SILICON

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

Domestic Production and Use: Silicon materials were produced at six facilities in 2022, 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:	2018	2019	2020	2021	2022[e]
Production, ferrosilicon[1] and silicon metal[2]	430	310	277	313	310
Imports for consumption:					
Ferrosilicon, all grades	140	127	140	125	200
Silicon metal	116	124	97	96	120
Exports:					
Ferrosilicon, all grades	12	8	4	7	8
Silicon metal	45	40	31	53	49
Consumption, apparent,[3] ferrosilicon[1] and silicon metal[2]	637	517	481	475	570
Price, average, cents per pound of silicon:					
Ferrosilicon, 50% silicon[4]	104.24	102.35	103.38	137.94	NA
Ferrosilicon, 75% silicon[5]	107.58	89.15	87.40	192.28	350
Silicon metal[2, 5]	134.15	105.70	96.84	220.31	400
Stocks, producer, ferrosilicon[1] and silicon metal,[2] yearend	19	15	12	11	17
Net import reliance[6] as a percentage of apparent consumption:					
Ferrosilicon, all grades	<50	<50	>50	<50	>50
Silicon metal[2]	<25	<50	<50	<25	<50
Total	32	40	42	34	45

Recycling: Insignificant.

Import Sources (2018–21): Ferrosilicon: Russia, 40%; Canada, 14%; Brazil, 12%; Malaysia, 9%; and other, 25%. Silicon metal: Brazil, 31%; Canada, 24%; Norway, 14%; Thailand, 7%; and other, 24%. Total: Russia, 22%; Brazil, 20%; Canada, 18%; Norway, 8%; and other, 32%.

Tariff: Item	Number	Normal Trade Relations 12–31–22
Silicon:		
More than or equal to 99.99% silicon	2804.61.0000	Free.
More than or equal to 99.00% but less than 99.99% silicon	2804.69.1000	5.3% ad valorem.
Other	2804.69.5000	5.5% ad valorem.
Ferrosilicon:		
More than 55% but less than or equal to 80% silicon:		
More than 3% calcium	7202.21.1000	1.1% ad valorem.
Other	7202.21.5000	1.5% ad valorem.
More than 80% but less than or equal to 90% silicon	7202.21.7500	1.9% ad valorem.
More than 90% silicon	7202.21.9000	5.8% ad valorem.
Other:		
More than 2% magnesium	7202.29.0010	Free.
Other	7202.29.0050	Free.

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

Government Stockpile: None.

Prepared by **Emily K. Schnebele [(703) 648–4945, eschnebele@usgs.gov]**

SILICON

Events, Trends, and Issues: Combined domestic ferrosilicon and silicon metal production in 2022, expressed in terms of contained silicon, was unchanged from that in 2021. One producer restarted a silicon metal production facility in early 2022 owing to increased demand for silicon metal in North America. By August 2022, average U.S. spot market prices increased by over 80% for both 75%-grade ferrosilicon and silicon metal compared with the annual averages in 2021.

Excluding the United States, ferrosilicon accounted for over 60% of world silicon production on a silicon-content basis in 2022. The leading countries for ferrosilicon production were, in descending order on a silicon-content basis, China, Russia, and Norway. For silicon metal, the leading producers were, in descending order on a silicon-content basis, China, Brazil, and Norway. China accounted for almost 70% of total global estimated production of silicon materials in 2022. Global production of silicon materials, on a silicon-content basis, was estimated to be about 4% less than that in 2021. Global production of steel, the leading use of ferrosilicon, decreased in 2022 compared with production in 2021 owing to supply chain disruptions resulting from the conflict between Russia and Ukraine and intermittent coronavirus disease 2019 (COVID-19) pandemic-related lockdowns in China.

In August, the President signed the Creating Helpful Incentives to Produce Semiconductors and Science (CHIPS) Act of 2022; the Act supports an increase in U.S. semiconductor manufacturing by providing grants for semiconductor manufacturing, grants for research investments, and tax incentives for chip manufacturing.

World Production and Reserves:

	Production[e, 7]		Reserves[8]
	2021	2022	
United States	313	310	The reserves in most major producing countries are ample in relation to demand. Quantitative estimates were not available.
Australia	50	50	
Bhutan[9]	85	85	
Brazil	389	400	
Canada	49	49	
China	6,400	6,000	
France	127	120	
Germany	63	63	
Iceland	111	110	
India[9]	59	59	
Kazakhstan	122	120	
Malaysia[9]	85	92	
Norway	362	360	
Poland[9]	49	49	
Russia	644	640	
Spain	60	57	
Ukraine[9]	49	19	
Other countries	128	210	
World total (rounded)	9,150	8,800	

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.

[e]Estimated. NA Not available.

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

[2]Metallurgical-grade silicon metal.

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

[4]Source: CRU Group, transaction prices based on weekly averages. Average spot prices for ferrosilicon, 50% grade, were discontinued in April 2022.

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

[6]Defined as imports – exports ± adjustments for industry stock changes.

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

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

[9]Silicon content of ferrosilicon only.