INDUSTRIES & MARKETS

Lab-grown diamond industry



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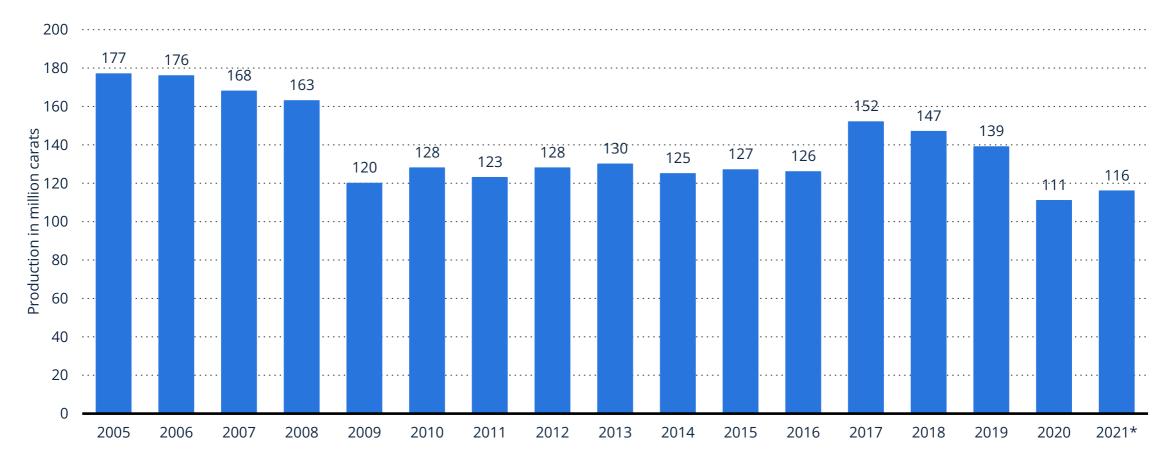
CHAPTER 01

Natural diamond overview

Production volume of rough diamonds worldwide from 2005 to 2021 (in million carats)

Global production volume of rough diamonds 2005-2021

3

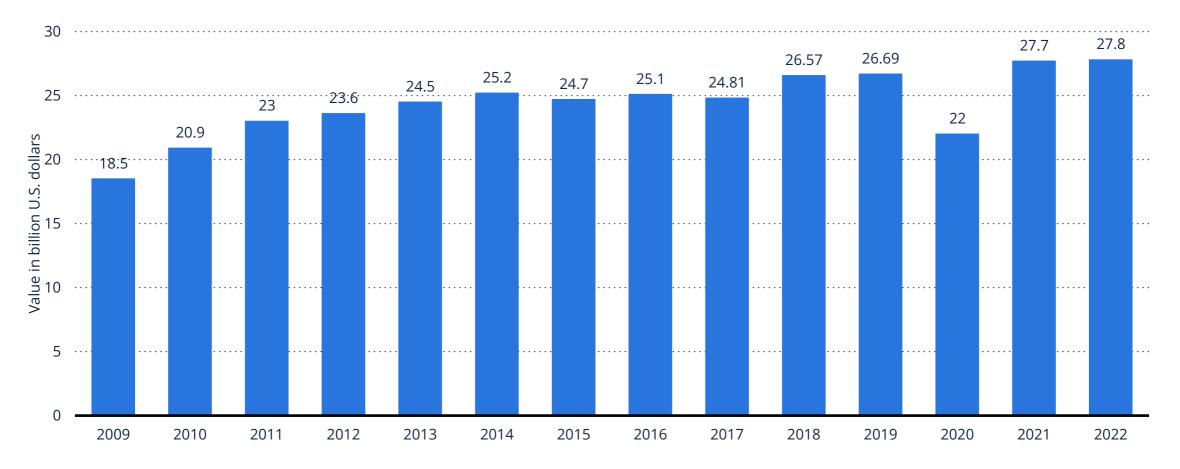


Description: In 2005, the worldwide production volume of rough diamonds stood at approximately 177 million carats in total. More than a decade later, in 2021, production had decreased to 116 million carats. Read more Note(s): Worldwide; 2005 to 2021; * Estimated. This statistic was assembled from several Bain & Co. publications. Read more Source(s): Bain & Company; Kimberley Process; Various sources (company data, experts)



Value of polished diamonds worldwide from 2009 to 2022 (in billion U.S. dollars)

Polished diamond value worldwide 2009-2022



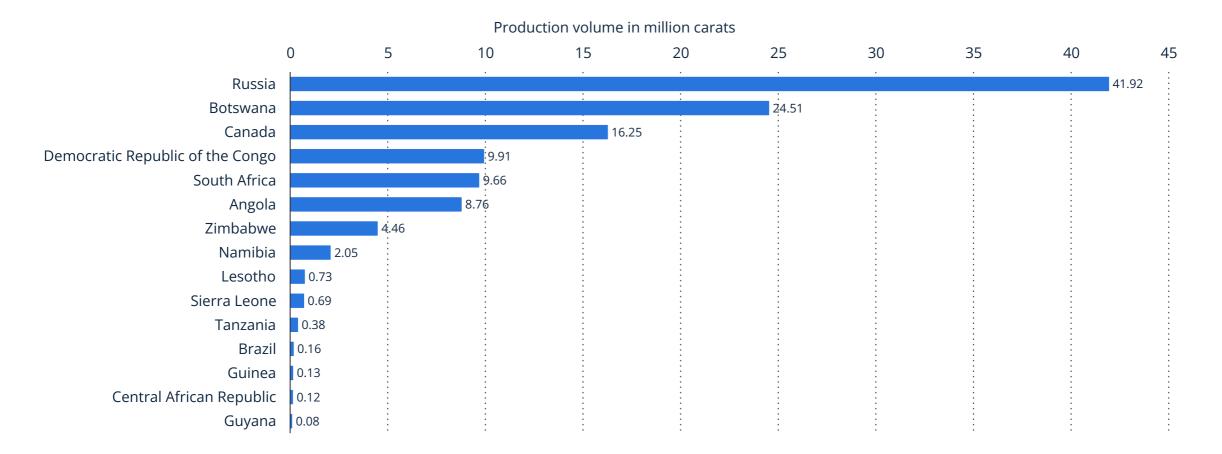
Description: In 2022, the total global demand value of new polished diamonds amounted to 27.8 billion U.S. dollars, up by approximately 100 million U.S. dollars from the previous year. Read more Note(s): Worldwide; 2009 to 2022; demand value for new polished diamonds. Source(s): De Beers

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Production volume of diamonds worldwide in 2022, by country (in million carats)

Global diamond production by country 2022

5





Production volume of diamonds worldwide in 2021, by political stability of producer countries and type (in million carats)

Production volume of diamonds globally 2021, by political stability of producers



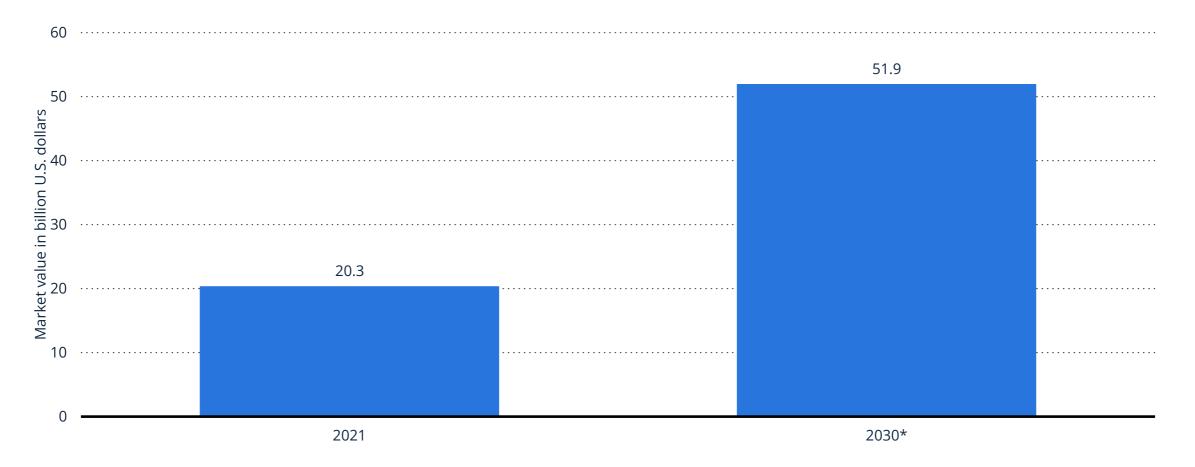
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Description: In 2021, countries that were classified as politically unstable accounted for the largest global production share of both gemstone quality diamonds and industrial diamonds. Nearly 38 million carats of gemstone quality diamonds, and nearly 25.6 million carats of industrial diamonds were produced in politically unstable countries that year. Read more Note(s): Worldwide; 2021 Source(s): BMLRT (Österreich) CHAPTER 02

Lab-grown diamond overview

Market value of lab-grown diamonds worldwide in 2021, with a forecast for 2030 (in billion U.S. dollars)

Global market value of lab-grown diamonds 2021-2030

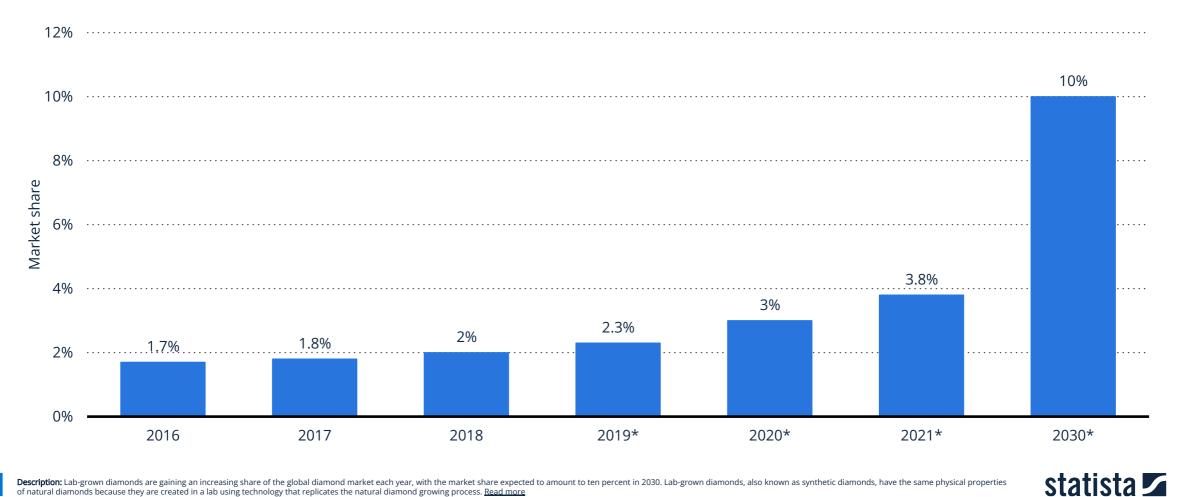


Description: The market value of lab-grown diamonds amounted to more than 20 billion U.S. dollars in 2021. Lab-grown diamonds are expected to witness a significant increase in market value by 2030, to nearly 52 billion U.S. dollars. Read more Note(s): Worldwide; 2021; * Forecast based on a market value increase of 9.8 percent from 2022 to 2030. Read more Source(s): MarkWide Research



Diamond market share of lab-grown diamonds worldwide from 2016 to 2030

Global market share of lab-grown diamonds 2016-2030



Description: Lab-grown diamonds are gaining an increasing share of the global diamond market each year, with the market share expected to amount to ten percent in 2030. Lab-grown diamonds, also known as synthetic diamonds, have the same physical properties of natural diamonds because they are created in a lab using technology that replicates the natural diamond growing process. Read more Note(s): Worldwide; 2016 to 2018; *Forecast. Read more Source(s): IGDA

Selected figures about lab-grown diamond production worldwide in 2020

Lab-grown diamonds selected production figures 2020

	Lower range	Upper range
Global production volume (in million carats)	6	7
China's share of global production (in percent)	50	60



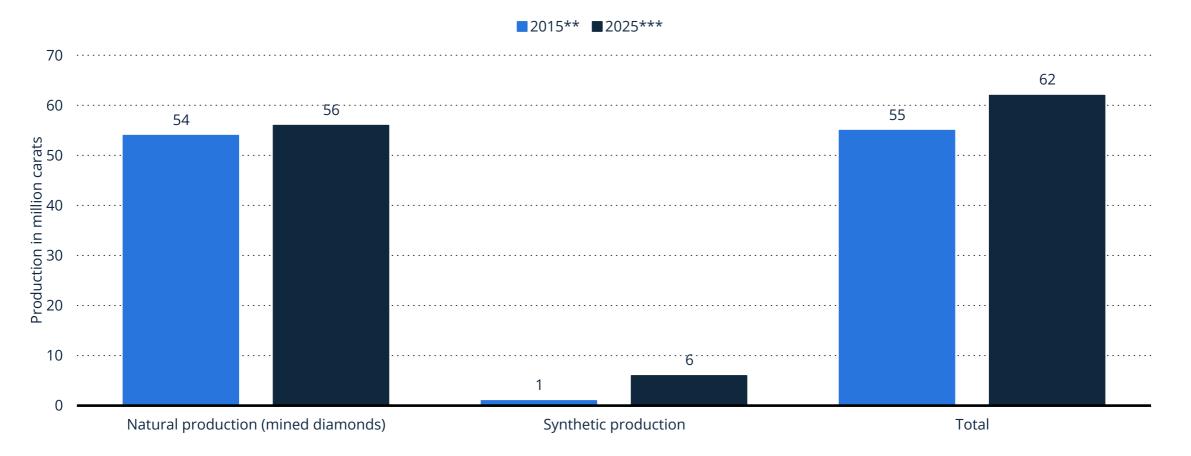
CHAPTER 03

Production



Natural and synthetic gem diamond production worldwide in 2015 and 2025 (in million carats)*

Global synthetic and natural gem diamond production 2015 & 2025



12 Description: This statistic shows the estimated natural and synthetic gem quality diamond production worldwide in 2015, with a forecasted figure for 2025. It is forecasted that in 2025 natural diamond production will be some 56 million carats worldwide and that synthetic diamond production will amount to six million carats. Read more Note(c): worldwide: Some for the in abrasive quality. ** Estimated *** Energies. Read more

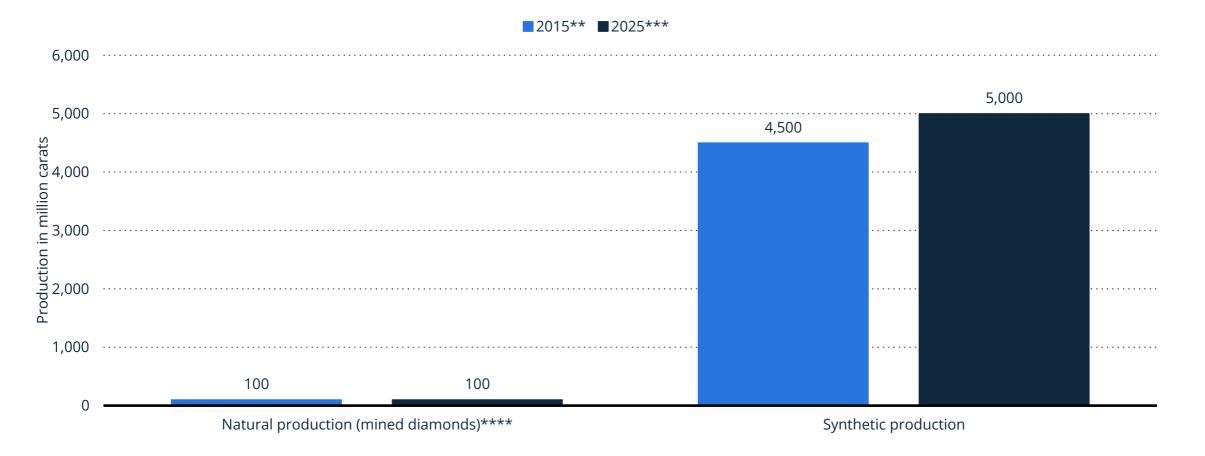
Note(s): Worldwide, * Gem diamonds refer to jewelry quality diamonds, as opposed to industrial diamonds that are used industrially for their abrasive quality. ** Estimated. *** Forecast. Read more Source(s): Paul Zimnisky



Natural and synthetic industrial diamond production worldwide in 2015 and 2025 (in million carats)*

Global synthetic and natural industrial diamond production 2015 & 2025

13



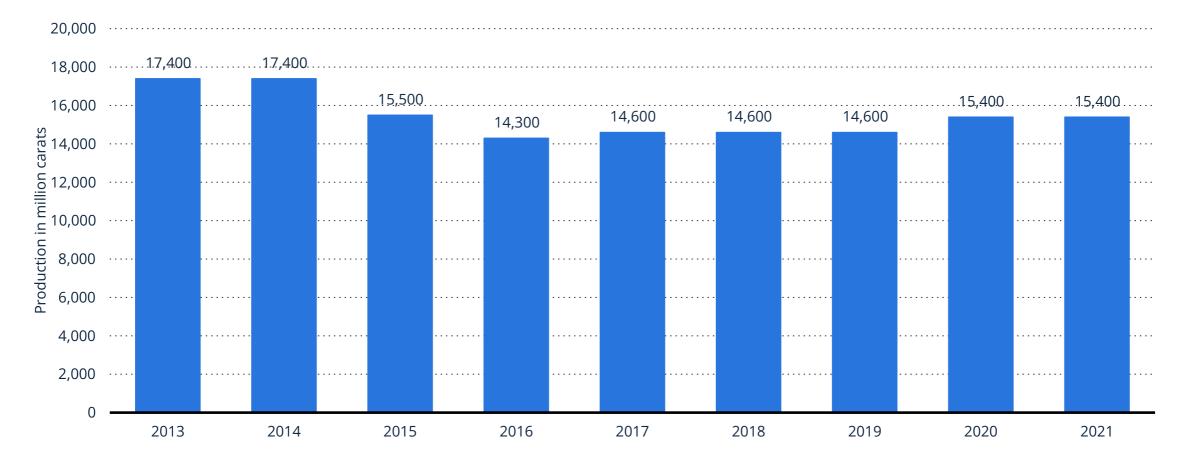
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Description: This statistic shows the estimated natural and synthetic diamond production for industrial purposes worldwide in 2015, with a forecasted figure for 2025. It is forecasted that in 2025 natural diamond production for industrial uses will be less than 100 million carats worldwide and that synthetic industrial diamond production will amount to five billion carats. Read more Note(s): Worldwide; * Abrasive quality industrial diamonds. ** Estimated. *** Forecast. **** Less than 100 million carats. Read more Source(s): Paul Zimnisky

Synthetic industrial diamond production worldwide from 2013 to 2021 (in million carats)

Synthetic industrial diamond production worldwide 2013-2021

14

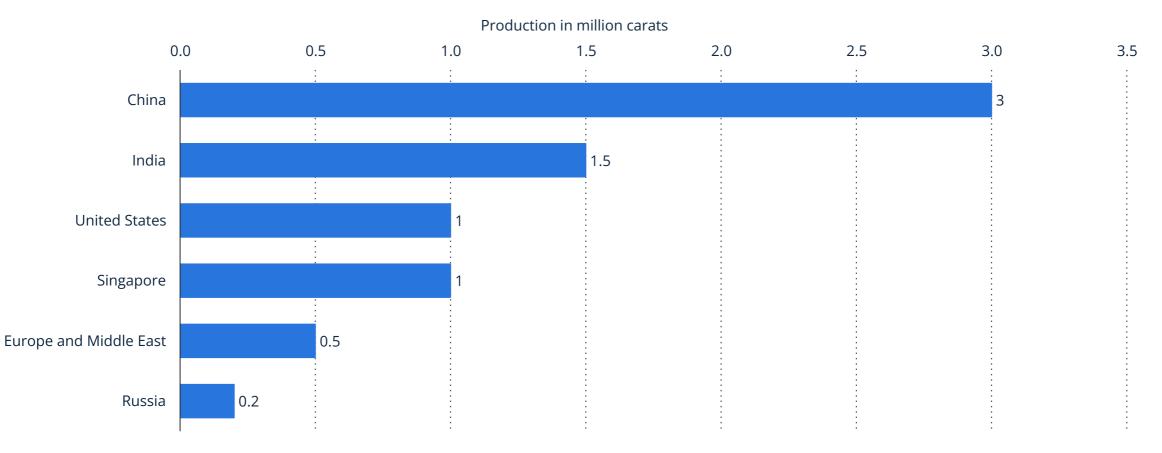


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Description: In 2021, the global production of synthetic industrial diamonds (also known as lab-grown diamonds) was estimated to have been some 15.4 billion carats. Industrial diamonds are diamonds that are used for industrial purposes, such as for their abrasive properties, rather than as gemstones in jewelry. Read more Note(5: Worldwide: 2013 to 2021 Source(s): US Geological Survey

Lab-grown diamond production worldwide in 2020, by region (in million carats)

Lab-grown diamond production 2020, by world region



15 Description: Between six and seven million carats of lab-grown diamonds were produced worldwide in 2020. Of that amount, China manufactured between 50 and 60 percent, using mainly the high-pressure, high-temperature technology. India was the second largest lab-grown diamond producer that year, having produced approximately 1.5 million carats. <u>Read more</u> Note(s): Worldwide; 2020; all figures are approximate Source(s): AWDC; Bain & Company; Various sources (company data, expert interviews, publication analysis)

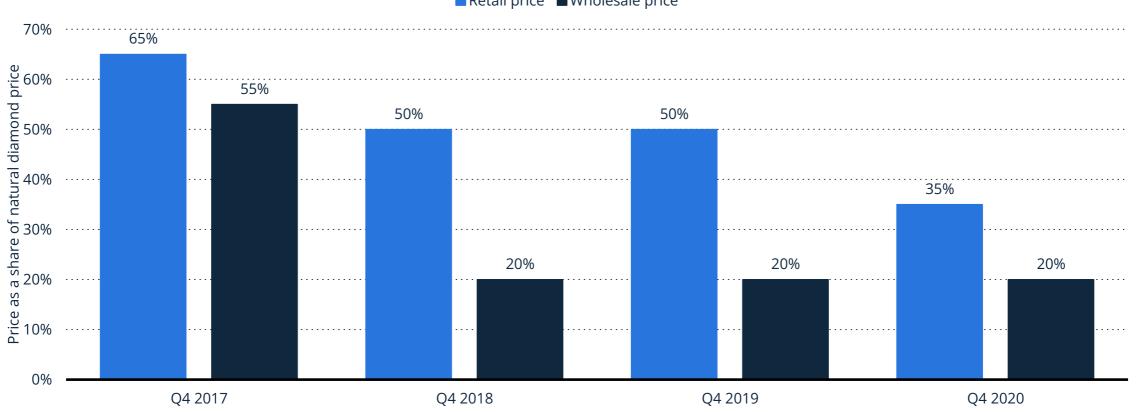


CHAPTER 04

Price

Price of lab-grown diamonds as a share of natural diamond prices from Q4 2017 to Q4 2020 by channel (in percent)

Lab-grown diamond price in proportion to natural diamonds by channel Q4 2017-Q4 2020



■ Retail price ■ Wholesale price

Description: The price discounts of lab-grown diamonds relative to mined diamonds decreased by the fourth quarter (Q4) of 2020. By that time, the retail price of lab-grown diamonds was around 35 percent of the retail price for natural/mined diamonds, and the wholesale price of lab-grown diamonds was just 20 percent of the wholesale price for natural diamonds. Read more Note(s): Worldwide; Q4 2017 to Q4 2020

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Source(s): Bain & Company; Thomson Reuters; Various sources (Retailers' websites)

17

Price difference of lab-created diamonds from natural diamonds from 2016 to 2023, by weight (in U.S. dollars)

Natural and synthetic diamonds price difference 2016-2023, by weight

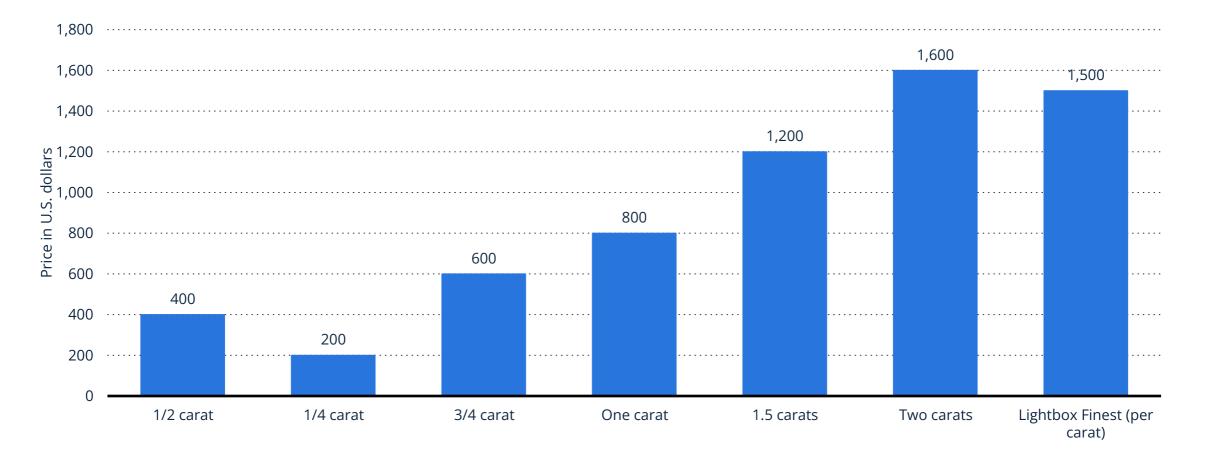
	Q4 2016	Q4 2017	Q4 2018	Q4 2019	Q4 2020	Q4 2021	Q4 2022	Q1 2023
0.5 carat lab	1305	1170	875	700	585	640	555	580
0.5 carat natural	1490	1425	1500	1260	1430	1390	1235	1255
1 carat lab	5250	4515	3675	2700	1945	1745	1485	1435
1 carat natural	6200	5925	6325	5626	5850	6215	5620	5635
1.5 carat lab	10600	8450	6550	4985	3740	3370	2785	2445
1.5 carat natural	12125	12050	12750	12325	12375	14225	13925	13625
3 carat lab	0	0	0	0	19950	13580	11095	9065
3.0 carat natural	0	0	0	0	63000	66750	67000	72125



Retail price of Lightbox's lab grown diamonds as of 2023 by carat size (in U.S. dollars)

Lab grown diamond retail price of Lightbox 2023, by carat size

19



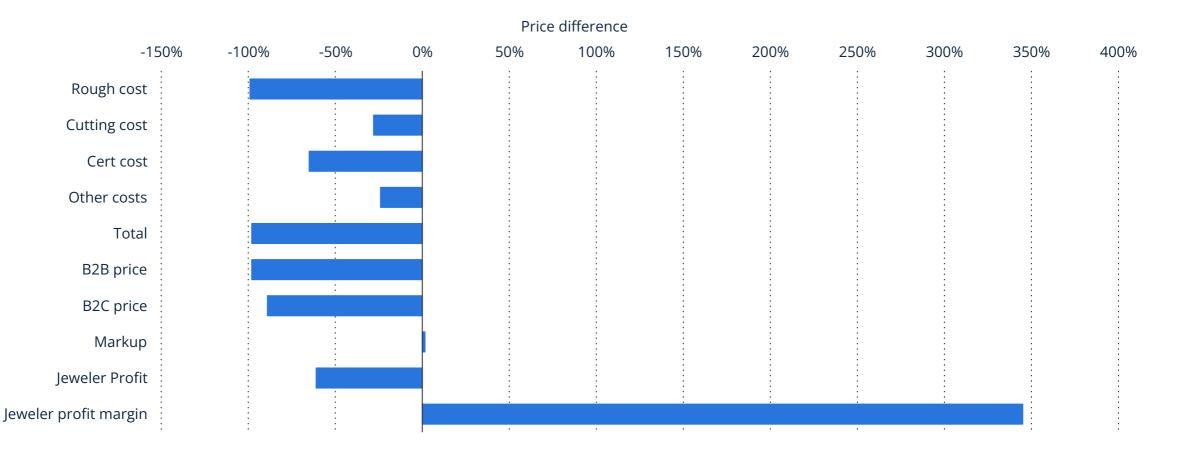
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Description: The retail price of one-carat diamonds from the De Beers-owned lab grown diamonds company Lightbox stood at some 800 U.S. dollars as of 2023. This company's lab grown diamond offers include one quarter, half, three quarter carat, one carat, 1.5 carats, two carats, and so on. The company also has a premium category that has a higher price, called Lightbox Finest. Read more Note(s): Worldwide; 2023 Source(s): Lightbox

Price difference of lab-created diamonds from natural diamonds in the United States as of September 2023, by cost category (in percent)

Natural and synthetic diamonds price difference in U.S. 2023

20



Description: In 2023, in the United States the total price difference of a natural diamond was 98 percent when compared with a lab-created diamond. Lab-created diamonds are produced by using technology that replicates the natural processes that create diamonds found in the earth. The end result is a lab-created diamond that is the same as a mined diamond chemically, physically, and optically. Read more
Note(s): United States; September 2023
Source(s): Diamonds.net



CHAPTER 05

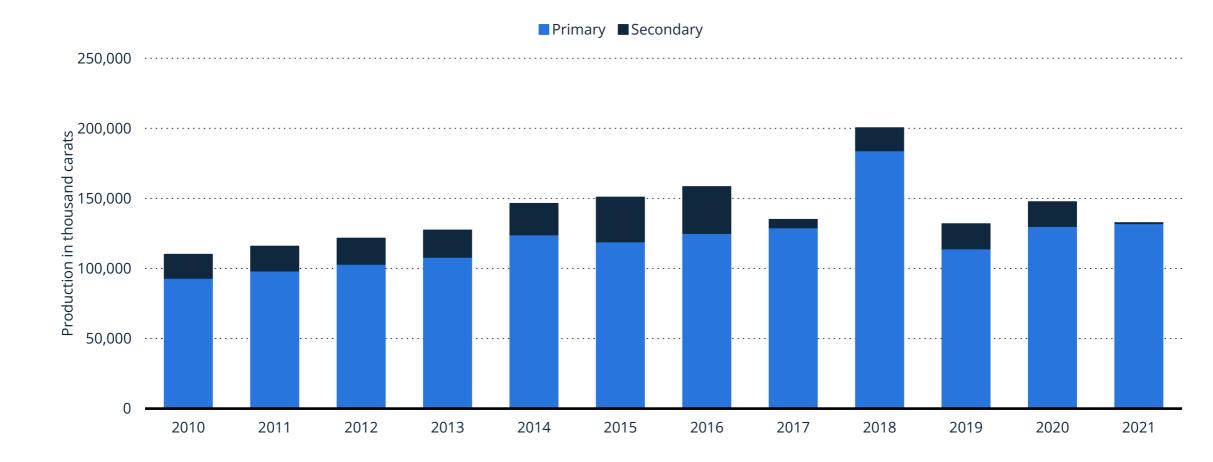
United States & China



Production of synthetic industrial diamonds in the United States from 2010 to 2021 (in 1,000 carats)

Synthetic industrial diamond production in the U.S. 2010-2021

22

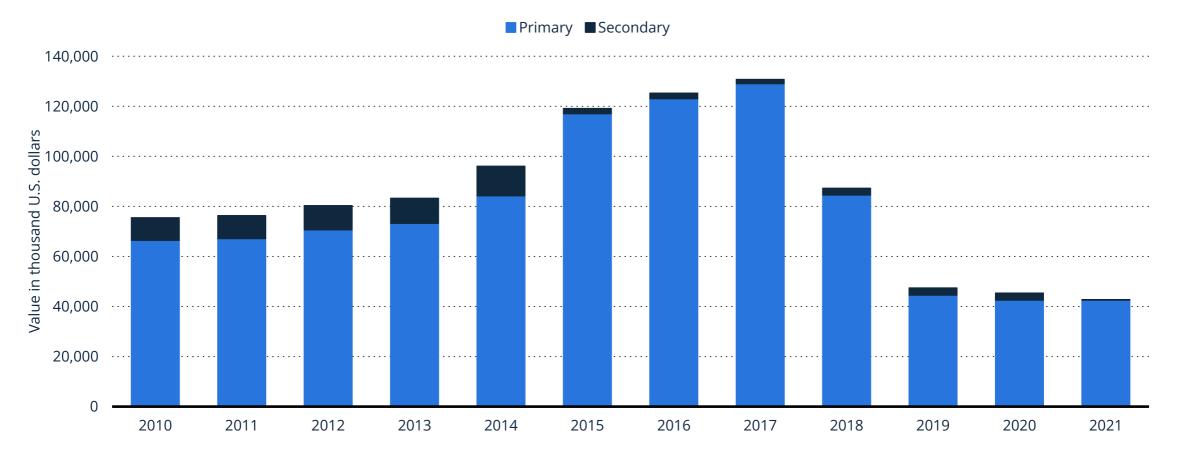


Description: In 2021, some 132 million carats of synthetic industrial diamonds (also known as lab-grown diamonds) were produced in the United States through primary production. In that same year, nearly 0.6 million additional carats of industrial synthetic diamonds were generated through secondary production. Industrial diamonds are diamonds that are used for industrial purposes, such as for their abrasive properties, rather than as gemstones in jewelry. Read more Note(s): United States States



Value of synthetic diamond production in the United States from 2010 to 2021 (in 1,000 U.S. dollars)

Synthetic diamond production value in the U.S. 2010-2021

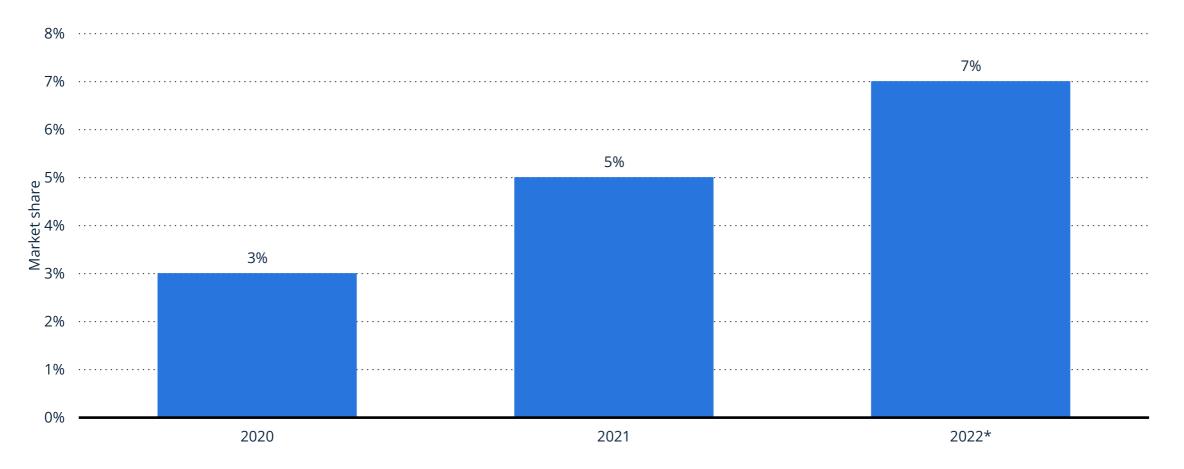


23 Description: In 2021, some 42.5 million U.S. dollars worth of synthetic diamonds were produced in the United States through primary production. U.S. secondary synthetic diamond production was valued at 0.3 million U.S. dollars that year. <u>Read more</u> Note(s): United States; 2010 to 2021; synthetic industrial diamonds Source(s): US Geological Survey



Market share of lab-grown diamonds among United States specialty jewelers from 2020 to 2022

Lab-grown diamonds U.S. specialty jeweler market share 2020-2022



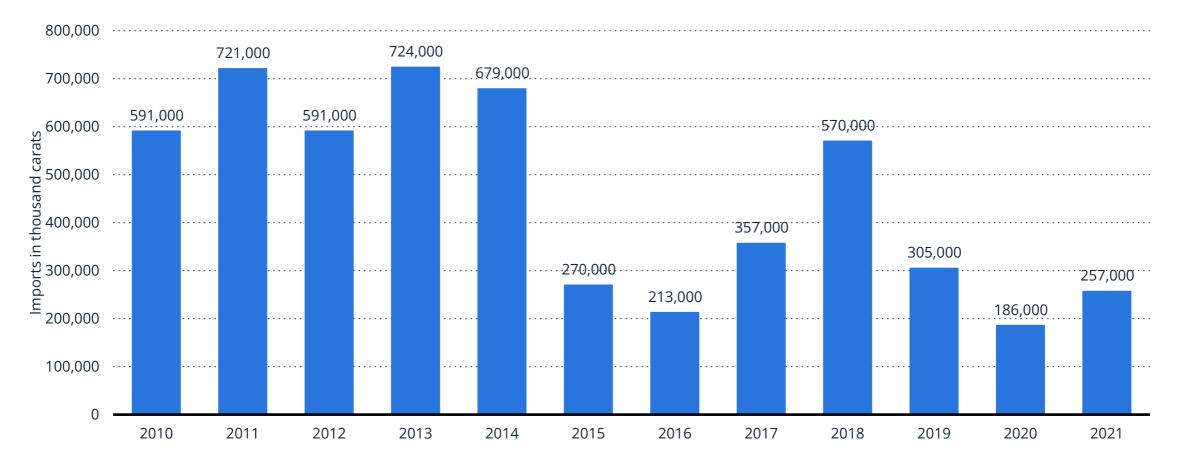
24 Description: As of June 2022, lab-grown diamonds accounted for a seven percent share of the overall diamond jewelry sales among United States-based specialty jewelers. That was a notable increase compared to the market share of lab-diamonds in U.S. specialty jewelers in 2020, when it amounted to just three percent of diamond sales. Read more Note(s): United States; 2020 to 2022; U.S. specialty jewelers; *As of June 2022. Read more Source(s): Edahn Golan Diamond Research & Data



Imports of synthetic diamonds into the United States from 2010 to 2021 (in 1,000 carats)

Synthetic diamond imports to the U.S. 2010-2021

25

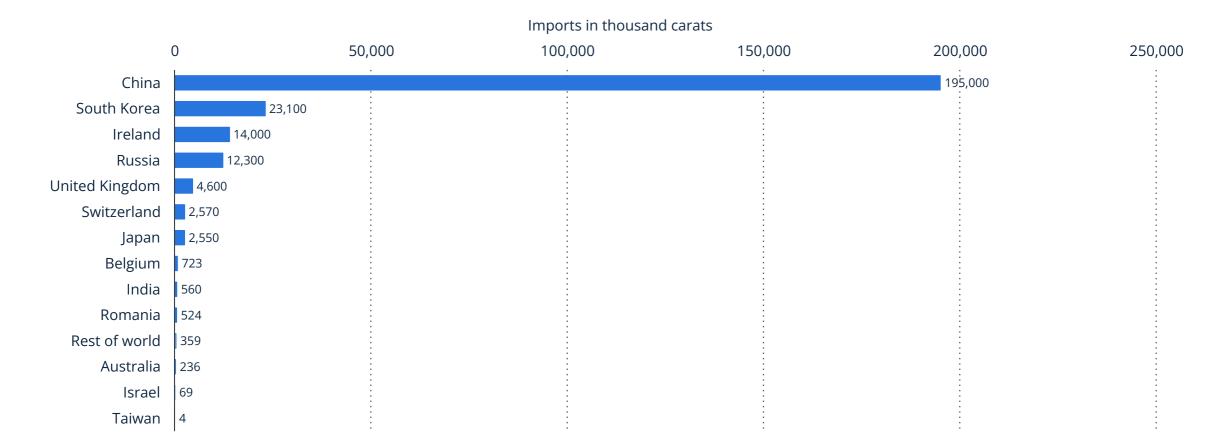


Description: In 2021, 257 million carats of synthetic diamonds, also known as lab diamonds, were imported to the United States for consumption. <u>Read more</u> Note(s): United States; 2010 to 2021 Source(s): US Geological Survey



Imports of synthetic diamonds to the United States in 2021, by country of origin (in 1,000 carats)

Synthetic diamond import volume to the U.S. 2021, by country of origin

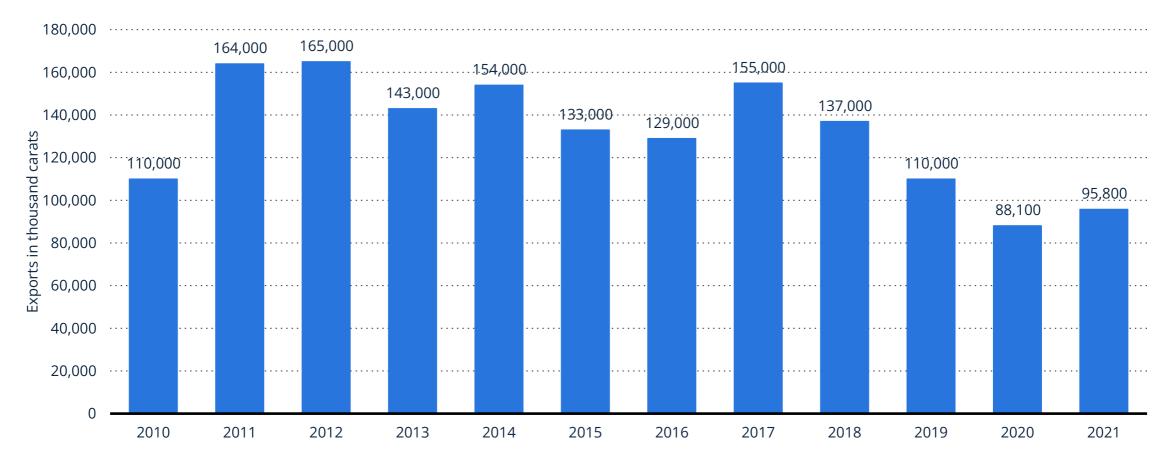




Exports of synthetic diamonds from the United States from 2010 to 2021 (in 1,000 carats)

Synthetic diamond exports from the U.S. 2010-2021

27

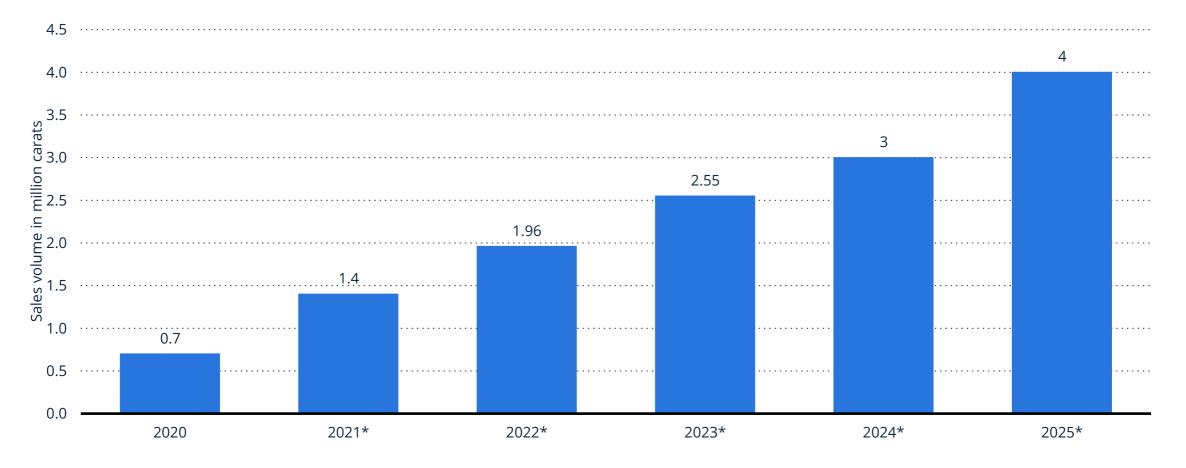


Description: In 2021, approximately 95.8 million carats of synthetic industrial diamonds were exported from the United States. The U.S. export volume of synthetic industrial diamonds peaked in 2012 at 165 million carats. Read more Note(s): United States; 2010 to 2021; synthetic industrial diamonds Source(s): US Geological Survey



Sales volume of rough lab-grown diamonds in China in 2020 with estimates until 2025 (in million carats)

Sales of uncut lab-grown diamonds in China 2020-2025



28 Description: About 700,000 carats of uncut lab-grown diamonds were sold in China in 2020, a significantly smaller amount than the 5.6 million carats in the United States. Nevertheless, the lab-grown diamond market in China is expected to grow strongly over the next few years, reaching four million carats by 2025. Read more Notes: China: 2020



Source(s): AVIC Securities; Bain & Company; De Beers; Eastmoney.com; Intelligence Research Group

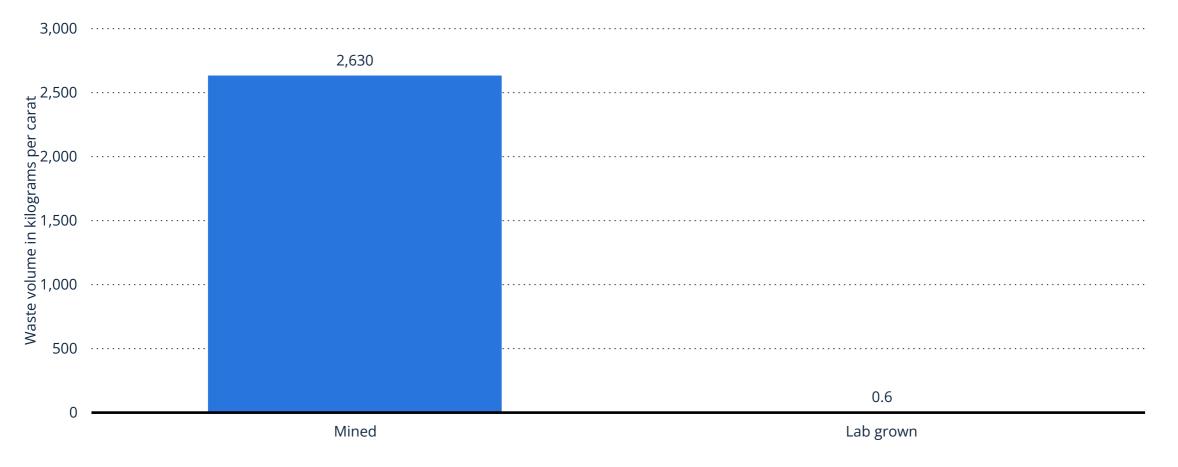
CHAPTER 06

Environmental footprint

Mineral waste volume from lab-grown and mined diamond production worldwide (in kilograms per carat)

Lab-grown and mined diamonds mineral waste production volume worldwide

30



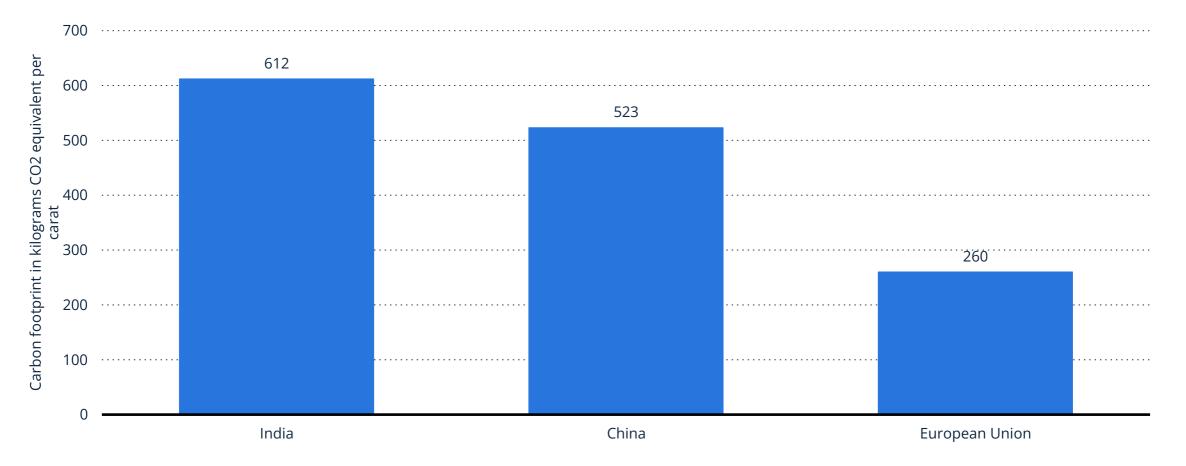
Description: The production of one carat of mined diamonds typically produces some 2.63 metric tons of mineral waste as a by-product. Lab-grown diamonds, on the other hand, only produce an average mineral waste of 600 grams per carat produced. The production of mined diamonds involves the movement of substantial volumes of earth in order to obtain the diamonds, which makes diamond mining a much more environmentally disruptive process than producing lab-diamonds. Read more Note(s): Worldwide; 2014 Source(s): Frost & Sullivan; Sports Illustrated



Carbon footprint of cut and polished lab-grown diamonds worldwide in 2023, by region (in kilograms of CO2 equivalent per carat)

Global carbon footprint of cut and polished lab-grown diamonds 2023, by region

31



Description: In 2023, India's production of cut and polished lab-grown diamonds had the largest carbon footprint of any lab-grown diamond producing region in the world, amounting to 612 kilograms of CO2 equivalent per carat produced. China had the secondlargest carbon footprint for the production of cut and polished lab diamonds that year, with a value of 523 kilograms of CO2 equivalent per carat. <u>Read more</u> Note(s): Worldwide; 2023 Source(s): Only Natural Diamonds; Sphera statista 🗹

Energy consumption of diamond production worldwide as of 2021, by production method (in kilowatt hours per carat)

Global diamond production energy consumption 2021, by production method

Production method	Lower range	Upper range
HPHT*	28	245
MPCVD**	77	143
Mining	96	150

32 Description: As of 2021, the production of lab-grown diamonds using the high pressure high temperature (HPHT) method had the largest range of energy consumption, with a lower range value of 28 kilowatt hours and an upper range of 245 kilowatt hours of energy consumed per carat produced. Conversely, mined diamond production (natural diamonds) had the narrowest range of energy consumed, ranging from a low of 96 kilowatt hours to a high of 150 kilowatt hours per carat produced. Read more Note(s): Worldwide; 2021; *High pressure high temperature (HPHT) **Microwave plasma chemical vapor deposition (MPCVD) Read more Source(s): Alicat Scientific; MDPI (Energies)



Sources

Alicat Scientific **AVIC** Securities AWDC Bain & Company BMLRT (Österreich) De Beers Diamonds.net Eastmoney.com Edahn Golan Diamond Research & Data Frost & Sullivan IGDA Intelligence Research Group **Kimberley Process** Lightbox MarkWide Research MDPI (Energies) Only Natural Diamonds Paul Zimnisky Sphera Sports Illustrated Thomson Reuters US Geological Survey

Various sources (company data, expert interviews, publication analysis) Various sources (company data, experts) Various sources (Retailers' websites)

