



Critical Minerals

▶ **COBALT**

RESERVES

Countries
The World Top 10
World Cobalt Reserves

PRODUCTION

Countries
The World Top 10
World Cobalt Production

▶ **LITHIUM**

RESERVES

Countries
The World Top 9
World Lithium Reserves

PRODUCTION

Countries
The World Top 8
World Lithium Production

▶ **COPPER**

RESERVES

Countries
The World Top 10
World Copper Reserves

PRODUCTION

Countries
The World Top 10
World Copper Production

▶ **MANGANESE**

RESERVES

Countries
The World Top 10
World Manganese Reserves

PRODUCTION

Countries
The World Top 10
World Manganese Production

▶ **RARE EARTHS**

RESERVES

Countries
The World Top 10
World Rare Earths Reserves

PRODUCTION

Countries
The World Top 10
World Rare Earths Production

▶ **GRAPHITE**

RESERVES

Countries
The World Top 10
World Graphite Reserves

PRODUCTION

Countries
The World Top 10
World Graphite Production

▶ **NICKEL**

RESERVES

Countries
The World Top 9
World Nickel Reserves

PRODUCTION

Countries
The World Top 10
World Nickel Production

▶ **SILICON**

PRODUCTION

Countries
The World Top 10
World Silicon Production

Executive summary

Critical minerals play a key role in some key transition-related technologies: batteries (cobalt, lithium, nickel, manganese and graphite), wind (rare earths) and solar (silicon).

The extraction of these raw materials is concentrated in a few countries which, together with high prices and expected growth in demand, could jeopardize security of supply.

In recent years, many critical raw materials have experienced significant price spikes. Most of them show the significant growth rates in term of production (e.g., lithium CAGR 2010-2023 of +15%), also reflecting the estimated growth in demand, linked to the energy transition. Cobalt and lithium are, among the critical minerals, the most concentrated in terms of reserves and production.

In terms of **reserves**, cobalt had a growth of 2,700 kton in 2023 (+33%), the most significant increase recorded in Democratic Republic of Congo (+2,000 kton) where 57% of the world reserves are concentrated; for lithium there was an increase of 2,000 kton compared to 2022, owing to large amount of reserves in China and Argentina; on the other hand, Chile is the country with the highest geographical concentration of reserves (34%).

Regarding **production** in particular, cobalt is concentrated 74% in the Democratic Republic of Congo, rare earths 68% in China, nickel over 50% in Indonesia, and almost 50% of lithium is produced in Australia.

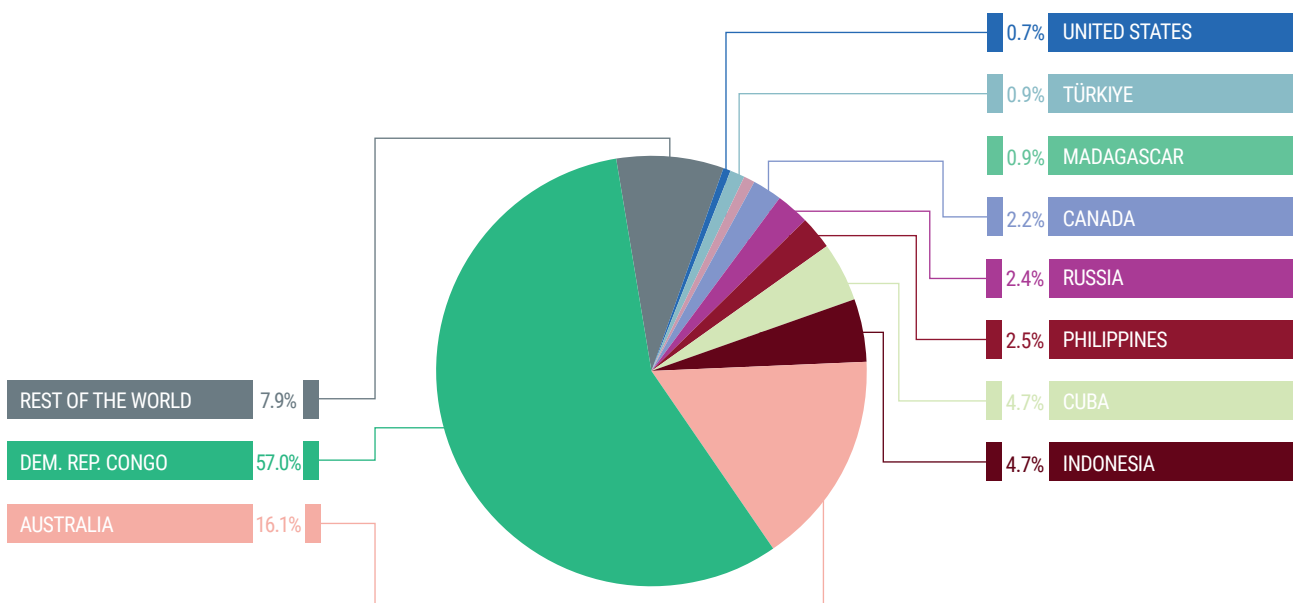
Cobalt - Reserves

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	1,400,000	1,100,000	1,200,000	1,200,000	1,400,000	1,400,000	1,500,000	1,700,000	13.3%	1.5%
Brazil	89,000	78,000								-100.0%
Canada	150,000	240,000	250,000	230,000	220,000	220,000	220,000	230,000	4.5%	3.3%
China	80,000	80,000	80,000	80,000	80,000	80,000	140,000		-100.0%	-100.0%
Cuba	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	0.0%	0.0%
Dem. Rep. Congo	3,400,000	3,400,000	3,400,000	3,600,000	3,600,000	3,500,000	4,000,000	6,000,000	50.0%	4.5%
Indonesia						600,000	600,000	500,000	-16.7%	
Madagascar		130,000	140,000	120,000	100,000	100,000	100,000	100,000	0.0%	
Morocco	20,000		17,000	18,000	14,000	13,000	13,000		-100.0%	-100.0%
New Caledonia	370,000	200,000								-100.0%
Papua New Guinea			56,000	56,000	51,000	47,000	47,000	49,000	4.3%	
Philippines		250,000	280,000	260,000	260,000	260,000	260,000	260,000	0.0%	
Russia	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	0.0%	0.0%
South Africa		31,000	24,000	50,000	40,000					
Türkiye							36,000	91,000	152.8%	
United States	33,000	23,000	38,000	55,000	53,000	69,000	69,000	69,000	0.0%	5.8%
Zambia	270,000	270,000								-100.0%
Others	740,000	610,000	640,000	570,000	560,000	610,000	610,000	780,000	27.9%	0.4%
World (rounded)	7,300,000	7,100,000	6,900,000	7,000,000	7,100,000	7,600,000	8,300,000	11,000,000	32.5%	3.2%

The World Top 10 (2023)

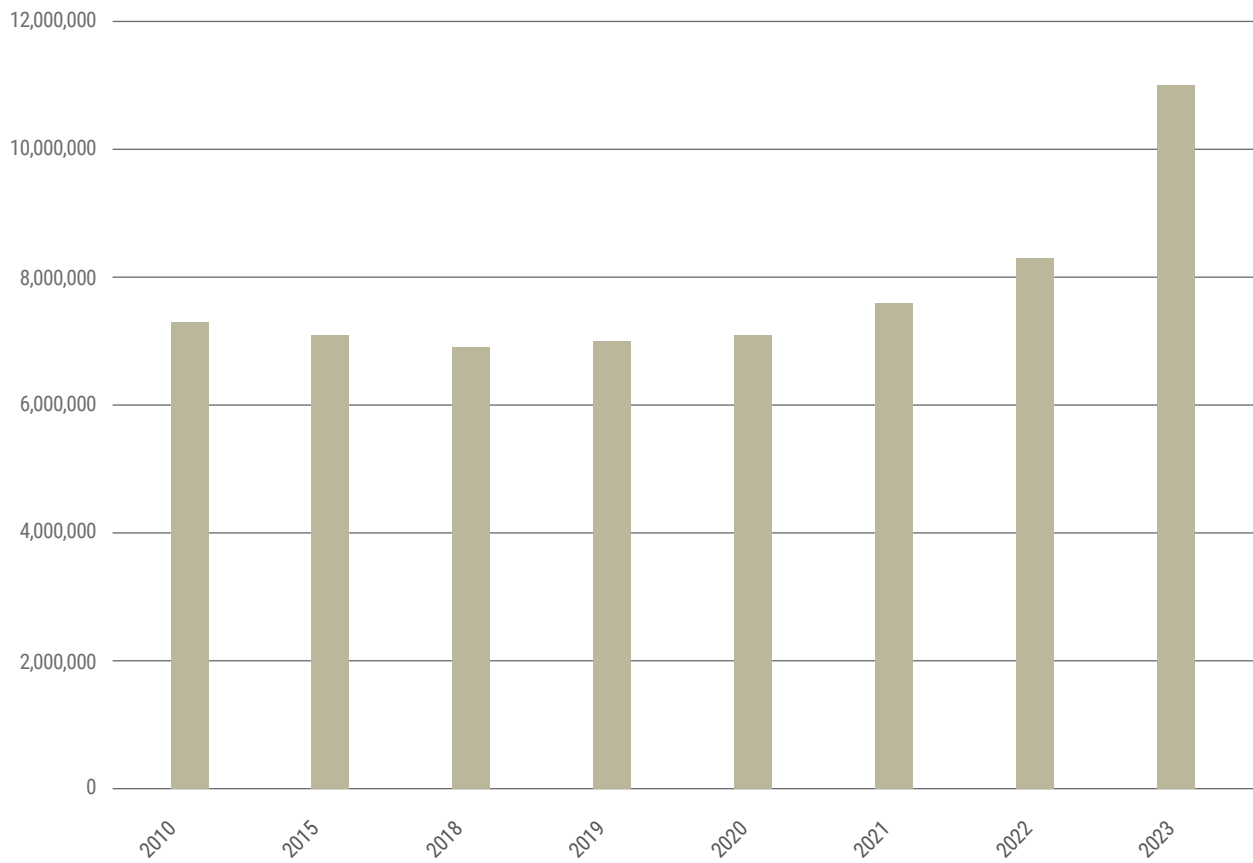


^(*) Data source: U.S. Geological Survey.

Cobalt - Reserves

World Cobalt Production

(tons)



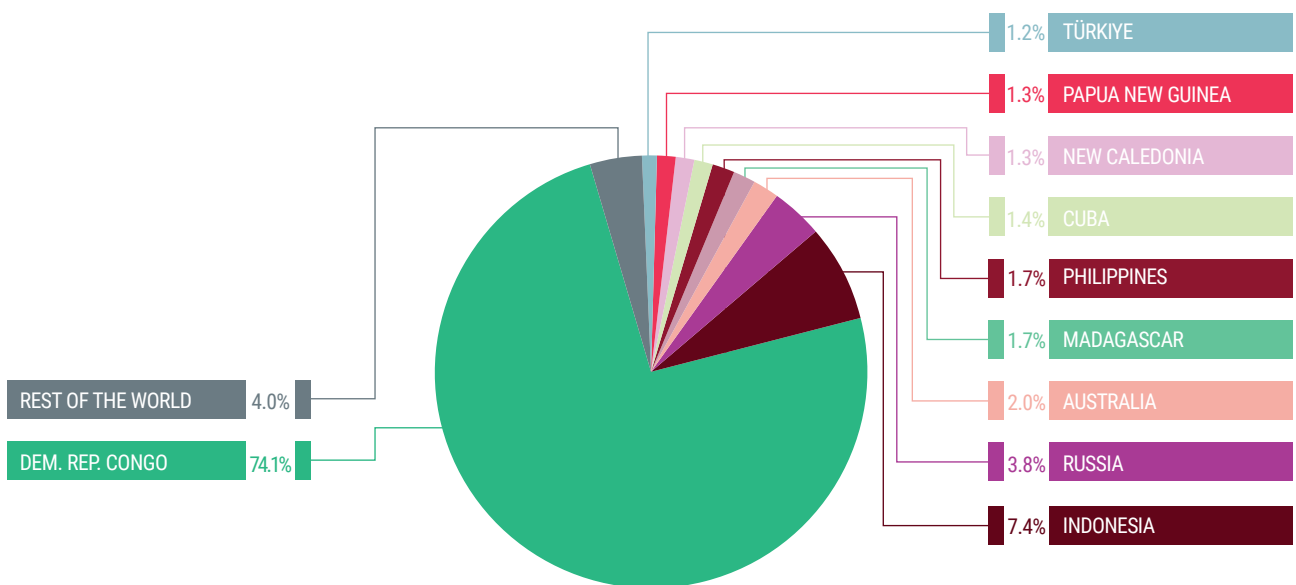
Cobalt - Production

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	3,850	6,000	4,880	5,740	5,630	5,295	5,790	4,600	-20.6%	1.4%
Brazil	1,600									-100.0%
Canada	4,600	6,900	3,520	3,340	3,690	4,361	3,060	2,100	-31.4%	-5.9%
China	6,500	7,700	2,000	2,500	2,200	2,200	2,200		-100.0%	-100.0%
Cuba	3,600	4,300	3,500	3,800	3,800	4,000	3,700	3,200	-13.5%	-0.9%
Dem. Rep. Congo	47,400	63,000	104,000	100,000	98,000	119,000	144,000	170,000	18.1%	10.3%
Indonesia					1,100	2,700	9,600	17,000	77.1%	
Madagascar		3,700	3,300	3,400	850	2,800	3,500	4,000	14.3%	
Morocco	2,200		2,100	2,300	2,300	2,300	2,000			
New Caledonia	1,000	3,680	2,100				2,000	3,000	50.0%	8.8%
Papua New Guinea			3,280	2,910	2,940	2,953	2,990	2,900	-3.0%	
Philippines		4,300	4,600	5,100	4,500	3,600	3,900	3,800	-2.6%	
Russia	6,200	6,200	6,100	6,300	9,000	8,000	9,200	8,800	-4.3%	2.7%
South Africa		3,000	2,300	2,100						
Türkiye						2,400	2,100	2,800	33.3%	
United States		760	490	500	600	650	500	500	0.0%	
Zambia	5,700	4,600								-100.0%
Others	6,800	11,600	5,540	6,320	7,640	4,567	6,600	6,600	0.0%	-0.2%
World (rounded)	89,500	126,000	148,000	144,000	142,000	165,000	197,000	230,000	16.8%	7.5%

The World Top 10 (2023)

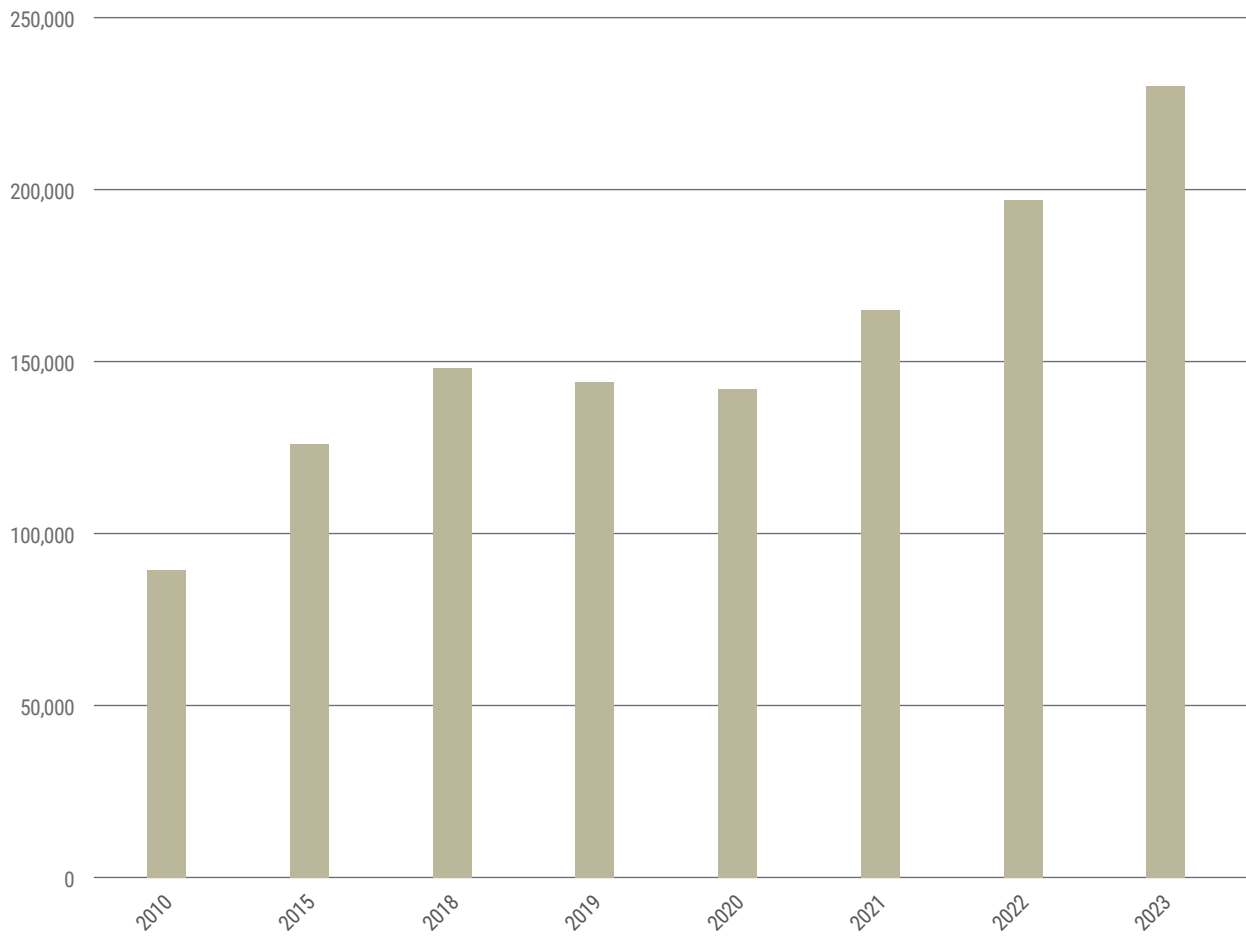


^(*) Data source: U.S. Geological Survey.

Cobalt - Production

World Cobalt Production

(tons)



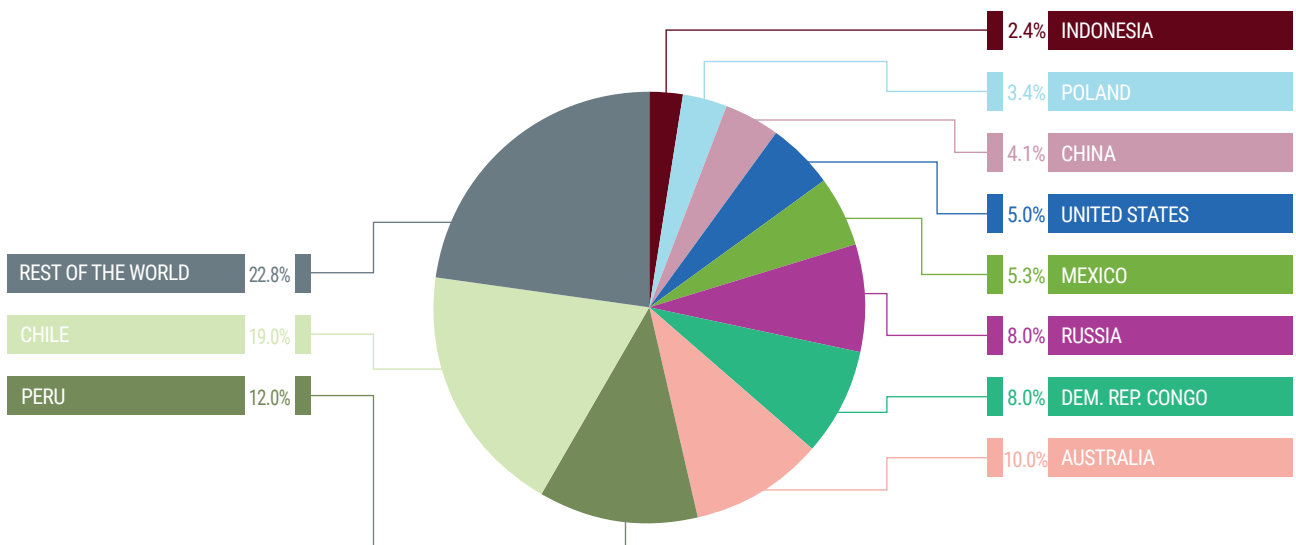
Copper - Reserves

Countries^(*)

(thousand tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	80,000	88,000	88,000	87,000	88,000	93,000	97,000	100,000	3.1%	1.7%
Canada	8,000	11,000			9,000	9,800	7,600	7,600	0.0%	-0.4%
Chile	150,000	210,000	170,000	200,000	200,000	200,000	190,000	190,000	0.0%	1.8%
China	30,000	30,000	26,000	26,000	26,000	26,000	27,000	41,000	51.9%	2.4%
Dem. Rep. Congo		20,000	20,000	19,000	19,000	31,000	31,000	80,000	158.1%	
Germany					2,000					
Indonesia	30,000		51,000	28,000		24,000	24,000	24,000	0.0%	-1.7%
Kazakhstan	18,000			20,000	20,000	20,000	20,000	20,000	0.0%	0.8%
Mexico	38,000	46,000	50,000	53,000	53,000	53,000	53,000	53,000	0.0%	2.6%
Peru	90,000	82,000	83,000	87,000	92,000	77,000	81,000	120,000	48.1%	2.2%
Poland	26,000				32,000	31,000	30,000	34,000	13.3%	2.1%
Russia	30,000	30,000	61,000	61,000	61,000	62,000	62,000	80,000	29.0%	7.8%
United States	35,000	33,000	48,000	51,000	48,000	48,000	44,000	50,000	13.6%	2.8%
Zambia	20,000	20,000	19,000	19,000	21,000	21,000	19,000	21,000	10.5%	0.4%
Others	80,000	150,000	210,000	220,000	200,000	180,000	200,000	180,000	-10.0%	6.4%
World (rounded)	630,000	720,000	830,000	870,000	870,000	880,000	890,000	1,000,000	12.4%	3.6%

The World Top 10 (2023)

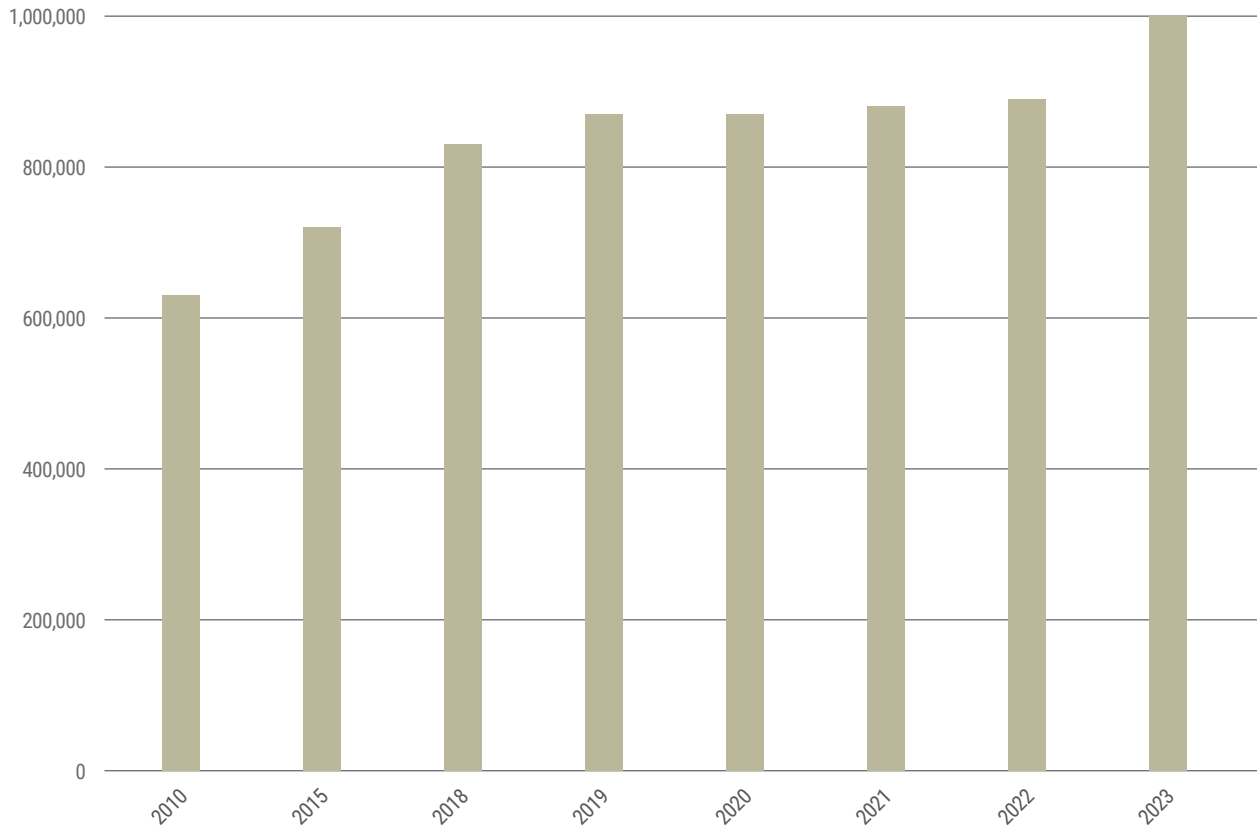


^(*) Data source: U.S. Geological Survey.

Copper - Reserves

World Copper Reserves

(thousand tons)



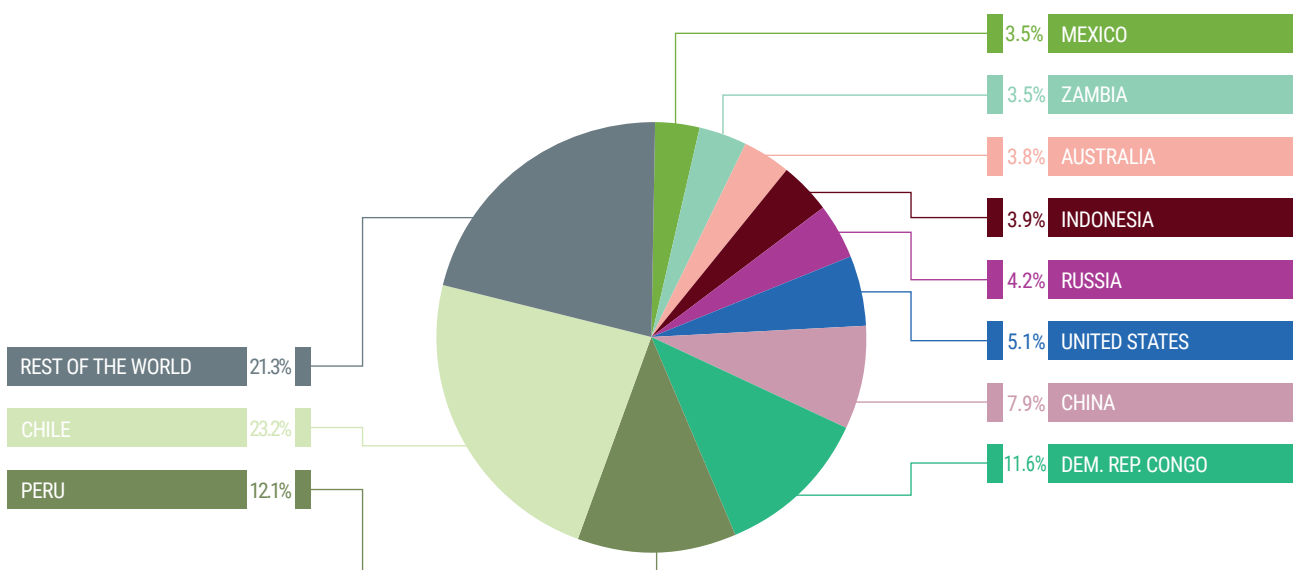
Copper - Production

Countries^(*)

(thousand tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	870	971	920	934	885	813	819	810	-1.1%	-0.5%
Canada	525	697		573	585	550	520	480	-7.7%	-0.7%
Chile	5,420	5,760	5,830	5,790	5,730	5,620	5,330	5,000	-6.2%	-0.6%
China	1,190	1,710	1,590	1,680	1,720	1,910	1,940	1,700	-12.4%	2.8%
Dem. Rep. Congo	343	1,020	1,230	1,290	1,600	1,740	2,350	2,500	6.4%	16.5%
Indonesia	872		651		505	731	941	840	-10.7%	-0.3%
Kazakhstan	380		603	562	552	510	593	600	1.2%	3.6%
Mexico	260	594	751	715	733	734	754	750	-0.5%	8.5%
Peru	1,250	1,700	2,400	2,460	2,150	2,300	2,450	2,600	6.1%	5.8%
Poland	425			399	393	391	393	400	1.8%	-0.5%
Russia	703	732	751	801	810	940	936	910	-2.8%	2.0%
United States	1,110	1,380	1,220	1,260	1,200	1,230	1,230	1,100	-10.6%	-0.1%
Zambia	690	712	854	797	853	842	797	760	-4.6%	0.7%
Others	1,900	3,800	3,540	3,100	2,840	2,850	2,850	3,100	8.8%	3.8%
World (rounded)	15,900	19,100	20,400	20,400	20,600	21,200	21,900	22,000	0.5%	2.5%

The World Top 10 (2023)

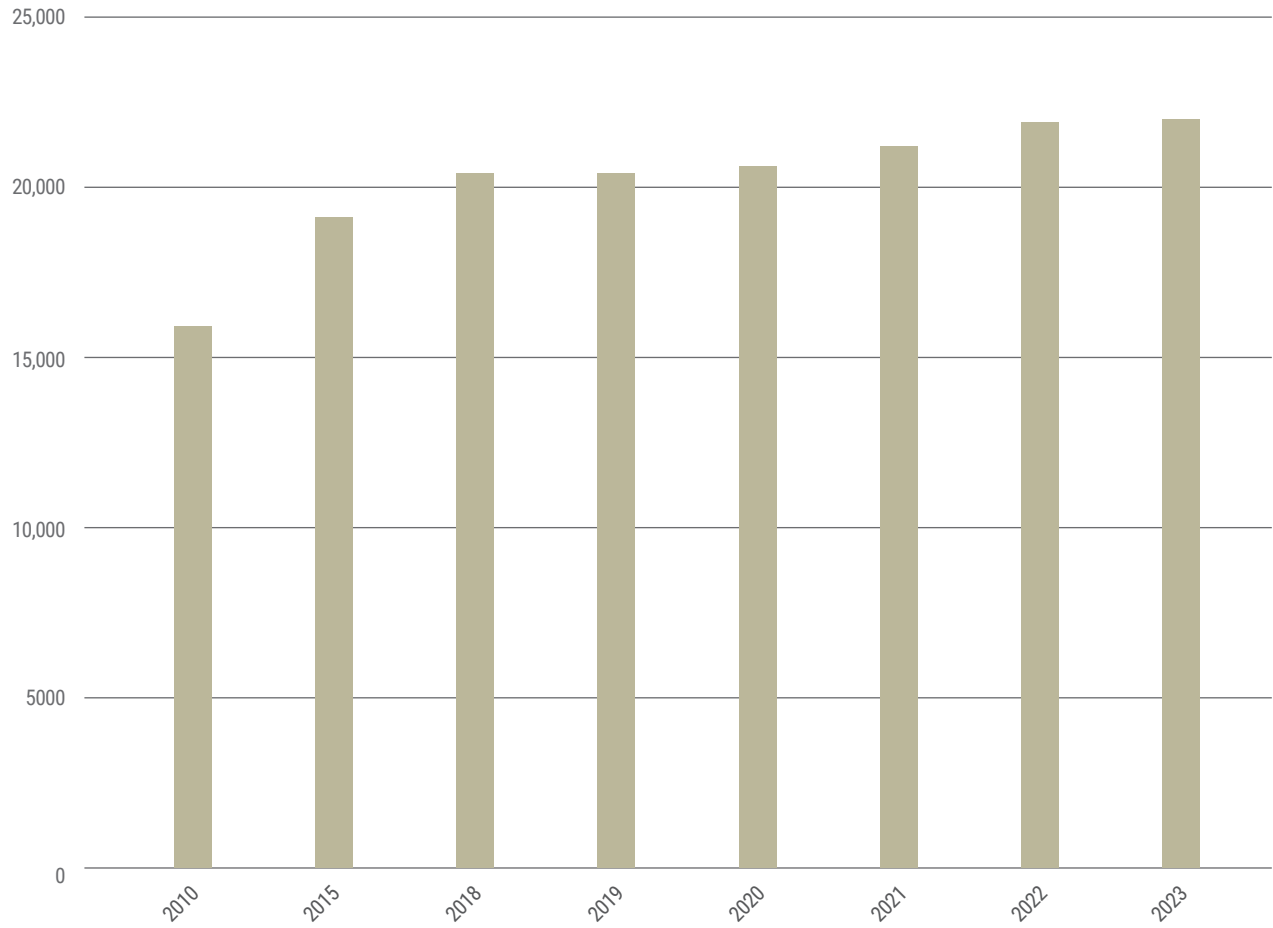


^(*) Data source: U.S. Geological Survey.

Copper - Production

World Copper Production

(thousand tons)



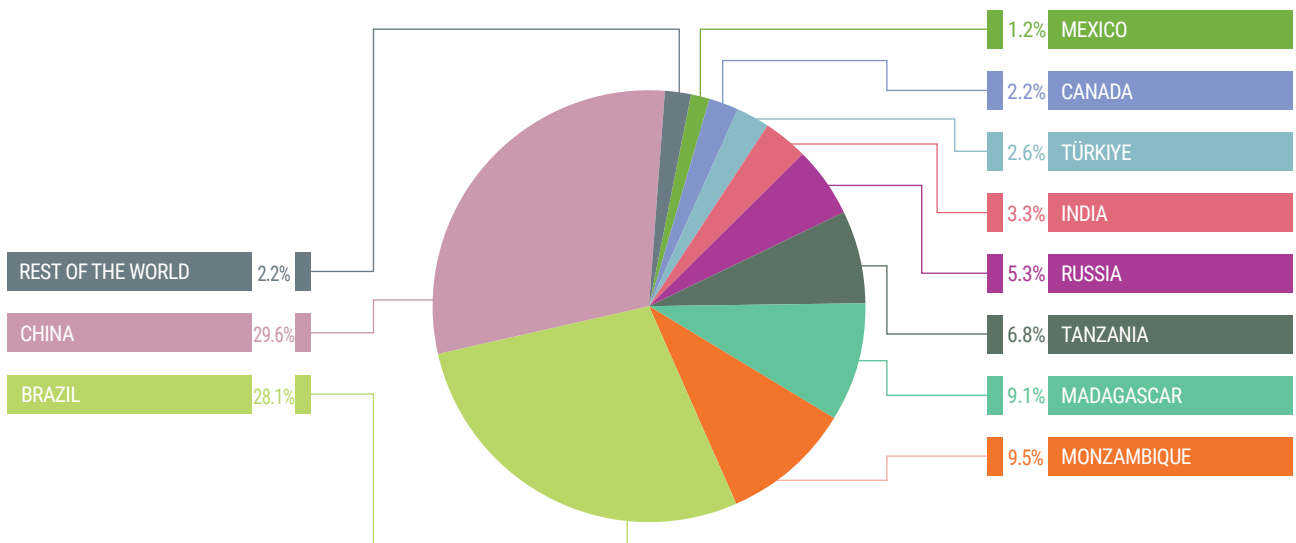
Graphite - Reserves

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Brazil	360,000	72,000,000	72,000,000	72,000,000	70,000,000	70,000,000	74,000,000	74,000,000	0.0%	50.6%
Canada								5,700,000		
China	55,000,000	55,000,000	73,000,000	73,000,000	73,000,000	73,000,000	52,000,000	78,000,000	50.0%	2.7%
India	5,200,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,600,000	7.5%	3.9%
North Korea			2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	0.0%	
South Korea							1,800,000	1,800,000	0.0%	
Madagascar	940,000	940,000	1,600,000	1,600,000	26,000,000	26,000,000	26,000,000	24,000,000	-7.7%	28.3%
Mexico	3,100,000	3,100,000	3,100,000	3,100,000	3,100,000	3,100,000	3,100,000	3,100,000	0.0%	0.0%
Monzambique			17,000,000	25,000,000	25,000,000	25,000,000	25,000,000	25,000,000	0.0%	
Norway			600,000	600,000	600,000	600,000	600,000	600,000	0.0%	
Russia							14,000,000	14,000,000	0.0%	
Sri Lanka					1,500,000	1,500,000	1,500,000	1,500,000	0.0%	
Tanzania			17,000,000	18,000,000	17,000,000	18,000,000	18,000,000	18,000,000	0.0%	
Türkiye		90,000,000	90,000,000	90,000,000	90,000,000	90,000,000	90,000,000	6,900,000	-92.3%	
Uzbekistan			7,600,000	7,600,000	7,600,000	7,600,000	7,600,000		-100.0%	
Other	6,400,000									-100.0%
World (rounded)	71,000,000	230,000,000	300,000,000	300,000,000	320,000,000	320,000,000	330,000,000	280,000,000	-15.2%	11.1%

The World Top 10 (2023)

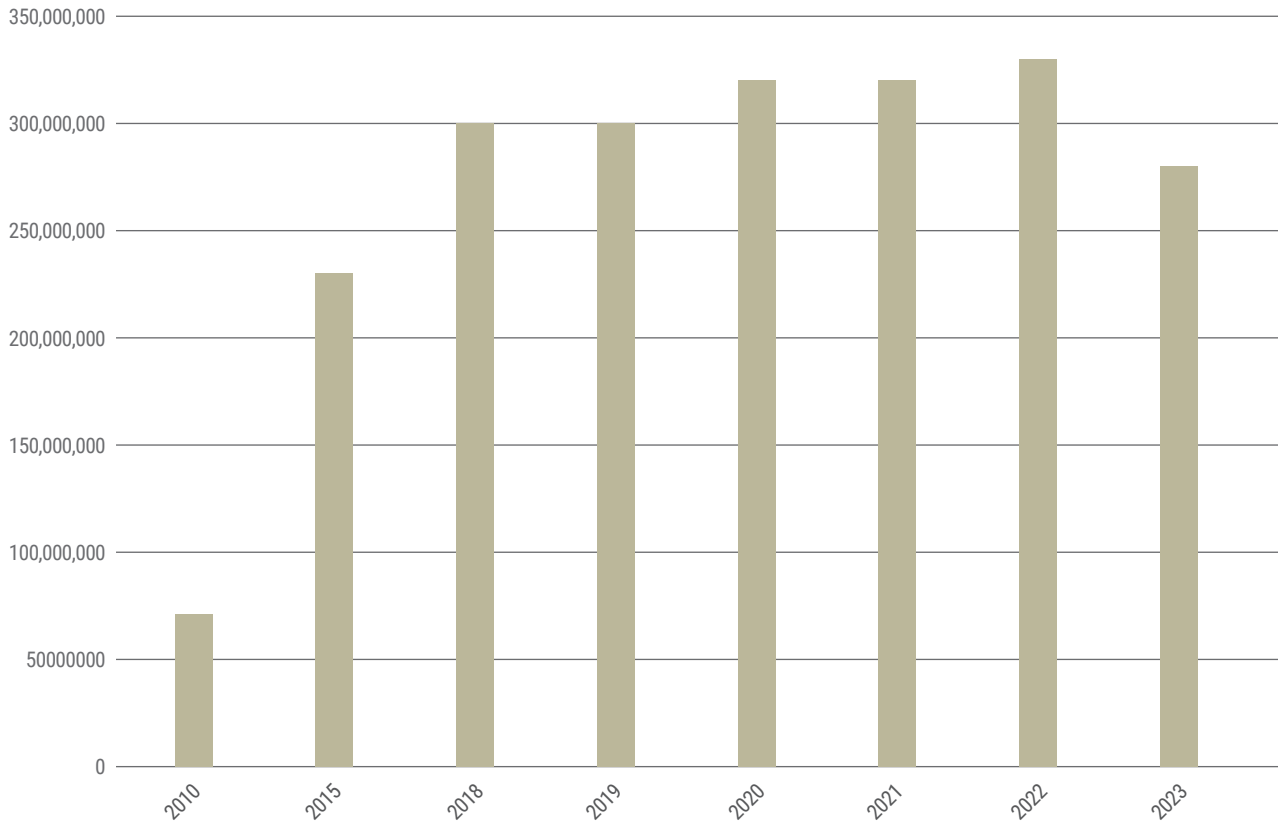


^(*) Data source: U.S. Geological Survey.

Graphite - Reserves

World Graphite Reserves

(tons)



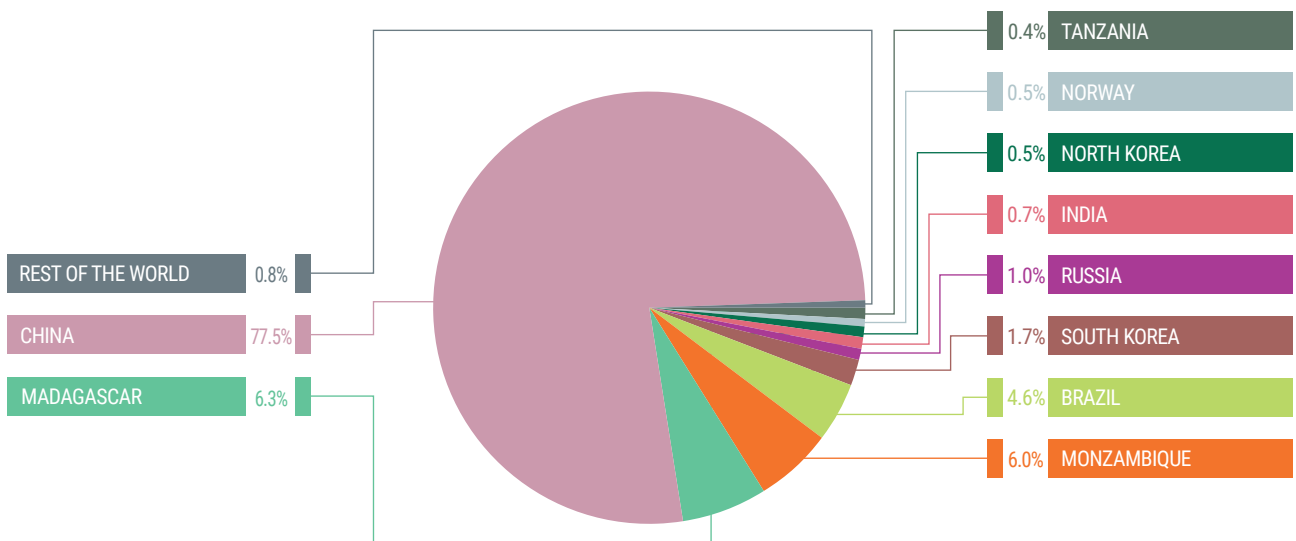
Graphite - Production

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Austria			1,000	1,000	500	500	500	500	0.0%	
Brazil	76,000	80,000	95,000	96,000	63,500	82,000	72,000	73,000	1.4%	-0.3%
Canada	25,000	30,000	40,000	11,000	8,000	12,000	13,000	3,500	-73.1%	-14.0%
China	600,000	780,000	693,000	700,000	762,000	820,000	1,210,000	1,230,000	1.7%	5.7%
Germany			800	800	300	250	170	150	-11.8%	
India	140,000	170,000	35,000	35,000	6,000	7,000	11,000	11,500	4.5%	-17.5%
North Korea	30,000	30,000	6,000	6,000	8,100	8,100	8,100	8,100	0.0%	-9.6%
South Korea						10,500	23,800	27,000	13.4%	
Madagascar	5,000	5,000	46,900	48,000	20,900	70,000	130,000	100,000	-23.1%	25.9%
Mexico	7,000	22,000	9,000	9,000	3,300	2,100	2,000	2,000	0.0%	-9.2%
Monzambique			104,000	107,000	28,000	72,000	166,000	96,000	-42.2%	
Namibia			3,460							
Norway	2,000	8,000	16,000	16,000	12,000	6,290	10,380	7,200	-30.6%	10.4%
Pakistan			14,000	14,000						
Romania	20,000									-100.0%
Russia		15,000	25,200	25,100	25,000	15,000	16,000	16,000	0.0%	
Sri Lanka	8,000	4,000	4,000	4,000	4,000	3,000	2,600	2,200	-15.4%	-9.5%
Tanzania			150	150			6,120	6,000	-2.0%	
Türkiye		32,000	2,000	2,000	2,500	2,700	2,800	2,000	-28.6%	
Ukraine	6,000	5,000	20,000	20,000	16,000	10,000	1,000	2,000	100.0%	-8.1%
Uzbekistan			100	100	100	110				
Vietnam			500	5,000	5,000	5,000	500	500	0.0%	
Zimbabwe		7,000	2,000							
Other	6,000		200							-100.0%
World (rounded)	925,000	1,190,000	1,120,000	1,100,000	966,000	1,130,000	1,680,000	1,600,000	-4.8%	4.3%

The World Top 10 (2023)

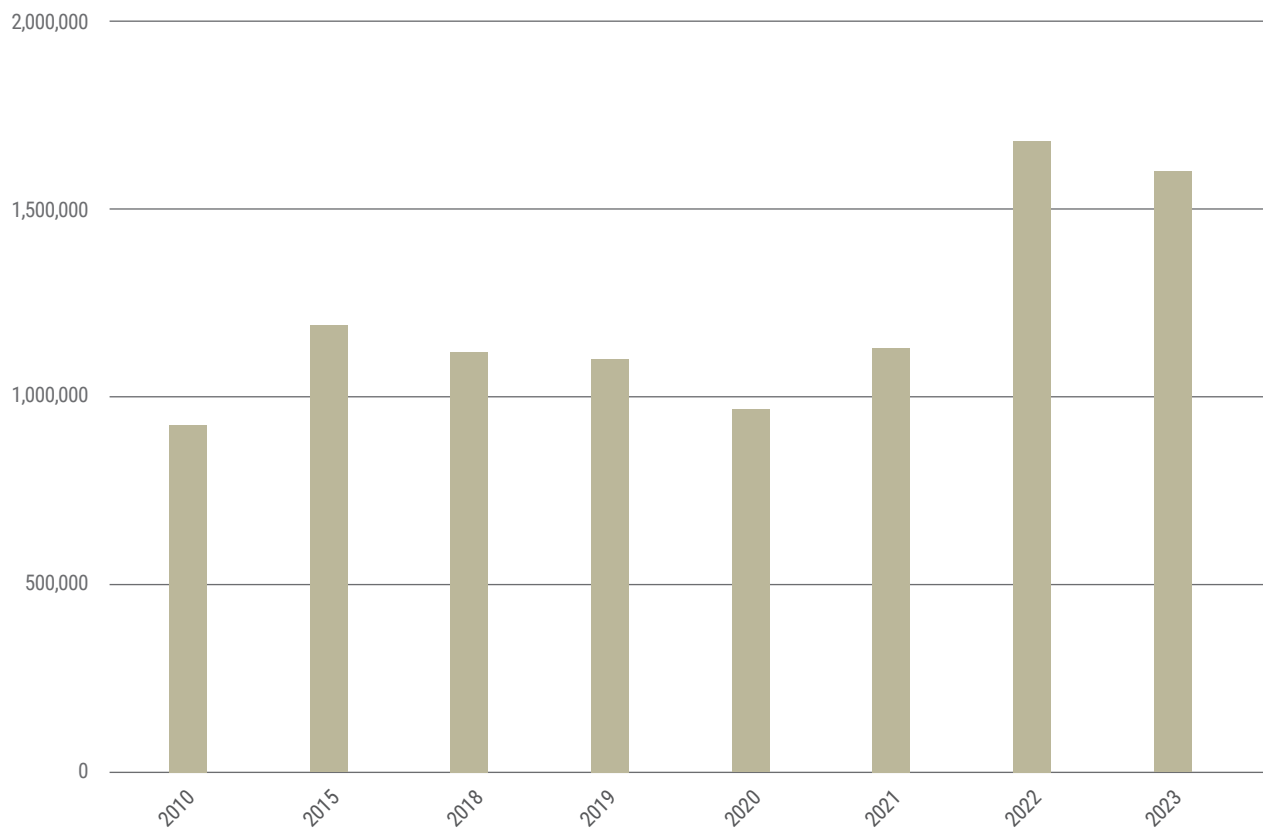


^(*) Data source: U.S. Geological Survey.

Graphite - Production

World Graphite Production

(tons)



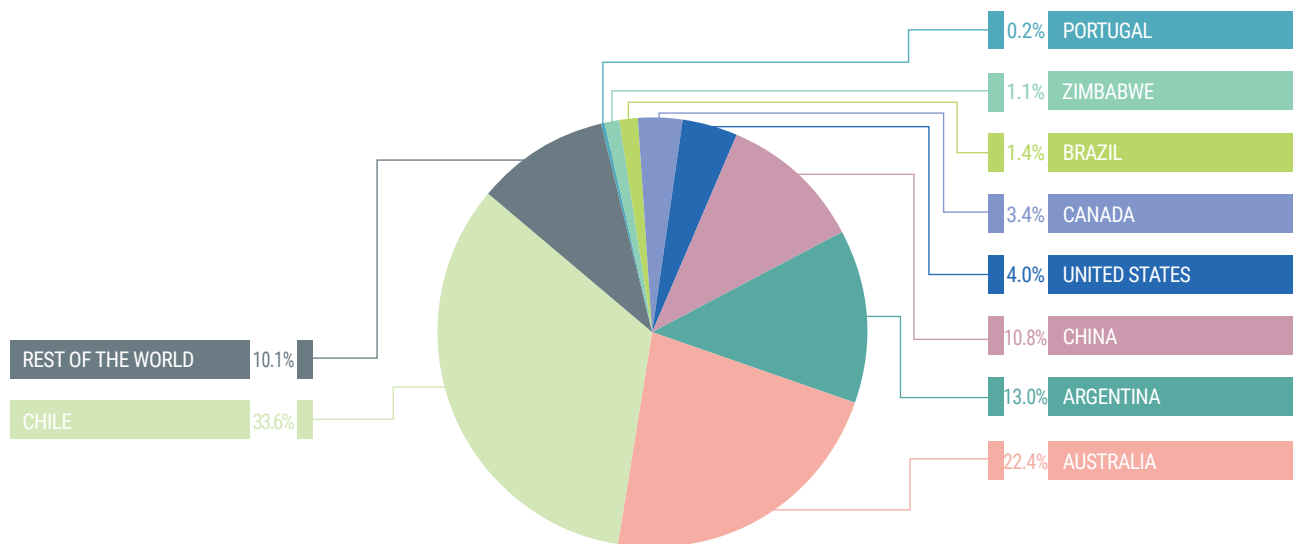
Lithium - Reserves

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Argentina	850,000	2,000,000	2,000,000	1,700,000	1,900,000	2,200,000	2,700,000	3,600,000	33.3%	11.7%
Australia	580,000	1,500,000	2,700,000	2,800,000	4,700,000	5,700,000	6,200,000	6,200,000	0.0%	20.0%
Brazil	64,000	48,000	54,000	95,000	95,000	95,000	250,000	390,000	56.0%	14.9%
Canada				370,000	530,000		930,000	930,000	0.0%	
Chile	7,500,000	7,500,000	8,000,000	8,600,000	9,200,000	9,200,000	9,300,000	9,300,000	0.0%	1.7%
China	3,500,000	3,200,000	1,000,000	1,000,000	1,500,000	1,500,000	2,000,000	3,000,000	50.0%	-1.2%
Portugal	10,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	0.0%	14.8%
United States	38,000	38,000	35,000	630,000	750,000	750,000	1,000,000	1,100,000	10.0%	29.5%
Zimbabwe	23,000	23,000	70,000	230,000	220,000	220,000	310,000	310,000	0.0%	22.2%
Others				1,100,000	2,100,000	2,700,000	3,300,000	2,800,000	-15.2%	
World (rounded)	13,000,000	14,000,000	14,000,000	17,000,000	21,000,000	22,000,000	26,000,000	28,000,000	7.7%	6.1%

The World Top 9 (2023)

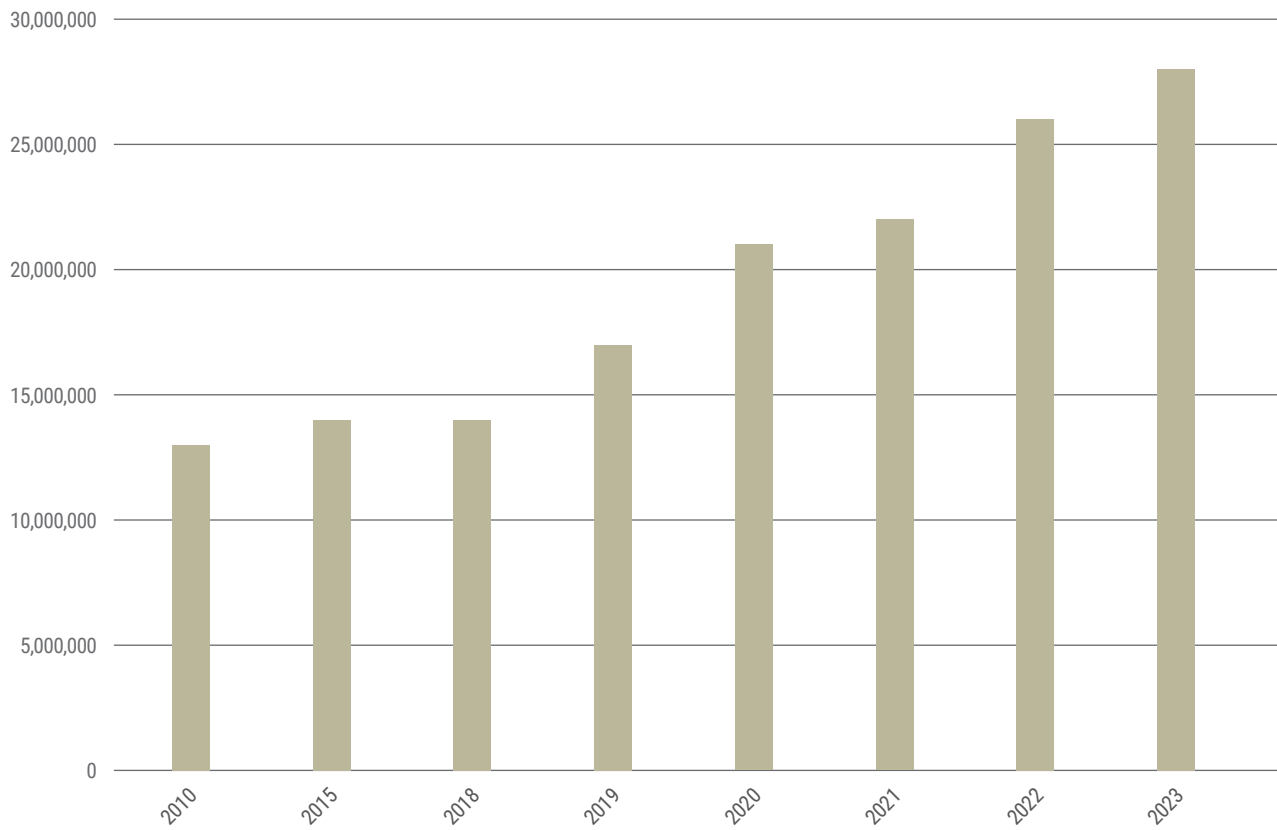


^(*) Data source: U.S. Geological Survey.

Lithium - Reserves

World Lithium Reserves

(tons)



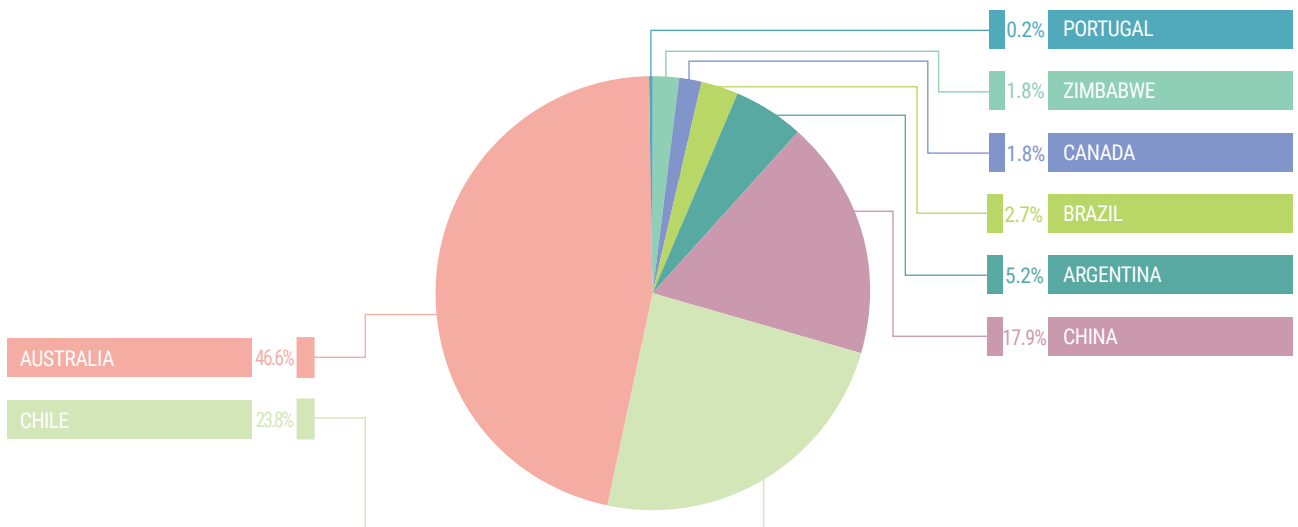
Lithium - Production

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Argentina	2,950	3,600	6,400	6,300	5,900	5,970	6,590	9,600	45.7%	9.5%
Australia	9,260	14,100	58,800	45,000	39,700	55,300	74,700	86,000	15.1%	18.7%
Brazil	160	200	300	2,400	1,420	1,700	2,630	4,900	86.3%	30.1%
Canada			2,400	200			520	3,400	553.8%	
Chile	10,510	10,500	17,000	19,300	21,500	28,300	38,000	44,000	15.8%	11.6%
China	3,950	2,000	7,100	10,800	13,300	14,000	22,600	33,000	46.0%	17.7%
Namibia			500							
Portugal	800	200	800	900	348	900	380	380	0.0%	-5.6%
Zimbabwe	470	900	1,600	1,200	417	710	1,030	3,400	230.1%	16.4%
World (rounded)	28,100	31,500	95,000	86,000	82,500	107,000	146,000	180,000	23.3%	15.4%

The World Top 8 (2023)

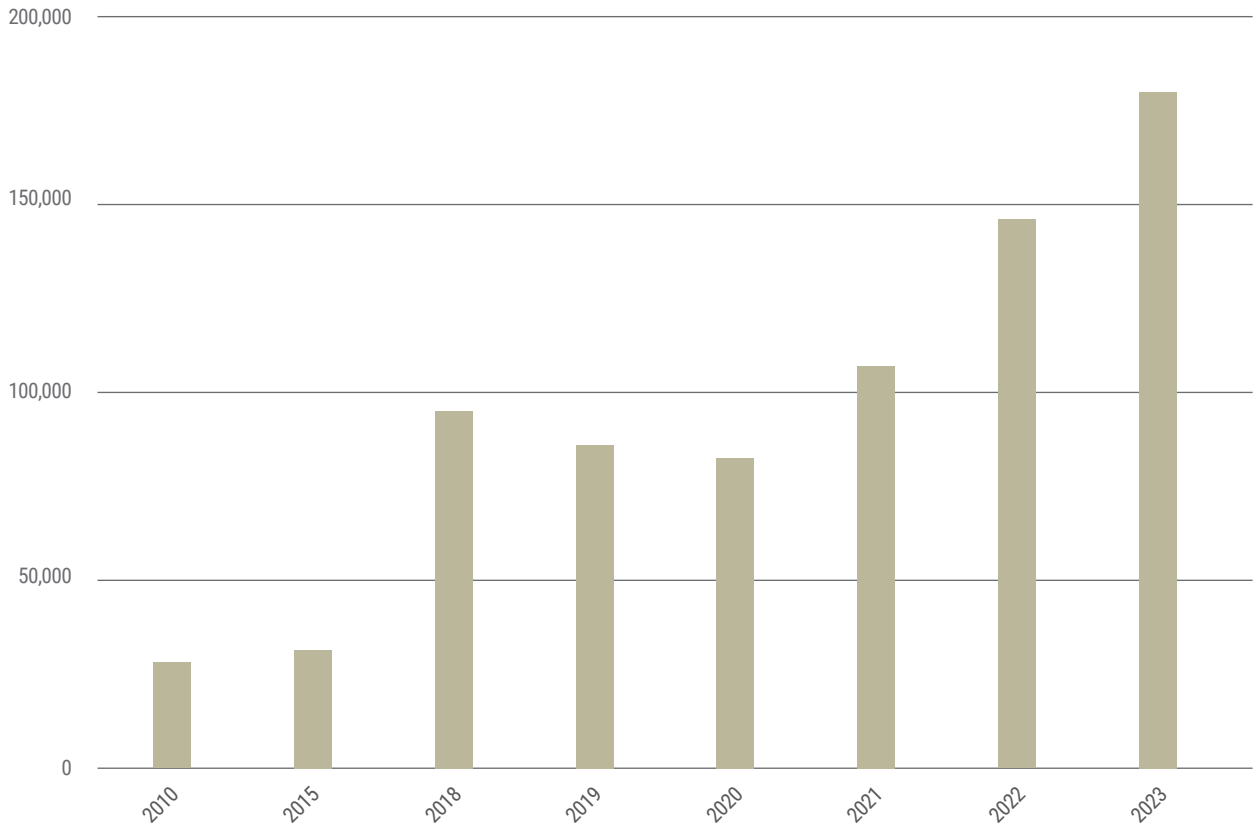


^(*) Data source: U.S. Geological Survey.

Lithium - Production

World Lithium Production

(tons)



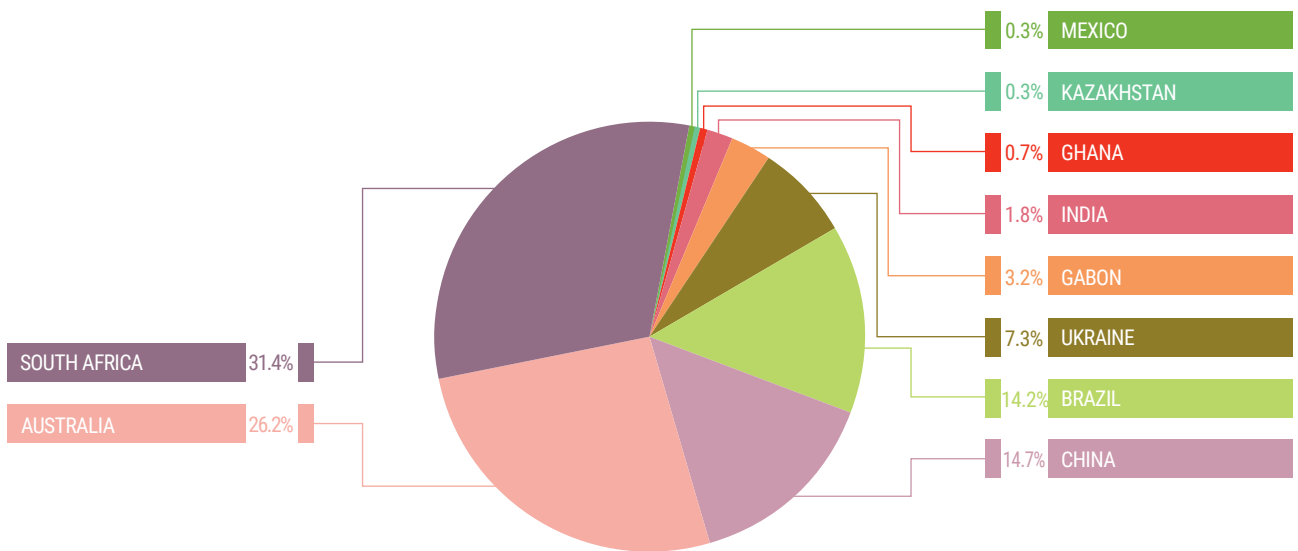
Manganese - Reserves

Countries^(*)

(thousand tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	93,000	91,000	99,000	100,000	230,000	270,000	270,000	500,000	85.2%	13.8%
Brazil	110,000	50,000	110,000	140,000	270,000	270,000	270,000	270,000	0.0%	7.2%
China	44,000	44,000	54,000	54,000	54,000	54,000	280,000	280,000	0.0%	15.3%
Gabon	52,000	22,000	65,000	61,000	61,000	61,000	61,000	61,000	0.0%	1.2%
Ghana		13,000	13,000	13,000	13,000	13,000	13,000	13,000	0.0%	
India	56,000	52,000	33,000	34,000	34,000	34,000	34,000	34,000	0.0%	-3.8%
Kazakhstan		5,000	5,000	5,000	5,000	5,000	5,000	5,000	0.0%	
Mexico	4,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	0.0%	1.7%
South Africa	120,000	200,000	230,000	260,000	520,000	640,000	640,000	600,000	-6.3%	13.2%
Ukraine	140,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	0.0%	0.0%
World (rounded)	630,000	620,000	760,000	810,000	1,300,000	1,500,000	1,700,000	1,900,000	11.8%	8.9%

The World Top 10 (2023)

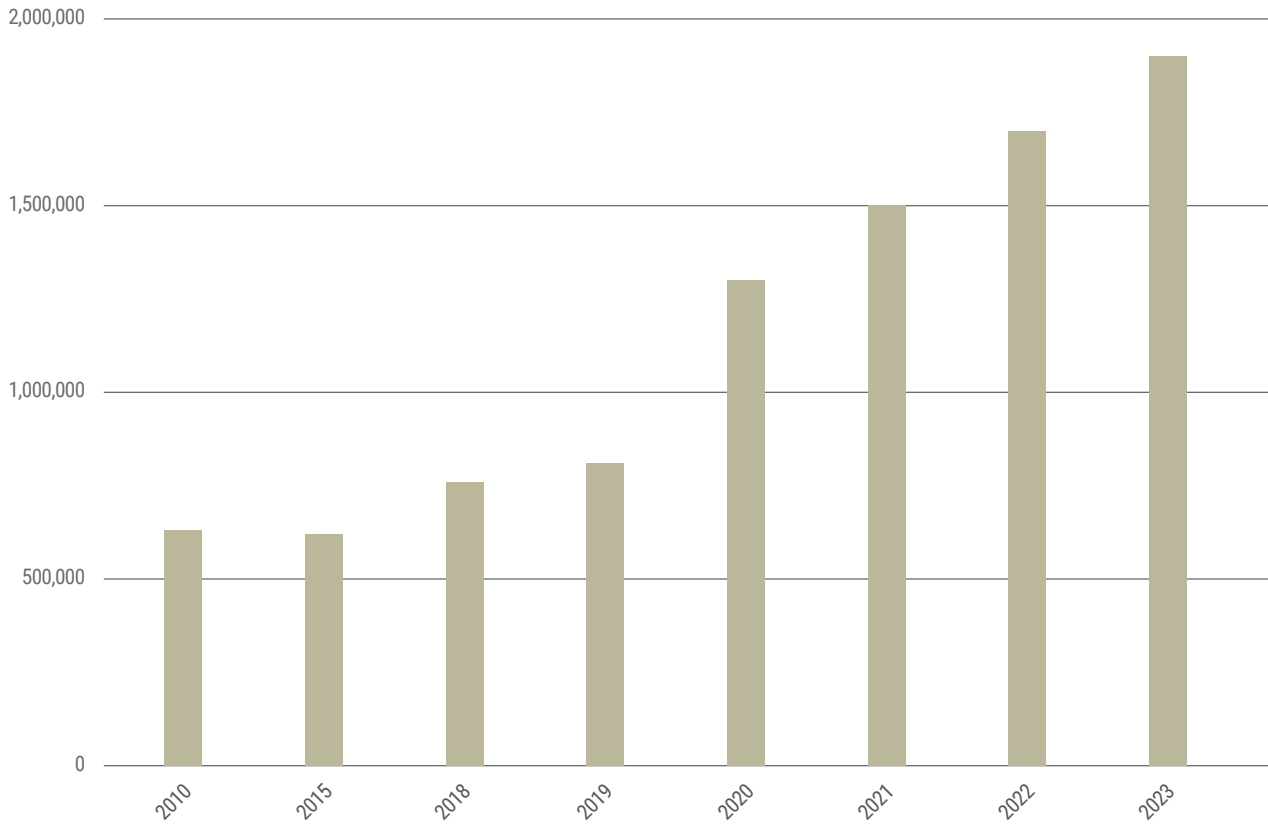


^(*) Data source: U.S. Geological Survey.

Manganese - Reserves

World Manganese Reserves

(thousand tons)



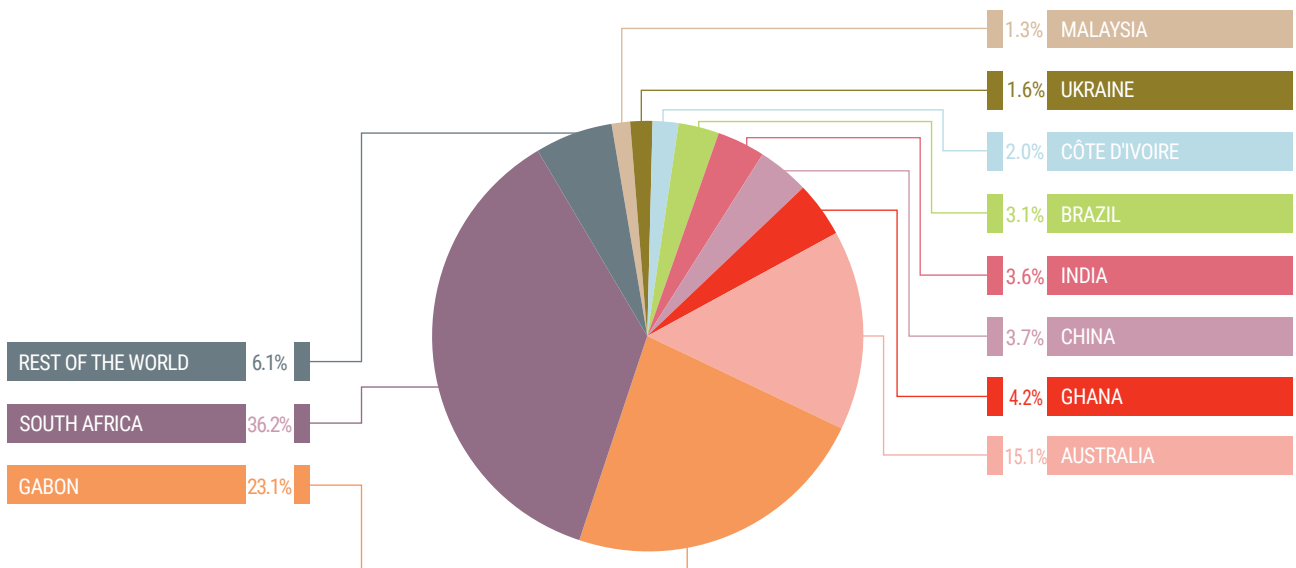
Manganese - Production

Countries^(*)

(thousand tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	3,100	2,450	3,480	3,180	3,330	3,260	3,040	3,000	-1.3%	-0.3%
Brazil	780	1,090	1,310	1,740	494	542	624	620	-0.6%	-1.8%
Burma			207	430	254	206	207	210	1.4%	
China	2,600	3,000	1,200	1,330	1,340	991	743	740	-0.4%	-9.2%
Côte d'Ivoire			395	482	525	362	394	390	-1.0%	
Gabon	1,420	2,020	2,330	2,510	3,310	4,340	4,670	4,600	-1.5%	9.5%
Georgia			200	116	186	224	166	160	-3.6%	
Ghana		416	1,360	1,550	637	940	844	840	-0.5%	
India	1,000	900	961	801	632	453	721	720	-0.1%	-2.5%
Kazakhstan		222	140	140	158	90	129	130	0.8%	
Malaysia		201	390	390	347	356	247	250	1.2%	
Mexico	175	220	210	202	198	226	221	220	-0.5%	1.8%
South Africa	2,900	5,900	5,800	5,800	6,500	7,200	7,300	7,200	-1.4%	7.2%
Ukraine	540	410	517	500	578	600	323	320	-0.9%	-3.9%
Vietnam				158	121	146	155	160	3.2%	
Other	1,340	678	391	270	260	150	325	330	1.5%	-10.2%
World (rounded)	13,900	17,500	18,900	19,600	18,900	20,100	19,800	20,000	1.0%	2.8%

The World Top 10 (2023)

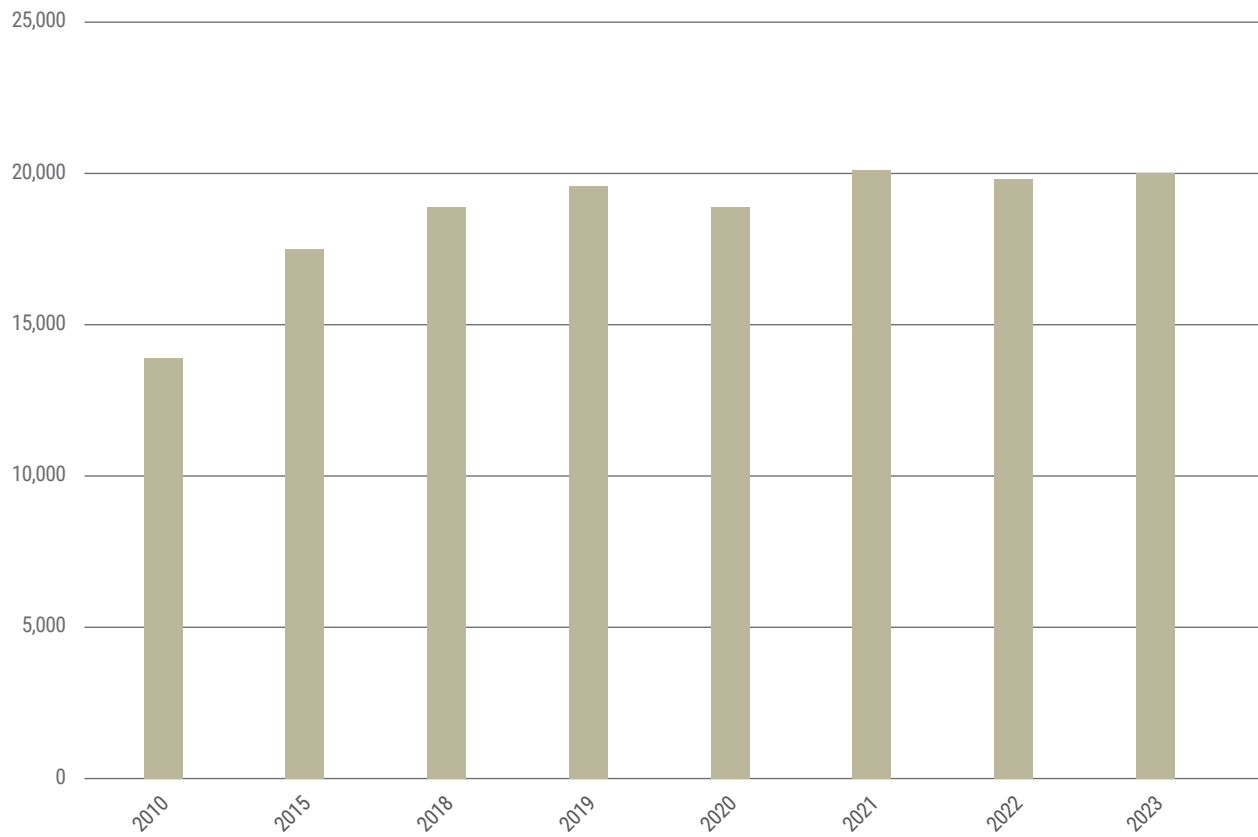


^(*) Data source: U.S. Geological Survey.

Manganese - Production

World Manganese Production

(thousand tons)



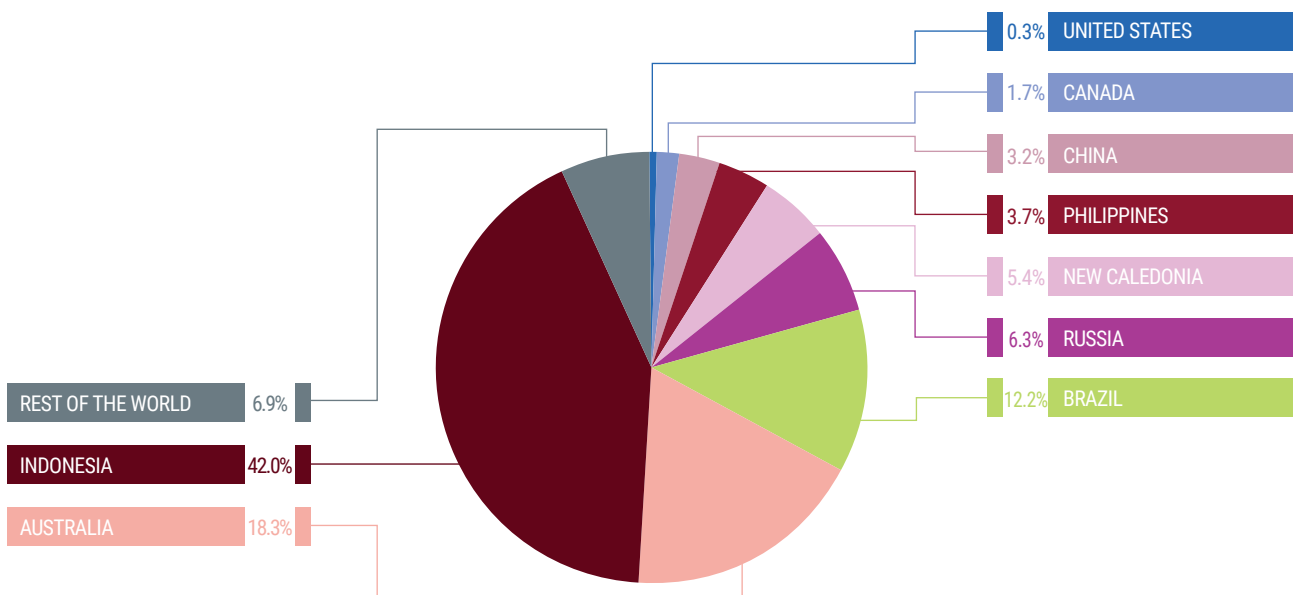
Nickel - Reserves

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	24,000,000	19,000,000	19,000,000	20,000,000	20,000,000	21,000,000	21,000,000	24,000,000	14.3%	0.0%
Botswana	490,000									-100.0%
Brazil	8,700,000	10,000,000	11,000,000	11,000,000	16,000,000	16,000,000	16,000,000	16,000,000	0.0%	4.8%
Canada	3,800,000	2,900,000	2,700,000	2,600,000	2,800,000	2,000,000	2,200,000	2,200,000	0.0%	-4.1%
China	3,000,000	3,000,000	2,800,000	2,800,000	2,800,000	2,800,000	2,100,000	4,200,000	100.0%	2.6%
Colombia	1,600,000	1,100,000	440,000							-100.0%
Cuba	5,500,000	5,500,000	5,500,000	5,500,000	5,500,000					-100.0%
Dominican Republic	960,000									-100.0%
Guatemala		1,800,000	1,800,000							
Indonesia	3,900,000	4,500,000	21,000,000	21,000,000	21,000,000	21,000,000	21,000,000	55,000,000	161.9%	22.6%
Madagascar	1,300,000	1,600,000	1,600,000							-100.0%
New Caledonia	7,100,000	8,400,000					7,100,000	7,100,000	0.0%	0.0%
Philippines		3,100,000	4,800,000	4,800,000	4,800,000	4,800,000	4,800,000	4,800,000	0.0%	
Russia	6,000,000	7,900,000	7,600,000	6,900,000	6,900,000	7,500,000	7,500,000	8,300,000	10.7%	2.5%
South Africa	3,700,000	3,700,000	3,700,000							-100.0%
United States		160,000	110,000	110,000	100,000	340,000	370,000	340,000	-8.1%	
Venezuela	490,000									-100.0%
Others	4,500,000	6,500,000	6,500,000	14,000,000	14,000,000	20,000,000	20,000,000	9,100,000	-54.5%	5.6%
World (rounded)	76,000,000	79,000,000	89,000,000	89,000,000	94,000,000	95,000,000	100,000,000	130,000,000	30.0%	4.2%

The World Top 9 (2023)

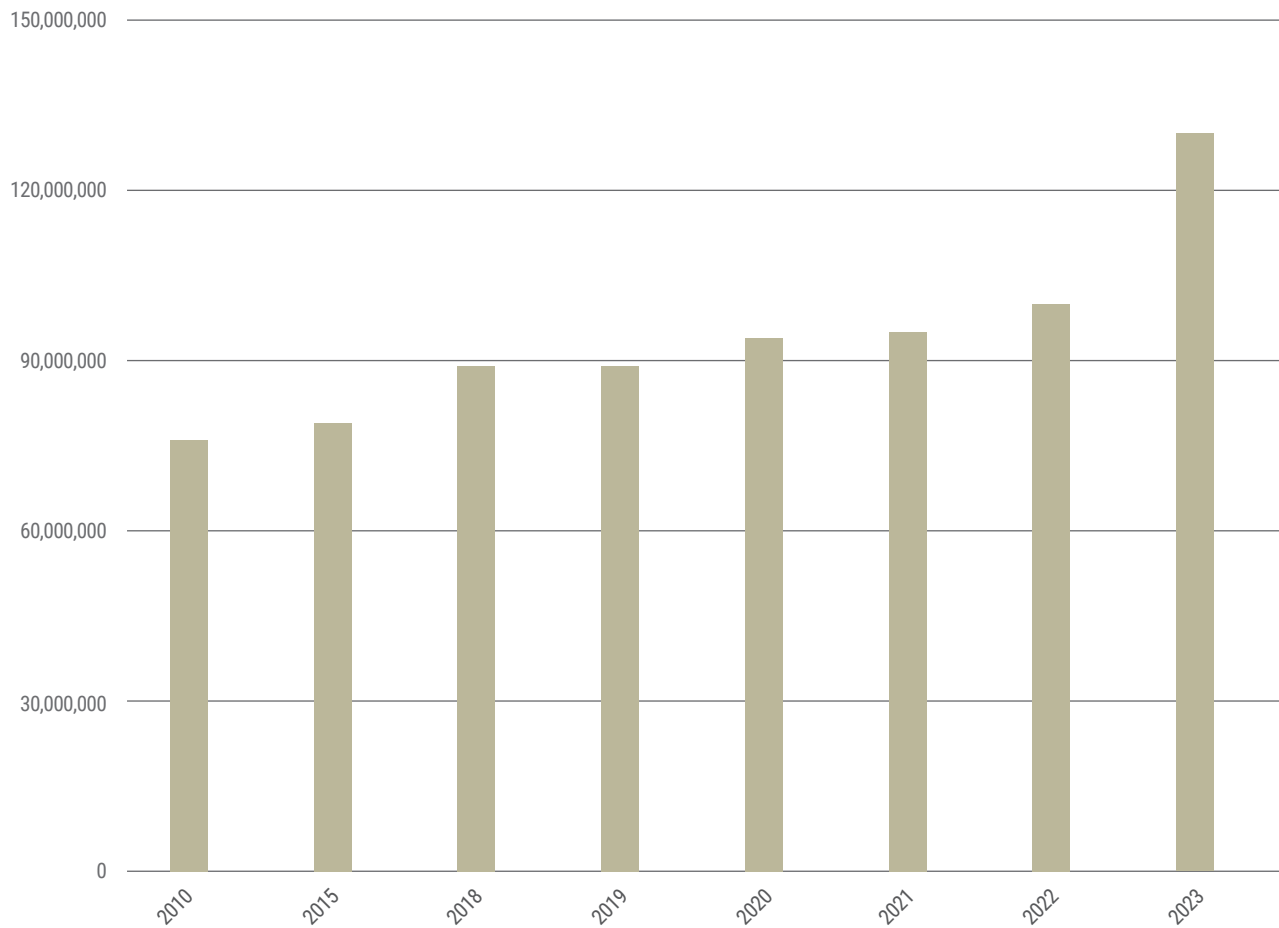


^(*) Data source: U.S. Geological Survey.

Nickel - Reserves

World Nickel Reserves

(tons)



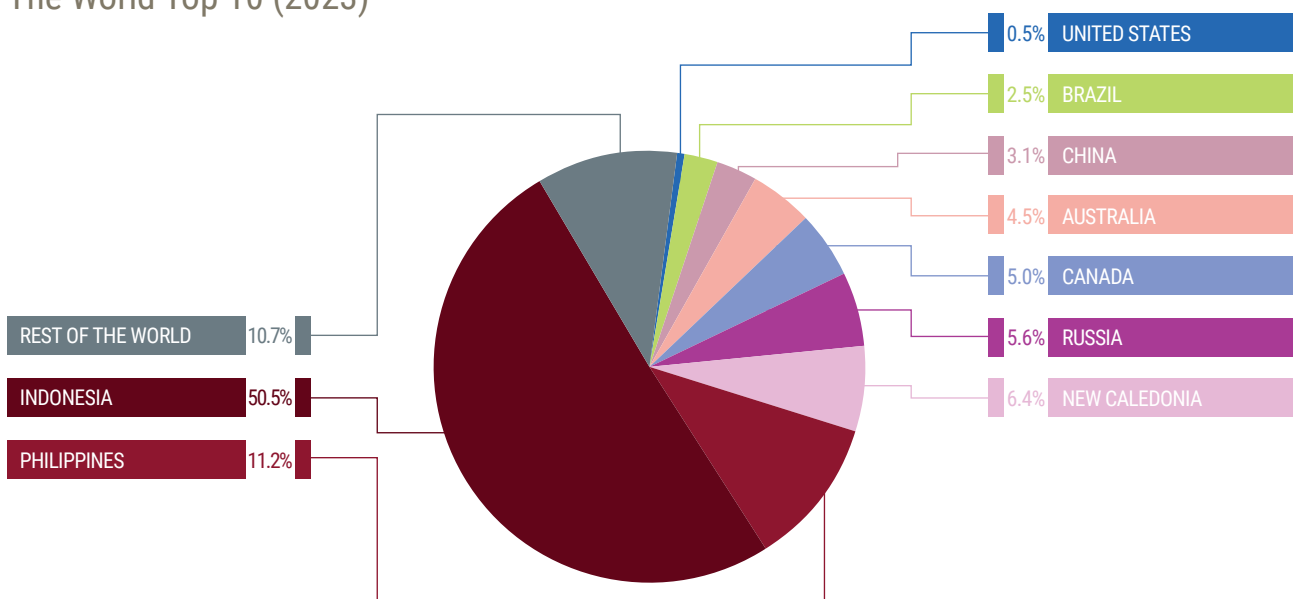
Nickel - Production

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	170,000	222,000	170,000	159,000	169,000	151,000	155,000	160,000	3.2%	-0.5%
Botswana	28,000									-100.0%
Brazil	59,100	160,000	74,400	60,600	77,100	76,000	88,500	89,000	0.6%	3.2%
Canada	158,000	235,000	176,000	181,000	167,000	134,000	143,000	180,000	25.9%	1.0%
China	79,000	92,900	110,000	120,000	120,000	109,000	114,000	110,000	-3.5%	2.6%
Colombia	72,000	40,400								
Cuba	70,000	56,400	51,000	49,200						
Dominican Republic				56,900						
Guatemala		52,400								
Indonesia	232,000	130,000	606,000	853,000	771,000	1,040,000	1,580,000	1,800,000	13.9%	17.1%
Madagascar	15,000	45,000								-100.0%
New Caledonia	130,000	186,000	216,000	208,000	200,000	186,000	200,000	230,000	15.0%	4.5%
Philippines	173,000	554,000	345,000	323,000	334,000	387,000	345,000	400,000	15.9%	6.7%
Russia	269,000	269,000	272,000	279,000	283,000	205,000	222,000	200,000	-9.9%	-2.3%
South Africa	40,000	56,700								-100.0%
United States		27,200	17,800	13,500	16,700	18,400	17,500	17,000	-2.9%	
Others	99,000	157,000	366,000	310,000	373,000	429,000	404,000	380,000	-5.9%	10.9%
World (rounded)	1,590,000	2,280,000	2,400,000	2,610,000	2,510,000	2,730,000	3,270,000	3,600,000	10.1%	6.5%

The World Top 10 (2023)

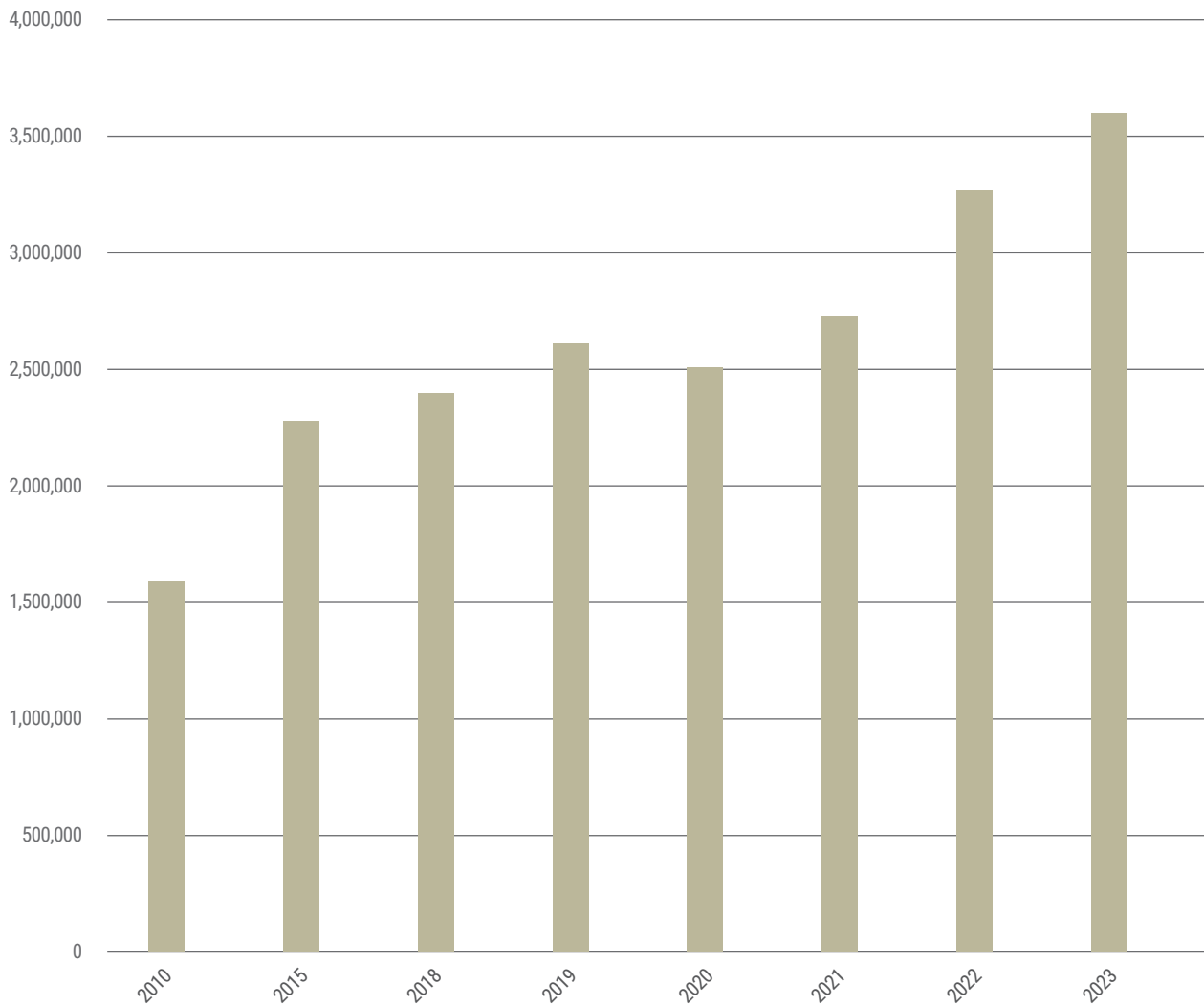


^(*) Data source: U.S. Geological Survey.

Nickel - Production

World Nickel Production

(tons)



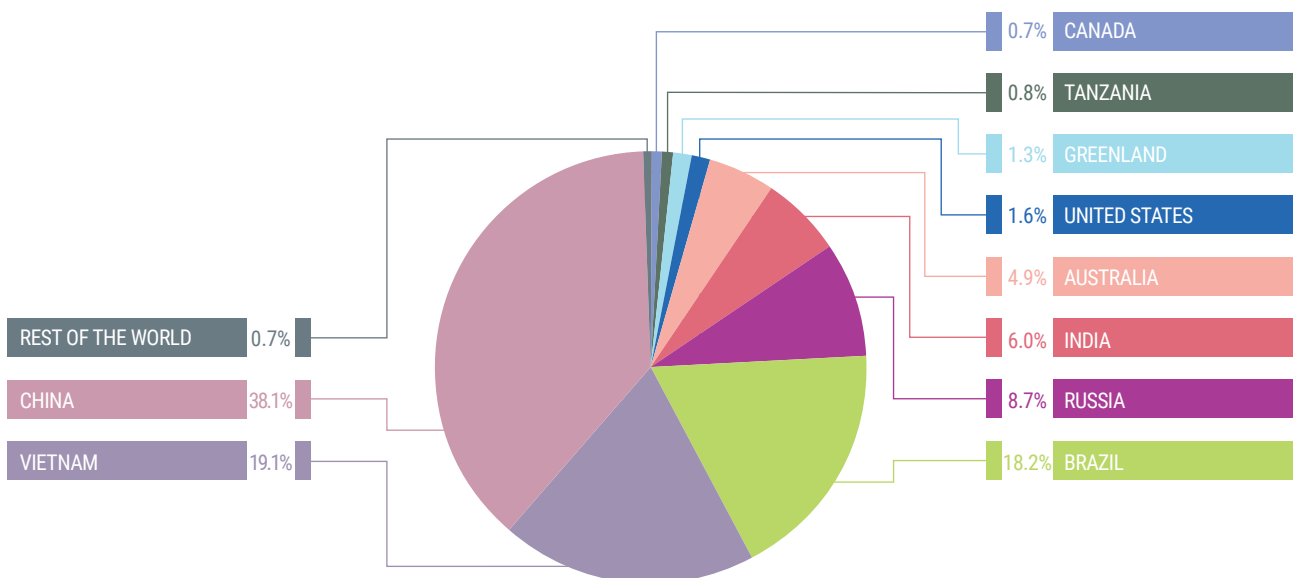
Rare Earths - Reserves

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia	1,600,000	3,200,000	3,400,000	3,300,000	4,100,000	4,000,000	4,200,000	5,700,000	35.7%	10.3%
Brazil	48,000	22,000,000	22,000,000	22,000,000	21,000,000	21,000,000	21,000,000	21,000,000	0.0%	59.6%
Canada				830,000	830,000	830,000	830,000	830,000	0.0%	
China	55,000,000	55,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	44,000,000	0.0%	-1.7%
Commonwealth of Independent States**	19,000,000									-100.0%
Greenland				1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	0.0%	
India	3,100,000	3,100,000	6,900,000	6,900,000	6,900,000	6,900,000	6,900,000	6,900,000	0.0%	6.3%
Malaysia	30,000	30,000	30,000							-100.0%
Russia			12,000,000	12,000,000	12,000,000	21,000,000	21,000,000	10,000,000	-52.4%	
South Africa				790,000	790,000	790,000	790,000	790,000	0.0%	
Tanzania						890,000	890,000	890,000	0.0%	
Thailand								4,500		
United States	13,000,000	1,800,000	1,400,000	1,400,000	1,500,000	1,800,000	2,300,000	1,800,000	-21.7%	-14.1%
Vietnam			22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	0.0%	
Others	22,000,000	41,000,000	4,400,000	310,000	310,000	280,000	280,000		-100.0%	-100.0%
World (rounded)	110,000,000	130,000,000	120,000,000	120,000,000	120,000,000	120,000,000	130,000,000	110,000,000	-15.4%	0.0%

The World Top 10 (2023)



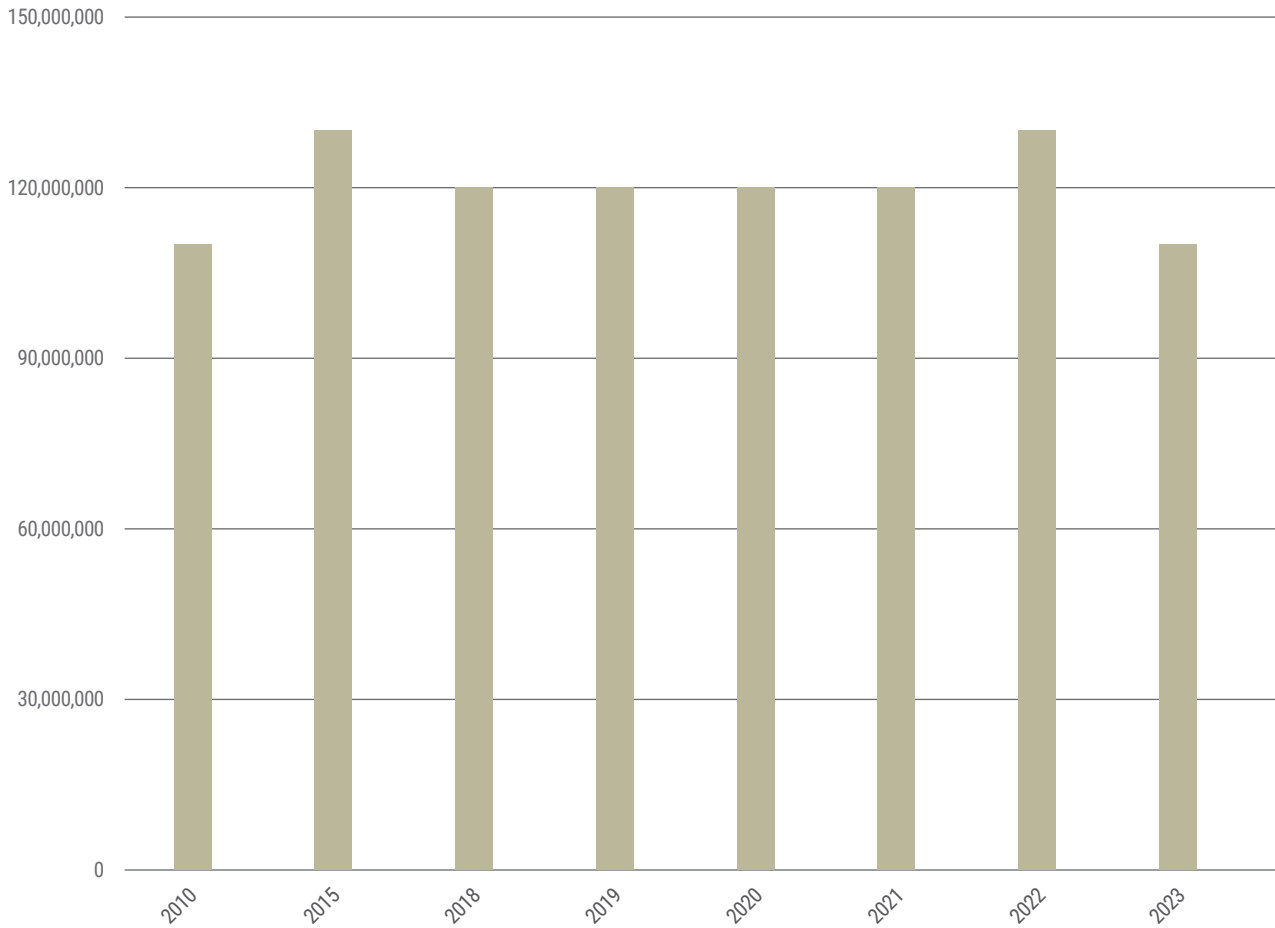
(*) Data source: U.S. Geological Survey.

(**) The aggregate includes the following states according to international definitions: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Mordova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan. However, some of these countries may non produce rare earths.

Rare Earths - Reserves

World Rare Earths Reserves

(tons)



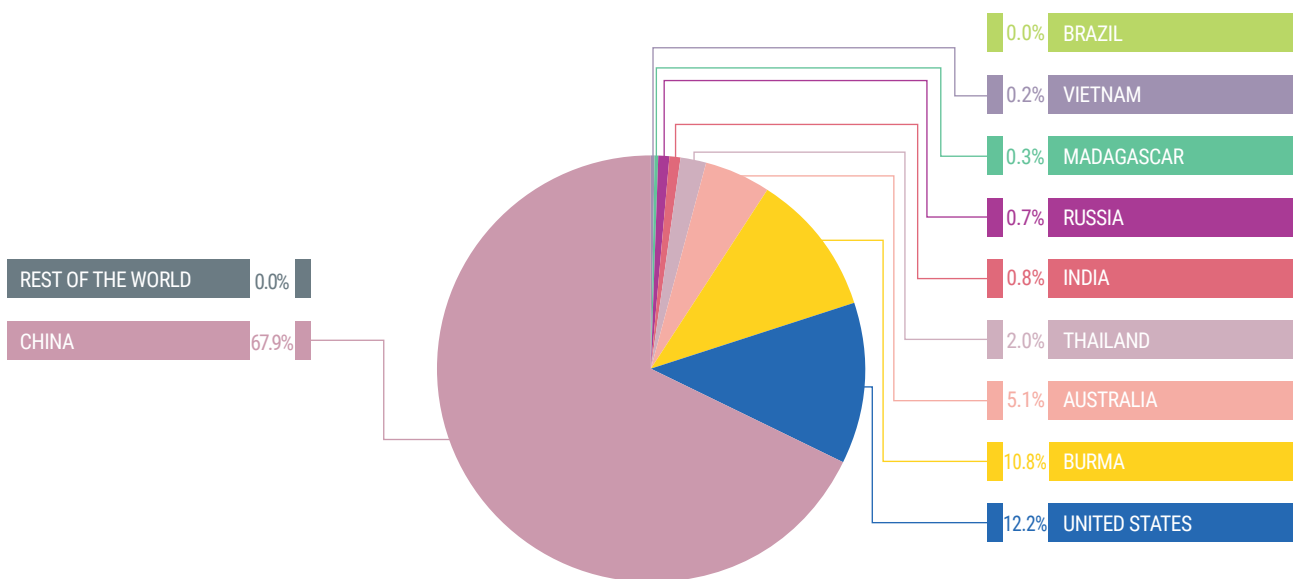
Rare Earths - Production

Countries^(*)

(tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia		12,000	21,000	20,000	21,000	24,000	18,000	18,000	0.0%	
Brazil	550	880	1,100	710	600	500	80	80	0.0%	-13.8%
Burma							12,000	38,000	216.7%	
Burundi			630	200	300	200				
China	130,000	105,000	120,000	132,000	140,000	168,000	210,000	240,000	14.3%	4.8%
India	2,800	1,700	2,900	2,900	2,900	2,900	2,900	2,900	0.0%	0.3%
Madagascar			2,000	4,000	2,800	6,800	960	960	0.0%	
Malaysia	30	500					80	80	0.0%	7.8%
Russia		2,800	2,700	2,700	2,700	2,600	2,600	2,600	0.0%	
Thailand		760	1,000	1,900	3,600	8,200	7,100	7,100	0.0%	
United States		5,900	18,000	28,000	39,000	42,000	42,000	43,000	2.4%	
Vietnam		250	920	1,300	700	400	1,200	600	-50.0%	
Others			60	66	100	60	80		-100.0%	
World (rounded)	133,000	130,000	190,000	220,000	240,000	290,000	300,000	350,000	16.7%	7.7%

The World Top 10 (2023)

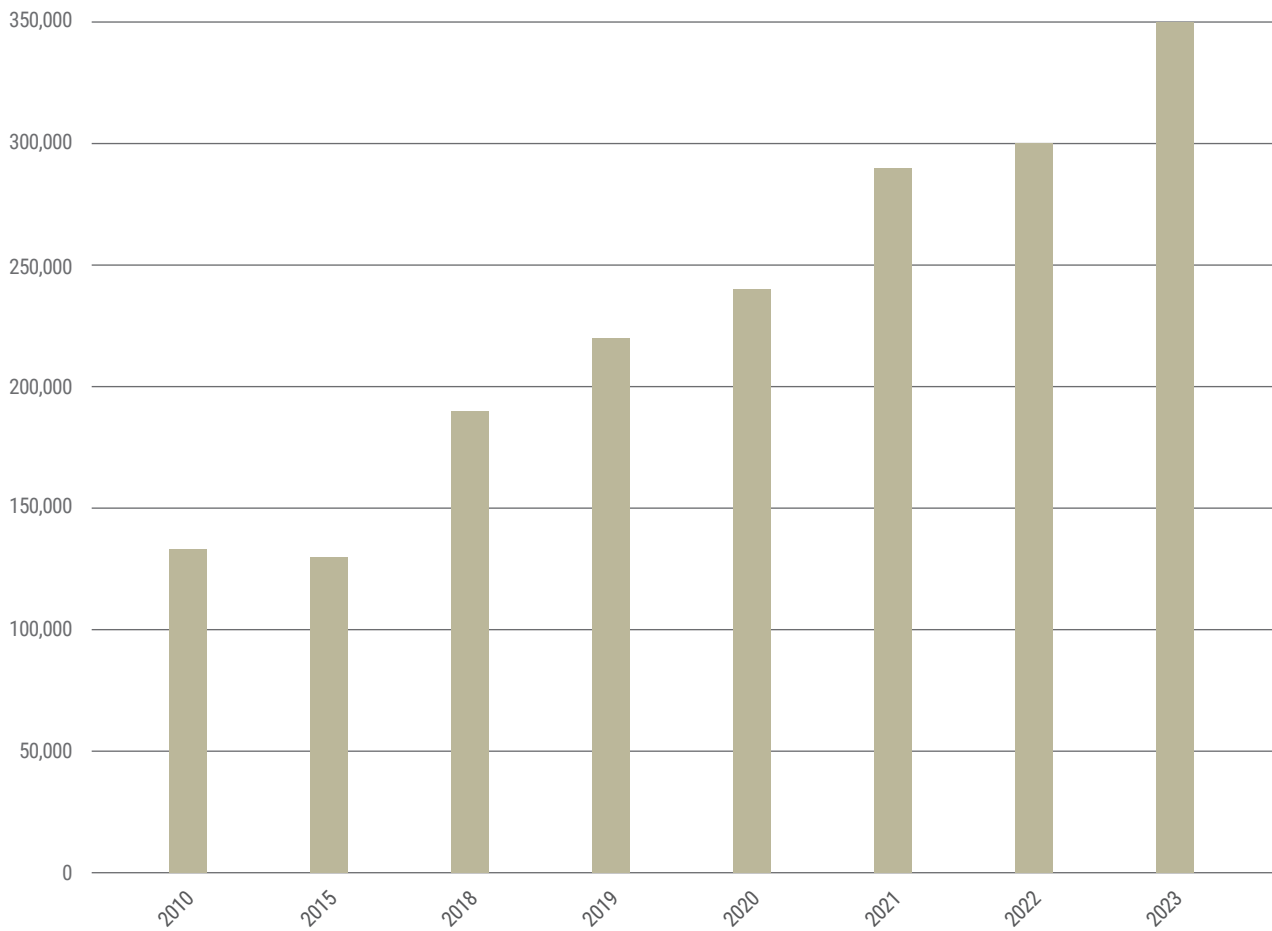


^(*) Data source: U.S. Geological Survey.

Rare Earths - Production

World Rare Earths Production

(tons)



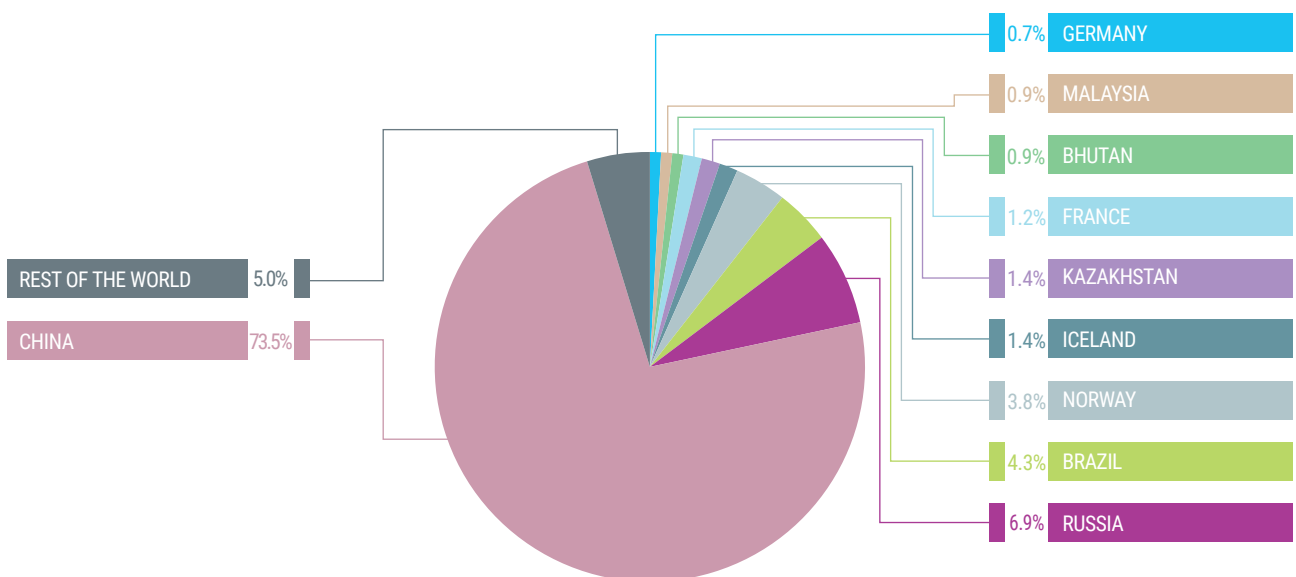
Silicon - Production

Countries^(*)

(thousand tons)

	2010	2015	2018	2019	2020	2021	2022	2023	Δ y/y (2023-2022)	CAGR (2023-2010)
Australia					42	50	48	50	4.2%	
Bhutan		78	90	90	67	85	75	80	6.7%	
Brazil	224	117	220	340	404	389	391	390	-0.3%	4.4%
Canada	52	54	57	57	47	49	49	50	2.0%	-0.3%
China	4,920	5,000	4,800	5,700	5,600	6,400	6,670	6,600	-1.0%	2.3%
France	127	121	140	130	112	127	121	110	-9.1%	-1.1%
Germany						63	62	60	-3.2%	
Iceland	74	75	83	88	103	111	128	130	1.6%	4.4%
India	66	60	57	60	59	59	59	60	1.7%	-0.7%
Kazakhstan					67	122	101	125	23.8%	
Malaysia		68	140	150	109	85	91	80	-12.1%	
Norway	303	375	370	375	345	362	339	340	0.3%	0.9%
Poland			43		42	49	47	50	6.4%	
Russia	643	747	600	610	576	644	626	620	-1.0%	-0.3%
South Africa	137	84		96						-100.0%
Spain		81	69	66	55	60	52	56	7.7%	
Ukraine	127	59	49	63	40	49	28	2	-92.9%	-27.3%
Venezuela	50									-100.0%
United States	176	411	430	310	277	313	310		-100.0%	-100.0%
Others	394	300	290	278	175	128	223	180	-19.3%	-5.8%
World (rounded)	7,290	7,630	7,400	8,410	8,120	9,150	9,110	9,000	-1.2%	1.6%

The World Top 10 (2023)



^(*) Data source: U.S. Geological Survey.

Silicon - Production

World Silicon Production

(thousand tons)

