

Critical Minerals

▶ COBALT

RESERVES

Countries
The World Top 10
World Cobalt Reserves

PRODUCTION

Countries
The World Top 10
World Cobalt Production

▶ COPPER

RESERVES

Countries
The World Top 10
World Copper Reserves

PRODUCTION

Countries
The World Top 10
World Copper Production

▶ LITHIUM

RESERVES

Countries
The World Top 9
World Lithium Reserves

PRODUCTION

Countries
The World Top 8
World Lithium Production

▶ NICKEL

RESERVES

Countries
The World Top 9
World Nickel Reserves

PRODUCTION

Countries
The World Top 9
World Nickel Production

RARE EARTHS

RESERVES

Countries
The World Top 10
World Rare Earths Reserves

PRODUCTION

Countries
The World Top 9
World Rare Earths Production

▶ SILICON

PRODUCTION

Countries
The World Top 10
World Silicon Production

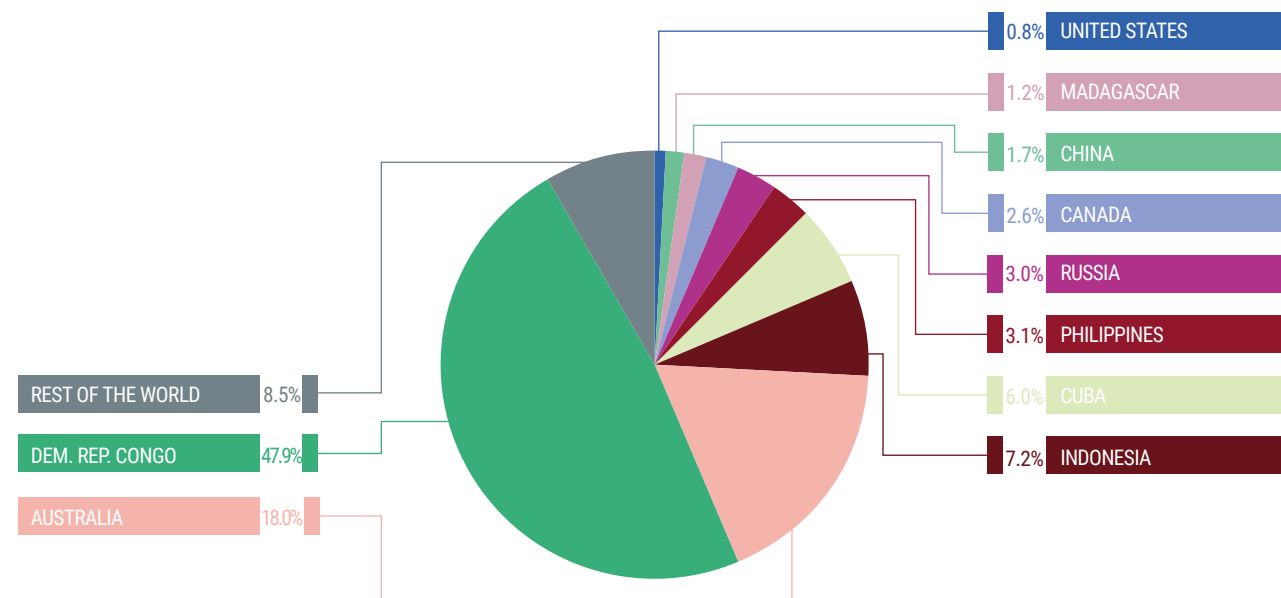
Cobalt - Reserves

Countries^(*)

(tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia	1,400,000	1,100,000	1,000,000	1,200,000	1,200,000	1,200,000	1,400,000	1,400,000	1,500,000	7.1%	0.6%
Brazil	89,000	78,000									-100.0%
Canada	150,000	240,000	270,000	250,000	250,000	230,000	220,000	220,000	220,000	0.0%	3.2%
China	80,000	80,000	80,000		80,000	80,000	80,000	80,000	140,000	75.0%	4.8%
Cuba	500,000	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	3,500,000	3,400,000	3,600,000	3,600,000	3,500,000	4,000,000	14.3%	1.4%
Indonesia								600,000	600,000	0.0%	
Madagascar		130,000	130,000	150,000	140,000	120,000	100,000	100,000	100,000	0.0%	
Morocco	20,000				17,000	18,000	14,000	13,000	13,000	0.0%	-3.5%
New Caledonia	370,000	200,000	64,000								-100.0%
Papua New Guinea				51,000	56,000	56,000	51,000	47,000	47,000	0.0%	
Philippines		250,000	290,000	280,000	280,000	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	250,000	0.0%	0.0%
South Africa		31,000	29,000	29,000	24,000	50,000	40,000				
Türkiye									36,000		
United States	33,000	23,000	21,000	23,000	38,000	55,000	53,000	69,000	69,000	0.0%	6.3%
Zambia	270,000	270,000	270,000	270,000							-100.0%
Others	740,000	610,000	690,000	560,000	640,000	570,000	560,000	610,000	610,000	0.0%	-1.6%
World (rounded)	7,300,000	7,100,000	7,000,000	7,100,000	6,900,000	7,000,000	7,100,000	7,600,000	8,300,000	9.2%	1.1%

The World Top 10 (2022)

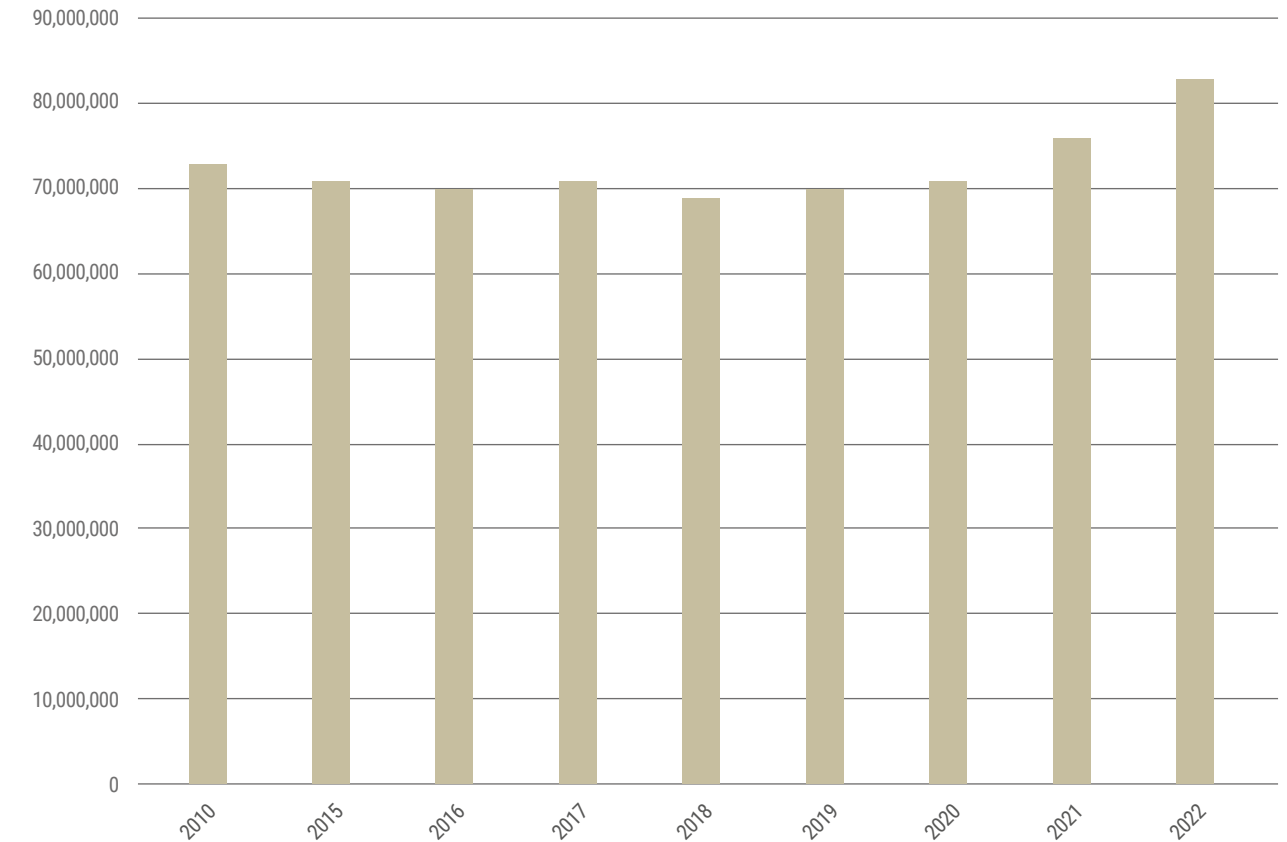


^(*) Data source: U.S. Geological Survey.

Cobalt - Reserves

World Cobalt Reserves

(tons)



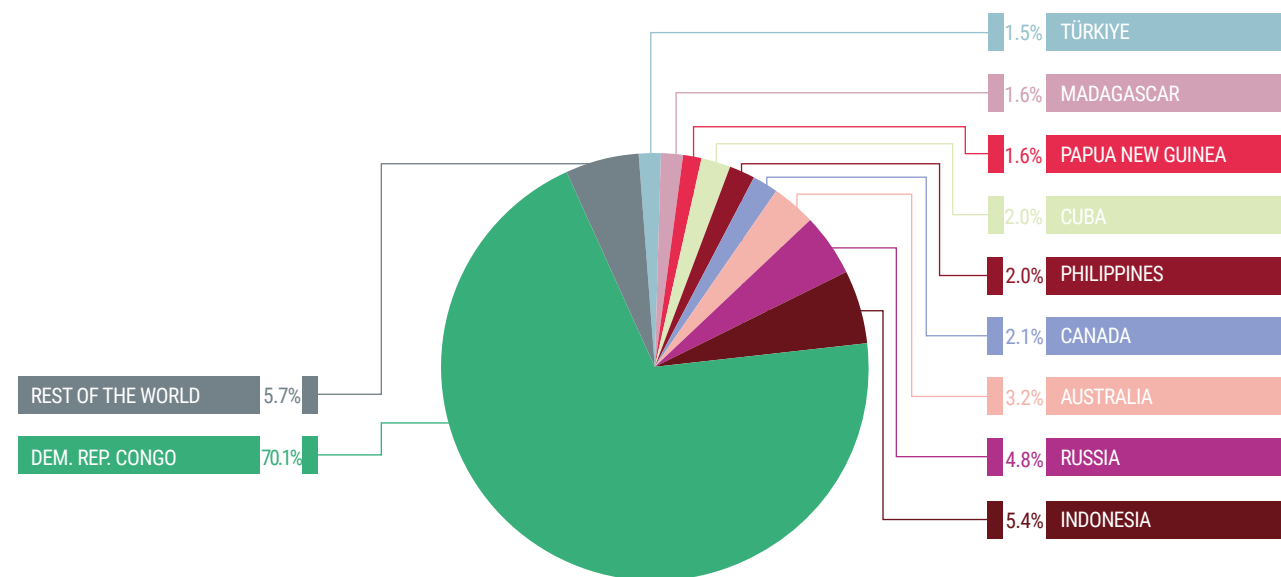
Cobalt - Production

Countries^(*)

(tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia	3,850	6,000	5,500	5,030	4,880	5,740	5,630	5,295	5,900	11.4%	3.6%
Brazil	1,600										-100.0%
Canada	4,600	6,900	4,250	3,870	3,520	3,340	3,690	4,361	3,900	-10.6%	-1.4%
China	6,500	7,700		3,100	2,000	2,500	2,200	2,200	2,200	0.0%	-8.6%
Cuba	47,400	63,000	64,000	73,000	104,000	100,000	98,000	119,000	130,000	9.2%	8.8%
Dem. Rep. Congo	3,600	4,300	4,200	5,000	3,500	3,800	3,800	4,000	3,800	-5.0%	0.5%
Indonesia							1,100	2,700	10,000	270.4%	
Madagascar		3,700	3,800	3,500	3,300	3,400	850	2,800	3,000	7.1%	
Morocco	2,200			2,200	2,100	2,300	2,300	2,300	2,300	0.0%	0.4%
New Caledonia	1,000	3,680	3,390		2,100						-100.0%
Papua New Guinea			2,190	3,310	3,280	2,910	2,940	2,953	3,000	1.6%	
Philippines		4,300	4,100	4,600	4,600	5,100	4,500	3,600	3,800	5.6%	
Russia	6,200	6,200	5,500	5,900	6,100	6,300	9,000	8,000	8,900	11.3%	3.1%
South Africa		3,000	2,300	2,300	2,300	2,100					
Türkiye								2,400	2,700		
United States		760	690	640	490	500	600	650	800	23.1%	
Zambia	5,700	4,600	3,000								-100.0%
Others	6,800	11,600	7,600	7,650	5,540	6,320	7,640	4,567	5,200	13.9%	-2.2%
World (rounded)	89,500	126,000	111,000	120,000	148,000	144,000	142,000	165,000	190,000	15.2%	6.5%

The World Top 10 (2022)

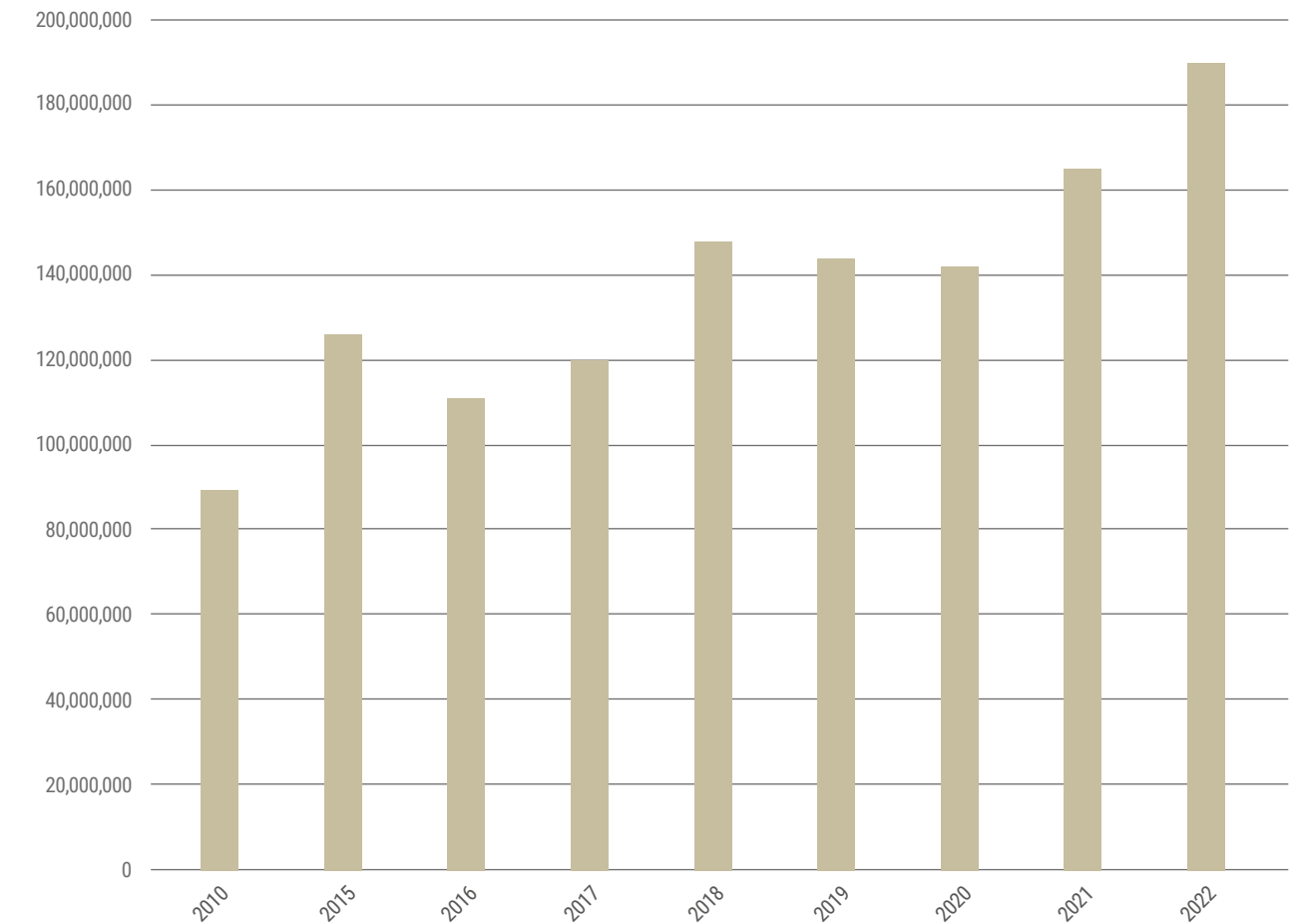


^(*) Data source: U.S. Geological Survey.

Cobalt - Production

World Cobalt Reserves

(tons)



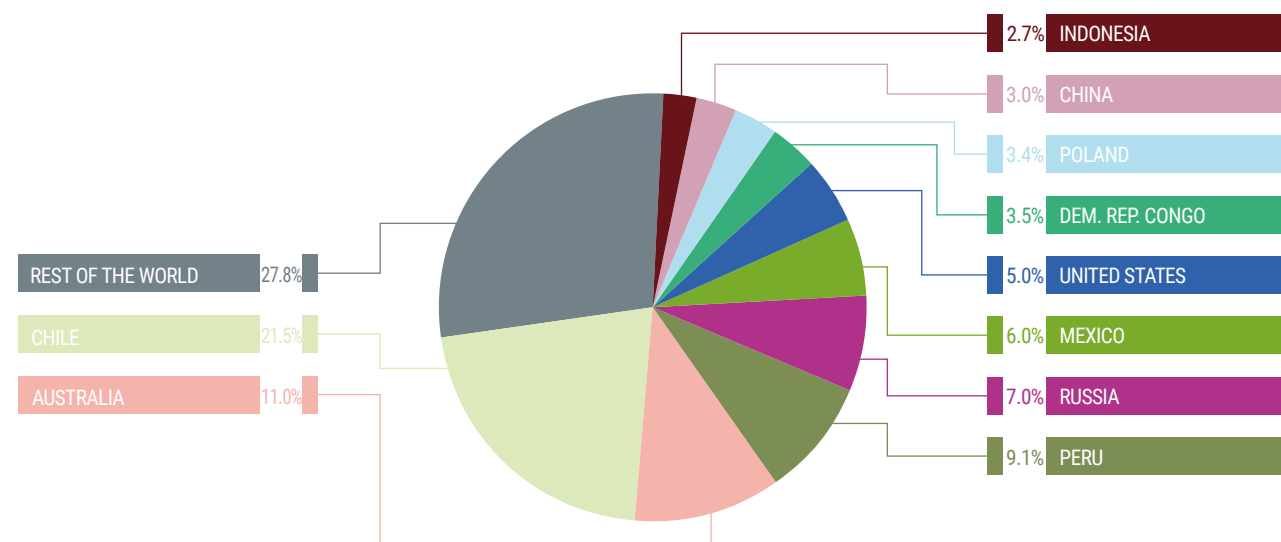
Copper - Reserves

Countries^(*)

(thousand tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia	80,000	88,000	89,000	88,000	88,000	87,000	88,000	93,000	97,000	4.3%	1.6%
Canada	8,000	11,000	11,000	11,000			9,000	9,800	7,600	-22.4%	-0.4%
Chile	150,000	210,000	210,000	170,000	170,000	200,000	200,000	200,000	190,000	-5.0%	2.0%
China	30,000	30,000	28,000	27,000	26,000	26,000	26,000	26,000	27,000	3.8%	-0.9%
Dem, Rep, Congo		20,000	20,000	20,000	20,000	19,000	19,000	31,000	31,000	0.0%	
Germany							2,000				
Indonesia	30,000			26,000	51,000	28,000		24,000	24,000	0.0%	-1.8%
Kazakhstan	18,000					20,000	20,000	20,000	20,000	0.0%	0.9%
Mexico	38,000	46,000	46,000	46,000	50,000	53,000	53,000	53,000	53,000	0.0%	2.8%
Peru	90,000	82,000	81,000	81,000	83,000	87,000	92,000	77,000	81,000	5.2%	-0.9%
Poland	26,000						32,000	31,000	30,000	-3.2%	1.2%
Russia	30,000	30,000	30,000		61,000	61,000	61,000	62,000	62,000	0.0%	6.2%
United States	35,000	33,000	35,000	45,000	48,000	51,000	48,000	48,000	44,000	-8.3%	1.9%
Zambia	20,000	20,000	20,000	20,000	19,000	19,000	21,000	21,000	19,000	-9.5%	-0.4%
Others	80,000	150,000	150,000	260,000	210,000	220,000	200,000	180,000	200,000	11.1%	7.9%
World (rounded)	630,000	720,000	720,000	790,000	830,000	870,000	870,000	880,000	890,000	1.1%	2.9%

The World Top 10 (2022)

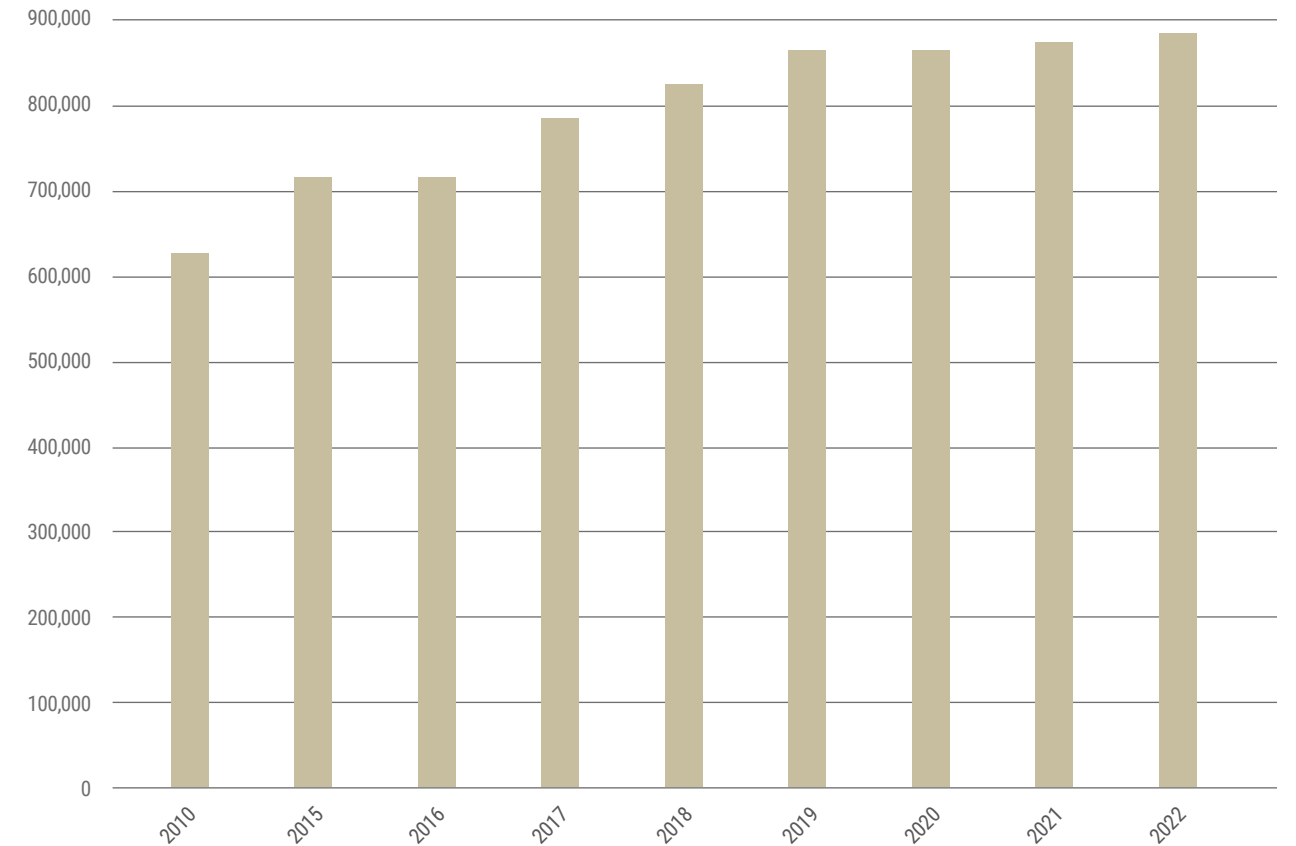


^(*)Data source: U.S. Geological Survey.

Copper - Reserves

World Copper Reserves

(thousand tons)



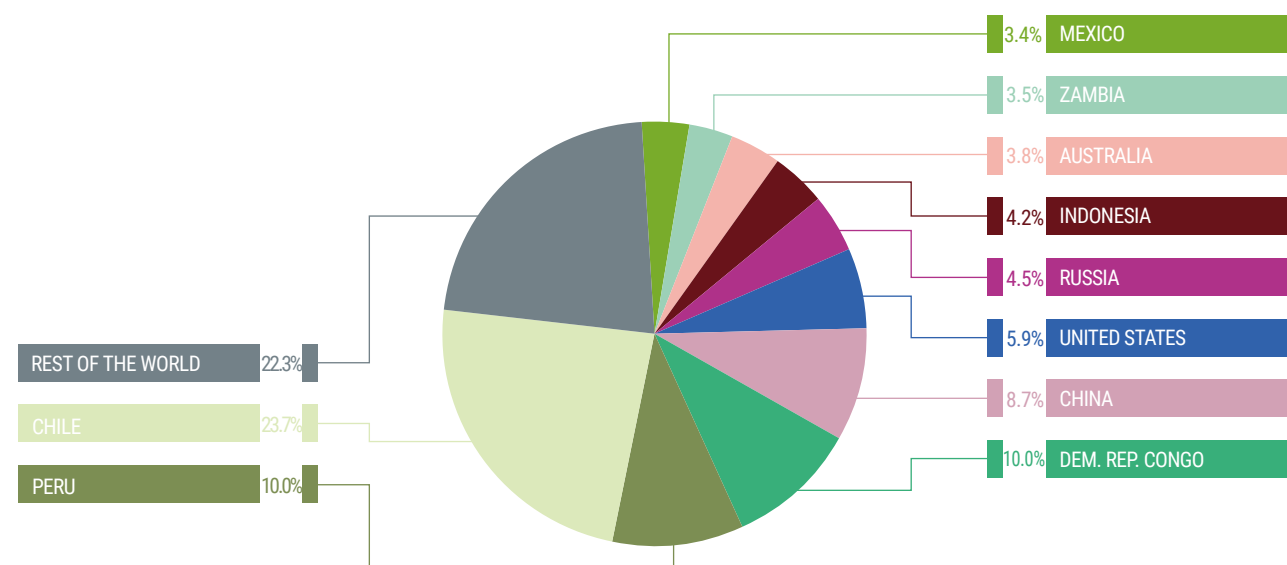
Copper - Production

Countries^(*)

(thousand tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia	870	971	948	860	920	934	885	813	830	2.1%	-0.4%
Canada	525	697	708			573	585	550	530	-3.6%	0.1%
Chile	5,420	5,760	5,550	5,500	5,830	5,790	5,730	5,620	5,200	-7.5%	-0.3%
China	1,190	1,710	1,900	1,710	1,590	1,680	1,720	1,910	1,900	-0.5%	4.0%
Dem. Rep. Congo	343	1,020	846	1,090	1,230	1,290	1,600	1,740	2,200	26.4%	16.8%
Indonesia	872		727	622	651		505	731	920	25.9%	0.4%
Kazakhstan	380				603	562	552	510	580	13.7%	3.6%
Mexico	260	594	752	742	751	715	733	734	740	0.8%	9.1%
Peru	1,250	1,700	2,350	2,450	2,400	2,460	2,150	2,300	2,200	-4.3%	4.8%
Poland	425					399	393	391	390	-0.3%	-0.7%
Russia	703	732		705	751	801	810	940	1,000	6.4%	3.0%
United States	1,110	1,380	1,430	1,260	1,220	1,260	1,200	1,230	1,300	5.7%	1.3%
Zambia	690	712	763	794	854	797	853	842	770	-8.6%	0.9%
Others	1,900	3,800	4,160	4,250	3,540	3,100	2,840	2,850	3,400	19.3%	5.0%
World (rounded)	15,900	19,100	20,100	20,000	20,400	20,400	20,600	21,200	22,000	3.8%	2.7%

The World Top 10 (2022)

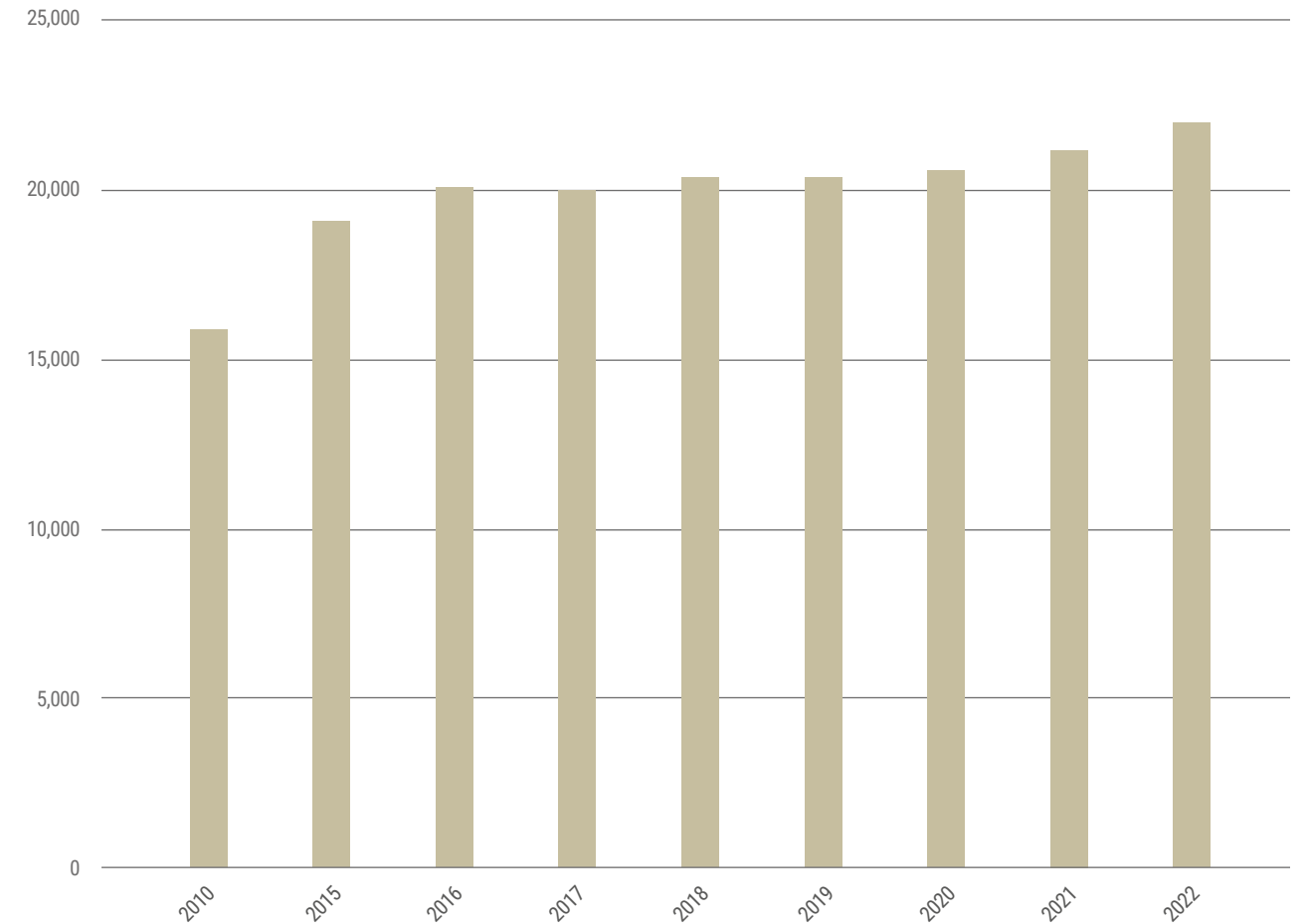


^(*) Data source: U.S. Geological Survey.

Copper - Production

World Copper Production

(thousand tons)



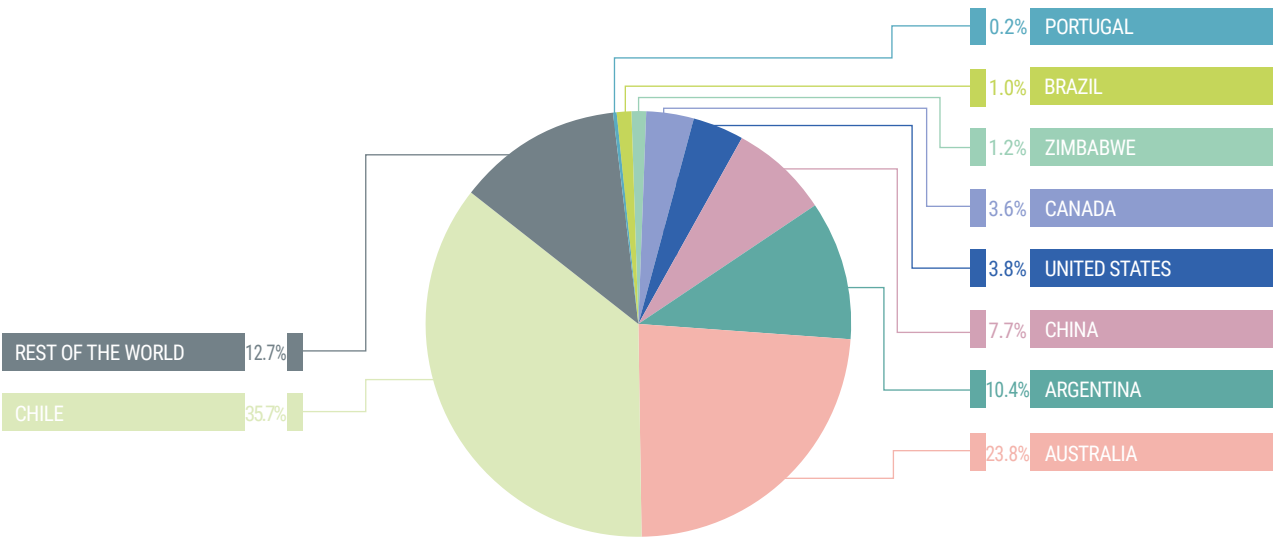
Lithium - Reserves

Countries^(*)

(tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Argentina	850,000	2,000,000	2,000,000	2,000,000	2,000,000	1,700,000	1,900,000	2,200,000	2,700,000	22.7%	10.1%
Australia	580,000	1,500,000	1,600,000	2,700,000	2,700,000	2,800,000	4,700,000	5,700,000	6,200,000	8.8%	21.8%
Brazil	64,000	48,000	48,000	48,000	54,000	95,000	95,000	95,000	250,000	163.2%	12.0%
Canada						370,000	530,000		930,000		
Chile	7,500,000	7,500,000	7,500,000	7,500,000	8,000,000	8,600,000	9,200,000	9,200,000	9,300,000	1.1%	1.8%
China	3,500,000	3,200,000	3,200,000	3,200,000	1,000,000	1,000,000	1,500,000	1,500,000	2,000,000	33.3%	-4.6%
Portugal	10,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	0.0%	16.1%
United States	38,000	38,000	38,000	35,000	35,000	630,000	750,000	750,000	1,000,000	33.3%	31.3%
Zimbabwe	23,000	23,000	23,000	23,000	70,000	230,000	220,000	220,000	310,000	40.9%	24.2%
Others						1,100,000	2,100,000	2,700,000	3,300,000	22.2%	
World (rounded)	13,000,000	14,000,000	14,000,000	16,000,000	14,000,000	17,000,000	21,000,000	22,000,000	26,000,000	18.2%	5.9%

The World Top 9 (2022)

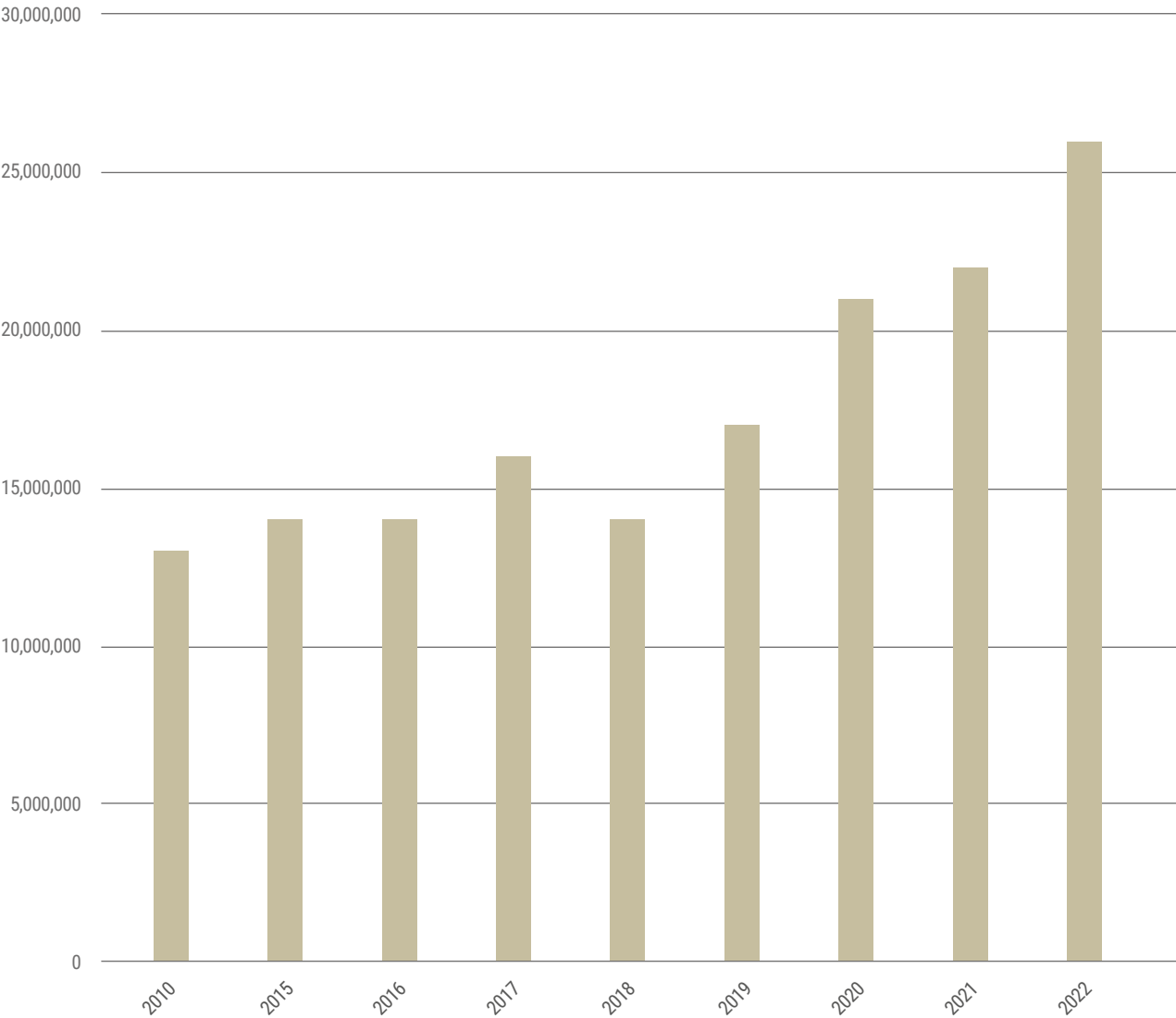


^(*) Data source: U.S. Geological Survey.

Lithium - Reserves

World Lithium Reserves

(tons)



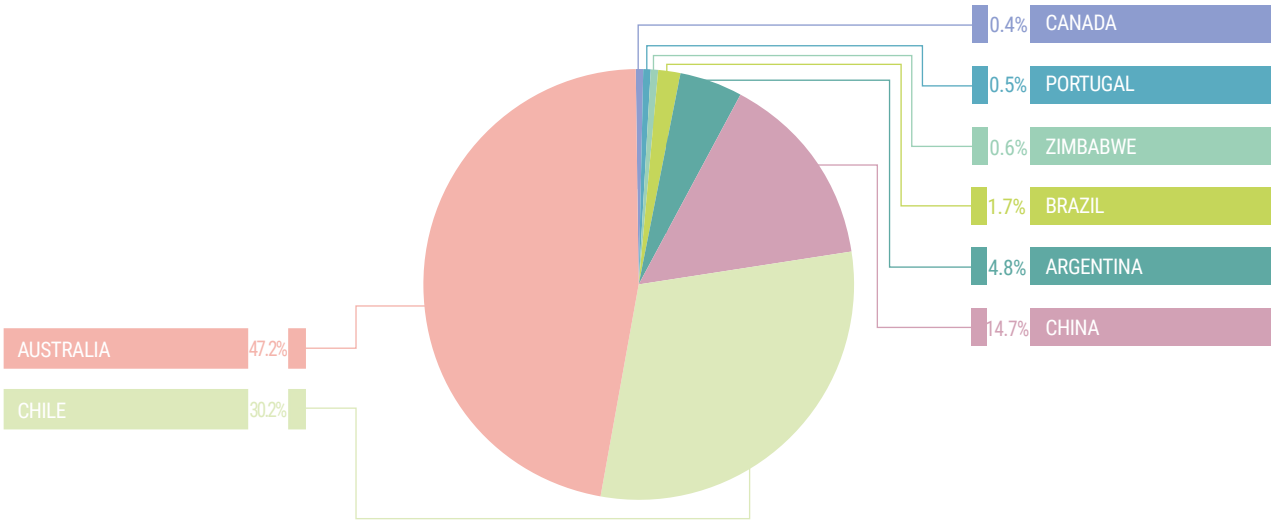
Lithium - Production

Countries^(*)

(tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Argentina	2,950	3,600	5,800	5,700	6,400	6,300	5,900	5,970	6,200	3.9%	6.4%
Australia	9,260	14,100	14,000	40,000	58,800	45,000	39,700	55,300	61,000	10.3%	17.0%
Brazil	160	200	200	200	300	2,400	1,420	1,700	2,200	29.4%	24.4%
Canada					2,400	200			500		
Chile	10,510	10,500	14,300	14,200	17,000	19,300	21,500	28,300	39,000	37.8%	11.5%
China	3,950	2,000	2,300	6,800	7,100	10,800	13,300	14,000	19,000	35.7%	14.0%
Namibia					500						
Portugal	800	200	400	800	800	900	348	900	600	-33.3%	-2.4%
Zimbabwe	470	900	1,000	800	1,600	1,200	417	710	800	12.7%	4.5%
World (rounded)	28,100	31,500	38,000	69,000	95,000	86,000	82,500	107,000	130,000	21.5%	13.6%

The World Top 8 (2022)

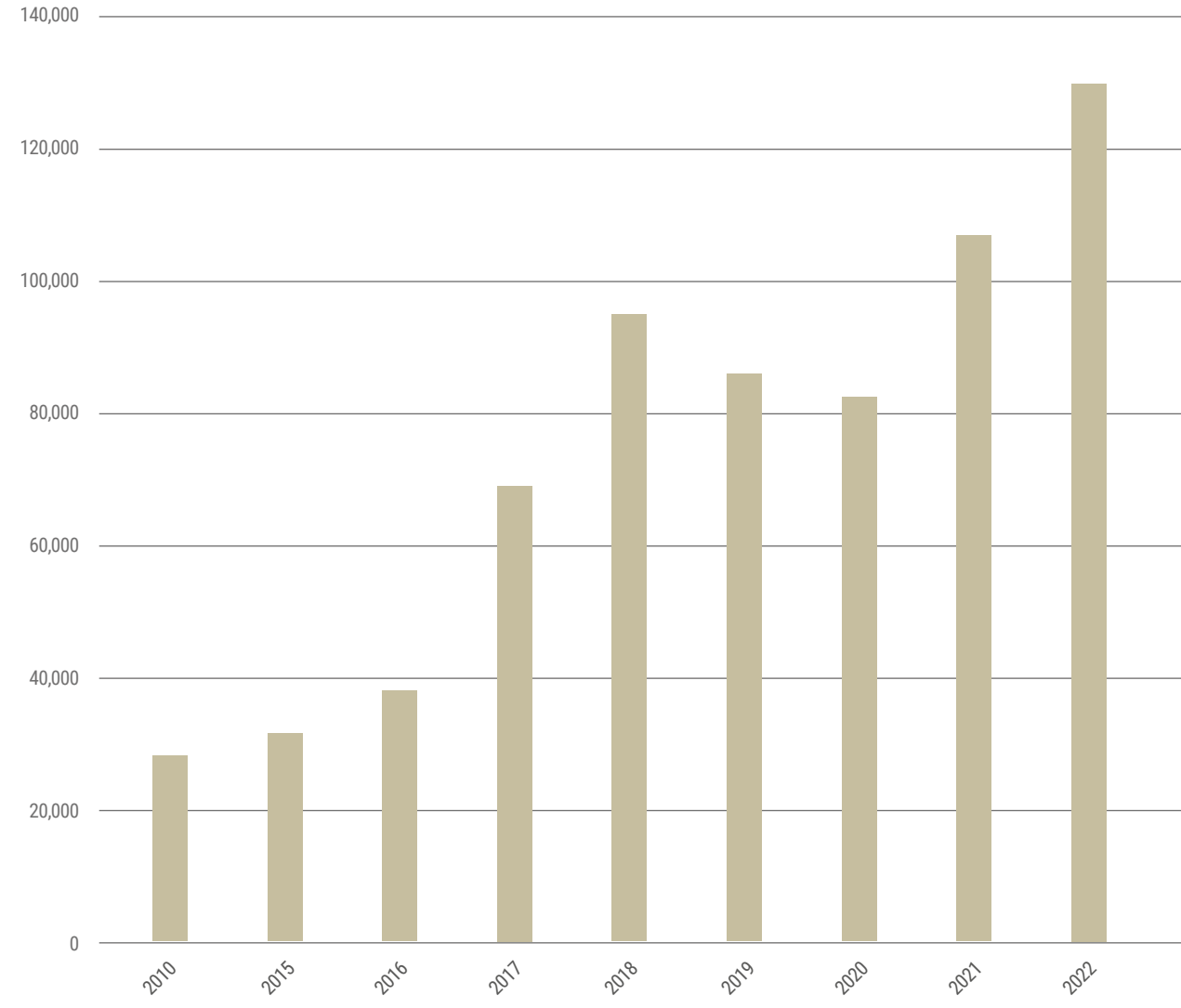


^(*)Data source: U.S. Geological Survey.

Lithium - Production

World Lithium Production

(tons)



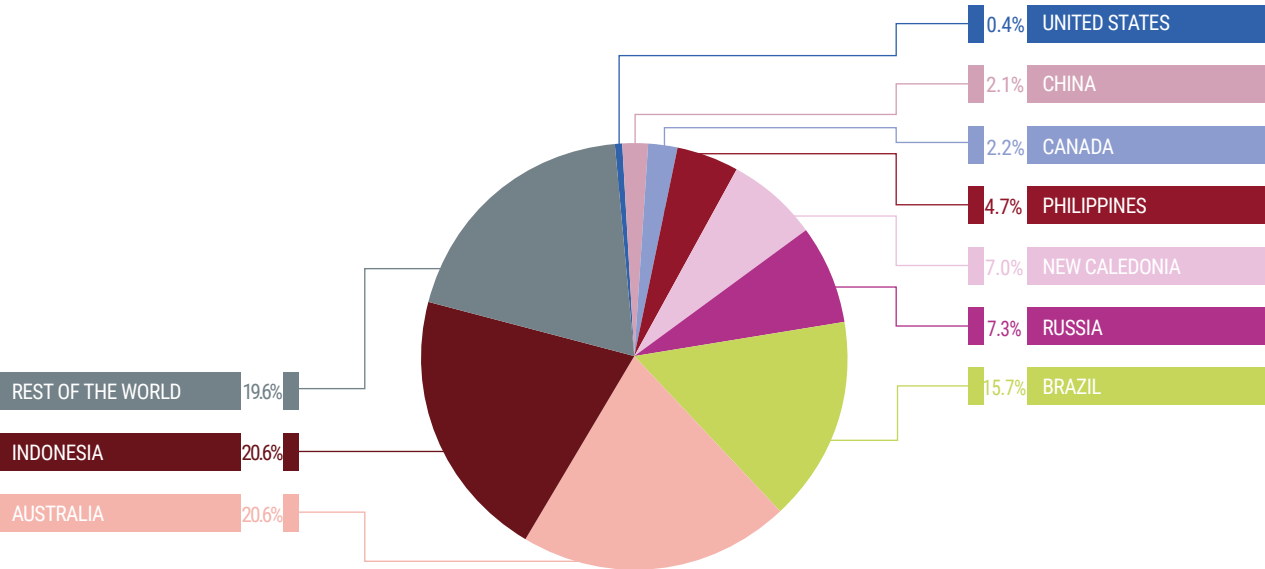
Nickel - Reserves

Countries^(*)

(tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia	24,000,000	19,000,000	19,000,000	19,000,000	19,000,000	20,000,000	20,000,000	21,000,000	21,000,000	0.0%	-1.1%
Botswana	490,000										-100.0%
Brazil	8,700,000	10,000,000	10,000,000	12,000,000	11,000,000	11,000,000	16,000,000	16,000,000	16,000,000	0.0%	5.2%
Canada	3,800,000	2,900,000	2,900,000	2,700,000	2,700,000	2,600,000	2,800,000	2,000,000	2,200,000	10.0%	-4.5%
China	3,000,000	3,000,000	2,500,000	2,900,000	2,800,000	2,800,000	2,800,000	2,800,000	2,100,000		-2.9%
Colombia	1,600,000	1,100,000	1,100,000	1,100,000	440,000						-100.0%
Cuba	5,500,000	5,500,000	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	1,800,000	1,800,000						
Indonesia	3,900,000	4,500,000	4,500,000	4,500,000	21,000,000	21,000,000	21,000,000	21,000,000	21,000,000	0.0%	15.1%
Madagascar	1,300,000	1,600,000	1,600,000	1,600,000	1,600,000						-100.0%
New Caledonia	7,100,000	8,400,000	6,700,000						7,100,000		0.0%
Philippines		3,100,000	4,800,000	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	7,600,000	7,600,000	6,900,000	6,900,000	7,500,000	7,500,000	0.0%	1.9%
South Africa	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000						-100.0%
United States		160,000	160,000	130,000	110,000	110,000	100,000	340,000	370,000	8.8%	
Venezuela	490,000										-100.0%
Others	4,500,000	6,500,000	6,500,000	6,500,000	6,500,000	14,000,000	14,000,000	20,000,000	20,000,000	0.0%	13.2%
World (rounded)	76,000,000	79,000,000	78,000,000	74,000,000	89,000,000	89,000,000	94,000,000	95,000,000	100,000,000	5.3%	2.3%

The World Top 9 (2022)

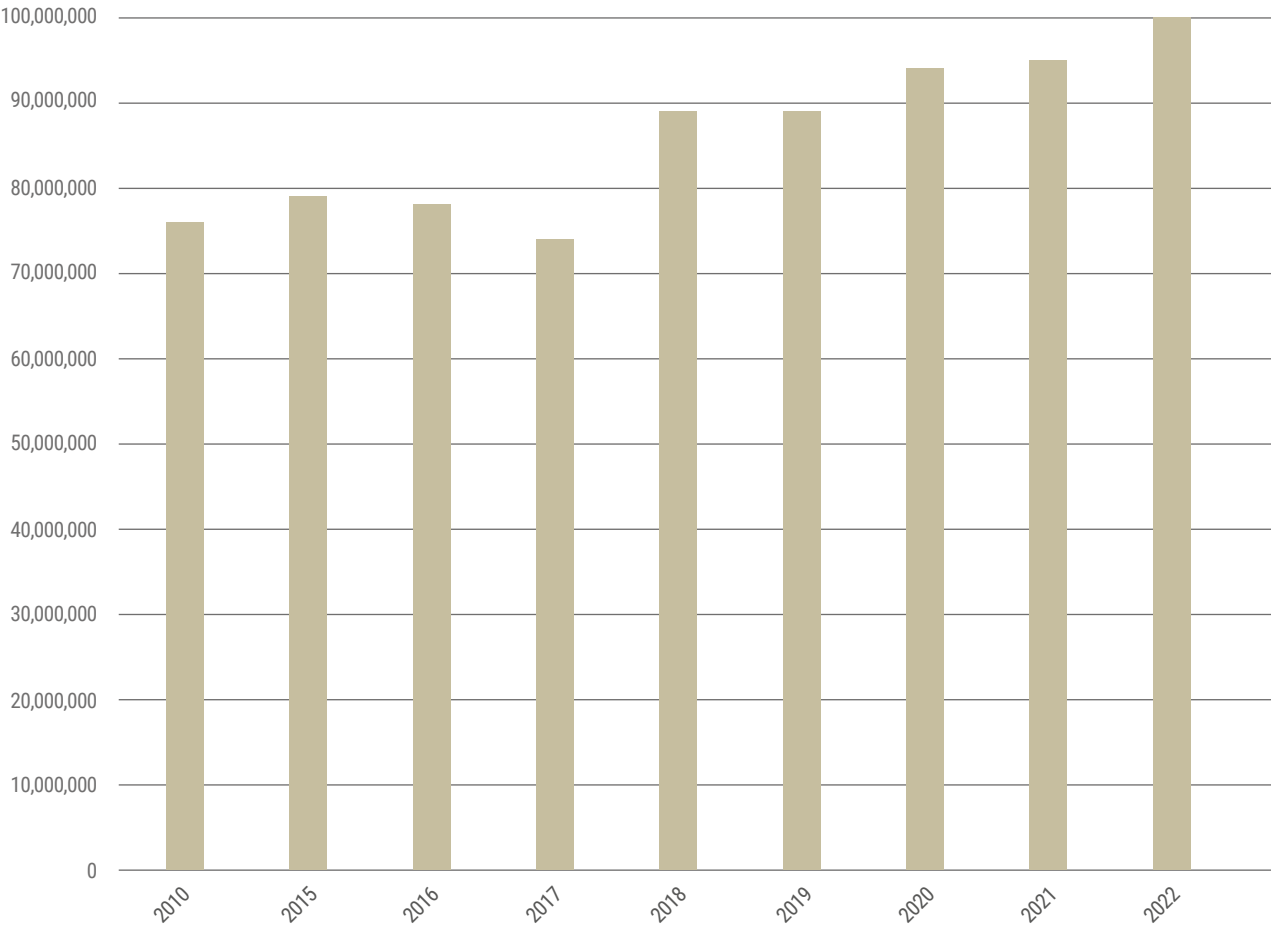


^(*)Data source: U.S. Geological Survey.

Nickel - Reserves

World Nickel Reserves

(tons)



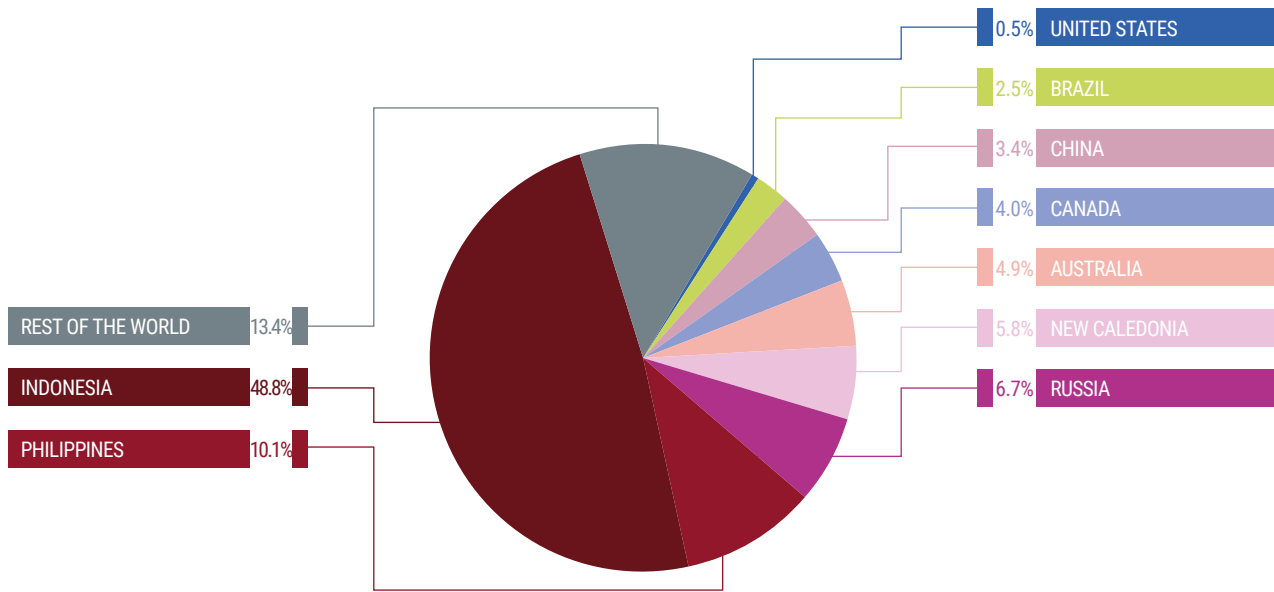
Nickel - Production

Countries^(*)

(tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia	170,000	222,000	204,000	179,000	170,000	159,000	169,000	151,000	160,000	6.0%	-0.5%
Botswana	28,000										-100.0%
Brazil	59,100	160,000	160,000	78,600	74,400	60,600	77,100	76,000	83,000	9.2%	2.9%
Canada	158,000	235,000	236,000	214,000	176,000	181,000	167,000	134,000	130,000	-3.0%	-1.6%
China	79,000	92,900	98,000	103,000	110,000	120,000	120,000	109,000	110,000	0.9%	2.8%
Colombia	72,000	40,400	41,600	45,500							-100.0%
Cuba	70,000	56,400	51,600	52,800	51,000	49,200					-100.0%
Dominican Republic						56,900					
Finland				34,600							
Guatemala		52,400	54,000	53,700							
Indonesia	232,000	130,000	199,000	345,000	606,000	853,000	771,000	1,040,000	1,600,000	53.8%	17.5%
Madagascar	15,000	45,000	49,000	41,700							-100.0%
New Caledonia	130,000	186,000	207,000	215,000	216,000	208,000	200,000	186,000	190,000	2.2%	3.2%
Philippines	173,000	554,000	347,000	366,000	345,000	323,000	334,000	387,000	330,000	-14.7%	5.5%
Russia	269,000	269,000	222,000	214,000	272,000	279,000	283,000	205,000	220,000	7.3%	-1.7%
South Africa	40,000	56,700	49,000	48,400							-100.0%
United States		27,200	24,100	22,100	17,800	13,500	16,700	18,400	18,000	-2.2%	
Others	99,000	157,000	150,000	146,000	366,000	310,000	373,000	429,000	440,000	2.6%	13.2%
World (rounded)	1,590,000	2,280,000	2,090,000	2,160,000	2,400,000	2,610,000	2,510,000	2,730,000	3,300,000	20.9%	6.3%

The World Top 9 (2022)

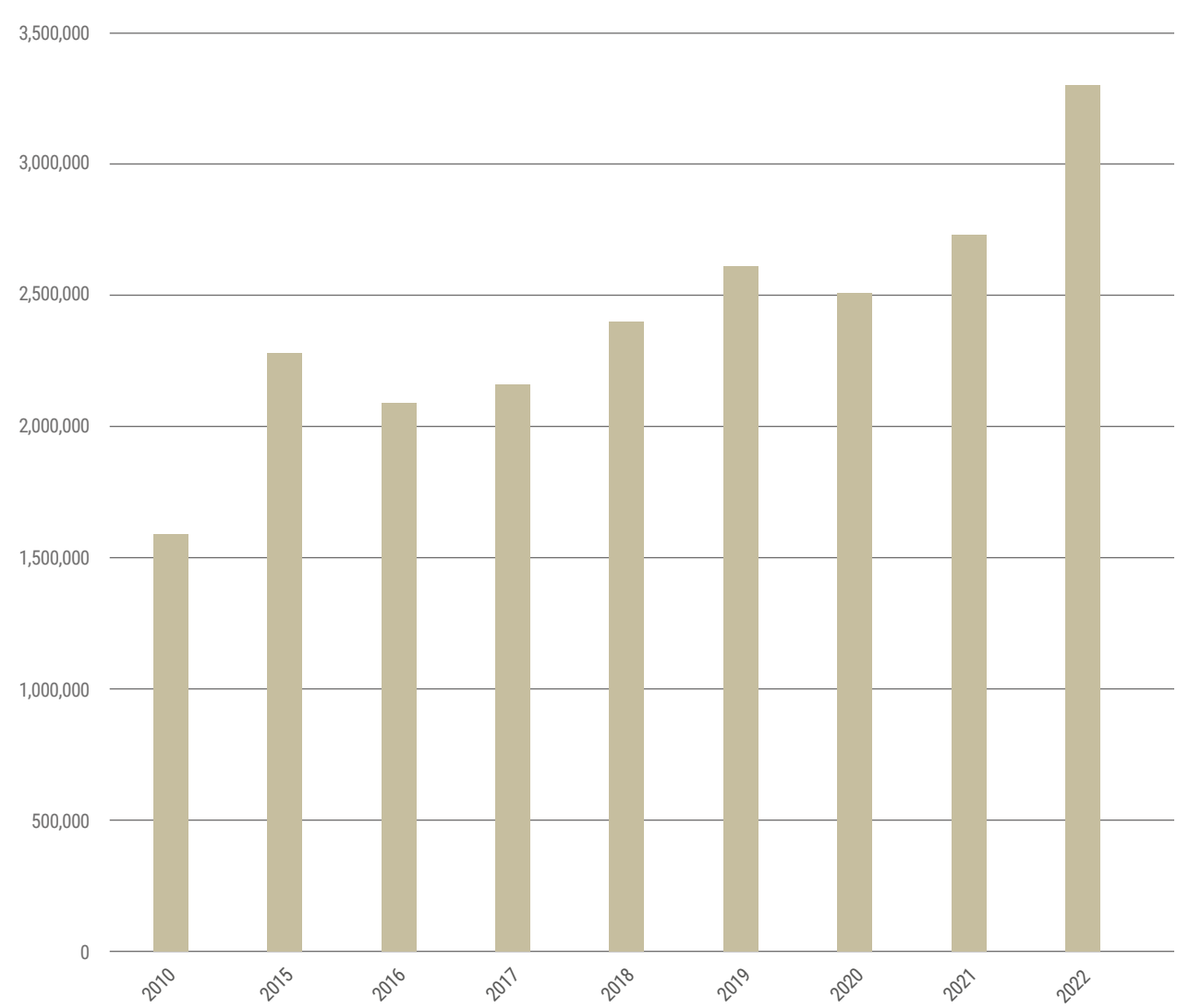


^(*)Data source: U.S. Geological Survey.

Nickel - Production

World Nickel Production

(tons)



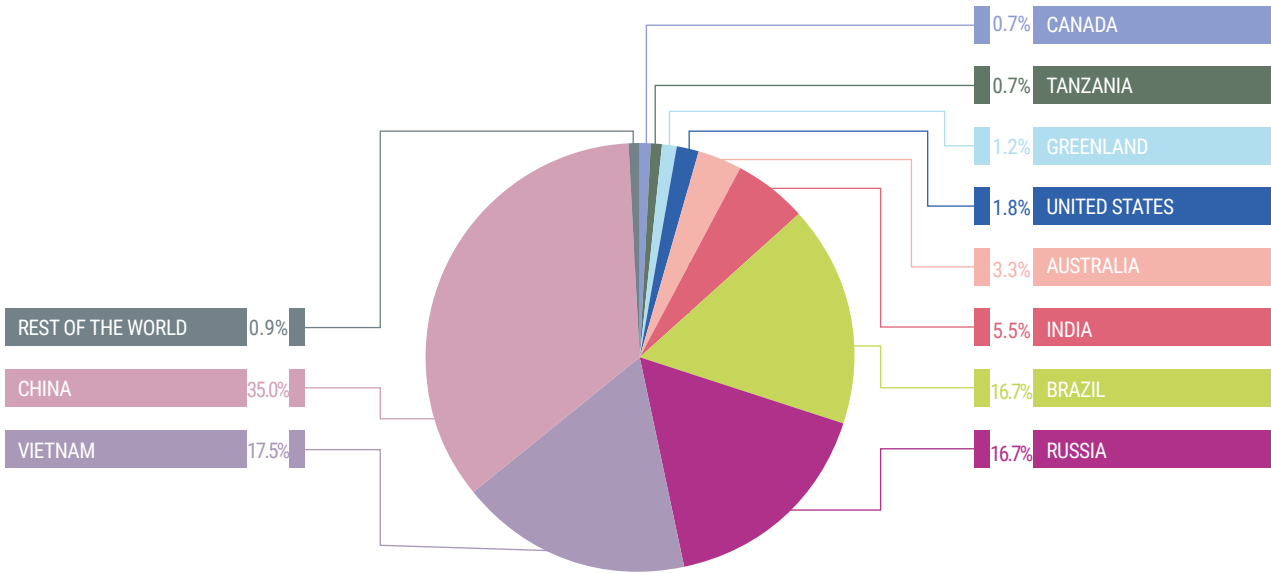
Rare Earths - Reserves

Countries^(*)

(tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia	1,600,000	3,200,000	3,400,000	3,400,000	3,400,000	3,300,000	4,100,000	4,000,000	4,200,000	5.0%	8.4%
Brazil	48,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	21,000,000	21,000,000	21,000,000	0.0%	66.0%
Canada			830,000	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	44,000,000	0.0%	-1.8%
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	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	6,900,000	0.0%	6.9%
Malawi			136,000	140,000							
Malaysia	30,000	30,000	30,000	30,000	30,000						-100.0%
Russia			18,000,000	18,000,000	12,000,000	12,000,000	12,000,000	21,000,000	21,000,000	0.0%	
South Africa			860,000	860,000		790,000	790,000	790,000	790,000	0.0%	
Tanzania								890,000	890,000	0.0%	
United States	13,000,000	1,800,000	1,400,000	1,400,000	1,400,000	1,400,000	1,500,000	1,800,000	2,300,000	27.8%	-13.4%
Vietnam			22,000,000	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	0.0%	-30.5%
World (rounded)	110,000,000	130,000,000	120,000,000	120,000,000	120,000,000	120,000,000	120,000,000	120,000,000	130,000,000	8.3%	1.4%

The World Top 10 (2022)

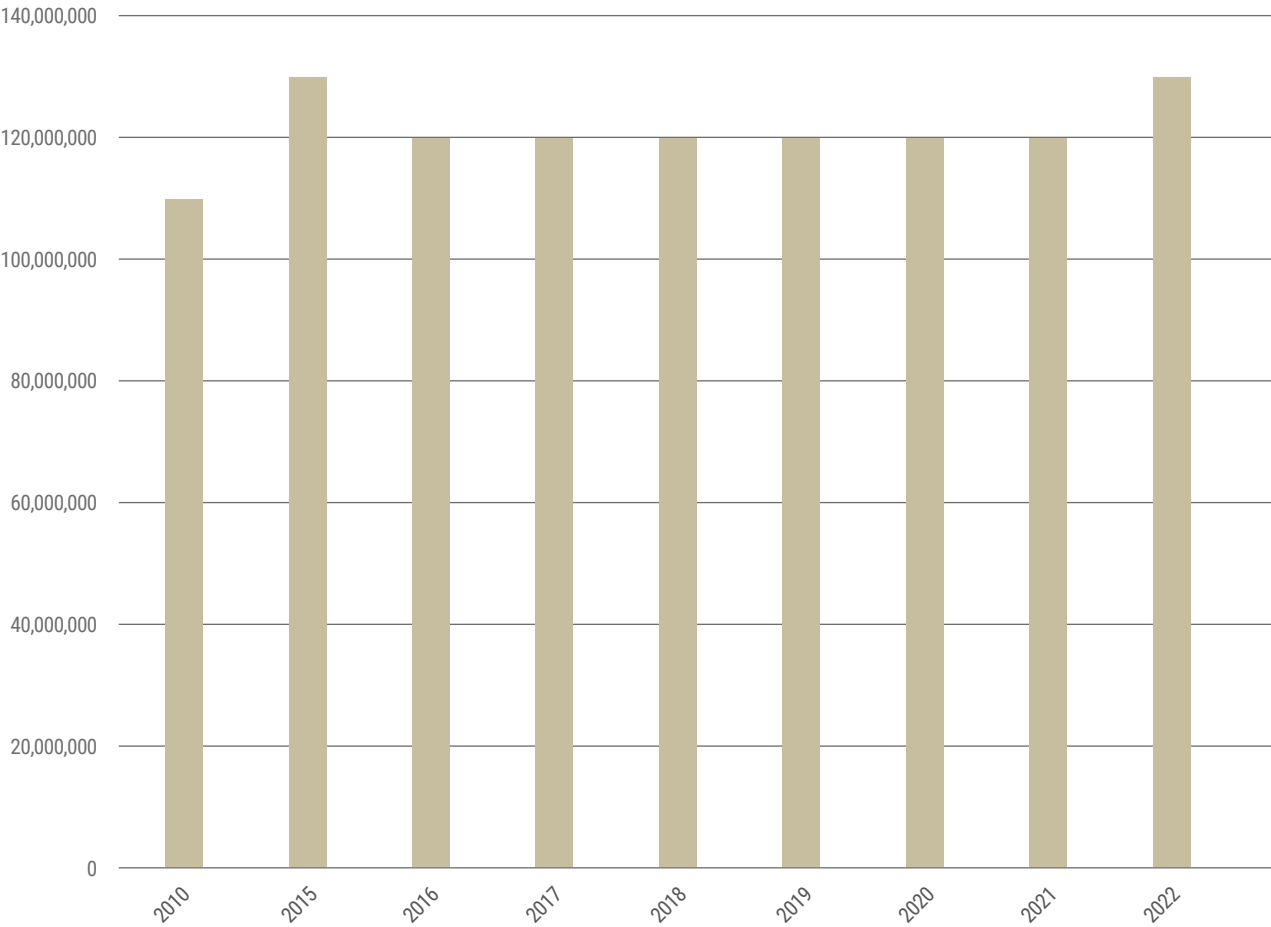


(*) Data source: U.S. Geological Survey.
(**) The aggregate includes the following states according to international definitions: Armenia, Azerbaijan, Belarus, Georgia, Kazaktstan, Kyrgyzstan, Mordova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.
However, some of these countries may non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

Rare Earths - Reserves

World Rare Earths Reserves

(tons)

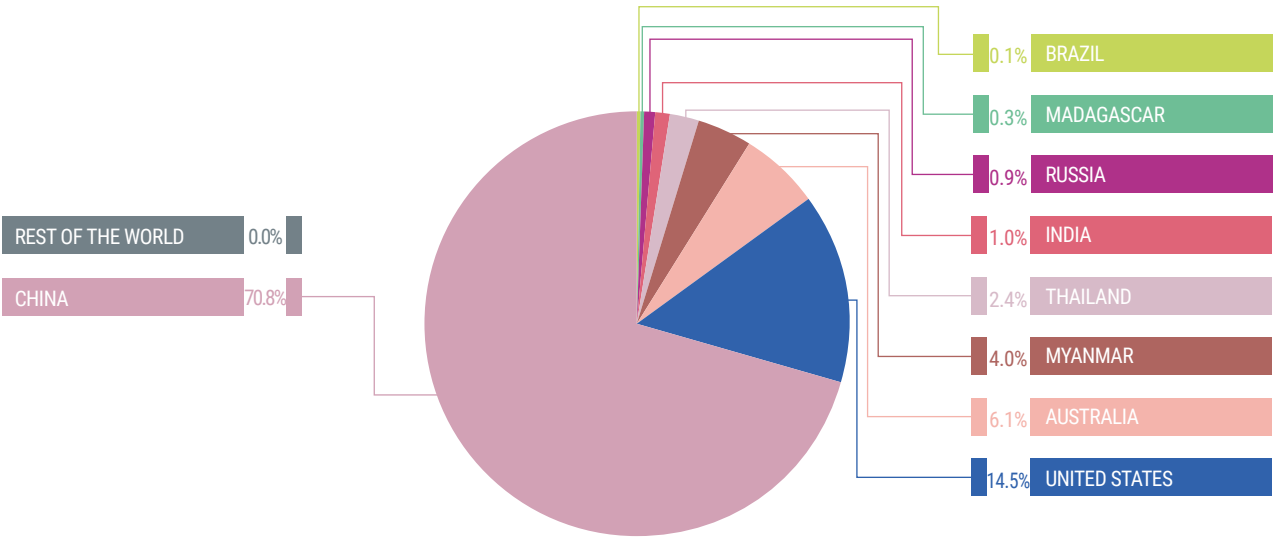


Rare Earths - Production

Countries^(*)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia		12,000	15,000	19,000	21,000	20,000	21,000	24,000	18,000	-25.0%	
Brazil	550	880	2,200	1,700	1,100	710	600	500	80	-84.0%	-14.8%
Burundi					630	200	300	200		-100.0%	
China	130,000	105,000	105,000	105,000	120,000	132,000	140,000	168,000	210,000	25.0%	4.1%
India	2,800	1,700	1,500	1,800	2,900	2,900	2,900	2,900	2,900	0.0%	0.3%
Madagascar					2,000	4,000	2,800	6,800	960	-85.9%	
Malaysia	30	500	300	180							-100.0%
Myanmar					19,000	25,000	31,000	35,000	12,000	-65.7%	
Russia		2,800	2,800	2,600	2,700	2,700	2,700	2,600	2,600	0.0%	
Thailand		760	1,600	1,300	1,000	1,900	3,600	8,200	7,100	-13.4%	
United States		5,900			18,000	28,000	39,000	42,000	43,000	2.4%	
Vietnam		250	220	200	920	1,300	700	400		-100.0%	
Others					60	66	100	60	80	33.3%	
World (rounded)	133,000	130,000	129,000	132,000	190,000	220,000	240,000	290,000	300,000	3.4%	7.0%

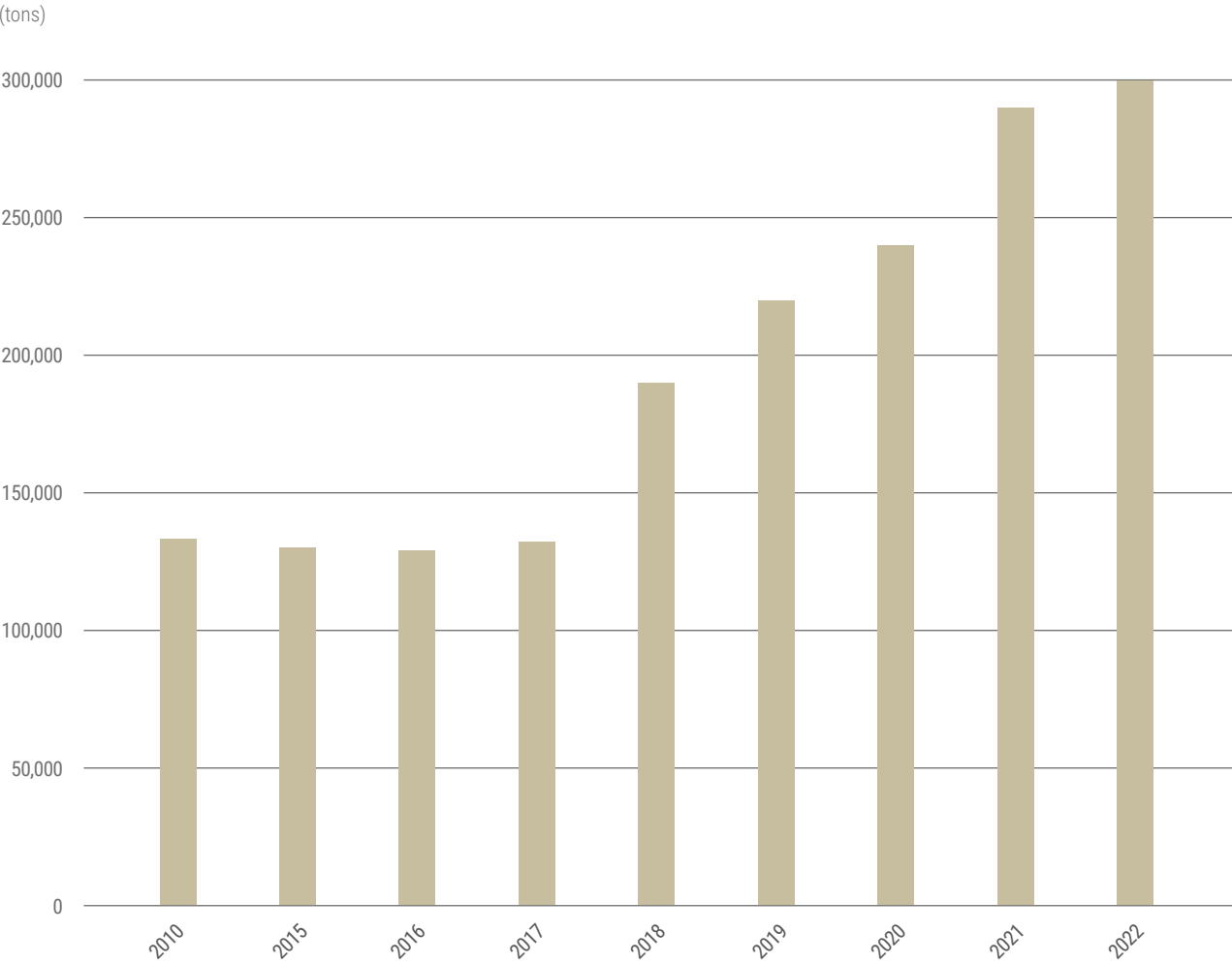
The World Top 9 (2022)



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

Rare Earths - Production

World Rare Earths Production



Silicon - Production

Countries^(*)

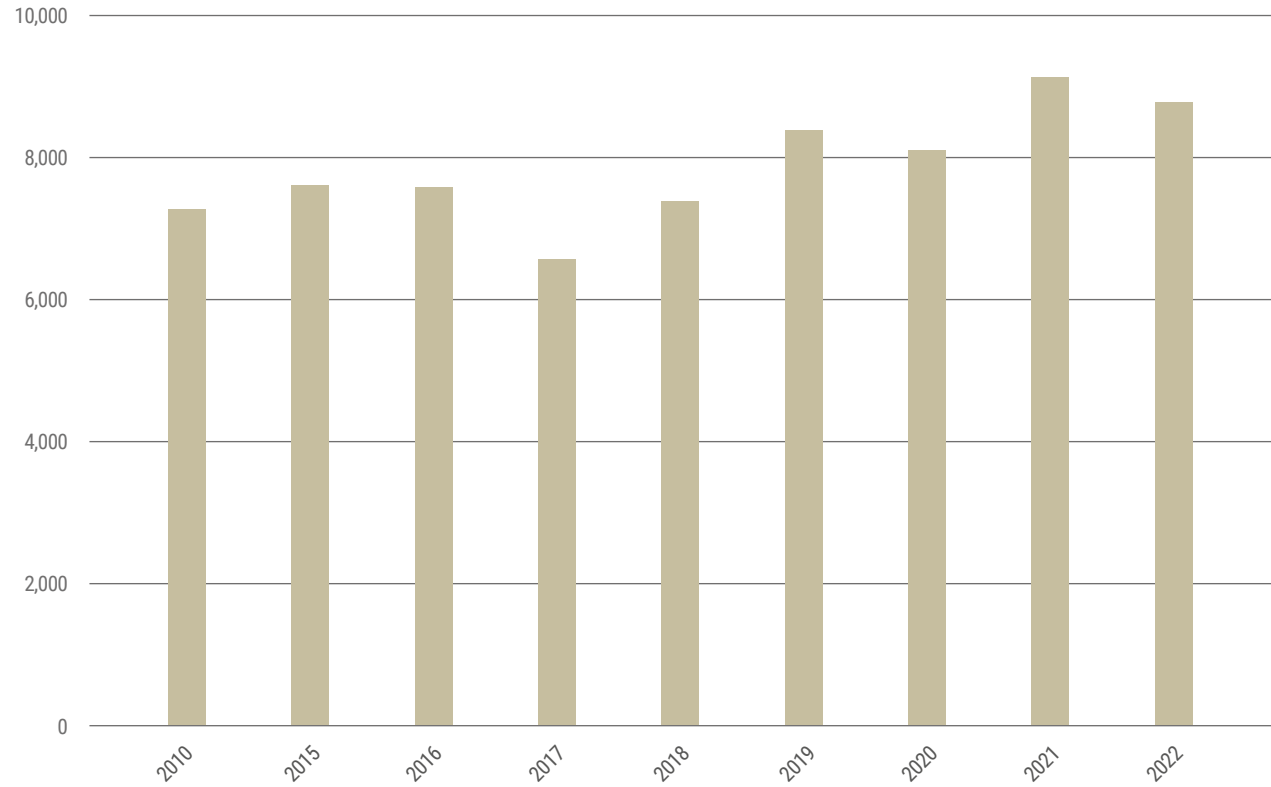
(thousand metric tons)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	Δ y/y (2022-2021)	CAGR (2022-2010)
Australia							42	50	50	0.0%	
Bhutan		78	69	55	90	90	67	85	85	0.0%	
Brazil	224	117	110	170	220	340	404	389	400	2.8%	5.0%
Canada	52	54	51	54	57	57	47	49	49	0.0%	-0.2%
China	4,920	5,000	5,000	4,000	4,800	5,700	5,600	6,400	6,000	-6.3%	1.9%
France	127	121	120	126	140	130	112	127	120	-5.5%	-2.6%
Germany								63	63	0.0%	
Iceland	74	75	79	76	83	88	103	111	110	-0.9%	2.9%
India	66	60	59	59	57	60	59	59	59	0.0%	-1.2%
Kazakhstan							67	122	120	-1.6%	
Malaysia		68	82	113	140	150	109	85	92	8.2%	
Norway	303	375	380	375	370	375	345	362	360	-0.6%	1.4%
Poland					43		42	49	49	0.0%	
Russia	643	747	750	670	600	610	576	644	640	-0.6%	0.0%
South Africa	137	84	85	65		96					-100.0%
Spain		81	81	69	69	66	55	60	57	-5.0%	
Ukraine	127	59	66	60	49	63	40	49	19	-61.2%	-14.6%
Venezuela	50										-100.0%
United States	176	411	384	415	430	310	277	313	310	-1.0%	4.8%
Others	394	300	310	274	290	278	175	128	210	64.1%	-5.1%
World (rounded)	7,290	7,630	7,600	6,580	7,400	8,410	8,120	9,150	8,800	-3.8%	1.6%

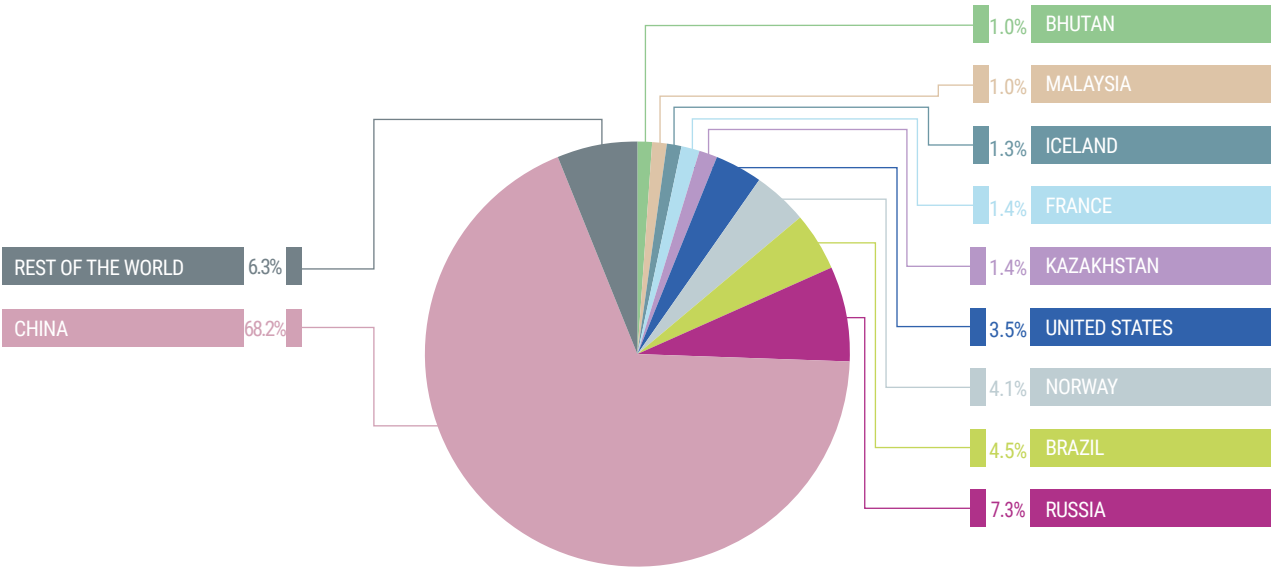
Silicon - Production

World Silicon Production

(tons)



The World Top 10 (2022)



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