

## SILICON

(Data in thousand metric tons of silicon content unless otherwise noted)

**Domestic Production and Use:** Estimated value of silicon alloys and metal produced in the United States in 2014 was \$1.24 billion. Four companies produced silicon materials in seven plants, all east of the Mississippi River. Ferrosilicon and metallurgical-grade silicon metal were produced in four and five plants, respectively. Two companies produced both products at two plants. Most ferrosilicon was consumed in the ferrous foundry and steel industries, predominantly in the eastern United States, and was sourced primarily from domestic quartzite (silica). The main consumers of silicon metal were producers of aluminum and aluminum alloys and the chemical industry. The semiconductor and solar energy industries, which manufacture chips for computers and photovoltaic cells from high-purity silicon, respectively, accounted for only a small percentage of silicon demand.

<b>Salient Statistics—United States:</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014<sup>e</sup></b>
Production:					
Silicon alloys and metal	W	326	383	365	359
Imports for consumption:					
Ferrosilicon, all grades <sup>1</sup>	157	156	173	159	163
Silicon metal	171	187	136	118	121
Exports:					
Ferrosilicon, all grades <sup>1</sup>	15	20	12	10	9
Silicon metal	65	79	75	38	42
Consumption, apparent:					
Ferrosilicon, all grades <sup>1</sup>	312	W	W	W	W
Silicon metal <sup>2</sup>	W	W	W	W	W
Total	W	564	601	599	599
Price, <sup>3</sup> average, cents per pound Si:					
Ferrosilicon, 50% Si	109	111	100	103	109
Ferrosilicon, 75% Si	97.2	102	91.7	94.3	98.3
Silicon metal <sup>2</sup>	140	158	127	122	121
Stocks, producer, yearend:					
Silicon alloys and metal	W	30	34	29	29
Net import reliance <sup>4</sup> as a percentage of apparent consumption:					
Ferrosilicon, all grades <sup>1</sup>	44	<50	<50	<50	<45
Silicon metal <sup>2</sup>	<50	<40	<25	<30	<40
Total	W	42	36	39	40

**Recycling:** Insignificant.

**Import Sources (2010–13):** Ferrosilicon: Russia, 45%; China, 23%; Canada, 12%; Venezuela, 12%; and other, 8%. Silicon metal: Brazil, 36%; South Africa, 21%; Canada, 14%; Australia, 9%; and other, 20%. Total: Russia, 24%; Brazil, 18%; Canada, 14%; Venezuela, 11%; and other, 33%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–14</b>
Silicon, more than 99.99% Si	2804.61.0000	Free.
Silicon, 99.00%–99.99% Si	2804.69.1000	5.3% ad val.
Silicon, other	2804.69.5000	5.5% ad val.
Ferrosilicon, 55%–80% Si:		
More than 3% Ca	7202.21.1000	1.1% ad val.
Other	7202.21.5000	1.5% ad val.
Ferrosilicon, 80%–90% Si	7202.21.7500	1.9% ad val.
Ferrosilicon, more than 90% Si	7202.21.9000	5.8% ad val.
Ferrosilicon, other:		
More than 2% Mg	7202.29.0010	Free.
Other	7202.29.0050	Free.
Ferrosilicon manganese	7202.30.0000	3.9% ad val.

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**Depletion Allowance:** Quartzite, 14% (Domestic and foreign); gravel, 5% (Domestic and foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** Combined domestic ferrosilicon and silicon metal production in 2014, expressed in terms of contained silicon, was expected to decrease slightly from that of 2013. Annual average U.S. ferrosilicon spot market prices in 2014 were expected to increase 5.1% for 50%-grade ferrosilicon and 4.3% for 75%-grade ferrosilicon, despite a slight decrease in crude steel production.

Demand for silicon metal comes primarily from the aluminum and chemical industries, with more than 75% of silicon metal typically consumed by the chemical industry. The annual average silicon metal spot market price was expected to decrease by about 8.2% in 2014 from that in 2013.

Moderate increases in silicon materials production capacity occurred worldwide in 2014. Annual production capacity (gross weight) was expected to increase in Iceland by 87,000 tons in 2015; however, global silicon capacity was expected to remain about the same owing to the closing of production facilities in Ukraine. However, world production of silicon materials was expected to decrease in 2014 from that in 2013, owing to less raw steel production throughout the Commonwealth of Independent States, Europe, and North America.

### World Production and Reserves:

	Production <sup>e, 5</sup>		Reserves <sup>6</sup>
	2013	2014	
United States	365	359	The reserves in most major producing countries are ample in relation to demand. Quantitative estimates are not available.
Bhutan <sup>7</sup>	54	54	
Brazil	230	230	
Canada	60	60	
China	5,200	5,000	
France	130	131	
Iceland	75	75	
India <sup>7</sup>	86	86	
Norway	362	369	
Russia	733	699	
South Africa	84	86	
Ukraine <sup>7</sup>	96	89	
Venezuela <sup>7</sup>	48	49	
Other countries	359	389	
World total (rounded)	7,880	7,680	

Ferrosilicon accounts for about 95% of world silicon production on a gross-weight basis and 77% on a silicon-content basis. The leading countries for ferrosilicon production were, in descending order and on a gross-weight basis, China, Russia, Norway, the United States, and Ukraine, and for silicon metal production were China, the United States, Norway, Brazil, and France. China was by far the leading producer of ferrosilicon (6,000,000 tons) and silicon metal (1,300,000 tons) in 2014.

**World Resources:** World and domestic resources for making silicon metal and alloys are abundant and, in most producing countries, adequate to supply world requirements for many decades. The source of the silicon is silica in various natural forms, such as quartzite.

**Substitutes:** Aluminum, silicon carbide, and silicomanganese can be substituted for ferrosilicon in some applications. Gallium arsenide and germanium are the principal substitutes for silicon in semiconductor and infrared applications.

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

<sup>1</sup>Ferrosilicon grades include the two standard grades of ferrosilicon—50% and 75% silicon—plus miscellaneous silicon alloys.

<sup>2</sup>Metallurgical-grade silicon metal.

<sup>3</sup>Based on U.S. dealer import price.

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

<sup>5</sup>Production quantities are combined totals of estimated silicon content for ferrosilicon and silicon metal, as applicable, except as noted.

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

<sup>7</sup>Ferrosilicon only.