

SILICON

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

Domestic Production and Use: Six companies produced silicon materials in 2021, all east of the Mississippi River. 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 alloys and the chemical industry, in particular for the manufacture of silicones. The semiconductor and solar energy industries, which manufacture chips for computers and photovoltaic cells from high-purity silicon, respectively, also consumed silicon metal.

Salient Statistics—United States:	2017	2018	2019	2020	2021^e
Production, ferrosilicon ¹ and silicon metal ²	415	430	310	277	310
Imports for consumption:					
Ferrosilicon, all grades	147	140	127	140	120
Silicon metal	136	116	124	97	93
Exports:					
Ferrosilicon, all grades	11	12	8	4	7
Silicon metal	71	45	40	31	57
Consumption, apparent, ³ ferrosilicon ¹ and silicon metal ²	616	637	517	481	459
Price, average, cents per pound of silicon:					
Ferrosilicon, 50% Si ⁴	94.47	104.24	102.35	103.38	110.00
Ferrosilicon, 75% Si ⁵	86.88	107.58	89.15	87.40	140.00
Silicon metal ^{2, 5}	116.56	134.15	105.70	96.84	140.00
Stocks, producer, ferrosilicon ¹ and silicon metal, ² yearend	26	19	15	12	11
Net import reliance ⁶ as a percentage of apparent consumption:					
Ferrosilicon, all grades	<50	<50	<50	>50	<50
Silicon metal ²	<50	<50	<50	<50	<50
Total	33	32	40	42	32

Recycling: Insignificant.

Import Sources (2017–20): Ferrosilicon: Russia, 40%; Canada, 14%; Brazil, 10%; Iceland, 8%; and other, 28%. Silicon metal: Brazil, 30%; Canada, 21%; Norway, 13%; Australia, 8%; and other, 28%. Total: Russia, 21%; Brazil, 20%; Canada, 17%; Norway, 7%; and other, 35%.

Tariff:	Item	Number	Normal Trade Relations 12–31–21
	Silicon, more than 99.99% Si	2804.61.0000	Free.
	Silicon, 99.00%–99.99% Si	2804.69.1000	5.3% ad valorem.
	Silicon, other	2804.69.5000	5.5% ad valorem.
	Ferrosilicon, 55%–80% Si:		
	More than 3% Ca	7202.21.1000	1.1% ad valorem.
	Other	7202.21.5000	1.5% ad valorem.
	Ferrosilicon, 80%–90% Si	7202.21.7500	1.9% ad valorem.
	Ferrosilicon, more than 90% Si	7202.21.9000	5.8% ad valorem.
	Ferrosilicon, other:		
	More than 2% Mg	7202.29.0010	Free.
	Other	7202.29.0050	Free.

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

Government Stockpile: None.

SILICON

Events, Trends, and Issues: Combined domestic ferrosilicon and silicon metal production in 2021, expressed in terms of contained silicon, increased from that in 2020. One producer reopened its ferrosilicon production facility in March 2021 owing to increased demand for ferrosilicon products and improved domestic pricing. The facility had closed in July 2020 owing to decreased demand and lower prices—in part because of the global COVID-19 pandemic, as well as competition from lower priced imported ferrosilicon. Domestic production during the first 8 months of 2021 was about 5% more, on a silicon-content basis, than that during the same period in 2020. By August 2021, average U.S. spot market prices increased by almost 9% for 50%-grade ferrosilicon and by almost 60% for 75%-grade ferrosilicon compared with the annual averages in 2020; the average silicon metal spot market price increased by almost 50% compared with the annual average spot price in 2020.

Excluding the United States, ferrosilicon accounted for almost 70% of world silicon production on a silicon-content basis in 2021. The leading countries for ferrosilicon production were, in descending order and on a silicon-content basis, China, Russia, and Norway. For silicon metal, the leading producers were China, Brazil, and Norway. China accounted for approximately 70% of total global estimated production of silicon materials in 2021. Global production of silicon materials, on a silicon-content basis, was estimated to be about 5% more than that in 2020. Global production of steel, the leading use of ferrosilicon, increased in 2021 compared with production in 2020 owing to increased demand following the negative effects of the global COVID-19 pandemic.

World Production and Reserves:

	Production ⁷		Reserves ⁸
	2020	2021 ^e	
United States	277	310	The reserves in most major producing countries are ample in relation to demand. Quantitative estimates are not available.
Australia	42	42	
Bhutan ⁹	67	70	
Brazil	404	390	
Canada	47	50	
China	5,600	6,000	
France	112	120	
Iceland	103	110	
India ⁹	59	60	
Kazakhstan	67	67	
Malaysia ⁹	109	80	
Norway	345	350	
Poland	42	42	
Russia	576	580	
Spain	55	58	
Ukraine ⁹	40	49	
Other countries	175	160	
World total (rounded)	8,120	8,500	

World Resources:⁸ 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.

^eEstimated.

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

²Metallurgical-grade silicon metal.

³Defined as production + imports – exports + adjustments for industry stock changes.

⁴Source: CRU Group, transaction prices based on weekly averages.

⁵Source: S&P Global Platts Metals Week, mean import prices based on monthly averages.

⁶Defined as imports – exports + adjustments for industry stock changes.

⁷Production quantities are the silicon content of combined totals for ferrosilicon and silicon metal, except as noted.

⁸See Appendix C for resource and reserve definitions and information concerning data sources.

⁹Silicon content of ferrosilicon only.