t of primary indium in the previous year (Platts Metals Week, 2008a; Ryan's Notes, 2008f).

During the previous few years, Japan had been sourcing an increasing amount of indium from the Republic of Korea and Canada, while decreasing its imports from China. In 2005, 70% of the indium imported into Japan originated from China. This percentage decreased to 55% in 2006 and 18% in 2007. The Republic of Korea accounted for 9% of imports in 2005, 27% of imports in 2006, and 63% of imports in 2007, and Canada's share of total imports rose from 7% in 2005 to 13% through the first 7 months of 2008 (Roskill's Letters From Japan, 2008).

Japan also is a leading consumer of indium. According to one news source, the country consumes about 700 to 800 t/yr of primary and secondary indium. According to another news source, Japan consumed 905 t of indium in 2007 (latest data available). Primary indium consumption was 283 t, 22% less than that of 2006 owing to increased consumption of secondary indium and inventory accumulation. Consumption of secondary indium was 623 t in 2007, up 15% from that of 2006. This trend was expected to shift in 2008, with primary consumption

increasing by 34% in 2008 from that of 2007 and secondary consumption declining by 8%. Overall consumption was projected to increase in 2008 from that of the previous year to 950 t (Ryan's Notes, 2008a; Watanabe, 2008c).

Major Japanese indium consumers included ITO producers Mitsui Mining & Smelting, Nippon Mining & Metals, Sumitomo Metal Mining, Tosoh Corp., and Ulvac Technologies, Inc. Nippon Mining & Metals operated the world's leading ITO production plant—the 50 metric-ton-per-month (t/mo) Isohara plant near Tokyo. The company consumed about 45 t/mo of secondary indium sourced from secondary indium producers in Japan and the Republic of Korea and consumed 10 to 15 t/mo of primary indium. Mitsui Mining & Smelting was Japan's second leading ITO manufacturer. The company had planned to increase its ITO production capacity to 50 t/mo by March. However, the plans were temporarily shelved; a company spokesperson reportedly confirmed that the company's ITO production capacity in March remained at 30 t/mo (Platts Metals Week, 2008f; Ryan's Notes, 2008b; Watanabe, 2008a).

Honda Soltec Co., Ltd. announced that it would begin selling CIGS thin-film solar cells suitable for commercial and industrial use in October. Previous solar cell output had been primarily sold for residential use. The company's CIGS solar cell manufacturing plant had been in commercial production since October 2007 and would reach full production capacity [27.5 megawatts per year (MW/yr)] by December. The company also stated that it chose to manufacture CIGS instead of silicon-based cells owing to the lower power consumption required to manufacture the CIGS cells. Showa Shell Sekiyu K.K., the other indium-based thin-film solar cell manufacturer in Japan, has been producing copper indium selenide solar cells at its 20-MW/yr plant in Miyazaki since early 2007 and was constructing a second production plant also in Miyazaki, which would increase the company's capacity to 60 MW/yr by mid-2009. The company also announced that it may further expand its solar cell production in 2011 through the construction of a 1,000-MW/yr solar cell manufacturing plant, which would reportedly consume 30 t/yr of indium. Japan's 2008 consumption of indium for solar cell manufacturing was about 1 t/yr (Honda Soltec Co., Ltd., 2008; Platts Metals Week, 2008b; Watanabe, 2008c, d).

**Korea, Republic of.**—Korea Zinc Co., Ltd. produced primary and secondary indium at its Onsan zinc refinery. Production capacity at the plant was thought to be 200 t/yr of indium, of which 100 t/yr was primary and 100 t/yr was secondary. Secondary feedstock was sourced from Japanese ITO producers.

Indium Corp. constructed a secondary indium production facility, which began operating in May. The facility had the capacity to process 25 t/mo of indium-containing waste materials including ITO, indium-zinc oxide, and other indium-containing scrap used by the flat-panel display and solar cell production industries. The company already had been processing spent ITO targets at a lower monthly rate at its Liuzhou, China, facility. However, owing to regulations in China, the company planned to convert its Liuzhou facility to upgrade lower grade indium metal into higher purities (Indium Corp., 2008).

**Peru.**—Refined indium was produced at Doe Run Peru's La Oroya metallurgical complex and Votorantim Metais'

Cajamarquilla zinc refinery. Votorantim Metais planned to invest \$500 million to expand production at the Cajamarquilla zinc refinery by 2009 to increase its production of indium. A company spokesperson giving details on the Cajamarquilla expansion project mentioned that Votorantim would be producing indium at a rate of 38 t/yr, although it was not clear whether that rate would also include output from its indium production project under development in Brazil (Metal-Pages Ltd., 2007a).

**Russia.**—Chelyabinsk Zinc Plant OJSC and Ural Mining and Metals Co. (UMMC) produced refined indium. Almost all indium produced in Russia was thought to have been sold in Europe. In 2008, Chelyabinsk produced 4.2 t of indium. UMMC's Electro zinc smelter had the capacity to produce between 6 and 8 t/yr of indium, with actual output typically ranging between 5 and 6 t/yr. UMMC recovered indium concentrate and metal from lead waste and from the large stockpiles of lead dust at the facility, which exceeded 10,000 t in weight with a concentration of 1.3 kg of indium per metric ton (Metal-Pages Ltd., 2007b, c).

**Singapore.**—In July, SMG Indium Resources, Ltd. (Newtown, PA) signed a purchase and agency agreement with Singapore-based indium producer Unionmet Ltd. Early in the year, SMG Indium Resources was incorporated in the United States and was formed to purchase and stockpile indium metal. Unionmet's production facilities were in Liuzhou, Guangxi Province, China. Unionmet and its subsidiaries produced and traded indium ingots and several zinc products. Unionmet, acting as a purchasing agent for SMG Indium Resources, will source additional indium for the company from China (Metal Bulletin, 2008).

## Outlook

Long-term demand for indium is expected to continue to rise as the flat-panel market continues to expand, assuming that flat-panel display manufacturers continue to rely on ITO as the transparent conducting material. Although ITO substitutes have been developed, there is no evidence of a significant shift towards the use of these alternative materials in flat-panel displays. The LCD market still has significant room for growth; LCD television penetration has remained low, according to Corning. The company estimated that only 8% of installed televisions worldwide were LCDs. The Japan Electronics and Information Technology Industries Association forecasted global demand for flat screen televisions to increase to 180 million units in 2012 from 86.2 million units in 2007 (Ryan's Notes, 2008e).

The solar cell industry is experiencing growth, and the percentage of indium consumed for this market may increase substantially in the future. According to sources at Indium Corp., indium demand for thin-film CIGS solar cells potentially could increase to 300 t/yr by 2013. Current indium consumption was nearly 30 to 35 t/yr. Strong investment in CIGS solar cell projects coupled with new or recently expanded manufacturing plants in Europe, Japan, and the United States indicate that indium consumption for solar cells is expected to increase globally. The company also projected that the solar market was to increase to 15,000 MW by 2010. CIGS photovoltaic

production was expected to experience a compound annual growth rate of 185%; silicon-based photovoltaic was expected to increase more modestly at 40% (Platts Metals Week, 2008c; Watanabe, 2008d).

On the supply side, a critical element will be the ability of individual countries to recycle indium-containing electronic components and scrap. Because primary indium is produced as a byproduct at a limited number of nonferrous smelting operations, it is difficult for primary suppliers to quickly respond to demand changes. Primary production of indium may decrease in 2009 as some zinc smelters that produce byproduct indium reduce their zinc production.

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TABLE 1  
U.S. IMPORTS FOR CONSUMPTION OF UNWROUGHT INDIUM METAL, BY COUNTRY<sup>1</sup>

Country	2007		2008	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
Belgium	10,500	\$6,860	12,100	\$5,360
Canada	33,300	15,900	27,900	13,400
China	64,000	14,400	51,200	27,000
Costa Rica	--	--	87	9
France	6	10	--	--
Germany	1,640	488	848	381
Hong Kong	5,710	2,490	5,490	1,860
Israel	--	--	28	5
Japan	24,700	12,200	25,800	12,000
Kazakhstan	2,140	1,410	--	--
Korea, Republic of	--	--	2,020	1,030
Liechtenstein	110	40	--	--
Malaysia	--	--	23	3
Netherlands	322	171	--	--
Peru	1,520	873	2,660	1,110
Singapore	1	4	237	119
Sweden	--	--	169	25
Switzerland	145	15	213	26
Taiwan	380	95	876	152
United Kingdom	2,170	1,460	14,200	7,070
Total	147,000	56,400	144,000	69,500

-- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.



TABLE 2  
 INDIUM: ESTIMATED WORLD REFINERY PRODUCTION, BY COUNTRY<sup>1</sup>

(Metric tons)

Country	2004	2005	2006	2007	2008
Belgium	30	30	30	30	30
Brazil	--	--	--	--	5
Canada	50	45 <sup>r</sup>	50	50	45
China	200	300	350	320	310
Germany <sup>2</sup>	10	10	10	10	10
Italy	5	5	5	5	5
Japan	70	70	55	60	65
Kazakhstan <sup>3</sup>	NA <sup>r</sup>	NA <sup>r</sup>	NA <sup>r</sup>	NA <sup>r</sup>	NA
Korea, Republic of	--	50 <sup>r</sup>	60 <sup>r</sup>	70 <sup>r</sup>	75
Netherlands	5	5	5	5	5
Peru	6	6	6	6	6
Russia	11	12	12	12	12
Ukraine <sup>3</sup>	NA <sup>r</sup>	NA <sup>r</sup>	NA <sup>r</sup>	NA <sup>r</sup>	NA
United Kingdom	5	5	5	5	5
Total	392	538 <sup>r</sup>	588 <sup>r</sup>	573 <sup>r</sup>	573

<sup>r</sup>Revised. NA Not available. -- Zero.

<sup>1</sup>Table includes data available through August 5, 2009.

<sup>2</sup>Production of indium reinstated, because both PPM Pure Metals GmbH (PPM) and Norddeutsche Affinerie AG (NA) reported that they were producing indium in 2007. NA is reportedly using its own indium in designing new solar cell technologies, but no estimates of indium production were actually available. This data represents only estimated production by PPM at the company's Langelsheim special metals plant.

<sup>3</sup>Information is not adequate to estimate production.