



This is the print version of the [Skeptical Science](http://sks.to/solarmineral) article '[We do not have sufficient mineral resources for \[large-scale\] solar development](http://sks.to/solarmineral)', which can be found at <http://sks.to/solarmineral>.

Do we have sufficient mineral resources for solar development?

What The Science Says:

Multiple analyses have found that global mineral resources are likely sufficient to meet long-term demand across all energy transition sectors, including EVs and transmission.

Climate Myth: We do not have sufficient mineral resources for [large-scale] solar development

"[T]here simply aren't enough minerals and energy on earth to make a transition to 'renewables.'
([Energyskeptic](#))

A 2023 study that examined 75 emissions-reduction scenarios concluded that global reserves of critical materials are likely adequate to meet future demand for electricity generation infrastructure¹ (also Wang et al. 2023). According to that study, production rates for many critical materials will need to grow substantially, but "[g]lobal mineral reserves should adequately meet needs posed by power sector material demand (Wang et al. 2023)." The United States Department of the Interior has likewise concluded that "[o]ther than perhaps short term interruptions resulting from market forces or geopolitical events, it is not anticipated that there will be any long term material constraints that would prevent the development of a significant amount of energy from photoelectric cells²." Other analyses suggest that global mineral resources are likely sufficient to meet long-term demand across all energy transition sectors, including EVs and transmission.

In addition, as noted previously, innovations in recycling solar panels⁴ can potentially reduce future requirements for individual raw materials (Wang et al. 2023 at 320). Valuable materials in solar panels, including silver, copper, and crystalline silicon, are actively sought for the development of other products, including the next generation of solar panels⁵. Furthermore, the 2021 Infrastructure Investment and Jobs Act, and the 2022 Inflation Reduction Act, include provisions to identify and develop domestic sources of rare earth materials and other critical minerals required for our energy transition⁶. In tandem with the rollout of these incentives, a Department of the Interior interagency working group has likewise issued more than 60 concrete recommendations for responsibly overhauling an administrative framework still largely shaped by the Mining Law of 1872⁷. These recommendations include substantial research investments, permitting reform, and proactive public and Tribal engagement. The Department of Energy, in turn, recently announced a \$150 million initiative "to advance cost effective and environmentally responsible processes" for producing critical minerals and materials in the United States⁹.

Footnotes:

[1] Seth Borenstein, [Study: Enough rare earth minerals to fuel green shift](#) Associated Press, Jan. 27, 2023

[2] [Byproduct Mineral Commodities Used for the Production of Photovoltaic Cells](#) US Geologic Survey (2010), 2

[3] [Material and Resource Requirements for the Energy Transition](#), Energy Transitions Commission (2023); Hannah Ritchie, [We have enough minerals for the energy transition, but medium-term supply is a challenge \[Part 1\]](#), Sustainability by Numbers, Dec. 1, 2023. At least one researcher, Simon P. Michaux, has concluded the opposite, but his analysis generally focuses on currently known global reserves—deposits that can be economically mined or extracted with current technologies—rather than the broader category of global resources, and his analysis does not give the same weight as the Energy Transitions Commission's to potential reductions in material demand through advances in efficiency and recycling. Simon P. Michaux,

[Challenges and Bottlenecks for the Green Transition](#), GTK, Feb. 23, 2023. It also bears noting that the long-term sufficiency of global mineral resources does not imply an absence of ethical, economic, and environmental challenges in extracting those resources. See Energy Transitions Commission (above) at 71-114; Hannah Ritchie, [We have enough minerals for the energy transition, but medium-term supply is a challenge \[Part 2\]](#), Sustainability by Numbers, Dec. 7, 2023

[4] See Drew Mays, [Future of Solar Panel Recycling](#), Innovate Energy Group, July 6, 2023

[5] Jon Hurdle, [As Millions of Solar Panels Age Out, Recyclers Hope to Cash In](#) Yale Env't 360 (Feb. 28, 2023)

[6] Oscar Serpell, [Impacts of the Inflation Reduction Act on Rare Earth Elements](#) Kleinman Center for Energy Policy (Sep. 24, 2022)

[7] [Biden-Harris Administration Fundamental Principles for Domestic Mining Reform](#), U.S. Dep't of the Interior (Feb. 22, 2022)

[8] See [Recommendations to Improve Mining on Public Lands](#), U.S. Dep't of the Interior (Sept. 2023)

[9] [Biden-Harris Administration Announces \\$150 Million to Strengthen Domestic Critical Material Supply Chains](#), U.S. Dep't of Energy (Sept. 6, 2023)

This rebuttal is based on the report "[Rebutting 33 False Claims About Solar, Wind, and Electric Vehicles](#)" written by Matthew Eisenson, Jacob Elkin, Andy Fitch, Matthew Ard, Kaya Sittering & Samuel Lavine and published by the [Sabin Center for Climate Change Law](#) at Columbia Law School in 2024. Skeptical Science sincerely appreciates Sabin Center's generosity in collaborating with us to make this information available as widely as possible.

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