

SILICON

(Data in thousand metric tons, silicon content, unless otherwise specified)

Domestic Production and Use: Silicon materials were produced at six facilities in 2023, 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, respectively, from high-purity silicon also consumed silicon metal.

Salient Statistics—United States:	2019	2020	2021	2022	2023^e
Production, ferrosilicon ¹ and silicon metal ²	310	W	W	265	W
Imports for consumption:					
Ferrosilicon, all grades	127	140	125	175	160
Silicon metal	124	97	96	117	80
Exports:					
Ferrosilicon, all grades	8	4	7	9	6
Silicon metal	40	32	53	47	40
Consumption, apparent, ³ ferrosilicon ¹ and silicon metal ²	517	W	W	495	W
Price, average, cents per pound of silicon:					
Ferrosilicon, 50% silicon ⁴	102.35	103.38	137.94	NA	NA
Ferrosilicon, 75% silicon ⁵	89.15	87.40	192.28	312.10	150
Silicon metal ^{2,5}	105.70	96.84	220.31	361.86	190
Stocks, producer, ferrosilicon ¹ and silicon metal, ² yearend	15	W	11	17	19
Net import reliance ⁶ as a percentage of apparent consumption:					
Ferrosilicon, all grades	<50	>50	<50	>50	>50
Silicon metal ²	<50	<50	<25	<50	<50
Total	40	<50	<50	46	<50

Recycling: Insignificant.

Import Sources (2019–22): Ferrosilicon: Russia, 38%; Brazil, 13%; Canada, 13%; Malaysia, 9%; and other, 27%. Silicon metal: Brazil, 35%; Canada, 25%; Norway, 13%; Australia, 6%; and other, 21%. Total: Brazil, 23%; Russia, 21%; Canada, 18%; Norway, 7%; and other, 31%.

Tariff:	Item	Number	Normal Trade Relations 12–31–23
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.

Events, Trends, and Issues: Combined domestic ferrosilicon and silicon metal production in 2023 was withheld to avoid disclosing proprietary information but was estimated to be less than that in 2022. By September 2023, average U.S. spot market prices decreased by approximately 50% for both 75%-grade ferrosilicon and silicon metal compared with the annual average prices in 2022.

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Excluding the United States, ferrosilicon accounted for almost 60% of world silicon production on a silicon-content basis in 2023. 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 more than 70% of total global estimated production of silicon materials in 2023. Global production of silicon materials, on a silicon-content basis, was estimated to be essentially unchanged from that in 2022.

In January, a company announced plans to build a \$2.5 billion fully integrated silicon-based solar supply chain facility in Georgia that would manufacture silicon ingots, wafers, cells, and modules. Production was expected to commence in late 2024 and would be the first production of solar-grade wafers in the United States since 2016. Another U.S. company planned to restart an idled solar-grade polysilicon production facility in Washington in late 2023.

In support of the CHIPS and Science Act of 2022, the U.S. Department of Commerce, through the National Institute of Standards and Technology, issued a final rule in September to prevent funding from being used directly or indirectly to benefit foreign countries of concern. Countries of concern are determined to be those engaged in conduct that is detrimental to the national security or foreign policy of the United States.

World Production:

	Ferrosilicon ^e		Silicon metal ^e	
	2022	2023	2022	2023
United States ⁷	W	W	W	W
Australia	—	—	48	50
Bhutan	75	80	—	—
Brazil	189	190	202	200
Canada	20	20	29	30
China	3,770	3,600	2,900	3,000
France	25	20	96	90
Germany	—	—	62	60
Iceland	79	80	49	50
India	59	60	—	—
Kazakhstan	96	120	5	5
Malaysia	91	80	—	—
Norway	195	200	144	140
Poland	47	50	—	—
Russia	572	570	54	50
Spain	46	50	6	6
Ukraine	28	2	—	—
Other countries	144	100	79	80
World total (rounded) ⁸	5,440	5,200	3,670	3,800

World Resources:⁹ 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. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

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. Average spot prices for ferrosilicon, 50% grade, were discontinued in April 2022.

⁵Source: S&P Global Platts Metals Week, mean import prices based on monthly averages. Estimated 2023 price is the mean based on monthly average of January through September 2023.

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

⁷To avoid disclosing proprietary data, U.S. ferrosilicon and silicon production are not reported separately. See Salient Statistics for U.S. combined ferrosilicon and silicon metal production.

⁸Excludes U.S. production.

⁹See Appendix C for resource and reserve definitions and information concerning data sources.