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Rebutting 38 False Claims About Solar, Wind, Electric Vehicles, and Battery Storage

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Sabin Center for Climate Change Law

REBUTTING 38 FALSE CLAIMS ABOUT SOLAR, WIND, ELECTRIC VEHICLES, AND BATTERY STORAGE

SEPTEMBER 2026 EDITION

Columbia Law School | COLUMBIA CLIMATE SCHOOL
SABIN CENTER FOR CLIMATE CHANGE LAW

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This report, first published in April 2024, was revised in June 2024, October 2024, and February 2025 to incorporate feedback from readers. In August 2026, the Sabin Center undertook a more comprehensive review of the report, and updated it to incorporate new developments and newly identified false claims. Please send any corrections or suggested additions for future editions to Andrew.Kieffer@law.columbia.edu.

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INTRODUCTION

Getting the U.S. energy system onto an environmentally sustainable track will require rapid and widespread development of wind, solar, and other renewable energy facilities; corresponding storage, transmission, and distribution infrastructure; and timely industry-specific transitions, such as battery electric vehicles replacing their combustion-engine counterparts. Notable progress has been made in recent years, particularly in the build-out of renewable energy facilities, which reached record levels in 2025.[1] However, this momentum is now under threat, including from a hostile federal administration[2] and increasing state and local opposition.[3] Other Sabin Center reports have documented the sharp increase in restrictions on renewable energy development across the United States in recent years.[4] This increase has corresponded with a decline in public support for renewables development. Indeed, an April 2026 Pew Research Center survey found that only 57% of U.S. adults prioritize developing renewable energy sources over increased fossil fuel production, down from 79% support in 2020.[5] "Misinformation" and coordinated "disinformation" about the impacts of renewable energy development have likely contributed to this decline.[6] This report addresses some of the more prevalent and persistent distortions about solar energy, wind energy, electric vehicles, and battery storage systems, with the aim of promoting a more informed discussion.[7] It updates and expands an earlier version, published in 2024, adding new resources that strengthen the rebuttal of claims addressed in the 2024 report and responding to five new false claims that have become increasingly common over the last two years.

False claims about renewable energy, electric vehicles, and battery storage systems come in many varieties. Some claims rely on sheer bombast, seemingly designed to shock and inflame audiences, rather than

[1] U.S. Energy Information Administration, *Wind and solar generated a record 17% of U.S. electricity in 2026,* TODAY IN ENERGY (Mar. 20, 2026), https://www.eia.gov/todayinenergy/detail.php?id=67367.

[2] Matthew Eisenson, 100 Days of Trump 2.0: Renewable Energy Siting and Permitting, Climate Law Blog (May 5, 2025), https://blogs.law.columbia.edu/climatechange/2025/05/05/100-days-of-trump-2-0-renewable-energy-siting-and-permitting/; Michael B. Gerrard, Trump's Multi-Pronged Attack on Renewable Energy, N.Y.L.J., November 14, 2025 (2025), https://scholarship.law.columbia.edu/faculty_scholarship/4735.

[3] Matthew Eisenson et al., Opposition to Renewable Energy Facilities in the United States: June 2025 Edition, Sabin Ctr. for Climate Change L., June 2025, https://scholarship.law.columbia.edu/sabin_climate_change/251.

[4] Matthew Eisenson et al., Opposition to Renewable Energy Facilities in the United States: June 2025 Edition, Sabin Ctr. for Climate Change L. (June 2025), https://scholarship.law.columbia.edu/sabin_climate_change/251/; Matthew Eisenson et. al., Opposition to Renewable Energy Facilities in the United States: June 2024 Editio, Sabin Ctr. for Climate Change L. (June 2024), https://scholarship.law.columbia.edu/sabin_climate_change/226/; Matthew Eisenson, Opposition to Renewable Energy Facilities in the United States: May 2023 Edition, Sabin Ctr. for Climate Change L. (May 2023), https://scholarship.law.columbia.edu/sabin_climate_change/200/; Hillary Aidun, et. al., Opposition to Renewable Energy Facilities in the United States: March 2022 Edition, Sabin Ctr. for Climate Change L. (Mar. 2022), https://scholarship.law.columbia.edu/sabin_climate_change/186/.

[5] Brian Kennedy & Emma Kikuchi, *Americans' Shifting Views on Energy Issues*, PEW RSCH. CTR. (Apr. 3, 2026), https://www.pewresearch.org/science/2026/04/03/americans-shifting-views-on-energy-issues/.

[6] See Misinformation and disinformation, AM. PSYCHOLOGICAL ASSOC., https://www.apa.org/topics/journalism-facts/misinformation-disinformation (last visited March 25, 2024) (explaining the distinction between misinformation and disinformation); ANAHI AYALA IACUCCI, USING SOCIAL MEDIA IN COMMUNITY-BASED PROTECTION at 230 (2021),https://www.unhcr.org/innovation/wp-content/uploads/2021/01/Using-Social-Media-in-CBP.pdf (same).

[7] The authors recognize that similar misinformation persists regarding energy transmission infrastructure, the buildout of which is necessary to support the expansion of renewable energy generation and electric vehicle adoption, but transmission is outside the scope of this report. See LU NELSEN, FROM THE GROUND UP: ADDRESSING KEY COMMUNITY CONCERNS IN CLEAN ENERGY TRANSMISSION at 10, 12, 15-16 (2013), https://perma.cc/ENA2-S3DW (archived Aug. 28, 2019); See Queued Up . . . But in Need of Transmission, DEP'T OF ENERGY, Apr. 2022 https://perma.cc/KWQ9-2PEY (archived Jan. 21, 2025).

contribute to informed debate on pressing policy choices (e.g., "Solar farms depend entirely on subsidies from your hard earned money. When the subsidies are gone, the solar farms are abandoned!").[8] Some emphasize theoretical impacts of poorly-designed renewable energy projects while ignoring the many well-established methods to minimize or even eliminate those impacts[9] (e.g., "[I]ndustrial-scale solar isn't right for rural-agricultural areas . . . [because] [t]he land (forest, farmland, vegetation, soil) is forever destroyed.").[10] Some frame any departure from the status quo, such as the use of farmland for solar production, as categorically inconceivable (e.g., "Ask yourself, if several thousand acres of agricultural land is converted to industrial solar facilities, who will grow your food? Bill Gates? Mark Zuckerberg?").[11] Some rely on unsubstantiated theories of causation, such as speculation that whale deaths stem from noise related to wind farm surveys, despite the fact that marine biologists have found that the sounds during offshore wind surveying are similar "to the sound of a fan in a room."[12] Some drill down with single-minded focus on the toxicity or carbon footprint of renewable energy infrastructure or its component parts,[13] while declining to acknowledge that fossil fuel extraction, production, and distribution cause far greater environmental contamination, harm to human health, and climate instability.[14]

This report does not examine the origins of the false claims or the motivations of those who disseminate them. However, it is well documented that much of it comes from deliberately misleading sources, such as astroturf "local" organizations funded by distant policy advocates, themselves funded by fossil-fuel producers.[15] One academic center that has studied these origins in more detail, Brown University's Climate and Development Lab, has extensively mapped out some of the connections among such groups in the context of opposition to offshore wind development.[16]

This report instead examines the substance of various claims against solar, wind, electric vehicle, and battery storage deployment, focusing only on those claims that the authors have determined to be

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[8] How Solar Affects YOU!, NO TO SOLAR, https://perma.cc/63GB-ZQ3B (archived Nov. 1, 2023).

[9] See, etc., BILL PEDERSON & BROOKS LAMB, AGRIVOLTAICS: PRODUCING SOLAR ENERGY WHILE PROTECTING FARMLAND (2021), https://cbey.yale.edu/sites/default/files/2021-10/CBEY_REPORTS_AGRIVOLTAICS_FINAL_0.pdf; BIODIVERSITY CONSULTANCY, MITIGATING BIODIVERSITY IMPACTS ASSOCIATED WITH SOLAR AND WIND ENERGY DEVELOPMENT (2021), https://portals.iucn.org/library/sites/library/files/documents/2021-004-En.pdf.

[10] 10 Reasons Industrial-Scale Solar Isn't Right for Agricultural-Rural Areas, CITIZENS FOR RESPONSIBLE SOLAR, https://perma.cc/PYC8-SRPJ (archived Mar. 25, 2024).

[11] Welcome to No Solar in Logan County (Ohio), NO SOLAR IN LOGAN COUNTY (OHIO), https://perma.cc/P45M-W5NF (archived Nov. 1, 2023).

[12] Pearl Marvell, Wind Opponents Spread Myth about Dead Whales, YALE CLIMATE CONNECTIONS, Sept. 19, 2023, https://yaleclimateconnections.org/2023/09/wind-opponents-spread-myth-about-dead-whales/.

[12] NO TO SOLAR, supra note 8.

[14] See Hannah Ritchie, What are the safest and cleanest sources of energy?, OUR WORLD IN DATA, Feb. 10, 2020, https://ourworldindata.org/safest-sources-of-energy.

[15] David Gelles, The Texas Group Waging a National Crusade Against Climate Action, N.Y. TIMES, Dec. 4, 2022, https://www.nytimes.com/2022/12/04/climate/texas-public-policy-foundation-climate-change.html; Marvell, supra note 12; Isaac Slevin, William Kattrup, Charlotte Marcil & J. Timmons Roberts, *Beyond Dark Money: Information Subsidies and Complex Networks of Opposition to Offshore Wind on the U.S. East Coast*, 119 Energy Rsch. & Soc. Sci. 103829 (2025); Mariel Lutz & Jenny Rowland-Shea, *The Oil and Gas Industry Is Behind Offshore Wind Misinformation*, Ctr. for Am. Progress (Dec. 11, 2023), https://www.americanprogress.org/article/the-oil-and-gas-industry-is-behind-offshore-wind-misinformation/?utm_source=chatgpt.com; David Anderson, *Fueling the Opposition: How Fossil Fuel Interests Are Fighting to Kill Wind and Solar Farms Before They Are Built*, Energy & Pol'y Inst. (2024), https://energyandpolicy.org/fossil-fuel-funding-opposition-renewable-energy/.

[16] ISAAC SLEVIN ET AL., CLIMATE AND DEVELOPMENT LAB, AGAINST THE WIND: A MAP OF THE ANTI-OFFSHORE WIND NETWORK IN THE EASTERN UNITED STATES (2023), https://www.climatedevlab.brown.edu/post/against-the-wind-a-map-of-the-anti-offshore-wind-network-in-the-eastern-united-states; Climate & Development Lab, Brown University, Legal Entanglements: Mapping Connections of Anti-Offshore Wind Groups and Their Lawyers in the Eastern United States (2025), https://www.climatedevlab.brown.edu/post/legal-entanglements-mapping-connections-of-anti-offshore-wind-groups-and-their-lawyers-in-the-easte.

unfounded. Critically, the purpose of this report is not to establish that renewable energy can be deployed without any adverse impacts or that each and every argument against it is baseless. Indeed, the energy transition will inevitably have some adverse impacts on the environment and communities. However, renewable energy and its offshoots can also significantly reduce climate threats and improve public health, while providing jobs for millions of Americans. Ultimately, as Michael Gerrard has written, the energy transition will inevitably involve "difficult tradeoffs," and it will require difficult sacrifices, "in order to avoid far worse impacts."[17]

With that context, this report identifies and examines 38 of the most pervasive misconceptions about solar energy, wind energy, electric vehicles, and battery storage systems. The report updates an earlier version, published in April 2024, which addressed 33 false claims. The five additional false claims covered in this update relate to the national security risks of offshore wind development, the affordability of electric vehicles, and the impacts of battery storage development. In addition to rebutting these new claims, this update also references newly published studies and other research that further support and substantiate the rebuttals to the 33 false claims in the original report.

The false claims about each of the technologies are presented roughly in the following order: misconceptions pertaining to human health, then misconceptions pertaining to environmental impacts, then misconceptions pertaining to economic impacts, and then other misconceptions that do not fit into any of these categories.[18] To identify the most common misconceptions regarding renewables and electric vehicles, the authors first conducted primary research that included reviewing social-media groups and websites created to oppose renewable energy projects or policies, as well as existing press coverage about misinformation.[19] The authors then developed fact-based responses to these misconceptions, relying to the greatest extent possible on academic literature and government publications.

This is not the first publication to attempt to debunk or contextualize dubious claims about renewable energy and electric vehicles. Below is a short, non-comprehensive list of other efforts to clarify misinformation and disinformation pertaining to renewable energy and electric vehicles:

- The United States Environmental Protection Agency's breakdown of "electric vehicle myths."[20]
- RMI's Reality Check: The IEA Busts 10 Myths about the Energy Transition.[21]
- USA Today's Do wind turbines kill birds? Are solar panels toxic? The truth behind green-energy debates.[22]

[17] Michael B. Gerrard, A Time For Triage, 39(6) ENVTL. F. 38 (November/December 2022), https://scholarship.law.columbia.edu/faculty_scholarship/3867

[18] The dividing line among these categories is often blurry: for example, climate change has impacts on human health, the non-human environment, and the economy.

[19] See, e.g., NO TO SOLAR, supra note 8; NO SOLAR IN LOGAN COUNTY (OHIO), supra note 11; DEFIANCE COUNTY CITIZENS FOR RESPONSIBLE SOLAR, https://www.defiancecountycitizensforresponsiblesolar.com/ (last visited March 25, 2024); Windmills Kill, https://windmillskill.com/ (last visited March 25, 2024); Solar, ALLIANCE FOR WISE ENERGY DECISIONS, https://wiseenergy.org/solar/ (last visited March 25, 2024); Letters: America Decides to Make Its Electrical Grid Dysfunctional, WALL STREET JOURNAL, June 12, 2022, https://www.wsj.com/articles/electric-grid-energy-green-blackout-generator-renewable-solar-wind-11654900508. See also, e.g., Julia Simon, Misinformation is derailing renewable energy projects across the United States, NPR, Mar. 28, 2022, https://www.npr.org/2022/03/28/1086790531/renewable-energy-projects-wind-energy-solar-energy-climate-change-misinformation.

[20] Electric Vehicle Myths, ENVT'L PROTECTION AGENCY, https://perma.cc/CBX5-2WG7 (last updated Jan. 21, 2025).

[21] Kingsmill Bond & Sam Butler-Sloss, Reality Check: The IEA Busts 10 Myths about the Energy Transition, RMI, Sept. 29, 2023, https://rmi.org/reality-check-the-iea-busts-10-myths-about-the-energy-transition/.

[22] Elizabeth Weise, Do wind turbines kill birds, Are solar panels toxic? The truth behind green-energy debates, USA TODAY, Feb. 4, 2024 (updated Feb. 6, 2024), https://www.usatoday.com/story/news/investigations/2024/02/04/green-energy-fact-checked/72390472007/.

- Carbon Brief's factchecks on electric vehicles and renewable energy, including: Factcheck: How electric vehicles help to tackle climate change;[23] Factcheck: 21 misleading myths about electric vehicles;[24] Factcheck: Is solar power a 'threat' to UK farmland?;[25]and Factcheck: 16 misleading myths about solar power.[26]
- The Center for American Progress's The Truth About Offshore Wind: Busting Oil Money Myths and Misinformation.[27]
- The Annenberg Public Policy Center's website FactCheck.org, which includes factchecks on climate change related topics,[28] including electric vehicles.[29]
- The Brown Climate and Development Lab's Discourses of Climate Delay in the Campaign Against Offshore Wind: A Case Study from Rhode Island.[30]
- Emily Atkin's A guide to electric car misinformation.[31]

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[23] Zeke Hausfather, Factcheck: How electric vehicles help to tackle climate change, CARBONBRIEF, May 13, 2019, https://www.carbonbrief.org/factcheck-how-electric-vehicles-help-to-tackle-climate-change/.

[24] Simon Evans, Factcheck: 21 misleading myths about electric vehicles, CARBONBRIEF, Oct. 24, 2023, https://www.carbonbrief.org/factcheck-21-misleading-myths-about-electric-vehicles/.

[25] Josh Gabbatis et al., Factcheck: Is solar power a 'threat' to UK farmland?, CARBONBRIEF, Aug. 25, 2022, https://www.carbonbrief.org/factcheck-is-solar-power-a-threat-to-uk-farmland/.

[26] Josh Gabbatiss & Molly Lempriere, Factcheck: 16 Misleading Myths About Solar Power, Carbon Brief (Aug. 28, 2025), https://interactive.carbonbrief.org/factcheck/solar/index.html

[27] Michael Freeman, The Truth About Offshore Wind: Busting Oil Money Myths and Misinformation, CENTER FOR AMERICAN PROGRESS, June 6, 2023, https://www.americanprogress.org/article/the-truth-about-offshore-wind-busting-oil-money-myths-and-misinformation/.

[28] See Issues: climate change, FACTCHECK.ORG, https://www.factcheck.org/issue/climate-change/ (last visited March 25, 2024).

[29] See D'Angelo Gore et al., Trump's Misleading Claims About Electric Vehicles and the Auto Industry, FACTCHECK.ORG, Oct. 2, 2023, https://www.factcheck.org/2023/10/trumps-misleading-claims-about-electric-vehicles-and-the-auto-industry/; Catalina Jaramillo, Electric Vehicles Contribute Fewer Emissions than Gasoline-Powered Cars Over Their Lifetimes, FACTCHECK.ORG, Feb. 7, 2024, https://www.factcheck.org/2024/02/electric-vehicles-contribute-fewer-emissions-than-gasoline-powered-cars-over-their-lifetimes/

[30] DISCOURSES OF CLIMATE DELAY IN THE CAMPAIGN AGAINST OFFSHORE WIND: A CASE STUDY FROM RHODE ISLAND, BROWN CLIMATE AND DEVELOPMENT LAB (April 2023), https://ecori.org/wp-content/uploads/2023/04/delay_and_misinformation_tactics_in_anti_osw_campaigns-ri_case_study_4-10-23.pdf.

[31] Emily Atkin, A guide to electric car misinformation (part 1), HEATED, March 27, 2024, https://heated.world/p/a-guide-to-electric-car-misinformation.

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PART A: FALSE CLAIMS ABOUT SOLAR ENERGY

PART A: FALSE CLAIMS ABOUT SOLAR ENERGY

False Claim #1: Electromagnetic fields from solar farms are harmful to human health.

> *"The EMF (electromagnetic field) from solar farms poses serious health risks, especially to those who have electromagnetic hypersensitivity."*[32]

The electromagnetic fields generated at a solar farm are similar in strength and frequency to those of toaster ovens and other household appliances and harmless to humans. A detailed analysis from North Carolina State University concluded that there is "no conclusive and consistent evidence" of "negative health impact[s] from the EMF [electromagnetic fields] produced in a solar farm."[33]

EMF exposure levels vary according to the EMF source, proximity to the source, and duration of the exposure.[34] On a solar farm, EMFs are highest around electrical equipment such as inverters. However, even when standing next to the very largest inverter at a utility-scale solar farm, one's exposure level (up to 1,050 milligauss, or mG) is less than one's exposure level while operating an electric can opener (up to 1,500 mG), and well within accepted exposure limits (up to 2,000 mG).[35] When standing just nine feet from a residential inverter, or 150 feet from a utility-scale inverter, one's exposure drops to "very low levels of 0.5 mG or less, and in many cases . . . less than background levels (0.2 mG)."[36] For comparison, a typical American's average background exposure level is 1mG, reaching 6 mG when standing three feet from a refrigerator, and 50 mG when standing three feet from a microwave.[37]

The electromagnetic fields present on a solar farm constitute "non-ionizing radiation," which, by definition, generates "enough energy to move atoms in a molecule around (experienced as heat), but not enough energy to remove electrons from an atom or molecule (ionize) or to damage DNA."[38] In addition, EMFs are extremely low in frequency, which means they contain "less energy than other commonly encountered types of non-ionizing radiation like radio waves, infrared radiation, and visible light."[39]

False Claim #2: Toxic heavy metals, such as lead and cadmium, leach out from solar panels and pose a threat to human health.

> "Studies have shown the heavy metals in solar panels namely lead and cadmium, can leach out of the cells and get into groundwater, as well as affect plants."[40]

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[32] NO TO SOLAR, *supra* note 8.
[33] Tommy Cleveland, Health and Safety Impacts of Solar Photovoltaics, NC STATE UNIVERSITY, 14 (May 2017), https://nccleantech.ncsu.edu/wp-content/uploads/2019/10/Health-and-Safety-Impacts-of-Solar-Photovoltaics-PV.pdf.
[34] *Id*. at 15.
[35] *Id*. *See also* Massachusetts Department of Energy Resources et al., Questions & Answers: Ground-Mounted Solar Photovoltaic Systems, 10-11 (Jun. 2015), https://www.masscec.com/sites/default/files/documents/solar-pv-guide%20%28rev%202024-10-30%29.pdf.
[36] Tommy Cleveland, supra note 33 at 15.
[37] *Id.*; Massachusetts Clean Energy Center, Study of Acoustic and EMF Levels from Solar Photovoltaic Projects (Dec. 2012), https://files.masscec.com/research/StudyAcousticEMFLevelsSolarPhotovoltaicProjects.pdf.
[38] Tommy Cleveland, supra note 33, at 16.
[39] *Id.* at 15.
[40] Emily Chantiri, The Dark Side of Renewable Technology: Fossil Fuels Are Used to Produce Solar Panels, AUSTRALIAN COMPUTER SOCIETY (Feb. 2, 2023), https://ia.acs.org.au/article/2023/the-dark-side-of-renewable-technology.html.

Roughly 40% of new solar panels in the United States and 5% of new solar panels in the world contain cadmium,[41] but this cadmium is in the form of cadmium telluride, which is non-volatile, non-soluble in water, and has 1/100th the toxicity of free cadmium.[42] Most solar panels, like many electronics, contain small amounts of lead.[43] However, the Massachusetts Department of Energy Resources has assessed that "because PV panel materials are enclosed, and don't mix with water or vaporize into the air, there is little, if any, risk of chemical releases to the environment during normal use."[44] The Massachusetts Department of Energy Resources has further assessed that, even in the unlikely event of panel breakage, releases of chemicals used in solar panels are "not a concern."[45]

All materials in a solar panel are "insoluble and non-volatile at ambient conditions," and "don't mix with water or vaporize into air."[46] Moreover, they are encased in tempered glass that not only withstands high temperatures, but is also strong enough to pass hail tests and is regularly installed in Arctic and Antarctic conditions.[47] It is theoretically possible that, when exposed to extremely high heat exceeding that of a typical residential fire, panels "could emit vapors and particulates from PV panel components to the air." But that risk is limited by the fact that "the silicon and other chemicals that comprise the solar panel would likely bind to the glass that covers the PV cells and be retained there."[48] When a cadmium telluride panel is exposed to fire of an intensity sufficient to melt the glass on the panel, "over 99.9% of the cadmium [is encapsulated in] the molten glass."[49] Furthermore, a 2013 analysis found that, even in the worst-case scenarios of earthquakes, fires, and floods, "it is unlikely that the [cadmium] concentrations in air and sea water will exceed the environmental regulation values."[50]

One peer-reviewed study in the *Journal of Natural Resources and Development* found it unlikely for lead or cadmium to leach into the soil from functional solar panels.[51] Measuring heavy metal concentrations in the soil at various distances, researchers found no significant differences in lead or cadmium concentrations directly underneath solar panels, compared to soil 45 or 100 feet away.[52] The study further found that "lead and cadmium were not elevated in soils near PV systems and were far below levels considered to be an imminent or future danger to environmental health."[53]

Although the study did find higher levels of selenium in soil directly underneath solar panels, the study noted that the presence of selenium was possibly a "result of the cement used in construction," rather than leaching from the panels themselves.[54] In addition, the study noted that even the highest selenium concentrations observed were below the EPA's risk threshold for mammals.[55] Finally, the study noted that fly ash, a product of coal combustion "commonly disposed of in landfills and as a soil amendment in agriculture," contains significantly higher concentrations of lead (40x), cadmium (1.1x),

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[41] Polycrystalline Thin-Film Research: Cadmium Telluride, NAT'L RENEWABLE ENERGY LABORATORY, May 2022, https://www.nrel.gov/docs/fy21osti/76975.pdf; Taking Cadmium Telluride Technology to the Next Level, US-MAC, https://www.usa-cdte.org/ (last visited March 25, 2024).
[42] Health and Safety Impacts of Solar Photovoltaics at 7, NC CLEAN ENERGY TECHNOLOGY CENTER, May 2017, https://content.ces.ncsu.edu/health-and-safety-impacts-of-solar-photovoltaics.
[43] Mark Hutchins, The weekend read: A lead-free future for solar PV, PV MAGAZINE, Oct. 26, 2019, https://www.pv-magazine.com/2019/10/26/the-weekend-read-a-lead-free-future-for-solar-pv/.
[44] Massachusetts Department of Energy Resources et al., *supra* note 35 at 5.
[45] *Id.*
[46] *Id.*
[47] *Id.*
[48] *Id.*
[49] NC CLEAN ENERGY TECHNOLOGY CENTER, *supra* note 42 at 7.
[50] Yasunari Matsuno, Environmental risk assessment of CdTe PV systems to be considered under catastrophic events in Japan, FIRST SOLAR, Dec. 1, 2013, https://www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/Sustainability-Peer-Reviews/Japan_Peer-Review_Matsuno_CdTe-PV-Tsunami.ashx.
[51] Seth A. Robinson et al., Potential for leaching of heavy metals and metalloids from crystalline silicon photovoltaic systems," 9 J. NAT. RES. AND DEV. 19, 21 (2019), https://doi.org/10.5027/jnrd.v9i0.02.
[52] *Id.* at 21-22.
[53] *Id.*; U.S. Environmental Protection Agency, Ecological Soil Screening Level (2018), https://perma.cc/93UQ-68PQ (last updated April 25, 2024).
[54] Robinson et al., *supra* note 51, at 21-22.
[55] *Id.*

and selenium (4x) than the soil samples taken directly underneath the solar panels in the study area.[56]

False Claim #3: Solar panels generate too much waste and will overwhelm our landfills.

"Solar panels pose a huge risk for overfilling the landfills."[57]

The amount of waste that solar panels are expected to generate over the next few decades is trivial compared to the amount of waste that will be generated by fossil fuels. A study published in Nature Physics in October 2023 found that "35 years of cumulative PV module waste (2016-2050) is dwarfed by the waste generated by fossil fuel energy and other common waste streams."[58] Specifically, the study found that "if we do not decarbonize and transition to renewable energy sources, coal ash and oily sludge waste generated by fossil fuel energy would be 300-800 times and 2-5 times larger [in mass], respectively, than PV module waste."[59]

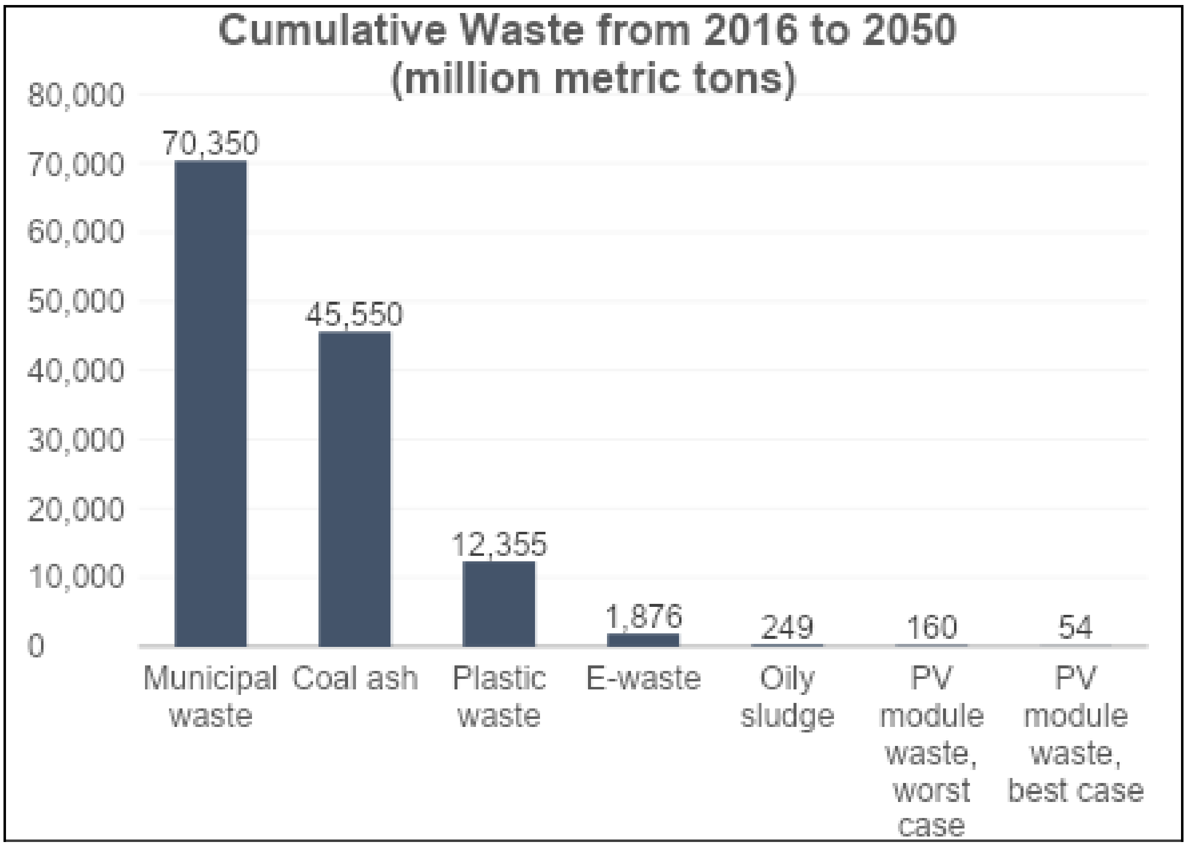

Figure 1: PV module waste from 2016-2050 compared to other sources of waste.
Source: The Sabin Center for Climate Change Law (visualizing data from Heather Mirletz et al.).[60]

In addition, although only about 10% to 15% of solar panels are recycled in the United States,[61] recycling capacity is

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[56] *Id.*
[57] NO TO SOLAR, supra note 8.
[58] Heather Mirletz et al., Unfounded concerns about photovoltaic module toxicity and waste are slowing decarbonization, NATURE PHYSICS, October 2023, https://www.nature.com/articles/s41567-023-02230-0.
[59] *Id.*
[60] *Id.*
[61] Allyson Chu, Scientists found a solution to recycle solar panels in your kitchen, WASH. POST (Jul. 5, 2023), https://www.washingtonpost.com/climate-solutions/2023/07/05/solar-panel-recycling-microwave-technology/#.

increasing. The DOE states that recycling processes for silicon and cadmium telluride PV modules already exist and that multiple recycling facilities in the United States have the capacity to recycle solar panels.[62] DOE has also supported PV recycling research through several recent programs. For example, DOE's Materials, Operation, and Recycling of Photovoltaics program selected four projects to receive $15.7 million in funding in 2024 to support improvements across the PV lifecycle, including recycling and end-of-life management.[63]Prior to this, DOE's FY2022 Photovoltaics Research and Development program – now no longer active – allocated $10 million in funding to increase the reuse and recycling of solar energy technologies.[64] A 2024 study on solar PV recycling concluded that "PV recycling will reduce waste, and CO2 emissions, while contributing to a sustainable environment," and that "[i]t is expected that the research for efficient PV recycling strategies will accelerate as the PV industry grows and as many more organizations and government work towards a sustainable future."[65]

Already, some companies have been able to recover 90% of solar panels' mass in their recycling processes.[66] One commercial recycling plant in France can recycle more than 95% of a solar module.[67] Bulk materials such as glass, steel, and aluminum are recoverable through existing recycling lines,[68] while certain semiconductor materials (tellurium and cadmium) can also be recovered at very high rates of 95% to 97%.[69] Valuable materials in the panels, including silver, copper, and crystalline silicon, are actively sought for the development of other products, including the next generation of solar panels.[70] In addition, new companies are emerging with innovative technologies to recycle solar panels.[71]

False Claim #4: Clearing trees for solar panels negates any climate change benefits.

> *"It isn't 'green' to cut down thousands of acres of trees to build large solar plants. Trees remove carbon from the atmosphere and slow global warming. Deforestation contributes to climate change."*[72]

Forests have immense ecological benefits, recreational benefits, and intrinsic value. However, when looking at the narrow but important issue of carbon accounting, it is usually not true that removing trees to build a solar farm negates the emissions reductions from solar generation. In fact, an acre of solar panels in the United States usually offsets significantly more carbon dioxide emissions than an acre of average U.S. forest can sequester.

In the United States, the emissions intensity of electricity produced by natural gas-fired power plants is roughly 1,071 pounds of carbon dioxide equivalent per megawatt-hour (MWh).[73] The lifecycle emissions intensity of solar PV, meanwhile,

[62] U.S. Dep't of Energy, End-of-Life Management for Solar Photovoltaics, https://www.energy.gov/cmei/systems/end-life-management-solar-photovoltaics (last visited June 17, 2026).
[63] U.S. Dep't of Energy, Materials, Operation, and Recycling of Photovoltaics (MORE PV) Funding Program, https://www.energy.gov/cmei/systems/materials-operation-and-recycling-photovoltaics-more-pv-funding-program (last visited June 17, 2026).
[64] U.S. Dep't of Energy, SETO Fiscal Year 2022 Photovoltaics Research and Development (PVRD) Funding Program, https://www.energy.gov/cmei/systems/seto-fiscal-year-2022-photovoltaics-research-and-development-pvrd-funding-program-0 (last visited June 17, 2026).
[65] Zita Ngagoum Ndalloka et al., Solar photovoltaic recycling strategies, 270 Solar Energy 112379 (March 2024), at 9-10, https://www.sciencedirect.com/science/article/pii/S0038092X24000732

[66]M.M. Aman, et al., A review of Safety, Health and Environmental (SHE) issues of solar energy system, 41 Renewable and Sustainable Energy Reviews 1190 (2015), https://doi.org/10.1016/j.rser.2014.08.086.
[67] Rong Deng et al., Recent progress in silicon photovoltaic module recycling processes, 187 Resources, Conservation and Recycling 106612 (2022), at 10, https://www.sciencedirect.com/science/article/pii/S0921344922004463.
[68]Garvin A. Heath, Research and Development Priorities for Silicon Photovoltaic Module Recycling to Support a Circular Economy, 5 Nature Energy 502, 503 (2020), https://doi.org/10.1038/s41560-020-0645-2; U.S. Dep't of Energy, Office of Energy Efficiency & Renewable Energy, Solar Energy Technologies Office, Photovoltaics End-of-Life Action Plan 11 (2022), https://perma.cc/F5WA-CQDM.
[69]Md. Shahariar Chowdhury et al., An overview of solar photovoltaic panels' end-of-life material recycling, 27 Energy Strat. Reviews 100431, 100437 (2020), https://doi.org/10.1016/j.esr.2019.100431.
[70]Jon Hurdle, As Millions of Solar Panels Age Out, Recyclers Hope to Cash In, Yale Env't. 360 (Feb. 28, 2023), https://e360.yale.edu/features/solar-energy-panels-recycling.
[71] *Id.*
[72]5 Things You Need to Know About Solar, Citizens for Responsible Solar, https://perma.cc/VE5H-U33V (last visited March 25, 2024).
[73] Nat'l Renewable Energy Laboratory, Life Cycle Greenhouse Gas Emissions from Electricity Generation: Update (Sept. 2021) (Table 1), https://perma.cc/BQ23-EDVB. NREL calculates emissions intensity using grams of carbon dioxide equivalent per kilowatt-

is about 95 pounds per MWh, a difference of 976 pounds per MWh compared to natural gas.[74] According to a 2022 study in the *IEEE Journal of Photovoltaics*, utility-scale solar power produces between 394 and 447 MWh per acre per year.[75] When displacing electricity from natural gas, an acre of solar panels would therefore avoid approximately 385,000 to 436,000 pounds, or about 175 to 198 metric tons, of carbon dioxide per year.

By comparison, according to the EPA, an average acre of U.S. forest sequesters 0.857 metric tons of carbon dioxide per year.[76] Thus, an average acre of solar panels in the United States reduced approximately 204–231 times more carbon dioxide per year than an acre of forest. Moreover, as climate change increases mean temperatures and the frequency of wildfires, the carbon storage capacity of forests is shrinking and thus this delta will likely increase over time.[77]

Furthermore, while removing trees from forests releases stored carbon, such emissions can be offset by solar energy generation and the resulting reduction in fossil fuel-driven emissions. The EPA has estimated the average acre of forests contains 83 metric tons of carbon, and approximately half of that amount is sequestered in soil.[78] Even assuming that all 83 metric tons of carbon (comprising 304 metric tons of carbon dioxide)[79] were released when building a solar farm on an acre of forested land, those emissions could be offset within two years of operation of a typical solar farm.[80]

Granted, impacts to forested lands from solar development should still be considered in siting decisions so as to avoid and mitigate any potential harms to the ecological, recreational, and community resources provided by forest cover. Nevertheless, national data does not support the contention that solar development is a significant driver of deforestation.[81] Indeed, only about 4% of solar projects in the United States are being sited on currently forested lands.[82]

False Claim #5: Solar energy is worse for the climate than burning fossil fuels.

"It is likely that solar farms are making climate change worse."[83]

There is overwhelming evidence that the lifecycle emissions[84] of solar energy generation are far lower than those of fossil

hour.

74 *Id.*

75 Mark Bolinger and Greta Bolinger, Land Requirements for Utility-Scale PV: An Empirical Update on Power and Energy Density, 12 IEEE J. VOLTAICS 589, 593 (2022), https://www.doi.org/10.1109/JPHOTOV.2021.3136805

76 Greenhouse Gas Equivalencies Calculator – Revision History, U.S. ENV'T PROT. AGENCY, https://perma.cc/L7SC-TYVR (archived Jan. 21, 2025).

77 Panmei Jiang et al., *Wildfires Correlate with Reductions in Aboveground Tree Carbon Stocks and Sequestration Capacity on Forest Land in the Western United States*, 893 Sci. Total Env't 164832 (2023).

78 Greenhouse Gas Equivalencies Calculator – Calculations and References, U.S. ENV'T PROT. AGENCY, https://perma.cc/4NZW-KXJD (archived Jan. 21, 2025).

79 EPA's Greenhouse Gases Equivalencies Calculator explains that, to convert carbon density to carbon dioxide density, metric tons of carbon should be multiplied by the ratio of the molecular weight of carbon dioxide to that of carbon (44/12). Id.

80 This calculation is based on the fact that an acre of solar panels displacing electricity from natural gas would save between 175 to 198 metric tons of carbon dioxide per year, as described earlier in this entry.

81 Indeed, on a national basis, the total acreage of forested lands is growing. *See* U.S. Forest Growth Rates: Understanding the Numbers Behind the Canopy, Real American Hardwood, Apr. 2, 2026, https://www.realamericanhardwood.com/blog/us-forests-growth-rate.

82 L. Kruitwagen et al., A Global Inventory of Photovoltaic Solar Energy Generating Units, 598 Nature 604 (October 2021) (Supplemental Data for Supplemental Figure 10), https://doi.org/10.1038/s41586-021-03957-7. Supplemental data for SupplementalFigure 10 establishes that, as of December 2018, solar capacity across all land types in the U.S. was 54.14 GW, while solar capacity across land labelled as "tree covered" was 2.15 GW. Id. This represents roughly 4% of the total capacity.

83 NO TO SOLAR, supra note 8.

84 Lifecycle emissions for energy technologies encompass emissions associated with the operation of an energy facility, such as combustion of fossil fuels. Lifecycle emissions also encompass upstream emissions associated with resource extraction, manufacturing, and construction of a facility, along with downstream emissions associated with

fuel generation, including natural gas generation.[85] A 2024 study by the former National Renewable Energy Laboratory (NREL), now known as the National Laboratory of the Rockies, provides a cradle-to-grave lifecycle assessment of utility-scale solar photovoltaic systems installed in the United States.[86] The report finds that lifecycle greenhouse gas emissions from U.S. utility-scale PV systems range from 10 to 36 grams of carbon dioxide equivalent per kilowatt-hour (g CO_2e/kWh), depending on supply chain, installation location, and end-of-life assumptions.[87] For NREL's benchmark system, the report estimates lifecycle emissions of 19 g CO_2e/kWh, an energy payback time of 0.6 years, and a carbon payback time of 2.1 years.[88]

These findings are consistent with NREL's broader 2021 survey of lifecycle greenhouse gas emissions, which examined "approximately 3,000 published life cycle assessment studies on utility-scale electricity generation from wind, solar photovoltaics, concentrating solar power, biopower, geothermal, ocean energy, hydropower, nuclear, natural gas, and coal technologies, as well as lithium-ion battery, pumped storage hydropower, and hydrogen storage technologies."[89] The report found widespread agreement that all modes of solar power have total lifecycle emissions significantly below those of all fossil fuels.[90] The report found specifically that the total lifecycle emissions for solar photovoltaic (PV) and concentrating solar power (CSP) panels were 43 and 28 grams of CO_2-eq/KWh (carbon dioxide-equivalents per kilowatt-hour), respectively.[91] Coal, by contrast, generated lifecycle emissions of 1,001 grams of CO_2-eq/KWh, and natural gas generated lifecycle emissions of 486 grams of CO_2-eq/KWh.[92]

decommissioning of a facility. Nat'l Renewable Energy Laboratory, supra note 73, at 1.

[85] See generally id. at 3; Steffen Schlömer et al., 2014: Annex III: Technology-specific Cost and Performance Parameters, CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE 1329, 1335 (2014), https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-iii.pdf; Carbon Footprint of Solar Panel Manufacturing, COOL EFFECT (June 1, 2021), https://www.cooleffect.org/solar-carbon-footprint..

[86] Brittany L. Smith, Ashok Sekar, Heather Mirletz, Garvin Heath & Robert Margolis, An Updated Life Cycle Assessment of Utility-Scale Solar Photovoltaic Systems Installed in the United States, National Renewable Energy Laboratory, NREL/TP-7A40-87372, Mar. 2024, https://www.nrel.gov/docs/fy24osti/87372.pdf.

[87] *Id.*

[88] *Id.* (The report defines the benchmark system as "an installation in Fredonia, Kansas with an average imported supply chain and partial recycling").

[89] See Nat'l Renewable Energy Laboratory, supra note 73, at 1.

[90] *Id.* at 1-3.

[91] Steffen Schlömer et al., 2014: Annex III: Technology-specific Cost and Performance Parameters, CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE 1329, 1335 (2014), https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-iii.pdf

[92] *Id.*

Table 1. Median Published Life Cycle Emissions Factors for Electricity Generation Technologies, by Life Cycle Phase

	Generation Technology	One-Time Upstream	Ongoing Combustion	Ongoing Non Combustion	One-Time Downstream	Total Life Cycle	Sources
Renewable	Biomass	NR	—	NR	NR	52	EPRI 2013 Renewable Electricity Futures Study 2012
	Photovoltaic[a]	~28	—	~10	~5	43	Kim et al. 2012 Hsu et al. 2012 NREL 2012
	Concentrating Solar Power[b]	20	—	10	0.53	28	Burkhardt et al. 2012
	Geothermal	15	—	6.9	0.12	37	Eberle et al. 2017
	Hydropower	6.2	—	1.9	0.004	21	DOE 2016
	Ocean	NR	—	NR	NR	8	IPCC 2011
	Wind[c]	12	—	0.74	0.34	13	DOE 2015
Storage	Pumped-storage hydropower	3.0	—	1.8	0.07	7.4	DOE 2016
	Lithium-ion battery	32	—	NR	3.4	33	Nicholson et al. 2021
	Hydrogen fuel cell	27	—	2.5	1.9	38	Khan et al. 2005
Nonrenewable	Nuclear[d]	2.0	—	12	0.7	13	Warner and Heath 2012
	Natural gas	0.8	389	71	0.02	486	O'Donoughue et al. 2013
	Oil	NR	NR	NR	NR	840	IPCC 2011
	Coal	<5	1010	10	<5	1001	Whitaker et al. 2012

Figure 2: Lifecycle greenhouse gas emissions for selected electricity sources.
Source: NREL 2021[93]

To be fair, there are some outlier studies. For example, one study examined a worst-case scenario in which the coal-powered manufacture of inefficiently sized solar PV cells may contribute to greater lifecycle emissions than the cleanest and most efficient fossil fuel plants.[94] However, the conclusion that solar is worse for the climate than fossil fuels is not backed up by NREL's more extensive survey.

In addition to having smaller greenhouse gas emissions, solar power likewise outperforms fossil fuels in minimizing direct heat emissions. A 2019 Stanford publication notes that, for solar PV and CSP, net heat emissions are in fact negative, because these technologies "reduce sunlight to the surface by converting it to electricity," ultimately cooling "the ground or a building below the PV panels."[95] The study found that rooftop and utility-scale solar PV have heat emissions equivalent to negative 2.2 g-CO2e/kWh-electricity, compared to the positive heat emissions associated with natural gas, nuclear, coal, and biomass.

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[93] Nat'l Renewable Energy Laboratory, supra note 73, at 3.

[94] Jaime Fernández Torres & Fontina Petrakopoulou, A Closer Look at the Environmental Impact of Solar and Wind Energy, GLOBAL CHALLENGES, June 22, 2022, https://onlinelibrary.wiley.com/doi/10.1002/gch2.202200016.

[95] Mark Z. Jacobson, Evaluation of Nuclear Power as a Proposed Solution to Global Warming, Air Pollution, and Energy Security, Dec. 22, 2019, https://web.stanford.edu/group/efmh/jacobson/Articles/I/NuclearVsWWS.pdf.

Technology	Anthropogenic heat emissions
Solar PV-rooftop	-2.2
Solar PV-utility	-2.2
CSP	-2.2
Wind-onshore	-1.7 to -0.7
Wind-offshore	-1.7 to -0.7
Geothermal	0
Hydroelectric	0
Wave	0
Tidal	0
Nuclear	1.6
Biomass	3.4
Natural gas-CCS/U	0.61
Coal-CCS/U	1.5

Figure 3: The 100-year CO2e emissions impact associated with different energy sources' heat emissions, measured in g-CO2e/kWh-electricity.
Source: M.Z. Jacobson[96]

Looking at academic scholarship from outside of the United States, a 2022 analysis from India's Hirwal Education Trust's College of Computer Science and Information Technology describes the global impact of solar panel heat emissions as "relatively small."[97]

False Claim #6: Solar development is inherently harmful to biodiversity.

"Construction of an industrial-scale solar powerplant . . . creat[es] an ecological wasteland."[98]

The impact of solar development on biodiversity depends on site-specific conditions, including the local ecosystem, the existing land use, the density and layout of the project, and the management practices employed at the site.[99] When applying best practices for project design, including by incorporating pollinator habitat and minimizing soil disturbance, large-scale solar farms on previously developed land, including farmland, can sustain and even increase local biodiversity.[100] While developing solar projects on previously undeveloped land may contribute to habitat loss and degradation, as well as negative impacts to local biodiversity, these impacts can be mitigated through careful design, construction, and operation.[101]

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[96] *Id.* Reproduced and adapted with permission.

[97] Sudesh Nagu Kadam et. al, Solar Panel Heat Emission and Its Environmental Impact, 2 INT'L J. ADVANCED RSCH. SCI. COMMC'N TECH. 3 (Dec. 2022), 113, 116, https://ijarsct.co.in/Paper13924.pdf.

[98] CITIZENS FOR RESPONSIBLE SOLAR, *supra* note 10.

[99] *See* Parikhit Sinha et al., Best Practices in Responsible Land Use for Improving Biodiversity at a Utility-Scale Solar Facility, 2 CASE STUDIES IN THE ENV'T, 1, 1-2, 7-10 (2018), https://doi.org/10.1525/cse.2018.001123.

[100] *Id.*

[101] *Id.*; Steven M. Grodsky et al., Solar energy development impacts flower-visiting beetles and flies in the Mojave Desert, 263 BIOLOGICAL CONSERVATION 109336 (2021), https://www.sciencedirect.com/science/article/pii/S0006320721003888?via%3Dihub; Anna

Microclimates within solar farms can enhance botanical diversity, which, in turn, can enhance the diversity of the site's invertebrate and bird populations.[102] In addition, the shade under solar panels can offer critical habitat for a wide range of species, including endangered species.[103] Shady patches likewise prevent soil moisture loss, boosting plant growth and diversity, particularly in areas impacted by climate extremes.[104]

Proactive measures taken before and after construction can further enhance biodiversity impacts. Prior to installation, developers can mitigate adverse impacts by examining native species' feeding, mating and migratory patterns and ensuring that solar projects are not sited in sensitive locations or constructed at sensitive times.[105] For example, developers can schedule construction to coincide with indigenous reptiles' and amphibians' hibernation periods, while avoiding breeding periods.[106]

Additionally, developers can invest in habitat restoration once solar projects have been installed, such as by replanting indigenous flowering species that provide nectar to insects, which also benefits mammals and ground nesting birds.[107] A recent study on the impact of newly-established insect habitat on solar farms in agricultural landscapes found increases in floral abundance, flowering plant species richness, insect group diversity, native bee abundance, and total insect abundance.[108]

Pollinators play a crucial role in U.S. farming, with more than one third of crop production reliant on pollinators.[109] Bee populations alone contribute an estimated $20 billion annually to U.S. agriculture production and up to $217 billion worldwide.[110] Recognizing these benefits, DOE and its research partners have supported and published research on how solar facilities can better account for wildlife, ecosystem services, and pollinator habitat.[111] The available evidence, therefore, does not support the claim that solar development inherently creates an "ecological wasteland." Rather, biodiversity outcomes depend heavily on where projects are built and how they are designed, constructed, and managed.

Suuronen et al., Influence of Solar Power Plants on Microclimatic Conditions and the Biotic Community in Chilean Desert Environments, 60 ENVT'L MANAGEMENT 630 (2017), https://link.springer.com/article/10.1007/s00267-017-0906-4; Hall Sawyer et al., Trade-offs between utility-scale solar development and ungulates on western rangelands, 20 FRONTIERS IN ECOLOGY AND THE ENV'T 345 (2022), https://esajournals.onlinelibrary.wiley.com/doi/10.1002/fee.2498.

102 Parikhit Sinha et al., supra note 98 at 1-2.

103 HANNAH MONTAG ET AL., THE EFFECTS OF SOLAR FARMS ON LOCAL BIODIVERSITY at 34 (Apr. 2016), https://helapco.gr/wp-content/uploads/Solar_Farms_Biodiversity_Study.pdf; Maggie Graham et al., Partial shading by solar panels delays bloom, increases floral abundance during the late-season for pollinators in a dryland, agrivoltaic ecosystem, 11 SCI. REP. 7452, 7458, 7463 (2021), https://doi.org/10.1038/s41598-021-86756-4.

104 Greg Barron-Bafford et al., Agrivoltaics provide mutual benefits across the food-energy-water nexus in the drylands, 2 NATURE SUSTAINABILITY 848, 851 (2019), https://doi.org/10.1038/s41893-019-0364-5.

105 The Biodiversity Consultancy, Mitigating biodiversity impacts associated with solar and wind energy development, IUCN (2021), 12, https://portals.iucn.org/library/sites/library/files/documents/2021-004-En.pdf.

106 *Id.* at 51.

107 *Id.* at 54, 82.

108 Leroy J. Walston et al., If you build it, will they come? Insect community responses to habitat establishment at solar energy facilities in Minnesota, USA, 19 ENVT'L RESEARCH LETTERS 14053 (2024), at 1, https://iopscience.iop.org/article/10.1088/1748-9326/ad0f72.

109 Pollinator Habitat Planting: CP42, U.S. DEP'T AGRICULTURE, https://perma.cc/SE2Q-PWKX (archived Jan. 21, 2025).

110 *Id.*

111 Buzzing Around Solar: Pollinator Habitat Under Solar Arrays, U.S. DEP'T ENERGY (Jun. 21, 2022), https://perma.cc/8DKD-EYCR (archived Jan. 21, 2025).

False Claim #7: Solar projects will reduce agricultural production, hurting farmers and rural communities.

> "Ask yourself, if several thousand acres of agricultural land is converted to industrial solar facilities, who will grow your food? Bill Gates? Mark Zuckerberg?"[112]

Ambitious solar deployment would use a relatively small percentage of U.S. land when compared to the land currently being used for agriculture. The DOE estimated that total U.S. solar development would take up roughly 10.3 million acres in a scenario in which cumulative solar deployment reaches 1,050–1,570 GW by 2050, the highest land-use scenario that DOE assessed in its 2021 Solar Futures Study.[113] Even if all 10.3 million acres of solar farms were sited on farmland, they would occupy only 1.15% of the 895,300,000 acres of U.S. farmland as of 2021.[114] However, many of these projects will not be located on farmland.[115] In addition, no solar projects will be sited on private farm land without the consent of the landowner, who often receives substantial lease payments in exchange for use of their land.

Furthermore, solar arrays can be designed to allow, and even enhance, continued agricultural production on site. This practice, known as agrivoltaics, provides numerous benefits to farmers and rural communities, especially in hot or dry climates.[116] Agrivoltaics allow farmers to grow crops and even to graze livestock such as sheep beneath or between rows of solar panels.[117] When mounted above crops and vegetation, solar panels can provide beneficial shade during the day.[118] Multiple studies have shown that these conditions can enhance a farm's productivity and efficiency.[119] One study found, for example, that "lettuces can maintain relatively high yields under PV" because of their capacity to calibrate "leaf area to light availability."[120] Extra shading from solar panels also reduces evaporation, thereby reducing water usage for crops by around 14-29%, depending on the level of shade.[121] Reduced evaporation from solar installations can likewise mitigate soil erosion.[122] Solar farms can also create refuge habitats for endangered pollinator species, further boosting crop yields while supporting native wild species.[123] Overall, agrivoltaics can increase the economic value of the average farm by over 30%, while increasing annual income by about 8%.[124] Farmers in other countries have begun implementing agrivoltaic systems.[125] As of March 2019, Japan had 1,992 agrivoltaic farms, growing over 120 different crops while simultaneously generating 500,000 to 600,000 MWh of energy.[126] As of August 2026, there were at least 671 agrivoltaic projects in the United States, producing 10,473 MW

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[112] NO SOLAR IN LOGAN COUNTY (OHIO), supra note 11.

[113] U.S. Dep't. Energy Solar Energy Technologies Office, Solar Futures Study, U.S. DEP'T. ENERGY OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, at vi, 179 (Sep. 2021), https://perma.cc/TKM2-FLC7 (archived Feb. 25, 2025).

[114] U.S. Dep't. of Agriculture, Farms and Land in Farms: 2021 Summary, 4 (Feb. 2022), https://perma.cc/PW8B-QJLJ (archived Feb. 25, 2025).

[115] Eric Larson et al., Net-Zero American: Potential Pathways, Infrastructure, and Impacts: Final Report, Princeton University, 247 (Oct. 29, 2021), https://netzeroamerica.princeton.edu/the-report.

[116] National Renewable Energy Laboratory, Agrivoltaics, https://perma.cc/35Q7-ZRGS (archived Feb. 25, 2025).

[117] Michael Nuckols, Considerations when leasing agricultural lands to solar developers, CORNELL SMALL FARMS (Apr. 6, 2020), https://smallfarms.cornell.edu/2020/04/considerations-when-leasing-agricultural-lands-to-solar-developers/; Elnaz Adeh et al., Solar PV power potential is greatest over croplands, 9 SCI. REP. 4 (2019), https://doi.org/10.1038/s41598-019-47803-3.

[118] Henry J. Williams et. al., The potential for agrivoltaics to enhance solar farm cooling, APPLIED ENERGY 332 (2023), https://doi.org/10.1016/j.apenergy.2022.120478.

[119] Raúl Aroca-Delgado et al., Compatibility between Crops and Solar Panels: An Overview from Shading Systems, 10 SUSTAINABILITY 743, 745 (2018), https://doi.org/10.3390/su10030743.

[120] Hélène Marrou et. al, Productivity and Radiation use Efficiency of Lettuces Grown in the Partial Shade of Photovoltaic Panels, 44 EUR. J. AGRONOMY 54, 60, 63 (2013), https://doi.org/10.1016/j.eja.2012.08.003.

[121] Harashavardhan Dinesh & Joshua M. Pearce, The potential of agrivoltaic systems, 54 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 299, 302 (2016), https://doi.org/10.1016/j.rser.2015.10.024.

[122] *Id.*

[123] Empowering Biodiversity on Solar Farms, UNIVERSITY OF GEORGIA COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES, 2020, https://www.caes.uga.edu/research/impact/impact-statement/9839/empowering-biodiversity-on-solar-farms.html.

[124] Dinesh & Pearce, supra note 120, at 305.

[125] See, e.g., Makoto Tajima and Tetsunari Iida, Evolution of Agrivoltaic Farms in Japan, 2361 AIP CONF. PROC. 030002 (2021), https://doi.org/10.1063/5.0054674.

[126] *Id.* at 2. This is enough energy to power roughly 50,000 American households. U.S. Energy Information Admin., Use of energy explained: Energy use in homes, https://perma.cc/D98R-NHH7 (archived Jan. 21, 2025).

of power.[127]

Furthermore, the argument that solar development will imperil the food supply is belied by the fact that tens of millions of acres of farmland are currently being unused[128] or used to grow crops for other purposes, such as the production of corn ethanol. Currently, roughly 90 million acres of agricultural land in the United States is dedicated to corn, with nearly 45% of that corn being used for ethanol production.[129] Solar energy could provide a significantly more efficient use of the same land. A 2025 study published in the Proceedings of the National Academy of Sciences found that converting just 3.2% of land currently used for corn ethanol to utility-scale solar would increase the share of utility-scale solar energy in the U.S. energy mix from 3.9% to 13%.[130] The study also found that one hectare of utility-scale solar could generate the same amount of energy as approximately 31 hectares of corn-ethanol crops.[131] Additionally, corn-derived ethanol used to power internal combustion engines has been calculated to require between 63 and 197 times more land than solar PV powering electric vehicles to achieve the same number of transportation miles.[132] If converted to electricity to power electric vehicles, ethanol would still need roughly 32 times more land than solar PV to achieve the same number of transportation miles.[133] And even when accounting for other energy by-products of ethanol production, solar PV produces between 14 and 17 times more gross energy per acre than corn.[134] The figure below contrasts the land use requirements of solar PV with dedicated biomass and other energy sources. Whereas dedicated biomass consumes an average of 160,000 hectares of land per terawatt-hour per year, ground-mounted solar PV consumes an average of 2,100.[135]

[127] Nat'l Renewable Energy Lab'y, *InSPIRE Agrivoltaics Map*, Open Energy Info. (last visited Aug. 18, 2026), https://openei.org/wiki/InSPIRE/Agrivoltaics_Map

[128] Chris Hubbuch, *Abandoned Farmlands Could Play a Role in Fighting Climate Change. A New Study Shows Exactly Where They Are*, UW–Madison News (May 29, 2024), https://news.wisc.edu/abandoned-farmlands-could-play-a-role-in-fighting-climate-change-a-new-study-shows-exactly-where-they-are/ (finding that the US has approximately 30.30 million acres of abandoned or unused cropland).

[129] Corn and Other Feed Grains - Feed Grains Sector at a Glance, U.S. DEP'T OF AGRICULTURE (last updated Jan. 5, 2025), https://perma.cc/RR6A-HZKY (archived Feb. 25, 2025).

[130] Matthew A. Sturchio et al., *Ecologically Informed Solar Enables a Sustainable Energy Transition on U.S. Corn-Ethanol Croplands*, *Proceedings of the National Academy of Sciences*, Apr. 21, 2025, https://www.pnas.org/doi/10.1073/pnas.2501605122.

[131] *Id.*

[132] PAUL MATHEWSON & NICHOLAS BOSCH, CORN ETHANOL VS. SOLAR: LAND USE COMPARISON at 1 (Clean Wisconsin 2023), https://www.cleanwisconsin.org/wp-content/uploads/2023/01/Corn-Ethanol-Vs.-Solar-Analysis-V3-9-compressed.pdf.

[133] *Id.*

[134] *Id.*

[135] Jessica Lovering et al., Land-use intensity of electricity production and tomorrow's energy landscape, PLOS ONE, July 2022, at 8, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0270155#pone-0270155-t001.

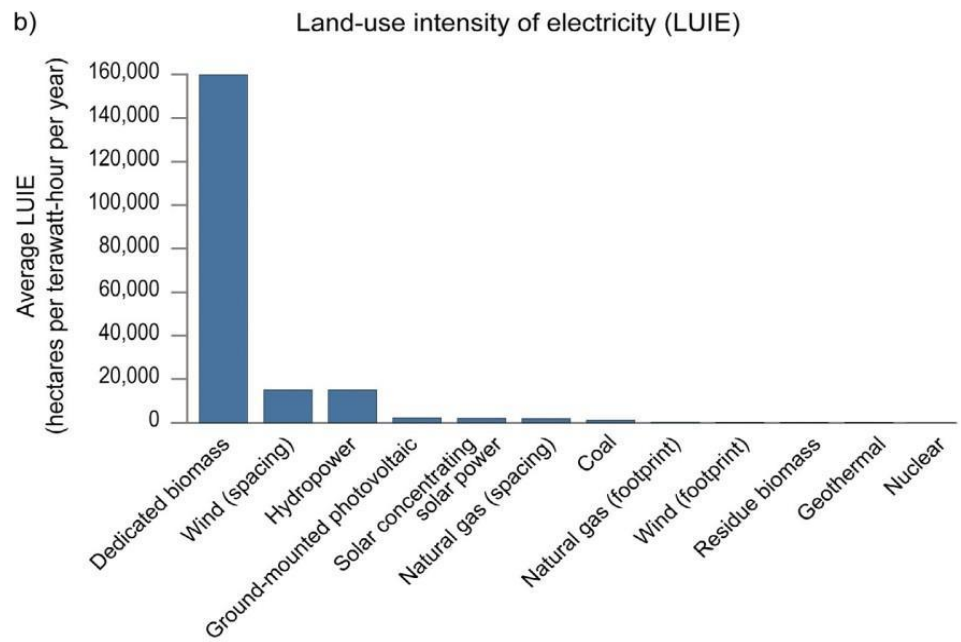

Figure 4: Average land-use intensity of electricity, measured in hectares per terawatt-hour per year.
Source: U.S. Global Change Research Program (visualizing data from Jessica Lovering et al.).[136]

Finally, while solar installations, like any infrastructure projects, will inevitably have some adverse impacts, the failure to build the infrastructure necessary to avoid climate change poses a far more severe threat to agricultural production. Climate change already harms food production across the country and globe through extreme weather events, weather instability, and water scarcity.[137] The most recent Intergovernmental Panel on Climate Change (IPCC) report forecasts that climate change will cause up to 80 million additional people to be at risk of hunger by 2050.[138] A 2024 study forecast a 20% price increase for cereal grains, fruits, vegetables, and other crops by 2050 due to climate change.[139] These price increases would strain consumers globally, while also producing uneven regional effects.[140] Moreover, while higher carbon dioxide levels may initially increase yield for certain crops at lower temperature increases, these crops will likely provide lower nutritional

[136] U.S. Global Change Research Program, Fifth National Climate Assessment at 32-29 (2023), https://nca2023.globalchange.gov/downloads/NCA5_Ch32_Mitigation.pdf (visualizing data from Jessica Lovering et al., supra note 134 at 8).

[137] Alisher Mirzabaev et al., Severe climate change risks to food security and nutrition, 39 Climate Risk Management 100473, 3 (2023), https://www.sciencedirect.com/science/article/pii/S2212096322000808 ("Adverse consequences are already occurring, and the chances of their exacerbation under climate change are high"); Food and Agriculture Organization of the United Nations, Climate Change and Food Security: Risks and Responses at ox-xii (2015), https://www.fao.org/3/i5188e/I5188E.pdf; Agriculture and Climate, U.S. Env't. Prot. Agency, https://perma.cc/A48A-DCQX (archived Jan. 21, 2025); Laura Reiley & Kadir van Lohuizen, Climate change is pushing American farmers to confront what's next, Wash. Post, Nov. 10, 2023, https://www.washingtonpost.com/business/interactive/2023/american-agriculture-farming-climate-change/.

[138] IPCC, Climate Change 2022: Impacts, Adaptation, and Vulnerability (2022), 717, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf.

[139] Mark W. Rosegrant et al., "Food and Nutrition Security Under Changing Climate and Socioeconomic Conditions," 41 Global Food Security 100755 (2024). .

[140] *Id.*; see also Climate Change 2022: Impacts, Adaptation, and Vulnerability, supra note 137, at 796.

quality.[141] For example, wheat grown at 546–586 parts per million (ppm) CO_2 has a 5.9–12.7% lower concentration of protein, 3.7–6.5% lower concentration of zinc, and 5.2–7.5% lower concentration of iron.[142] Distributions of pests and diseases will also change, harming agricultural production in many regions.[143] Such impacts will only intensify for as long as we continue to burn fossil fuels.[144]

False Claim #8: Solar development will destroy U.S. jobs.

> "Requirements for renewable energy mean that Americans' oil and gas jobs are being sacrificed to Chinese making wind turbines and solar panels."[145]

Solar development creates significantly more jobs per unit of energy generated than other types of energy production, including natural gas.[146] Moreover, the number of jobs created by the renewable energy industry, including solar, is expected to far exceed the number lost due to transition away from fossil fuels. The United States' Fifth National Climate Assessment predicts that there will be nearly 3,000,000 new solar, wind, and transmission-related jobs in the United States by 2050 in a high electrification scenario and 6,000,000 new jobs in a 100% renewable scenario, with less than 1,000,000 fossil fuel-related jobs lost.[147] Still, the transition will have workforce impacts that need to be proactively managed so as to minimize social harm to displaced labor from fossil fuel-related industries.

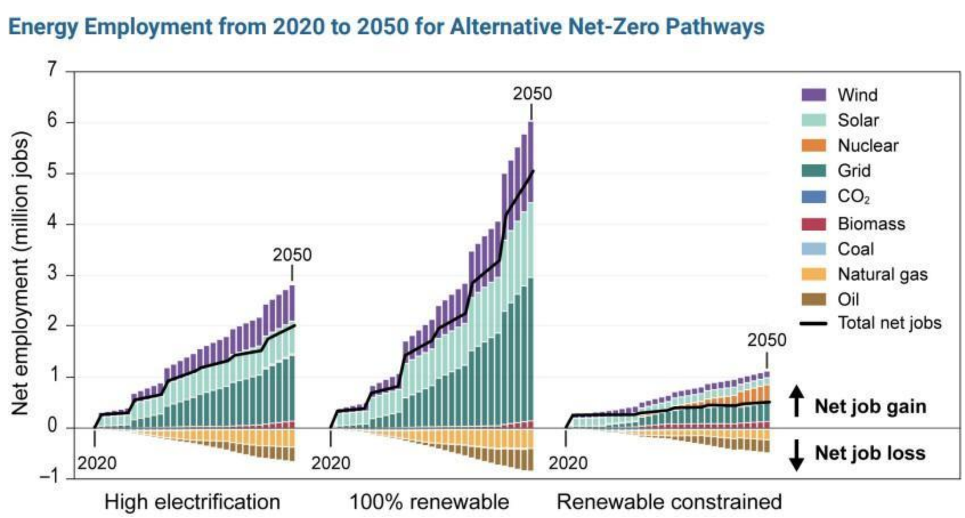

Figure 5: Energy employment from 2020 to 2050 under various U.S. net-zero GHG emissions scenarios.
Source: U.S. Global Change Research Program.[148]

[141] Climate Change 2022: Impacts, Adaptation, and Vulnerability, supra note 138, at 717.
[142] Mbow et al., supra note 129.
[143] *Id.*; Climate Change 2022: Impacts, Adaptation, and Vulnerability, supra note 139, at 718.
[144] Causes and Effects of Climate Change, UNITED NATIONS, https://www.un.org/en/climatechange/science/causes-effects-climate-chang (last visited March 25, 2024).
[145] Diana Furchtgott-Roth, The Hypocrisy of the Left on Energy Policy, HERITAGE FOUNDATION (May 9, 2023), https://www.heritage.org/energy-economics/commentary/the-hypocrisy-the-left-energy-policy.
[146] National Association of State Energy Officials et al., Wages, Benefits and Change, https://www.usenergyjobs.org/s/Wage-Report.pdf (last visited March 25, 2024).
[147] U.S. GLOBAL CHANGE RESEARCH PROGRAM, supra note 137, at 32-31.
[148] *Id.*

As of 2024, the solar industry supported approximately 370,600 U.S. jobs, including 181,700 construction jobs and 46,500 manufacturing jobs, with numbers generally increasing each year.[149] In addition, many of these jobs cannot be outsourced. In 2024, there were 178,713 jobs in installation and project development, nearly two-thirds of all solar jobs, and 21,833 jobs in operations and maintenance, most of which cannot be exported.[150] The number of jobs in solar energy generation already exceeds those in the fossil fuel generation industries. Throughout the United States, there are roughly 6.1 times as many jobs in solar generation alone than in coal generation, and there are roughly 1.84 times as many jobs in solar generation than in coal, gas, and oil generation combined.[151]

Domestic job growth in solar production and related industries has recently been supported by federal investments and tax incentives aimed at increasing domestic clean-energy manufacturing and shoring up domestic supply chains. Since the passage of the Inflation Reduction Act in 2022, announced U.S. solar manufacturing investments have totaled $47.8 billion, expected to create approximately 74,130 manufacturing jobs.[152] It should, however, be noted that the One Big Beautiful Bill Act (OBBA)[153] eliminated and accelerated the phase out of tax incentives that had supported solar deployment, including the residential clean energy credit and credits for certain wind and solar projects.[154] These changes create some uncertainty about the pace of future solar deployment and associated employment growth, but they still do not support the claim that solar development destroys U.S. jobs.

False Claim #9: Reliance on solar will make the United States dependent on China and other countries.

> "One of the biggest mistakes the West has done on green policies to cut CO2 emissions and trying to reduce dependence on oil and gas producing nations is that the transition to renewable energy puts the West at the mercy of China."[155]

Although the United States still imports many of the solar panels and components it uses, domestic solar manufacturing has expanded substantially in recent years. By early 2025, the United States had surpassed 50 GW of annual domestic solar module manufacturing capacity, enough to meet current domestic solar demand.[156] Federal investments have also supported more complete domestic supply chains. In December 2024, DOE's Loan Programs Office closed a $1.45 billion loan guarantee to Hanwha Qcells for a new solar manufacturing facility in Cartersville, Georgia.[157] DOE described the facility

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[149] United States Energy & Employment Report 2025, U.S. DEP'T OF ENERGY (June 2025), https://perma.cc/M466-4GY5 (archived Feb. 25, 2025)..

[150] National Solar Jobs Census 2024, INTERSTATE RENEWABLE ENERGY COUNCIL, https://irecusa.org/programs/solar-jobs-census/ (last visited March 25, 2024).

[151] United States Energy & Employment Report 2025, supra note 149 at 4.

[152] *Id.*

[153] Public Law No. 119-21 of 2025.

[154] Internal Revenue Service, *FAQs for Modification of Sections 25C, 25D, 25E, 30C, 30D, 45L, 45W, and 179D under Public Law 119-21, 139 Stat. 72 (July 4, 2025), Commonly Known as the One, Big, Beautiful Bill (OBBB)*, FS-2025-05 (Aug. 2025), https://www.irs.gov/newsroom/faqs-for-modification-of-sections-25c-25d-25e-30c-30d-45l-45w-and-179d-under-public-law-119-21-139-stat-72-july-4-2025-commonly-known-as-the-one-big-beautiful-bill-obbb]; Solar Energy Industries Association, *The Clean Energy Provisions in the "One Big Beautiful Bill"* (July 21, 2025) [https://seia.org/research-resources/clean-energy-provisions-big-beautiful-bill/.

[155] Kenneth Rapoza, How China's Solar Industry Is Set Up to Be the New Green OPEC, FORBES (Mar. 14, 2021), https://www.forbes.com/sites/kenrapoza/2021/03/14/how-chinas-solar-industry-is-set-up-to-be-the-new-green-opec/?sh=f3f6e851446d.

[156] Solar Energy Industries Association, United States Surpasses 50 GW of Solar Module Manufacturing Capacity (Feb. 4, 2025), https://seia.org/news/united-states-surpasses-50-gw-of-solar-module-manufacturing-capacity/.

[157] U.S. Department of Energy, Loan Programs Office, LPO Announces $1.45 Billion Loan Guarantee to Qcells to Finance a

as the first fully integrated silicon-based solar manufacturing facility constructed in the United States in more than a decade; it is expected to produce ingots, wafers, cells, and finished solar panels and support approximately 1,650 full-time operations jobs.[158] Many U.S. solar jobs are local and cannot easily be outsourced: in 2024, 178,713 solar jobs were in installation and project development, and 21,833 were in operations and maintenance.[159]

To the extent that there are concerns that solar energy will increase the United States' dependence on China specifically, it bears noting that China is no longer a major source of solar panel imports.[160]. In 2024, approximately 82% of U.S. solar panel imports came from four countries: Vietnam, Thailand, Malaysia, and Cambodia. Vietnam exported approximately 19.3 GW of crystalline-silicon solar panels to the United States, followed by Thailand at 12.9 GW, Malaysia at 7.6 GW, and Cambodia at 4.6 GW.[161] While the U.S. Department of Commerce found that companies in these four countries have been incorporating Chinese-sourced materials without paying corresponding tariffs, the U.S. Government has taken measures to crack down on noncompliance.[162] In particular, since June 2024, the U.S. government has required that solar manufacturers exporting from these countries to the U.S. certify their compliance with all relevant trade rules, subject to potential audit.[163] In addition, in 2026, the Trump Administration has imposed an additional 15% tariff and price floors for derivatives of polysilicon.[164]

False Claim #10: Utility-scale solar farms destroy the value of nearby homes.

> "Solar power plants decrease property values. Over time, industrial-scale solar counties' property values will decline and the county become less desirable, while other location's [sic] values will increase."[165]

Data across multiple studies do not support the claim that utility-scale solar farms destroy nearby home values.[166] The most comprehensive study to date, published in 2025, assessed 8.8 million land transactions across 3.699 solar sites and found that solar development had nominal impacts on residential property values.[167] Specifically, the study found that large-scale solar projects reduced residential property values within 3 miles by about 4.8%, with the effect diminishing with distance and time.[168]

Solar Manufacturing Facility in Georgia (Dec. 19, 2024), https://www.energy.gov/edf/articles/lpo-announces-145-billion-loan-guarantee-qcells-finance-solar-manufacturing-facility.

158 *Id.*

159 INTERSTATE RENEWABLE ENERGY COUNCIL, supra note 150.

160 Ian Tiseo, Distribution of solar photovoltaic modules imported in the united States in 2022, by country of origin, STATISTA, Jan. 25, 2024, https://www.statista.com/statistics/232941/us-imports-of-solar-equipment-by-source-contry/

161 David Feldman et al., Spring 2025 Solar Industry Update, NAT'L RENEWABLE ENERGY LABORATORY, 68 (Apr. 27, 2023), https://perma.cc/CR8U-DGYG (archived Jan. 21, 2025).

162 Eric McDaniel, The U.S. Imports Most of Its Solar Panels. A New Ruling Might Make That More Expensive, NATIONAL PUBLIC RADIO (Aug. 18, 2023), https://www.npr.org/2023/08/18/1194303196/solar-panel-imports-china%20and%20.

163 U.S. Department of Commerce, Department of Commerce Issues Preliminary Determination of Circumvention Inquiries of Solar Cells and Modules Produced in China, Dec. 2, 2022, https://perma.cc/RJP4-ZWRC (archived Jan. 21, 2025).

164 Nichola Groom, Trump Unveils Trade Actions to Compete with China on Solar and Chips, Reuters (Aug. 6, 2026), https://www.reuters.com/world/asia-pacific/trump-signs-executive-order-protect-us-polysilicon-industry-2026-08-06/; (finding that tariffs imposed by the U.S. government on Chinese-sourced solar panels have considerably diminished China's status as a principal U.S. supplier)

165 Property Values, CITIZENS FOR RESPONSIBLE SOLAR, https://perma.cc/UWK6-35Z2 (archived Feb. 25, 2025).

166 Richard Kirkland, Grand Solar Impact Study, KIRKLAND APPRAISALS, (Feb. 25, 2016), https://www.southripleysolar.com/wp-content/uploads/2020/09/Kirkland-Grandy-Solar-Impact-Study.pdf; Solar and Property Value, SOLAR ENERGY INDUSTRIES ASSOCIATION (Jul. 2019), https://www.seia.org/sites/default/files/2019-09/Solar%20Property%20Value%20FactSheet%202019-PRINT_1.pdf.

167 Chenyang Hu et al., Impact of Large-Scale Solar on Property Values in the United States: Diverse Effects and Causal Mechanisms, 122 Proc. Nat'l Acad. Sci. U.S. e2418414122 (2025), https://doi.org/10.1073/pnas.2418414122.

168 *Id.*

Notably, however, the study also found that solar projects increased agricultural and vacant land values by about 19.4% within 2 miles, reflecting the economic value of solar leases and development opportunities for landowners.[169] Other studies have also found that that solar projects can have a positive impact on certain property values. For example, a 2018 study of solar farms in Indiana and Illinois found properties within 1,320 feet of solar farms sold by an average of 1.92% more than comparable properties that were not located near any solar farms.[170]

Another study, which examined more than 1.8 million home transactions near 1,500 large-scale photovoltaic projects across six states,[171] found that homes located within 0.5 miles of solar farms experienced price reductions of 1.5%, compared to properties 2–4 miles away.[172] Homes located more than 1 mile from a solar farm experienced no statistically significant effect on price.[173] Similarly, a 2020 study examining 400,000 transactions around 208 utility-scale solar installations in Massachusetts and Rhode Island found a 1.7% decrease in property value for homes located within 1 mile of a project.[174] These declines were concentrated in suburban areas, where there is more competition for space.[175] In rural communities there was no impact on property values.[176] Other studies have also found that utility-scale solar farms have a greater impact on property values in areas with higher residential population density.[177]

By contrast, a separate study found that the presence of a fossil fuel fired power plant within 2 miles of one's home decreased its value by 4–7%, with the largest decreases within 1 mile and for high-capacity plants.[178] In that study, 92% of the power plants surveyed were fueled by natural gas.[179]

False Claim #11: Solar energy is more expensive than fossil fuels and completely dependent on subsidies.

> "Solar farms depend entirely on subsidies from your hard earned money. When the subsidies are gone, the solar farms are abandoned!"[180]

Unsubsidized utility-scale solar energy remains one of the least expensive sources of new electricity generation. According to the International Energy Agency's 2024 World Energy Outlook, photovoltaic solar power is "the cheapest electricity sources in most markets."[181]

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[169] *Id.*
[170] *Id.*
[171] Salma Elmallah et al., Shedding Light on Large-Scale Solar Impacts: An Analysis of Property Values and Proximity to Photovoltaics Across Six U.S. States, 175 Energy Policy 113425 (2023), https://doi.org/10.1016/j.enpol.2023.113425.
[172] *Id.* at 113425.
[173] *Id.*
[174] Vasundhara Gaur et al., Property Value Impacts of Commercial-Scale Solar Energy In Massachusetts And Rhode Island, DEP'T. ENV'T. AND NAT. RES. ECON. U. R.I., 4 (2020).
[175] *Id.* at 35.
[176] *Id.*
[177] Leila Al-Hamoodah et al., An Exploration of Property-Value Impacts Near Utility-Scale Solar Installations, LAWRENCE BERKELEY NATIONAL LABORATORY (May 2018), https://static1.squarespace.com/static/58d03116725e2542873aa638/t/6058df6f1107f91adc9cc20d/1616437113682/Link+in+No.+13C+-+An+Exploration+of+Property+Value+Impacts+Near+Utility+Scale+Solar+Installations.pdf.
[178] Lucas Davis, The Effect of Power Plants on Local Housing Value and Rents, 93 REV. ECON. STAT. 1391 (2011), https://doi.org/10.1162/rest_a_00119.
[179] *Id.* at 1400.
[180] NO TO SOLAR, supra note 7.
[181] World Energy Outlook 2024, INT'L. ENERGY AGENCY, 202, 214 (2020), https://iea.blob.core.windows.net/assets/a72d8abf-de08-4385-8711-b8a062d6124a/WEO2020.pdf

Solar energy compares favorably to fossil fuels in terms of levelized cost (i.e., lifetime costs divided by lifetime energy output). Lazard's June 2025 *Levelized Cost of Energy+* analysis estimates the unsubsidized Levelized Cost of Energy (LCOE) of utility-scale solar PV at $38–$78 per MWh, with an average value of approximately $58 per MWh.[182] By comparison, Lazard estimates the unsubsidized LCOE of gas combined cycle at $48–$109 per MWh, coal at $71–$173 per MWh, and gas peaking at $149–$251 per MWh.[183] The figure below from Lazard shows historical mean unsubsidized LCOE values for different types of utility-scale energy generation.

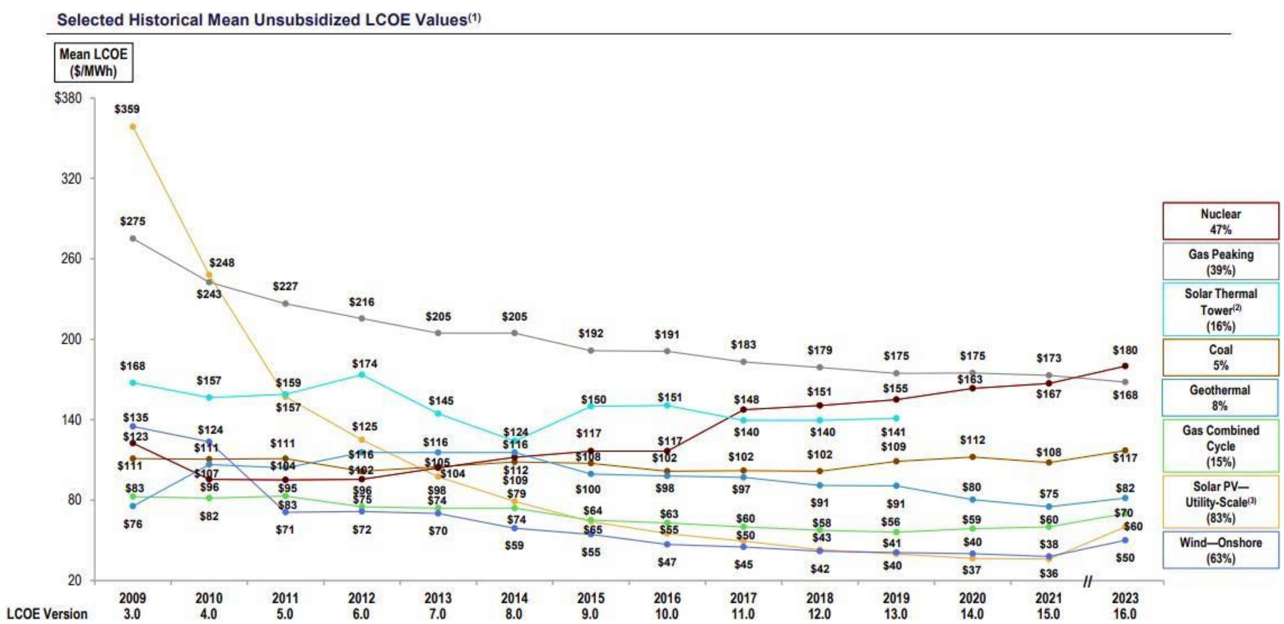

Figure 6: Selected historical mean unsubsidized LCOE values from Lazard's 2023 Report on the Levelized Cost of Energy. This graph reflects the average of the high and low LCOE for each technology in each year. The percentages on the right of the figure represent the decrease in average LCOE since 2009.
Source: Lazard.[184]

Lazard attributes the significant historical cost declines for utility-scale renewable energy generation to decreasing capital costs, improving technologies, and increased competition, among other factors.[185] While Lazard's 2025 analysis continues to show a major long-term decline in the cost of utility-scale solar, it suggests that historical cost declines have begun to level out.[186] Still, Lazard reports that average utility-scale solar LCOE has declined substantially since 2009 due decreasing capital costs, improving technologies, and increased competition, among other factors.[187]
For solar energy, as with onshore wind energy and electric vehicle batteries, historical decreases in costs have correlated with increases in cumulative capacity and sales.[188] As one example of decreasing costs of solar generation, the figure below

[182] Lazard, *Lazard's Levelized Cost of Energy* (June 2025), https://www.lazard.com/media/eijnqja3/lazards-lcoeplus-june-2025.pdf.
[183] *Id.*
[184] Levelized Cost of Energy Analysis: Version 16.0, LAZARD, 9 (Apr. 2023), https://www.lazard.com/media/2ozoovyg/lazards-lcoeplus-april-2023.pdf.(reproduced with permission)
[185] *Id.*
[186] Lazard, supra note 181, at 8.
[187] *Id.* at 13–14.
[188] See U.S. GLOBAL CHANGE RESEARCH PROGRAM, supra note 135, at 32-15..

from Inside Climate News shows a roughly 90% decline in solar module prices from 2011 to 2023.[189]Fossil fuels also receive federal subsidies. In fiscal year 2022, the most recent year for which EIA has published a comprehensive federal subsidy comparison, the federal government's tax expenditures for natural gas and petroleum totaled $2.1 billion.[190]

One shortcoming of relying on levelized cost as a metric for comparing solar with natural gas and other types of legacy power plants is that levelized cost does not take into account that additional energy generation is needed to compensate for any intermittency. But even when factoring in these so-called firming costs, the subsidized and unsubsidized LCOE of stand-alone solar is lower than the levelized cost of gas peaking and cost-competitive with gas combined cycle across most of the United States.[191] Solar-plus-storage systems are more expensive. However, when factoring in firming costs, both the subsidized and unsubsidized LCOE of solar plus storage is generally within or below the range of LCOE for gas peaking, depending on location within the United States.[192] In addition, the solar-plus-storage has seen notable cost declines in recent years.[193]

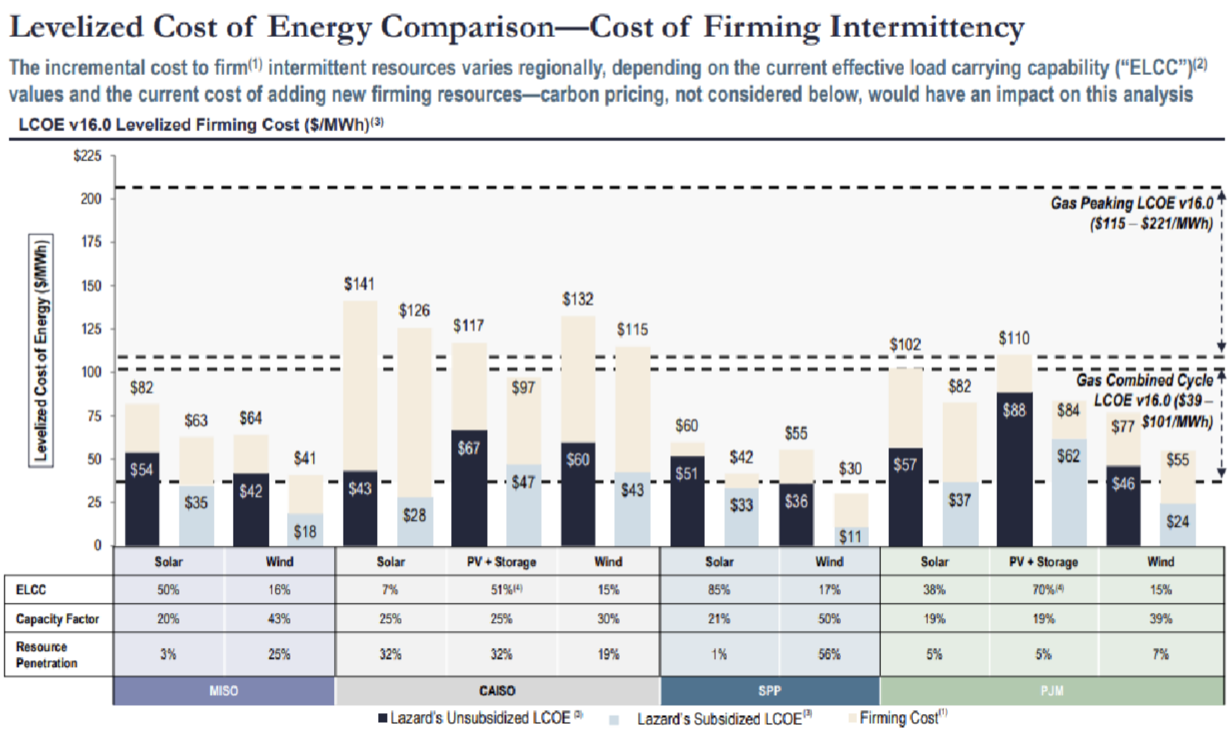

Figure 9: LCOE for wind, solar, and solar plus storage, adjusted for the cost of firming intermittency.
Source: Lazard.[194]

There is also no evidence that solar deployment raises consumers' electricity bills. Retail rates reflect many costs besides generation, including transmission, distribution, fuel, purchased-power costs, capacity costs, storm recovery, utility investment, and rate design. A 2026 Lawrence Berkeley National Laboratory and Brattle Group update found "no obvious

[189] Dan Gearino, Inexpensive Solar Panels Are Essential for the Energy Transition. Here's What's Happening With Prices Right Now, INSIDE CLIMATE NEWS (Jun. 15, 2023), https://insideclimatenews.org/news/15062023/inside-clean-energy-solar-panel-prices-drop/.
[190] U.S. Energy Information Administration, *Federal Financial Interventions and Subsidies in Energy in Fiscal Years 2016–2022* 3–4 (Aug. 2023), https://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf.
[191] LAZARD, supra note 181, at 8. California is the exception, where the subsidized and unsubsidized LCOE of solar exceeds that of gas combined cycle when factoring in firming costs. Id.
[192] *Id.*
[193] Shreeyashi Ojha, *Solar PV and Storage Cost Declines Drive Rapid Fall in 'Firm LCOE,' Says IRENA*, PV Tech (May 6, 2026), https://www.pv-tech.org/solar-pv-and-storage-cost-declines-drive-rapid-fall-in-firm-lcoe-says-irena/
[194] *Id.* Reproduced with permission.

correlation" between higher retail price increases and higher levels of wind and solar deployment from 2019 to 2025. The study thus concluded that the deployment of market-based wind and solar "do not appear to have increased prices in recent years."[195] In fact, increasing the amount of solar energy resources on the grid can actually reduce wholesale electricity prices, for example, when it displaces higher-cost marginal generation; LBNL found that wind and solar growth reduced average annual wholesale prices in organized U.S. markets, although natural gas prices had the largest effect.[196] Because solar has no fuel cost, it can reduce exposure to volatile natural gas prices, which LBNL identified as one contributor to retail price changes in 21 states in 2025.[197]

False Claim #12: Solar panels don't work in cloudy or cold climates.

"A cloud goes over and solar plummets"[198]

Solar panels generate energy even in cloudy or cold conditions.[199] Although cloudy weather may reduce power generation by more than 45% when compared to total generation in non-cloudy weather, substantial energy can still be generated during cloudy conditions.[200] Indeed, solar panels work well in both direct and indirect sunlight, and certain cloud conditions can even temporarily increase the amount of light reaching solar panels through "cloud lensing" — a natural phenomenon in which high-altitude frozen water crystals refract and focus sunlight, creating a temporary boost in solar energy.[201]

Furthermore, while the reduction in sunlight during the winter months significantly reduces solar generation, colder temperatures themselves generally do not reduce electricity output—and can actually increase solar panel efficiency by increasing voltage.[202] Crystalline silicon cells, which comprise approximately 84% of the U.S. market, and cadmium telluride cells, which comprise approximately 16% of the U.S. market, actually perform better in colder temperatures.[203] Only amorphous silicon cells, which represent a negligible percentage of the U.S market, experience decreased performance in colder temperatures.[204]

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[195] Lawrence Berkeley National Laboratory & The Brattle Group, *Retail Electricity Price Trends and Drivers: Data Update—2026 Edition* 3, 11–15, 29–31 (Apr. 2026), https://eta-publications.lbl.gov/sites/default/files/2026-03/retail_price_trends_2026_edition.pdf

[196] Andrew D. Mills et al., Lawrence Berkeley National Laboratory, *Impact of Wind, Solar, and Other Factors on Wholesale Power Prices: An Historical Analysis—2008 through 2017* (Nov. 2019), https://emp.lbl.gov/publications/impact-wind-solar-and-other-factors

[197] *Id.*

[198] Brian Gitt, Solar's Dirty Secrets: How Solar Power Hurts People and the Planet, ATOMIC INSIGHTS (Feb. 24, 2022), https://atomicinsights.com/solars-dirty-secrets-how-solar-power-hurts-people-and-the-planet/. [See comment from Chris Morris, March 17, 2022 at 2:23 AM].

[199] What happens to solar panels when it's cloudy or raining?, SOLAR ENERGY INDUSTRIES ASSOCIATION, https://www.seia.org/initiatives/what-happens-solar-panels-when-its-cloudy-or-raining (last visited March 25, 2024); Makbul A.M. Ramli et al., On the investigation of photovoltaic output power reduction due to dust accumulation and weather conditions, 99 RENEWABLE ENERGY 836, 843 (2016), https://doi.org/10.1016/j.renene.2016.07.063.

[200] Ramli et al., supra note 199, at 843.

[201] National Environmental Satellite, Data, and Information Service, National Oceanic and Atmospheric Administration, *How Do Clouds Affect Solar Energy?*, https://www.nesdis.noaa.gov/about/k-12-education/atmosphere/how-do-clouds-affect-solar-energy (last visited June 18, 2026).

[202] Pranjal Sarmah et al., Comprehensive Analysis of Solar Panel Performance and Correlations with Meteorological Parameters, 8 ACS OMEGA 47897, 47900 (2023), https://doi.org/10.1021/acsomega.3c06442; George Makrides et al., Temperature and thermal annealing effects on different photovoltaic technologies, 43 RENEWABLE ENERGY 407, 407-411 (2012), https://www.sciencedirect.com/science/article/pii/S0960148111006483.

[203] See Makrides et al., supra note 201, at 410-411; Solar Photovoltaics: Supply Chain Deep Dive Assessment, U.S. Dep't of Energy, Feb. 24, 2022, at iii, https://perma.cc/8XYH-TP72 (archived Feb. 25, 2025).

[204] See Makrides et al., supra note 201, at 407, 411; Solar Photovoltaics: Supply Chain Deep Dive Assessment, U.S. Dep't of Energy, supra note 187, at iii.

False Claim #13: Solar energy is unreliable and requires 100% fossil fuel backup.

"[S]olar plants require 100% back up all the time by fossil fuels."[205]

Complete reliance on solar generation, without other sources of power generation, energy storage, or other grid flexibility resources,[206] would pose intermittency challenges. However, an increasing number of planned solar projects are set to include an energy storage component,[207] and solar, wind, and storage together can provide the majority of the country's electricity without compromising reliability.[208]

When a local service area does face diminished solar capacity, for instance during a cloudy day, wind and other renewable sources, as well as battery storage and long-distance transmission that carries power from sunnier regions can supplement energy supply, ensuring reliable electricity supply.[209] As a result, increased reliance on solar energy need not require the construction of new natural gas plants for backup.[210] The DOE's 2021 "Solar Futures Study," for example, outlines three distinct decarbonization scenarios, each of which assumes both a massive increase in renewable energy generation and decrease in natural gas.[211] Under the "business as usual" reference scenario, natural gas, oil, and steam together decrease from roughly 39% of U.S. annual electricity generation in 2020 to roughly 31% by 2035/2036 and 30% by 2049/2050; under the same scenario, solar PV increases from roughly 3.4% in 2020 to 17.6% by 2035/2036 and 27.3% by 2049/2050.[212] Under the two non-reference decarbonization scenarios assessed in the studies, natural gas, oil, and steam shrink to roughly 4.7%-5.2% of annual electricity generation by 2035/2036 and 0% by 2049/2050; solar PV, meanwhile, increases to between 36.9% and 42.2% by 2035/2036 and to between 40.1% and 44.8% by 2049/2050.[213] Princeton University's Net-Zero America study, which assesses pathways to achieving net-zero greenhouse gas (GHG) emissions by 2050, likewise foresees significant reductions in fossil fuel consumption and generation, even when maintaining 500-1,000 GW of firm generating capacity to ensure reliability.[214] Across the suite of assessed net-zero scenarios, the study assumes that all thermal coal production and consumption will cease by 2030, oil production will decline between 25% to 85% by 2050, and natural gas production will decline between 20% and 90% by 2050.[215]

California has already increased solar energy generation while decreasing natural gas utilization. In 2012, in-state solar PV and solar thermal generated less than 2,000 GWh of electricity, while natural gas generated more than 121,000 GWh. By

[205] Solar Energy Is Unreliable, CITIZENS FOR RESPONSIBLE SOLAR, https://perma.cc/C8MS-QEUE (archived Feb. 25, 2025).

[206] Amory Lovins has identified eight "grid flexibility" resources that can substitute for bulk storage or fossil fuel backup: (1) efficient use, which reduces peak load; (2) flexible demand; (3) modern forecasting; (4) diversifying variable renewables; (5) integration with dispatchable alternatives and cogeneration; (6) distributed or managed thermal storage; (7) distributed electrical storage; and (8) hydrogen. Amory B. Lovins, Reliably integrating variable renewables: Moving grid flexibility resources from models to results, 30 ELECTRICITY J. 58, 58-61 (2017), https://www.sciencedirect.com/science/article/pii/S1040619017302889?via%3Dihub.

[207] JOSEPH RAND ET AL., QUEUED UP: CHARACTERISTICS OF POWER PLANTS SEEKING TRANSMISSION INTERCONNECTION AS OF THE END OF 2021 at 13 (Berkely Lab 2022), https://eta-publications.lbl.gov/sites/default/files/queued_up_2021_04-13-2022.pdf.

[208] See Eric Larson et al., supra note 115, at 88 (noting that, "[t]o ensure reliability, all cases maintain 500-1,000 GW of firm generating capacity through all years," compared to 7,400-9,900 GW for wind and solar in net-zero scenarios for 2050).

[209] Robert Fares, Renewable Energy Intermittency Explained: Challenges, Solutions, and Opportunities, Scientific America (Mar. 11, 2015), https://blogs.scientificamerican.com/plugged-in/renewable-energy-intermittency-explained-challenges-solutions-and-opportunities/; Mark Jacobson, Renewable Energy's Intermittency is Not a Showstopper, AM. PHYSICAL SOC'Y. (Apr. 20, 2022), https://physics.aps.org/articles/v15/54.

[210] The 2035 Report: Plummeting Solar, Wind, and Battery Costs Can Accelerate our Clean Electricity Future, U. CAL. BERKELEY GOLDMAN SCH. PUB. POL'Y, 4 (2020), https://cta-redirect.hubspot.com/cta/redirect/6000718/8a85e9ea-4ed3-4ec0-b4c6-906934306ddb.

[211] U.S. Dep't. Energy Solar Energy Technologies Office, Solar Futures Study, supra note 113, at 215.

[212] *Id.*

[213] *Id.*

[214] Larson et al., supra note 115, at 88, 261.

[215] *Id.* at 261.

2024, in-state solar PV and solar thermal generation had increased to more than 52,000 GWh, while in-state natural gas generation had declined to about 86,000 GWh. In California's total power mix, solar accounted for 21.30% in 2024, while natural gas accounted for 34.01%, and total non-GHG and renewable resources accounted for 62.23%.[216] More recently, EIA found that utility-scale solar generation in CAISO surpassed natural gas generation during the first five months of 2026, while natural gas generation decreased 60% compared with the same period in 2024. EIA also found that CAISO battery storage discharge tripled over the same period.[217]

Elsewhere in the United States, energy experts have asserted that Texas's and California's widespread adoption of solar generation helped prevent outages when electricity usage spiked during a recent summer heatwave.[218] And although the reliability of solar and wind energy was questioned following Texas' widespread power outages in the winter of 2021, Texas' grid failure was primarily caused by freezing natural gas infrastructure, rather than failures at solar and wind farms, though nuclear, coal, and wind also experienced disruptions at a smaller scale.[219]

Energy storage will also play an important role in achieving decarbonization while improving energy reliability. The DOE's "Solar Futures Study" forecasts that an additional 60 GW per year of storage will be needed to achieve decarbonization.[220] Fortunately, storage deployment has grown rapidly. American Clean Power and Wood Mackenzie reported that the United States installed 18.9 GW of battery energy storage systems in 2025, a 52% increase over 2024, with more than 50 GW of cumulative storage installed since 2019.[221] In addition, research on storage technologies has experienced significant breakthroughs in recent years. For example, sodium-ion batteries have emerged as a possible alternative to lithium-ion batteries, with sodium a much more abundant and less expensive material.[222] Researchers are likewise developing more efficient utility-scale methods for storing solar energy.[223]

Other researchers have highlighted energy efficiency and grid flexibility mechanisms that can complement and support solar and wind without the need for one-for-one fossil fuel backup or even bulk, utility-scale energy storage.[224] These include integrative design practices to reduce the energy demands of buildings and other sectors; demand flexibility and demand response mechanisms to compensate customers for reduced energy use during peak hours; and distributed thermal and electrical storage.[225]

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[216] California Energy Commission, 2024 Total System Electric Generation, https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2024-total-system-electric-generation.

[217] U.S. Energy Information Administration, Solar Generation in CAISO Surpassed Natural Gas in the First Five Months of 2026, June 16, 2026, https://www.eia.gov/todayinenergy/detail.php?id=67784.

[218] See E&E News & Benjamin Storrow, Solar Power Bails Out Texas Grid During Major Heat Wave, SCIENTIFIC AMERICAN, June 26, 2023, https://www.scientificamerican.com/article/solar-power-bails-out-texas-grid-during-major-heat-wave/; Romany Webb, *California Blackouts Highlight Need to Better Plan for Climate Impacts*, Climate L. Blog (Oct. 12, 2020), https://blogs.law.columbia.edu/climatechange/2020/10/12/california-blackouts-highlight-need-to-better-plan-for-climate-impacts/.

[219] Joshua W. Busby et al., Cascading risks: Understanding the 2021 winter blackout in Texas, 77 ENERGY RESEARCH AND SOCIAL SCIENCE 102106, 1-4 (2021), https://www.sciencedirect.com/science/article/pii/S2214629621001997; Adriana Usero & Salvador Rizzo, 'Frozen windmills' aren't to blame for Texas's power failure, WASH. POST, Feb. 18, 2021, https://www.washingtonpost.com/politics/2021/02/18/frozen-windmills-arent-blame-texass-power-failure-neither-is-green-new-deal/; Dionne Searcey, No, Wind Farms Aren't the Main Cause of the Texas Blackouts, N.Y. TIMES, Feb. 17, 2021 (updated May 3, 2021), https://www.nytimes.com/2021/02/17/climate/texas-blackouts-disinformation.html.

[220] U.S. Dep't. Energy Solar Energy Technologies Office, Solar Futures Study, supra note 113 at 33.

[221] American Clean Power Association, U.S. Energy Storage Monitor, Mar. 24, 2026, https://cleanpower.org/resources/u-s-energy-storage-monitor/.

[222] Karyn Hede, Longer Lasting Sodium-Ion Batteries on the Horizon, Pac. Nw. Nat'l. Lab'y. (Jul. 13, 2022), https://perma.cc/7G6K-5ENQ (archived Feb. 25, 2025)

[223] Robert Armstrong et al., The Future of Energy Storage: An Interdisciplinary MIT Study, MASS. INST. TECH. (Jun. 3, 2022), https://energy.mit.edu/wp-content/uploads/2022/05/The-Future-of-Energy-Storage.pdf.

[224] Amory B. Lovins, Reliably integrating variable renewables: Moving grid flexibility resources from models to results, supra note 206, at 58-61.

[225] *Id.*; Amory B. Lovins, How big is the energy efficiency resource?, 13 ENVT'L R. LETTERS at 1-14 (2018), https://iopscience.iop.org/article/10.1088/1748-9326/aad965; Amory B. Lovins & M. V. Ramana, Three Myths About Renewable

Finally, while solar energy is intermittent, multiple studies have highlighted that the panels themselves are highly reliable, with low degradation and failure rates, thus rarely requiring repair and replacement.[226] A study by NREL (now known as the National Laboratory of the Rockies) found that the median failure rate for panels installed between 2000 and 2015 was five out of 10,000 annually, a rate of 0.05%.[227] Researchers have described the failure rate of residential PV inverters as "acceptable, even good," with an inverter typically needing to be replaced only once in the lifetime of a PV system.[228]

False Claim #14: 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.'"[229]

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 infrastructure.[230] 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."[231] 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 cells."[232] Other analyses suggest that global mineral resources are likely sufficient to meet long-term demand across all energy transition sectors, including EVs and transmission.[233]

Energy and the Grid, Debunked, YALE ENV'T 360, Dec. 9, 2021, https://e360.yale.edu/features/three-myths-about-renewable-energy-and-the-grid-debunked.

226 Dirk C. Jordan et al., Photovoltaic failure and degradation modes, 25 PHOTOVOLTAICS RES. AND APPLICATIONS 318, 324 (2017), https://doi.org/10.1002/pip.2866; Dirk C. Jordan et al., PV field reliability status—Analysis of 100 000 solar systems, 28 PHOTOVOLTAICS RESEARCH AND APPLICATIONS 739, 747 (2020), https://doi.org/10.1002/pip.3262.

227 *Id.* at 324.

228 Emiliano Bellini, Survey shows 34.3% failure rate for residential inverters over 15 years, PV MAGAZINE, Feb. 8, 2023, https://www.pv-magazine.com/2023/02/08/survey-shows-34-3-failure-rate-for-residential-inverters-over-15-years/ (discussing Christof Bucher et al., Life Expectancy of PV Inverters and Optimizers in Residential PV Systems, BERN UNIVERSITY OF APPLIED SCIENCES, 2022, https://www.bfh.ch/dam/jcr:5bfd5c32-f70f-4bf6-8d60-fdab6094e164/2022_09_WCPEC-8_3DV.1.46_-_Life_Expectancy_of_PV_inverters.pdf).

229 Not Enough Rare Metals to Scale Up Solar Power, ENERGYSKEPTIC.COM (Feb. 21, 2021), https://energyskeptic.com/2021/solar-pv-cells-using-rare-elements-unlikely-to-scale-up-enough-to-replace-fossil-fuels/.

230 Seaver Wang et al., Future demand for electricity generation materials under different climate mitigation scenarios, 7 JOULE 309, 315 (Feb. 2023), https://www.cell.com/joule/pdfExtended/S2542-4351(23)00001-6; see also Seth Borenstein, Study: Enough rare earth minerals to fuel green shift, ASSOCIATED PRESS, Jan. 27, 2023, https://apnews.com/article/science-green-technology-climate-and-environment-renewable-energy-141761657a8e7a5627a0e49e601dd48e.

231 Wang et al., Future demand for electricity generation materials under different climate mitigation scenarios, supra note 230, at 320.

232 Byproduct Mineral Commodities Used for the Production of Photovoltaic Cells, US GEOLOGIC SURVEY (2010), 2, https://pubs.usgs.gov/circ/1365/Circ1365.pdf.

233 MATERIAL AND RESOURCE REQUIREMENTS FOR THE ENERGY TRANSITION, ENERGY TRANSITIONS COMMISSION (2023), https://www.energy-transitions.org/wp-content/uploads/2023/08/ETC-Materials-Report_highres-1.pdf; 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, https://www.sustainabilitybynumbers.com/p/transition-mineral-demand-part-one. 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, https://unece.org/sites/default/files/2023-02/1.%20Simon%20Michaus-Challenges%20and%20Bottlenecks%20for%20the%20Green%20Transition.pdf. It also bears noting that the long-term sufficiency of

In addition, as noted previously, innovations in recycling solar panels[234] can potentially reduce future requirements for individual raw materials.[235] 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 panels.[236] There is strong federal policy support for domestic critical mineral supply chains, though the specific policy framework has shifted over time. Earlier laws, including the 2021 Infrastructure Investment and Jobs Act and the 2022 Inflation Reduction Act, provided support for domestic critical mineral development.[237] For example, the IIJA provided billions of dollars for domestic battery-material processing, manufacturing, and recycling, while the IRA created tax incentives for domestic production and processing of critical minerals.[238] The OBBA modified the IRA to limit federal support, including accelerating the phase out of the IRA's critical-mineral production tax credit.[239] Nevertheless, some federal support for domestic mining, processing, recycling, and manufacturing remains. In 2025, for example, the DOE announced nearly $1 billion in funding opportunities (appropriated pursuant to the IIJA) to advance critical minerals and materials supply chains in the United States .[240]

global mineral resources does not imply an absence of ethical, economic, and environmental challenges in extracting those resources. See ENERGY TRANSITIONS COMMISSION, supra note 233, 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, https://www.sustainabilitybynumbers.com/p/transition-mineral-demand-part-two.

[234] See Drew Mays, Future of Solar Panel Recycling, INNOVATE ENERGY GROUP, July 6, 2023, https://www.ieg.solutions/post/the-future-of-solar-panel-recycling.

[235] Wang et al., Future demand for electricity generation materials under different climate mitigation scenarios, supra note 230, at 320.

[236] Jon Hurdle, As Millions of Solar Panels Age Out, Recyclers Hope to Cash In, YALE ENV'T 360 (Feb. 28, 2023), https://e360.yale.edu/features/solar-energy-panels-recycling.

[237] Oscar Serpell, Impacts of the Inflation Reduction Act on Rare Earth Elements, KLEINMAN CENTER FOR ENERGY POLICY (Sep. 24, 2022), https://kleinmanenergy.upenn.edu/news-insights/impacts-of-the-inflation-reduction-act-on-rare-earth-elements/

[238] Jack Andreasen Cavanaugh et al., Assessing the Energy Impacts of the One Big Beautiful Bill Act, Ctr. on Glob. Energy Pol'y at Columbia Univ. SIPA (July 14, 2025), https://www.energypolicy.columbia.edu/assessing-the-energy-impacts-of-the-one-big-beautiful-bill-act/.

[239] *Id.*

[240] U.S. Department of Energy, Energy Department Announces Actions to Secure American Critical Minerals and Materials Supply Chain, Aug. 13, 2025, https://www.energy.gov/articles/energy-department-announces-actions-secure-american-critical-minerals-and-materials-supply.

PART B: FALSE CLAIMS ABOUT WIND ENERGY

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False Claim #15: Electromagnetic radiation from wind turbines poses a threat to human health.

> "Recently, concerns about exposure to EMF from wind turbines, and associated electrical transmissions, have been raised at public meetings and legal proceedings."[241]

Multiple studies have found that the electromagnetic fields (EMFs) generated by wind turbines are lower than those generated by most common household appliances and that they easily meet rigorous international safety standards.[242] For context, the average home that is not located near power lines has a background level EMF of roughly 0.2 μT.[243] However, this value varies greatly depending on proximity to certain household appliances.[244] For example, from a distance of 4 feet, an electric can opener's EMF is 0.2 μT, but this value increases to 60 μT from a distance of 6 inches.[245] A 2020 academic study found that the EMF generated by turbines are approximately 0.44 μT at a distance of 1 meter but less than 0.1 μT at a distance of 4 meters, as shown below.[246]

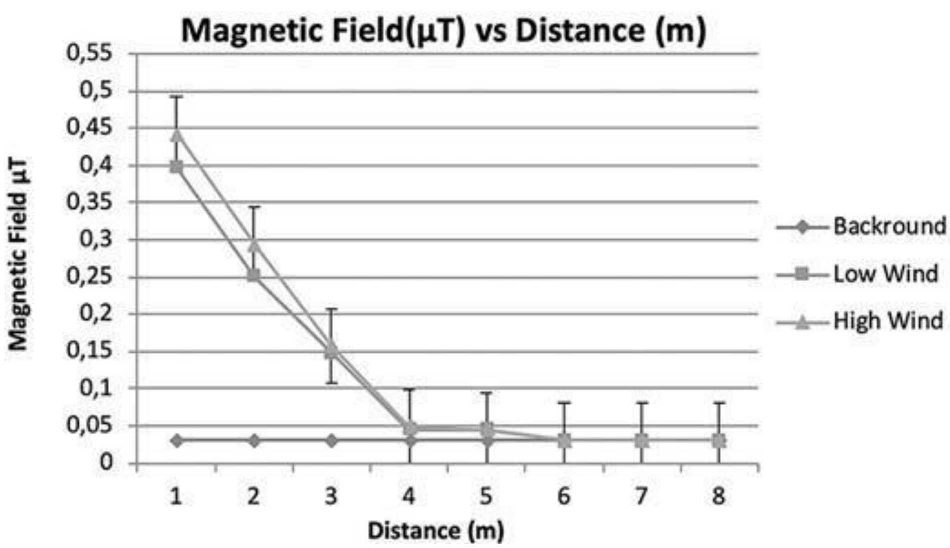

Figure 10: The EMF level, measured in microtesla (μT), is shown to drop dramatically with increase in distance from source.
Source: Alexias et al.[247]

[241] OHIO DEPARTMENT OF HEALTH, WIND TURBINES AND WIND FARMS: SUMMARY AND ASSESSMENTS at 8 (Apr. 12, 2022), https://odh.ohio.gov/wps/wcm/connect/gov/816f89dc-767f-4f08-8172-71c953b8ee02/ODH+Wind+Turbines+and+Farms+Summary+Assessment_2022.04.pdf?MOD=AJPERES.
[242] Lindsay C. McCallum et al., Measuring Electromagnetic Fields (EMF) Around Wind Turbines in Canada: Is there a Human Health Concern?, 13 ENV'T. HEALTH 1, 9 (2014), https://doi.org/10.1186/1476-069x-13-9; Aris Alexias et al., Extremely Low Frequency Electromagnetic Field Exposure Measurement in the Vicinity of Wind Turbines, 189 RADIATION PROTECTION DOSIMETRY 395, 397 (2020), https://doi.org/10.1093/rpd/ncaa053; Nektarios Karanikas et al., Occupational health hazards and risks in the wind industry, 7 ENERGY REP. 3750, 3752 (2021), https://doi.org/10.1016/j.egyr.2021.06.066.
[243] Radiation: Electromagnetic fields, WORLD HEALTH ORGANIZATION (August 4, 2016), https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields.
[244] *Id.*
[245] Electromagnetic Fields (EMF), WIS. DEP'T. OF HEALTH SERV. (Sept. 14, 2022), https://www.dhs.wisconsin.gov/air/emf.htm.
[246] Alexias et al., supra note 238, at 397.
[247] *Id.*

These EMF levels are not dependent on wind speeds.[248]

False Claim #16: Wind turbines frequently fall over, and blades or other components easily break off, threatening human health and safety.

> "There are many health hazards associated with living near turbines as a result of . . . broken flying blades."[249]

Turbine collapse or breakage are extremely rare, and utility-scale wind turbines are fitted with safety mechanisms to survive extreme weather conditions, such as hurricanes.[250] Turbine blade breakage does not pose a significant threat to humans.[251] The DOE has noted that, although the risk of turbine blades becoming detached during operation "was a concern in the early years of the wind industry," such failures "are virtually impossible with modern turbines due to improved engineering and the use of hazard sensors."[252] Turning to all turbine blade failures, rather than just turbine blade detachment, a 2015 study found that wind turbine blades fail at a rate of approximately 0.54% per year globally.[253] The DOE has further reported that "catastrophic wind turbine failures . . . are considered rare events with fewer than 40 incidents identified in the modern turbine fleet of more than 40,000 turbines installed in the United States as of 2014."[254]

When looking at deaths per terawatt-hour of energy produced, the mortality rate from wind energy pales in comparison to the rate associated with fossil fuels. Brown coal causes 32.72 human deaths per terawatt-hour of energy produced, while black coal cause 24.6 human deaths, oil causes 18.4 human deaths, natural gas causes 2.8 human deaths, and wind energy causes only 0.04 human deaths.[255]

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248 *Id.* at 398.

249 No Wind Turbines! Get the Facts!, SAVE PIATT COUNTY, https://web.archive.org/web/20240901083314/http://www.savepiattcounty.org/ (archived Sept. 1, 2024).

250 How do wind turbines survive severe storms?, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY, (June 20, 2017), https://perma.cc/85RN-M454 (archived Feb. 25, 2025).

251 M. McGugan et al., Damage Tolerance and Structural Monitoring for Wind Turbine Blades. 373 PHIL. TRANSACTIONS ROYAL SOC'Y A, 4 (2015), https://doi.org/10.1098/rsta.2014.0077.

252 Wind Energy Projects and Safety, Dep't of Energy, https://perma.cc/3GA4-SGJQ (archived Feb. 25, 2025); Riley Rourke & Mike Sullivan, Wind Turbine Blade Breaks Off in Plymouth, Massachusetts, Lands in Cranberry Bog, CBS News (Nov. 9, 2025), https://www.cbsnews.com/boston/news/wind-turbine-blade-falls-off-plymouth-massachusetts/.

253 GCube Insurance Services, Inc. GCube report: breaking blades: global trends in wind turbine downtime events (2015), summarized in Xiao Chen, A Critical Review of Damage and Failure of Composite Wind Turbines Blade Structures, IOP CONFERENCE SERIES: MATERIALS SCI. AND ENGINEERING (2020), at 4, https://iopscience.iop.org/article/10.1088/1757-899X/942/1/012001/pdf.

254 Wind Vision: A New Era for Wind Power in the United States, U.S. DEPARTMENT OF ENERGY, 105 (2015), https://perma.cc/4RFC-TRK8 (archived Feb. 25, 2025).

255 Hannah Ritchie, What are the safest and cleanest sources of energy?, supra note 14. To the extent that wind-related fatalities tend to occur disproportionately during the construction phase, this analysis may overstate the fatalities per terawatt-hour of wind, which would be expected to decline over time. See Benjamin K. Sovacool et al., Balancing safety with sustainability: assessing the risk of accidents for modern low-carbon energy systems, 112 Journal of Cleaner Production 3952, 3960, Jan. 20, 2016, https://www.sciencedirect.com/science/article/pii/S0959652615009877 (showing in Table 5 that most wind-related deaths occurred during construction).

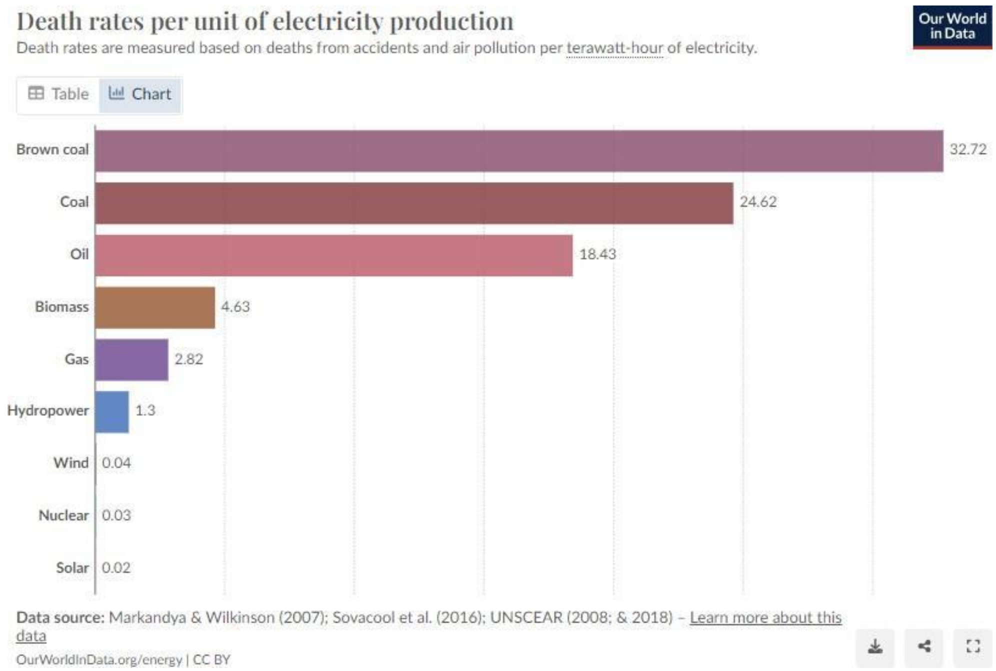

Figure 11: Death rates per unit of electricity production.
Source: Hannah Ritchie, Our World in Data.[256]

False Claim #17: Low-frequency noise from wind turbines harms human health and causes "wind turbine syndrome."

> "As wind turbines spring up like mushrooms around people's homes, Wind Turbine Syndrome has become an industrial plague."[257]

The weight of the evidence does not support the claim that low-frequency noise or infrasound from wind turbines directly causes "wind turbine syndrome" or other specific adverse health effects.[258] Individual cases of sleep disturbance among

[256] *Id.*

[257] Calvin Luther Martin, Your Guide to Wind Turbine Syndrome…A Roadmap to this Complicated Subject, NATIONAL WIND WATCH (July 2010), https://docs.wind-watch.org/WTSguide.pdf.

[258] Nathaniel Marshall et al., The Health Effects of 72 Hours of Simulated Wind Turbine Infrasound: A Double-Blind Randomized Crossover Study in Noise-Sensitive, Healthy Adults, 131 ENV'T HEALTH PROSPECTIVE, 1 (2023), https://doi.org/10.1289/EHP10757; Jenni Radun et al., Health Effects of Wind Turbine Noise and Road Traffic Noise on People Living Near Wind Turbines, 157 RENEWABLE & SUSTAINABLE ENERGY REV., 10 (2022), https://doi.org/10.1016/j.rser.2021.112040; Irene van Kamp et al., Health Effects Related to Wind Turbine Sound: An Update, 18 INT'L J. ENV'T RSCH & PUB. HEALTH, (2021), https://doi.org/10.3390%2Fijerph18179133; Wind Energy Technologies Office, Frequently Asked Questions about Wind Energy, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY, https://perma.cc/26AV-QBSV (archived Feb. 25, 2025); Jesper Schmidt et al., Health Effects Related to Wind Turbine Noise Exposure: A Systematic Review, 9 PLOS ONE, (2014), https://doi.org/10.1371/journal.pone.0114183; NHMRC Statement: Evidence on Wind Farms and Human Health, NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL (NHMRC), AUSTRALIAN GOVERNMENT, 1 (2015), https://www.nhmrc.gov.au/file/19045/download?token=0IAl7MHu; Tracy Merlin et al., Systematic review of the human health effects of wind farms, NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL, 2013, https://www.livingstoncounty-il.org/wordpress/wp-content/uploads/2015/01/PR-Ex.-281-2014-NHMRC-Australia.pdf; but see Richard R. James, Wind Turbine Infra and Low-Frequency Sound: Warning Signs That Were Not Heard, 32 BULLETIN OF SCIENCE, TECHNOLOGY, AND SOCIETY, 2012, https://journals.sagepub.com/doi/abs/10.1177/0270467611421845 (analyzing "historical evidence about what was known regarding infra and low-frequency sound from wind turbines and other noise sources during the period from the 1970s through the end of the 1990s" to conclude that wind energy may be causing adverse impacts to some people living near wind turbines); Anne Dumbrille et al., Wind turbines and adverse health effects: Applying Bradford Hill's criteria for causation, 6 ENVIRONMENTAL DISEASE 109, 2021, at 65,

people living in proximity to new wind turbines are more likely the result of annoyance about the presence of those turbines rather than inaudible noise emanating from them.[259]

A comprehensive 2026 study analyzed spatial wind turbine data from 2011–2023 against longitudinal health surveys from over 120,000 households and consumer spending records.[260] The study found "no detectable adverse health effects from turbine exposure at typical exposure distances," and "no detectable effects at typical exposure distances on insomnia and sleep problems, depression, anxiety, headaches, or related purchases."[261]

Another earlier study looked at complaints filed in relation to 51 Australian wind farms from 1993 to 2012.[262] Prior to 2009, complaints related to health and noise were rare, despite the fact that many small and large wind farms were already in operation.[263] However, following the coining of the phrase "wind turbine syndrome" in a self-published book that year, there was a dramatic spike in complaints.[264]

False Claim #18: Shadow flicker from wind turbines can trigger seizures in people with epilepsy.

> "Wind farms are more than just an eyesore. They can cause epileptic fits."[265]

Even at its peak, shadow flicker from wind turbines typically remains far weaker than what is known to trigger seizures in people with epilepsy.[266]

A 2021 academic study found that wind turbines operate between 0.5 to 1 Hz, much lower than the threshold frequency of 3 Hz typically required to cause a seizure.[267] Similarly, a 2012 report prepared for the Massachusetts Department of Environmental Protection found that shadow flicker frequencies from wind turbines are "usually in the range of 0.3–1.0 Hz, which is outside of the range of seizure thresholds according to the National Resource Council and the Epilepsy Foundation."[268] If shadow flicker were to reach 3 Hz, the probability of causing a seizure in a member of the photosensitive population would be approximately 1.7/100,000.[269]

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https://journals.lww.com/endi/fulltext/2021/06030/wind_turbines_and_adverse_health_effects applying.1.aspx (concluding that, while "[i]ncontrovertible proof of causation has tended to be an elusive goal," when a lower standard of causality is applied, "recurring sleep disturbance, anxiety, and stress" can be attributed to industrial wind turbines).

259 Irene van Kamp et al., supra note 259. A front-page newspaper article from 2015 that attempted to infer a direct causal relationship between turbine-related infrasound and human health impacts based on the findings of a non-peer-reviewed study was widely criticized. See Jacqui Hoepner & Will J Grant, Wind turbine studies: how to sort the good, the bad, and the ugly, Conversation, Jan. 21, 2015, https://theconversation.com/wind-turbine-studies-how-to-sort-the-good-the-bad-and-the-ugly-36548; Ketan Joshi, Windfarm weirdness syndrome is real. Just look at our national 'debate', Guardian, Feb. 23, 2015, https://www.theguardian.com/environment/2015/feb/23/windfarm-study-author-threatens-to-sue-media-watch-for-misrepresentation.

260 Niklas Rott, Douglas Almond & Osea Giuntella, *Wind Turbine Proximity and Health: Longitudinal Evidence from U.S. Households*, 123 Proc. Nat'l Acad. Sci. e2525715123 (2026).

261 *Id.*

262 Fiona Crichton et al., The Link between Health Complaints and Wind Turbines: Support for the Nocebo Expectations Hypothesis, 2 Frontiers Publ. Health, 2-3 (2014), https://doi.org/10.3389/fpubh.2014.00220.

263 *Id.*

264 *Id.*

265 Wind Turbines Can Trigger Epileptic Fits and Seizures, Say Scientists, Daily Mail (Apr. 9, 2008), https://www.dailymail.co.uk/news/article-562841/Wind-turbines-trigger-epileptic-fits-seizures-say-scientists.html.

266 Wind Energy Technologies Office, Frequently Asked Questions about Wind Energy, supra note 258.

267 Nektarios Karanikas et al., Occupational Health Hazards and Risks in the Wind Industry, 7 Energy Rep. 3750, 3752-3753 (2021), https://doi.org/10.1016/j.egyr.2021.06.066.

268 Wind Turbine Health Impact Study: Report of Independent Expert Panel, Massachusetts Department of Environmental Protection, 36 (2012), https://www.mass.gov/doc/wind-turbine-health-impact-study-report-of-independent-expert-panel/download.

269 *Id.*

Additional public-health studies have likewise found that wind turbines do not cause seizures.[270] Wind turbines with three blades, for example, would need to rotate at a speed of 60 rpm to cause a seizure.[271] However, modern turbines typically operate at maximum speeds between 15 and 17 rpm, depending on model, well below the 60 rpm threshold.[272]

False Claim #19: Wind turbines are a major threat to birds and bats.

> "The evidence is clear . . . that wind turbines present yet another threat to the lives of birds and bats."[273]

According to the National Audubon Society, two-thirds of all North American bird species are at heightened risk of extinction due to climate change.[274] Wildfires will destroy the nesting grounds of many species,[275] while extreme heatwaves will render their typical habitats uninhabitable.[276] For example, the American Goldfinch is projected to lose 65% of its range under a scenario of 3 degrees Celsius global warming, while the Allen's Hummingbird is projected to lose 64% of its range.[277]

By contrast, wind power is a relatively minor source of mortality for birds. The U.S. Fish and Wildlife Service has estimated that, throughout the United States, cats kill an average of 2.4 billion birds per year, and collisions with building glass kill an average of 599 million birds, while wind turbines kill an average of 234,000 birds per year.[278] Collisions with electrical lines cause an average of 25.5 million deaths per year, a number that could grow with the construction of new transmission lines to connect wind projects (and other renewables) to the grid.[279] These mortality figures rely on studies dating back to 2013 or 2014 and may be outdated due to the fact that there were fewer wind turbines 10 years ago than there are today.[280] However, research has found that wind power causes far fewer bird deaths than fossil fuels per unit of energy output, a metric that is not sensitive to the total number of wind turbines installed. While fossil fuels cause 5.2 avian fatalities per GWh, wind turbines cause only 0.3–0.4 avian fatalities per GWh.[281]

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[270] Oleksandr Zaporozhets et al., Environment Impact Assessment for New Wind Farm Developments in Ukraine, in 2022 IEEE 8TH INTERNATIONAL CONFERENCE ON ENERGY SMART SYSTEMS 386, 387 (Institute of Electrical and Electronics Engineers, 2022), https://doi.org/10.1109/ESS57819.2022.9969323; Loren Knopper et al., Wind Turbines and Human Health, 2 FRONTIERS PUBL. HEALTH, 14 (2014), https://doi.org/10.3389/fpubh.2014.00063

[271] Knopper et al., supra note 270, at 14.

[272] *Id.*

[273] FAQ: Impact on Wildlife, NATIONAL WIND WATCH, https://www.wind-watch.org/faq-wildlife.php (last visited March 25, 2024).

[274] Audubon Society, Survival by Degrees: 389 Bird Species on the Brink, NAT'L. AUDUBON SOC'Y., https://www.audubon.org/climate/survivalbydegrees (last visited March 25, 2024).

[275] Audubon Society, How Wildfires Affect Birds, NAT'L. AUDUBON SOC'Y., https://www.audubon.org/news/how-wildfires-affect-birds (last visited March 25, 2024)..

[276] Audubon Society, Survival by Degrees: 389 Bird Species on the Brink, supra note 274.

[277] *Id.*

[278] Threats to Birds, U.S. FISH & WILDLIFE SERVICE, https://perma.cc/Q3MW-AUHH (archived Feb. 25, 2025).

[279] *Id.*

[280] Do wind turbines kill birds? MIT CLIMATE PORTAL (Aug. 17, 2023), https://climate.mit.edu/ask-mit/do-wind-turbines-kill-birds (noting that the cited studies were published in 2013 and 2014, and the numbers are likely to be higher today because more wind farms have been built since then).

[281] Benjamin K. Sovacool, The avian benefits of wind energy: A 2009 update, 49 RENEWABLE ENERGY 19, 19 (2013), https://doi.org/10.1016/j.renene.2012.01.074. Sovacool's 2013 study explains that fossil fuels cause avian fatalities upstream during coal mining, through collision and electrocution with operating plant equipment, and indirectly through acid rain, mercury pollution, and climate change. Id. at 21. The study is based on operating performance in the United States and Europe. Id. at 19. Note that an earlier version of Sovacool's study, published in 2009, was critiqued for conflating birds and bats, among other issues; Sovacool responded directly to these critiques in a 2010 article and addressed many of them in the 2013 version of the study that is cited in this report. See Craig K.R. Willis, et al., Bats are not birds and other problems with Sovacool's (2009) analysis of animal fatalities due to electricity generation, 38 Energy Policy 2067 (2010); Benjamin K. Sovacool, Megawatts are not megawatt-hours and other responses to Willis et al., 38 ENERGY POLICY 2,070 (2010) (responding to critiques raised about an earlier version of the study on the avian benefits of wind energy).

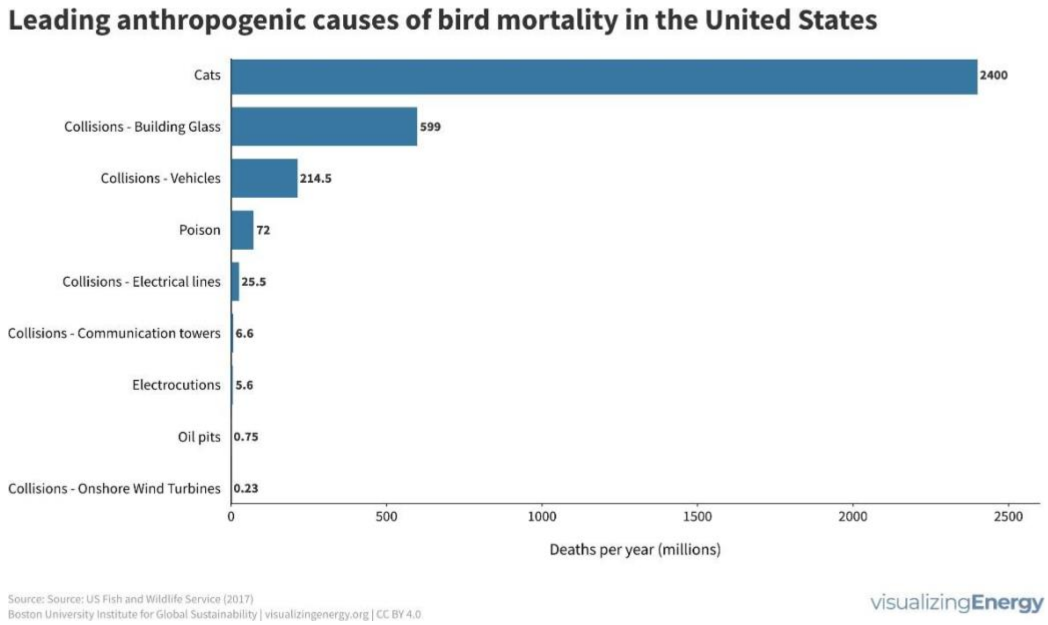

Figure 12: Leading anthropogenic causes of deaths to birds in the United States.
Source: Boston University Institute for Global Sustainability.[282]

The impacts of wind development on certain bat species may be more severe. One study published in 2021 estimated that the population of hoary bats in North America could decline by 50% by 2028 without adoption of measures to reduce fatalities.[283]

However, actionable steps can be taken to reduce bird and bat fatalities from wind turbines. With respect to birds, most deaths occur when turbines are sited near nesting places. Siting facilities to avoid where birds nest, feed and mate, as well as where they stop when migrating, has proved successful at reducing fatalities.[284] In addition, the wind turbine components that pose the greatest risk to birds are the blades and tower.[285] The relatively simple action of painting the tower black has been shown to reduce deaths of ptarmigans (a bird in the grouse family) by roughly 48%,[286] while painting one of the blades black has reduced deaths by 70%.[287] Other successful methods include slowing or stopping turbine motors when vulnerable species are present, in order to reduce the likelihood of collisions.[288] Deployment of this method in Wyoming has contributed to an 80% decline in eagle fatalities.[289] With respect to bats, strategies to minimize fatalities include curtailment (i.e., stopping wind turbines from spinning under certain circumstances), as well as ultrasonic acoustic

[282]Cutler Cleveland et al., Is Wind Energy a Major Threat to Birds?, VISUALIZING ENERGY, Oct. 9, 2023, https://visualizingenergy.org/is-wind-energy-a-major-threat-to-birds/.
[283] Nicholas A. Friedenberg & Winifred F. Frick, Assessing fatality minimization for hoary bats amid continued wind energy development, 262 BIOLOGICAL CONSERVATION, 2021, at 1, https://www.sciencedirect.com/science/article/pii/S000632072100361X; see also Minho Kim, Wind Energy Could Get Safer for Bats with New Research.
[284] Sovacool, The avian benefits of wind energy: A 2009 update, supra note 281, at 19-20.
[285] *Id.* at 23.
[286] Bard G. Stokke et al., Effect of tower base painting on willow ptarmigan collision rates with wind turbines, ECOLOGY AND EVOLUTION, Apr. 29, 2020, https://onlinelibrary.wiley.com/doi/10.1002/ece3.6307.
[287] Roel May et al., Paint it black: Efficacy of increased wind turbine rotor blade visibility to reduce avian fatalities, ECOLOGY & EVOLUTION, July 26, 2020, https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.6592; see also Neel Dhanesha, Can Painting Wind Turbine Blades Black Really Save Birds, AUDUBON MAGAZINE, Sep. 18, 2020, https://www.audubon.org/news/can-painting-wind-turbine-blades-black-really-save-birds..

[288]U.S. Dep't. of Energy Wind Energy Technologies Office, Environmental Impacts and Siting of Wind Projects, U.S. DEP'T OF ENERGY: OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, https://www.energy.gov/eere/wind/environmental-impacts-and-siting-wind-projects (last visited March 25, 2024).
[289]Christopher J.W. McClure et al., Eagle fatalities are reduced by automated curtailment of wind turbines, 58 BRITISH ECOLOGICAL SOC'Y. 446, 450-451 (2021), https://doi.org/10.1111/1365-2664.13831.

deterrents[290] and visual deterrents.[291] In 2022, the U.S. DOE awarded $7.5 million in research grants to study bat deterrent technologies.[292]

Overall, though it remains difficult to eliminate the risk of collisions entirely, wind power can ultimately help to protect bird and bat populations by displacing fossil fuels and mitigating climate change impacts.[293]

False Claim #20: Offshore wind development is harmful to whales and other marine life.[294]

> "Record numbers of endangered whales [are] being killed by windfarms off America's East Coast"[295]

When properly sited, offshore wind farms need not pose a serious risk of harm to whales or other marine life. During installation, the impact from construction noise can be mitigated by implementing seasonal restrictions on certain activities that coincide with whale migration. Once operational, wind turbines generate far less low-frequency sound than ships do, and there is no evidence that noise from turbines causes negative impacts to marine species populations.[296]

There has been considerable attention to how offshore wind development, including noise from pile-driving during construction, affects the critically endangered North Atlantic right whale, which has a total population of roughly 370.[297] But the main causes of mortality for right whales are vessel strikes (75% of anthropogenic deaths) and entanglements in fishing gear—not anything related to offshore wind development.[298] Critically, the National Oceanic and Atmospheric Administration (NOAA) has also found no link between offshore wind surveys or wind project development and whale deaths.[299] Other studies have similarly found "no evidence that offshore wind development in the Northeastern United States played a role in observed patterns of [whale] strandings."[300]

Moreover, any impacts to the North Atlantic right whale can be avoided or greatly minimized through proper planning. For example, in 2019, the developer of the 800-MW Vineyard Wind project entered into an agreement with three environmental organizations, which established seasonal restrictions on pile-driving during construction (to avoid excessive noise when right whales are present), as well as strict limits on vessel speeds during the operational phase (to avoid vessel strikes), among other measures.[301] In the final environmental impact statement for the project, the U.S. Bureau of Ocean Energy Management (BOEM) found that, "[g]iven the implementation of Project-specific measures, BOEM anticipates that vessel strikes as a result of [the project] alone are highly unlikely and that impacts on marine mammal individuals . . . would be

[290] Friedenberg & Frick, supra note 277, at 8.
[291]Chapter 4: Minimizing Collision Risk to Wildlife During Operations: Minimization: Deterrence, RENEWABLE ENERGY WILDLIFE INST. (Dec. 27, 2022), https://rewi.org/guide/chapters/04-minimizing-collision-risk-to-wildlife-during-operations/minimization-deterrence/.
[292]U.S. Dep't. of Energy Wind Energy Technologies Office, DOE Wind Energy Technologies Office Selects 15 Projects Totaling $27 Million to Address Key Deployment Challenges for Offshore, Land-Based, and Distributed Wind, U.S. DEP'T OF ENERGY, Sep. 21, 2023, https://web.archive.org/web/20250122133439/https://www.energy.gov/eere/wind/articles/doe-wind-energy-technologies-office-selects-15-projects-totaling-27-million (archived Jan. 22, 2025).
[293] Audubon Society, Wind Power and Birds, NAT'L. AUDUBON SOC'Y. (Jul. 21, 2020), https://www.audubon.org/news/wind-power-and-birds.
[294] While outside the scope of this report, it bears noting that journalists have uncovered financial connections between fossil fuel interest groups and certain groups alleging that offshore wind development leads to considerable negative impacts on whales. See Marvell, supra note 12.
[295] *See e.g.,* Mike Parker, Record Numbers of Endangered Whales Being Killed by Windfarms Off America's East Coast, EXPRESS, (Sept 2, 2023) https://www.express.co.uk/news/us/1808681/endangered-whales-killed-east-coast-windfarms (capitalization edited to sentence case).
[296]Jakob Tougaard et al., How Loud is the Underwater Noise from Operating Offshore Wind Turbines? 148 J. ACOUSTICAL SOC. OF AMER. 2885, 2888 (2020), https://doi.org/10.1121/10.0002453.
[297] North Atlantic Right Whale, NOAA FISHERIES, https://perma.cc/R37Q-2MHB (archived Feb. 25, 2025).
[298] *Id.*; VINEYARD WIND 1 OFFSHORE WIND PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT Vol. I, March 2023, at 3-95, https://perma.cc/F8AD-CJ32 (archived Feb. 25, 2025).
[299] Frequent Questions – Offshore Wind and Whales, NOAA https://perma.cc/Q8PY-TTEF (archived Jan. 21, 2025).
[300] Lesley H. Thorne & David N. Wiley, *Evaluating Drivers of Recent Large Whale Strandings on the East Coast of the United States*, 38 Conservation Biology e14302 (2024).
[301]Vineyard Wind – NGO Agreement, Jan. 22, 2019, https://www.nrdc.org/sites/default/files/vineyard-wind-whales-agreement-20190122.pdf.

expected to be minor; as such, no population-level impacts would be expected."[302] BOEM also found that project installation would be unlikely to cause noise-related impacts to right whales, due to the time of year during which construction activities would take place.[303]

Offshore wind development can have benefits for other marine species. For example, the base of an offshore wind turbine may function as an artificial reef, creating new habitats for native fish species.[304]

By contrast, offshore oil and gas drilling routinely harms marine life, while posing a persistent risk of catastrophic outcomes.[305] Sonar used for offshore oil and gas exploration emits much stronger pulses of sound than sonar used for wind farm surveying.[306] The 2010 Deepwater Horizon oil spill killed millions of marine animals, including as many as 800,000 birds.[307] More broadly, carbon dioxide emissions from fossil fuel use are making the ocean increasingly acidic, which inhibits shellfish and corals from developing and maintaining calcium carbonate shells and exoskeletons.[308] Finally, climate change is expected to have "long-term, high-consequence impacts" on whales and other marine mammals, including "increased energetic costs associated with altered migration routes, reduction of suitable breeding and/or foraging habitat, and reduced individual fitness, particularly juveniles."[309]

False Claim #21: Producing and transporting wind turbine components releases more carbon dioxide than burning fossil fuels.

> "[W]indmills are perhaps the worst boondoggle . . . because they require much more high quality energy to manufacture, install, maintain, and back up than [they] will ever produce."[310]

On a lifecycle basis, wind power emits far less greenhouse gases than fossil fuels per kilowatt-hour of energy generated.[311] According to NREL (now the National Laboratory of the Rockies), the average lifecycle emissions of offshore and onshore wind turbines is 13 g CO_2-eq/KWh.[312] Lifecycle emissions for fossil fuels are much higher, with natural gas and coal releasing 486 g CO_2-eq/KWh and 1001 g CO_2-eq/KWh emissions, respectively.[313] In other words, the average lifecycle emissions of wind energy is roughly 1/77th that of coal.[314]

Manufacturing accounts for only a small percentage (2.41%) of the lifecycle emissions for wind power turbines.[315] Most turbine emissions come from transportation, which accounts for over 90% of emissions for both offshore and onshore

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302 Vineyard Wind Final EIS, supra note 298, at 3-95.
303 *Id.* at 3-91.
304 Steven Degraer et al., Offshore Wind Farm Artificial Reefs Affect Ecosystem Structure and Functioning: A Synthesis, 33 OCEANOGRAPHY 48, 49 (2020), https://doi.org/10.5670/oceanog.2020.405; Offshore Renewable Energy Improves Habitat, Increases Fish, RHODE ISLAND SEA GRANT (July 26, 2020), https://seagrant.gso.uri.edu/offshore-renewable-energy-improves-habitat-increases-fish/.
305 Marvell, supra note 12.
306 *Id.*
307 Martha Harbison, More Than One Million Birds Died During the Deepwater Horizon Disaster. Audubon, NATIONAL AUDUBON SOCIETY (May 6, 2014), https://www.audubon.org/news/more-one-million-birds-died-during-deepwater-horizon-disaster.
308 National Ocean Service, What is Ocean Acidification?, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, https://oceanservice.noaa.gov/facts/acidification.html (last visited March 25, 2024).
309 Vineyard Wind Final EIS, supra note 298, at 3-85.
310 Developer Claims: Wind Energy Efficiency, INTERSTATE INFORMED CITIZENS COALITION, https://iiccusa.org/developer-claims/developer-claims-wind-energy-inefficiency/ (last visited March 25, 2024).
311 Stacey L. Dolan & Garvin A. Heath, Life Cycle Greenhouse Gas Emissions of Utility-Scale Wind Power, 16 J. INDUS. ECOLOGY, S136-S154 (2012), https://doi.org/10.1111/j.1530-9290.2012.00464.x; Shifang Wang et al., Life-Cycle Green-House Gas Emissions of Onshore and Offshore Wind Turbines, 210 J. CLEANER PROD. 804, 807-808 (2019), https://doi.org/10.1016/j.jclepro.2018.11.031; Nat'l Renewable Energy Laboratory, supra note 73, at 3.
312 Nat'l Renewable Energy Laboratory, supra note 73, at 3.
313 Id.
314 Id.
315 Wang et al., Life-Cycle Green-House Gas Emissions of Onshore and Offshore Wind Turbines, supra note 311, at 807.

operations.[316] Once operational, wind turbines create clean, emissions-free energy that offsets the carbon dioxide emissions associated with production and transportation.[317]

False Claim #22: Wind turbines will generate an unsustainable amount of waste.

"This clean, green energy is not so clean and not so green . . . [i]t's just more waste going in our landfills."[318]

Roughly 85% of the mass of a wind turbine, including the tower, gearbox, and generator, consist of metals that are easily recycled.[319] The remaining 15%, including the blades, consist of composite-based materials, such as fiberglass, that are more difficult to recycle.[320] However, new technologies are in development for recycling turbine blades, and turbine blades are in fact being recycled in some facilities.[321] A recent breakthrough supported by the DOE enabled all turbine components to be recycled,[322] and private companies in the United States have begun developing turbine blade recycling plants.[323]

One study from 2017 estimated that global annual waste of turbine blades will reach 2.9 million metric tons per year by 2050, with a total of 43 million metrics tons in cumulative waste generated between 2018 and 2050.[324] This is not insignificant. However, Nature Physics has projected that global cumulative waste from fossil fuel-based power generation between 2016 to 2050 is expected to produce roughly 45,550 million metric tons of coal ash alone, along with 249 million metric tons of oily sludge.[325] In other words, the cumulative waste from coal ash is expected to be roughly 1,000 times greater than that of turbine blades, and the cumulative waste of oily sludge is expected to be about 5-6 times greater than that of turbine blades. Importantly, both coal ash and oily sludge are known to be toxic.[326] For further context, in the United States alone, roughly 600 million short tons, or 544 million metric tons, of construction and demolition debris were generated across all sectors in 2018.[327] In effect, the annual construction and demolition waste in the United States alone is roughly 187 times greater than the anticipated annual waste from wind turbine blades across the globe in 2050.

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316 Id. at 804.

317 Sara Peach, What's the Carbon Footprint of a Wind Turbine?, Yale Climate Connections (June 30, 2021), https://yaleclimateconnections.org/2021/06/whats-the-carbon-footprint-of-a-wind-turbine/.

318 Donnelle Eller, Iowa's betting big on wind energy, but it's creating a problem: What happens to the blades once they're no longer useful?, Des Moines Register (Nov. 6, 2019), https://www.desmoinesregister.com/story/money/agriculture/2019/11/06/few-recycling-options-wind-turbine-blades-head-iowa-landfills/3942480002/

319 Muhammad Khalid et al., Recycling of Wind Turbine Blades Through Modern Recycling Technologies: A Road to Zero Waste, 44 Renewable Energy Focus 373, 375 (2023), https://doi.org/10.1016/j.ref.2023.02.001; Alejandro de la Garza, Time, Sept. 25, 2023, https://time.com/6316828/recycling-old-wind-turbine-blades/.

320 Id.

321 Jonas Jensen et al., Wind Turbine Blade Recycling: Experiences, Challenges and Possibilities in a Circular Economy, 97 Renewable & Sustainable Energy Rev.165, 171 (2018), https://doi.org/10.1016/j.rser.2018.08.041; Recycling & recovery of wind turbines, Roth International, https://www.roth-international.de/en/recycling-recovery/recycling-of-wind-turbines/ (last visited June 4, 2024).

322 Wind Energy Technologies Office, Carbon Rivers Makes Wind Turbine Blade Recycling and Upcycling a Reality with Support From DOE, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy (October 17, 2022), https://perma.cc/2WE8-XWC3.

323 Dave Downey, Here's How One Iowa Company is Taking Wind Turbine Blades Out of the Landfill, We Are Iowa (January 24, 2023), https://www.weareiowa.com/article/tech/science/environment/recycling-wind-turbine-blades-regen-fiber-travero-alliant-energy-fiberglass-iowa/524-88fe0610-cede-4a56-a9a3-01a36319927c.

324 Pu Liu & Claire Y. Barlow, Wind turbine blade waste in 2050, 62 Waste Management 229 (Apr. 2017), https://doi.org/10.1016/j.wasman.2017.02.007.

325 Mirletz et al., supra note 58, at 1376.

326 Id.

327 Construction and Demolition Debris: Material-Specific Data, United States Envt'l Protection Agency, https://perma.cc/C8F6-Y8AE (archived Feb. 25, 2025).

False Claim #23: Wind turbines take up too much land.

"The wind's low power density means massive materials and land/sea area requirements."[328]

Princeton University's 2021 report, Net-Zero America, concluded that the wind turbines needed for the United States to reach net-zero emissions by 2050 will have a direct footprint (i.e., the area covered by turbine bases and access roads) of between 603,678 and 2,479,208 acres.[329] This is notably less than the 4.4 million acres currently used for natural gas extraction and the 3.5 million acres for oil extraction.[330]

Some analyses significantly overstate the amount of land required for wind energy, either by including the unused space between turbines or by using a metric called the visual footprint that measures the area from which turbines are visible. As Amory Lovins has stated, "Saying that wind turbines 'use' the land between them is like saying that the lampposts in a parking lot have the same area as the parking lot: in fact, about 99 percent of its area remains available to drive, park, and walk in."[331] When a wind turbine is sited on farmland, it typically uses only 5% or less of the project area, leaving the rest available for agriculture and other purposes.[332] In fact, NREL estimates that about 98% of the area in a wind farm is available for agriculture or other uses.[333] Moreover, plant and animal species can safely grow and roam directly up to a turbine's base. This can help native species to flourish, as well as allowing farmers to continue cultivating crops and grazing animals after wind projects are installed.[334] And reclamation of wind (and solar) energy sites can begin as soon as plants begin operation, because wind and solar require only small amount of soil disturbance compared to other energy sources.[335]

Recent U.S. Department of Agriculture (USDA) research has confirmed that wind development is often compatible with agricultural land use. USDA's Economic Research Service found that, from 2012 to 2020, more than 90% of large-scale commercial wind turbines in rural areas were installed on either cropland or pasture-rangeland. USDA also found that most agricultural land near wind turbines remained in agricultural us after development: between 2012 and 2017, land cover changed on only about 4% of wind turbine sites that had been in agriculture before installation, and less than 1% shifted out of agriculture after installation.[336]

Moreover, depending on the location and the technology used, wind turbines can also require less land per kilowatt-hour generated than fossil fuels.[337] A report by the United Nations Economic Commission for Europe (UNECE) found that total land occupation (agriculture and urban) for wind power ranged from 0.3–1 m^2/KWh for 2022.[338] The exact value depends

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328 Home, NAT'L WIND WATCH, https://www.wind-watch.org/ (last visited March 25, 2024).

329 Larson et al., supra note 115, at 245. The report predicts that the "total wind farm area" will be significantly larger, but these numbers include the entire visual footprint of wind farms. Id. at 243, 245.

330 Dave Merrill, The U.S. Will Need a Lot More Land for a Zero-Carbon Economy, BLOOMBERG (June 3, 2021), https://www.bloomberg.com/graphics/2021-energy-land-use-economy/.

331 See Amory B. Lovins, Renewable Energy's 'Footprint' Myth, 24 ELECTRICITY JOURNAL 40, 41 (2011), https://www.sciencedirect.com/science/article/pii/S1040619011001436?via%3Dihub; Larson et al., supra note 115, at 245..

332 McGill University, Clearing the air: Wind farms more land efficient than previously thought, SCIENCEDAILY, Apr. 17, 2024, www.sciencedaily.com/releases/2024/04/240417182834.htm.

333 Paul Denholm et al., Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035 at 51, NAT'L RENEWABLE ENERGY LABORATORY, 2022, https://perma.cc/BV8Z-25SQ (archived Feb. 25, 2025).

334 Molly Bergen, How Wind Turbines are Providing a Safety Net for Rural Farmers, World Resources Institute (October 13, 2020), https://www.wri.org/insights/how-wind-turbines-are-providing-safety-net-rural-farmers.

335 Amalesh Dhar, Perspectives on environmental impacts and a land reclamation strategy for solar and wind energy systems, 718 Science of the Total Environment 134602, 11 (2020), https://www.sciencedirect.com/science/article/pii/S0048969719345930.

336 Karen Maguire, Sophia Tanner, Justin B. Winikoff & Ryan Williams, Utility-Scale Solar and Wind Development in Rural Areas: Land Cover Change (2009–20), U.S. Department of Agriculture, Economic Research Service, ERR-330 (May 2024), https://www.ers.usda.gov/publications/pub-details?pubid=109208; USDA Economic Research Service, Agricultural Land Near Solar and Wind Projects Usually Remained in Agriculture After Development (Sept. 12, 2024), https://www.ers.usda.gov/amber-waves/2024/september/agricultural-land-near-solar-and-wind-projects-usually-remained-in-agriculture-after-development.

337 Carbon Neutrality in the UNECE Region: Integrated Life-cycle Assessment of Electricity Sources, UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE (UNECE), United Nations, 70 (2022), https://unece.org/sites/default/files/2022-08/LCA_0708_correction.pdf.

338 Id.

on the type of wind tower, onshore or offshore siting, and the particular location of the turbine.[339] By comparison, natural gas values ranged from 0.6–3.3 m^2/KWh, and coal values from 7.2–23.8 m^2/KWh.[340] The UNECE report notes that these calculations do not include carbon capture and storage (CCS), which, if implemented, would decrease emissions but increase land use.[341]

Wind energy also uses far less land than biomass. Dedicated biomass consumes an average of 160,000 hectares of land per terawatt-hour per year.[342] By contrast, the land-use intensity of wind energy is only 170 hectares per terawatt-hour per year when looking at the direct footprint of wind or 15,000 hectares per terawatt-hour per year when including space between turbines.[343]

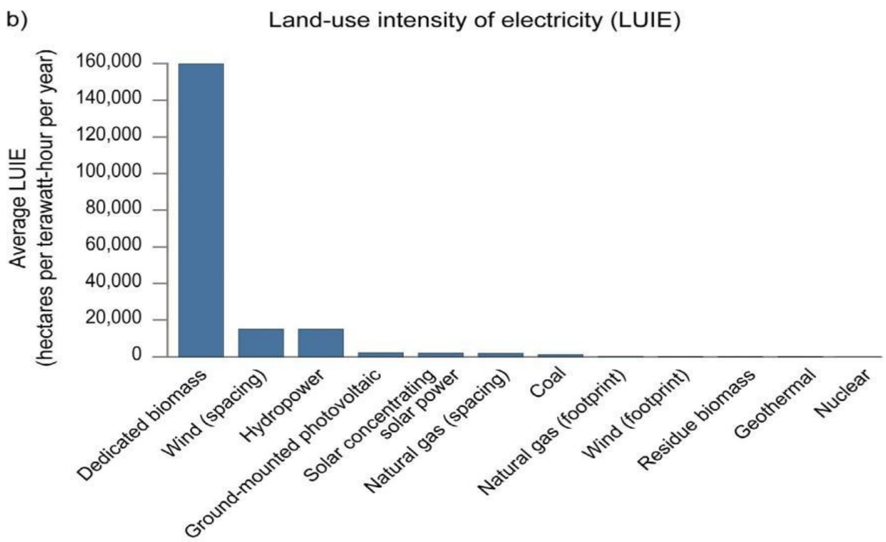

Figure 13: Average land-use intensity of electricity, measured in hectares per terawatt-hour per year.
Source: U.S. Global Change Research Program (visualizing data from Jessica Lovering et al.).[344]

Fossil fuel generation also has more harmful and enduring impacts on the land that it uses. Spills frequently occur as a result of the extraction, transportation, and distribution of oil and natural gas, causing soil and water damage. A 2017 study found that between 2% and 16% of unconventional oil and gas wells reported a spill each year, with more spills in some states than others.[345] Reclamation is difficult in areas surrounding extraction sites because of frequent leakage.[346] The land involved often suffers long-term damage and can only be used for limited purposes.[347] Moreover, abandoned coal mines and orphaned oil and gas wells can continue to threaten public health by contaminating groundwater, emitting methane and other noxious gases, and, in the case of abandoned coal strip mines, even result in continuing risk from falling

339 Id.
340 Id.
341 Id.
342 Jessica Lovering et al., supra note 135, at 8.
343 Id.
344 U.S. GLOBAL CHANGE RESEARCH PROGRAM, supra note 128, at 32-29 (visualizing data from Jessica Lovering et al., supra note 135, at 8).
345 Lauren A. Patterson, Unconventional Oil and Gas Spills: Risks, Mitigation Priorities, and State Reporting Requirements, 51 ENVT'L SCIENCE & TECHNOLOGY 2563, 2563 (2017), https://pubs.acs.org/doi/full/10.1021/acs.est.6b05749.
346 Brady Allred et al., Ecosystem Services Lost to Oil and Gas in North America, 348 SCI 401, (2015), https://www.science.org/doi/full/10.1126/science.aaa4785.
347 Id.

boulders.[348] There are currently over 130,000 documented orphaned oil and gas wells in the United States[349] and likely many more undocumented abandoned wells.[350] The same is true of coal mines; in one state, Kentucky, nearly 40% of purportedly "active" coal mines are "functionally abandoned."[351]

Finally, climate change produced by burning fossil fuels directly harms forests, oceans, crops, and wildlife, including by causing wildfires, algal blooms, droughts, and extreme weather events that mar the visual landscape.[352] Wind energy, in contrast, further protects local landscapes by mitigating climate impacts.

False Claim #24: Wind power, particularly offshore wind power, is too expensive.

> "[W]ind farms . . . cannot produce electricity competitively and require massive government subsidies for both installation and subsequent operation. Rate payers are hit [with] a double whammy, higher electric rates and higher taxes to pay the subsidies."[333]

Lazard's 2025 Levelized Cost of Energy analysis states that, despite macroeconomic challenges and headwinds, utility-scale solar and onshore wind remain the most cost-effective forms of new-build energy generation on an unsubsidized basis.[353] The analysis estimates that unsubsidized onshore wind has an LCOE range of $37 to $86 per MWh. That range is lower than Lazard's reported ranges for many conventional resources, including gas combined cycle ($48 to $109/MWh), coal ($71 to $173/MWh), and gas peaking ($149 to $251/MWh).[354]

Offshore wind is more expensive than onshore wind, but still cost competitive with fossil fuels. Lazard estimates an unsubsidized offshore wind LCOE range of $70 to $157 perMWh.[355] As the figure below from Lazard shows, although offshore wind power is more expensive than gas combined cycle when subsidies are not taken into account, the unsubsidized mean LCOE for offshore wind ($70 to $157) is still lower than that of gas peaking and coal.[356]

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348 See Orphaned Wells, U.S. DEP'T OF INTERIOR, https://web.archive.org/web/20250119203349/https://www.doi.gov/orphanedwells (archived Jan. 19, 2025); James Bruggers, Congressional Office Agrees to Investigate 'Zombie' Coal Mines, INSIDE CLIMATE NEWS, Jan. 12, 2024, https://insideclimatenews.org/news/12012024/kentucky-zombie-coal-mines/.

349 Federal Orphaned Well Program, U.S. BUREAU OF LAND MANAGEMENT, https://web.archive.org/web/20240306020936/https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/federal-orphaned-well-program (archived Mar. 6, 2024).

350 Studies suggest that there could be millions of undocumented abandoned wells. See e.g., https://www.edf.org/orphanwellmap

351 Bruggers, supra note 348.

352 Savannah Bertrand, Fact Sheet: Climate, Environmental, and Health Impacts of Fossil Fuels, Environmental and Energy Study Institute (December 17, 2021), https://www.eesi.org/papers/view/fact-sheet-climate-environmental-and-health-impacts-of-fossil-fuels-2021.

353 Lazard, Lazard Releases 2025 Levelized Cost of Energy+ Report (June 16, 2025), https://lazardltd.gcs-web.com/news-releases/news-release-details/lazard-releases-2025-levelized-cost-energy-report.

354 Lazard, Lazard's Levelized Cost of Energy+ 36–39 (Version 18.0, June 2025), https://www.lazard.com/media/eijnqja3/lazards-lcoeplus-june-2025.pdf.

355 Id.

356 Id.

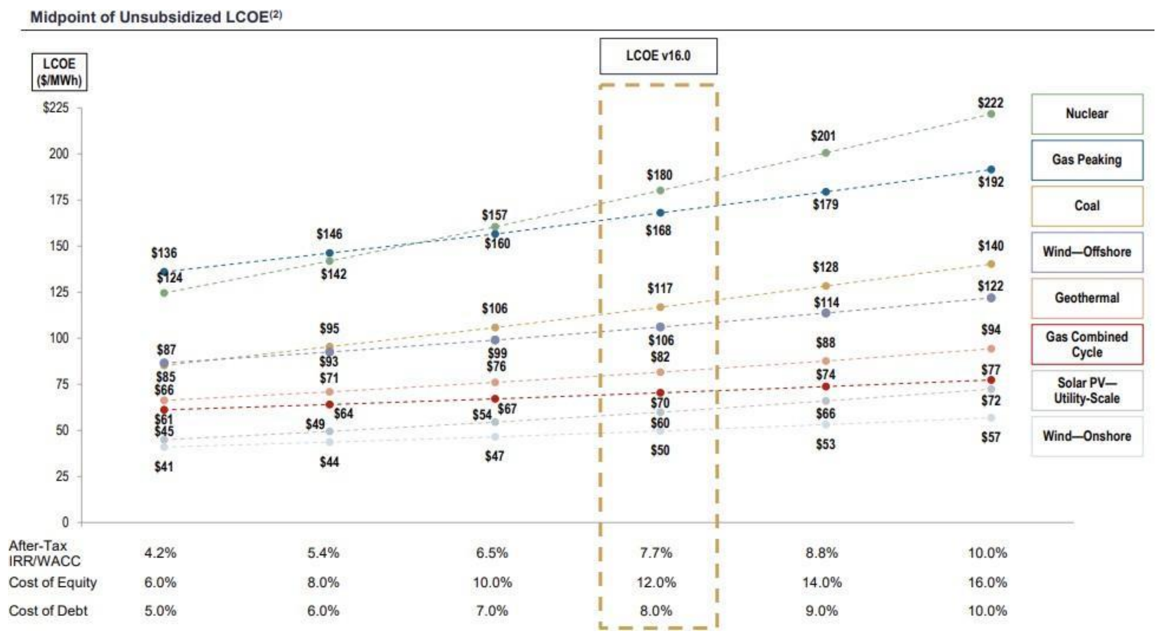

Figure 14: The range of unsubsidized LCOE for utility-scale energy sources across various cost of capital scenarios, highlighting the mean unsubsidized LCOE as of April 2023. "IRR" stands for "internal rate of return" and "WACC" stands for "weighted average cost of capital."

Source: Lazard.[336]

DOE's 2024 *Offshore Wind Market Report* found that rising interest rates, supply-chain constraints, and higher commodity prices during 2021–2023 increased offshore wind costs globally and in the United States. The report estimated that the unsubsidized LCOE for a hypothetical commercial-scale U.S. offshore wind project was approximately $125/MWh in 2023, with a range of $75/MWh to $149/MWh depending on siting conditions, proximity to port and grid infrastructure, financing assumptions, and other factors. DOE noted that this represented an average increase of more than 45% compared with the prior edition of the report.[357] That said, the cost picture is not simply one of permanent increase. DOE reported that, despite recent cost increases, global offshore wind costs have still declined by more than 50% since 2013.[358] DOE also forecasts that fixed-bottom offshore wind LCOE could average approximately $76/MWh by 2035 under mid-case estimates, with a narrower spread between estimates over time.[359] This well below the mean LCOE for fossil fuel plants.

Moreover, increasing reliance on wind energy does not automatically lead to higher customer costs. Retail electricity rates are shaped by many factors besides the cost of wind generation, including transmission, distribution, fuel and purchased-power costs, capacity costs, storm recovery, utility investment, and rate design. A 2026 Lawrence Berkeley National Laboratory and Brattle Group update found "no obvious correlation" between higher retail price increases and higher levels of market-based wind and solar deployment from 2019 to 2025, and concluded that market-based wind and solar "do not appear to have increased prices in recent years."[360] Developing wind energy projects can also reduce wholesale electricity prices by displacing higher-cost marginal fossil generation; Lawrence Berkeley National Laboratory found that wind and solar growth reduced average annual wholesale prices in organized U.S. markets.[361]

[357] Angel McCoy et al., Offshore Wind Market Report: 2024 Edition, National Renewable Energy Laboratory, NREL/TP-5000-90525, at viii–ix, 56–57 (Aug. 2024), https://www.nrel.gov/docs/fy24osti/90525.pdf.
[358]
[359] Id. at 57.
[360] Lawrence Berkeley National Laboratory & The Brattle Group, Retail Electricity Price Trends and Drivers: Data Update—2026 Edition 3, 11–15, 29–31 (Apr. 2026), https://eta-publications.lbl.gov/sites/default/files/2026-03/retail_price_trends_2026_edition.pdf
[361] Andrew D. Mills et al., Lawrence Berkeley National Laboratory, Impact of Wind, Solar, and Other Factors on Wholesale Power Prices: An Historical Analysis—2008 through 2017 (Nov. 2019), https://emp.lbl.gov/publications/impact-wind-solar-

False Claim #25: Wind turbines are bad for farmers and rural communities.

> "The construction of industrial wind turbines affects aquifers, water flow, tile lines, soil erosion, soil compaction, air pressure and current. In essence, it is destruction of the best soil in the world, the farmland that the generations before us were proud of and left for us to feed the world with."[362]

Wind power offers farmers the opportunity to earn additional income from leasing out their land, while also growing crops or grazing livestock.[363] As a result, many farmers view wind turbines as beneficial for their farmland and the local community.[364] And wind farms leave ample space for continued agricultural use: NREL (now the National Laboratory of the Rockies) estimates that about 98% of the area in a typical wind farm is available for agriculture or other uses.[365] The New York Farm Bureau has stated that "[w]ind turbines are geared towards continued farming activities, because wind turbines are typically spaced one acre apart."[366] Moreover, "[l]ivestock are unaffected by the presence of wind turbines and will graze right up to the base of wind turbines."[367]

The additional income from wind lease payments can help farmers keep their land in production.[368] One 2017 University of Michigan study found that farmers with wind turbines tend to invest twice as much in their farms as farmers without wind turbines.[369] In addition, property tax payments from utility-scale wind projects provide revenue to rural communities for investing in schools, roads, and bridges.[370]

Farmers with turbines also appear more confident that they will continue to own their farms at the time of death. In the University of Michigan study, survey results showed 80% of those with turbines had a plan of succession for their farm, while only 62% of those without a turbine had a succession plan.[371] The researchers concluded that this difference was likely due to added income the wind turbine provided.[372]

Wind farms can likewise contribute to agricultural productivity. A 2019 study of Gobi Desert wind farms, from China's Zhejiang University, found that turbine proximity made local vegetation "more metabolically efficient, with higher community coverage, density, and AGB [aboveground biomass]."[373] Recent research from Iowa State's Agronomy department posits that related benefits to agricultural yields might stem from increased photosynthesis capacity as turbines draw additional

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and-other-factors.

362 Save Piatt County, supra note 239.

363 See Wind Energy's Economic Impacts to Communities Energy, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, https://perma.cc/SNV4-NWSJ (archived Feb. 25, 2025); Elizabeth Weise, Wind energy gives American farmers a new crop to sell in tough times, USA Today, Feb. 16, 2020 (updated Feb. 20, 2020),https://www.usatoday.com/story/news/nation/2020/02/16/wind-energy-can-help-american-farmers-earn-money-avoid-bankruptcy/4695670002/.

364 Kirsty Holstead et al., Discourses of On-Farm Wind Energy Generation in the UK Farming Press, 19 J. Env't. Pol'y & Plan. 391, 399 (2017), https://doi.org/10.1080/1523908X.2016.1224157; Sarah Mills, Wind Energy and Rural Community Sustainability, in Handbook Sustainability & Soc. Sci. Rsch. 215, 219-221 (Walter Leal Filho, Robert W. Marans & John Callewaert eds., 2018), https://doi.org/10.1007/978-3-319-67122-2_12.

365 Paul Denholm et al., supra note 333 at 51.

366 New York Farm Bureau, Leasing Your Farmland for Wind & Solar Energy Development: A Beginner's Guide for Farmers at 3 (2014), https://www.nyfb.org/application/files/2014/9780/6349/file_y349d211hx.pdf; see also id. ("Wind turbine installations are compatible with livestock grazing and growing crops.").

367 Id.; see also id. ("Wind turbines are sturdy enough to withstand cattle using them as rubbing posts or for shade.").

368 Wind Energy's Economic Impacts to Communities, supra note 363; Kirsty Holstead et al., Discourses of On-Farm Wind Energy Generation in the UK Farming Press, 19 J. Env't. Pol'y & Plan. 391, 399 (2017), https://doi.org/10.1080/1523908X.2016.1224157; Mills, supra note 364, at 219-221.

369 Mills, supra note 364, at 219-221.

370 Wind Energy's Economic Impacts to Communities, supra note 363.

371 Mills, supra note 364, at 215, 219.

372 Id. at 215, 219-220.

373 Kang Xu et al., Positive Ecological Effects of Wind Farms on Vegetation in China's Gobi Desert, Sci. Reports 9, 6341 (2019) https://www.nature.com/articles/s41598-019-42569-0.

carbon dioxide out of the soil.[374] Further studies suggest that wind turbines may even increase crop yields on neighboring farms, by minimizing harmful temperature extremes in the surrounding area.[375] Moreover, while recognizing that wind farm installation can contribute to short-term soil degradation, a 2020 analysis from Brazil's Universidade Federal do Ceará concluded that these installations produce impacts less intense than those "caused by agricultural use and rainfall in the same period" and that local farmers found it possible "to reconcile agriculture and wind power generation without major repercussions on rural lots."[376]

False Claim #26: Wind energy is bad for U.S. jobs.

"Subsidised wind and solar destroy far more jobs than they ever 'create'"[377]

Wind power is a fast-growing industry, creating many U.S. jobs. In 2025, wind energy production employed roughly 133,000 U.S. workers, creating roughly 18,400 new jobs (up 16%) since 2019.[378] The DOE suggests that this sector could employ as many as 600,000 U.S. workers by 2050.[379] As noted previously, the United States' Fifth National Climate Assessment predicts that there will be nearly 3,000,000 new solar, wind, and transmission-related jobs by 2050 in a high electrification scenario and 6,000,000 new jobs in a 100% renewable scenario, with less than 1,000,000 fossil fuel-related jobs lost.[380] Still, the transition will have workforce impacts that need to be proactively managed so as to minimize social harm to displaced labor from fossil fuel-related industries.

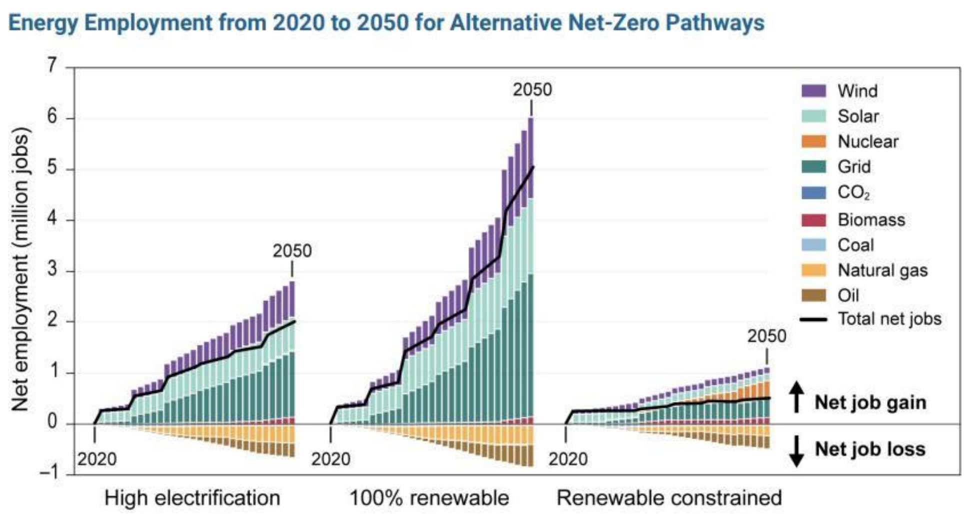

Figure 15: Energy employment from 2020 to 2050 under various U.S. net-zero GHG emissions scenarios.
Source: U.S. Global Change Research Program.[381]

[374] Ed Adcock, Iowa State University Research Finds Wind Farms Positively Impact Crops, IOWA STATE UNIVERSITY EXTENSION AND OUTREACH, Mar. 5, 2018, https://www.extension.iastate.edu/news/iowa-state-university-research-finds-wind-farms-positively-impact-crops.
[375] Daniel T. Kaffine, Microclimate effects of wind farms on local crop yields, 96 J. ENV'T. ECON. MGMT. 159, 159-160 (2019), https://doi.org/10.1016/j.jeem.2019.06.001.

[376] Manoel Fortunato Sobrinho Júnior et al., Soil Use and Occupation of Wind Farm Agricultural Areas, 19 MERCATOR - REVISTA DE GEOGRAFIA DA UFC, 1, 3, (2020), https://www.redalyc.org/journal/2736/273664287012/273664287012.pdf.
[377] Renewable Energy Job Myth: Subsidised Wind and Solar Destroy Far More Jobs Than They Ever "Create," STOP THESE THINGS, May 11, 2020, https://stopthesethings.com/2020/05/11/renewable-energy-job-myth-subsidised-wind-and-solar-destroy-far-more-jobs-than-they-ever-create/ (capitalization edited to sentence case).
[378] United States Energy & Employment Report 2025, OFFICE OF POLICY, OFFICE OF ENERGY JOBS, U.S. DEPARTMENT OF ENERGY, 24 (August 14,2026), https://www.energy.gov/policy/2025-us-energy-employment-report-useer.
[379] Wind Vision: A New Era for Wind Power in the United States, supra note 254, at 139.
[380] U.S. GLOBAL CHANGE RESEARCH PROGRAM, supra note 136, at 32-31.
[381] Id.

Most of the current domestic wind-related jobs are in manufacturing.[382] Over 500 U.S. manufacturing facilities now specialize in producing components for wind power generation.[383] For turbines installed in the United States, approximately 70% of tower manufacturing and 80% of nacelle assembly also occurs domestically.[384] Furthermore, the U.S. Bureau of Labor Statistics identified wind turbine service technicians as the fastest growing occupation between 2022 and 2023, growing roughly 45% in size during that time.[385] Unfortunately, however, the Trump Administration's recent cancellation of offshore wind projects has endangered or killed large numbers of jobs.[386]

False Claim #27: Wind turbines destroy nearby property values.

> "[T]he presence of a wind power facility is likely to drive down the value of surrounding properties."[387]

Multiple academic studies have assessed the impact of wind turbines on property values. A 2025 study by researchers at Lawrence Berkeley National Laboratory examined the impact of wind energy development on property values at the school district level. The study found that wind projects were associated with approximately 3% increases in district-wide housing values when compared with similar homes in the same-county school districts without wind projects.[388] The authors suggested that the increase may be linked to local economic benefits from wind development, including higher school district revenues and expenditures. This finding does not eliminate the possibility of localized effects for homes very close to turbines, but it further undermines the claim that wind projects broadly or permanently depress property values.[389]

Other studies suggest that, in some circumstances, wind energy development can reduce nearby property values. But the reductions are generally modest and shortlived. For example, a March 2024 study found that having a wind turbine in a home's viewshed reduces the sales price by 1.12% on average.[390] The study found that the negative impact of turbines on property values was primarily observed for urban, rather than rural, properties, and that any negative impact on property values disappeared within ten years after turbine installation.[391] The study also found that turbine installations have become less disruptive to home values over time: the researchers found no statistically-significant impact on home values for turbines installed after 2017 and stated that the 1.12% average impact "is larger than the effect one would expect for recent and future installations."[392]

For comparison, a December 2023 study found evidence that, when a wind development is announced within one mile of

[382] James Hamilton et al., Careers in Wind Energy, U.S. BUREAU OF LABOR STATISTICS (Sept. 2010), https://www.bls.gov/green/wind_energy/wind_energy.pdf.
[383] Wind Energy Technologies Office, Wind Manufacturing and Supply Chain, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY, https://perma.cc/JD46-GDJT (archived Feb. 25, 2025).
[384] Id. The nacelle is the housing that holds the gearbox, generator, drivetrain, and brake assembly.
[385] Fastest Growing Occupations, U.S. BUREAU OF LABOR STATISTICS (Sept. 2023), https://www.bls.gov/ooh/fastest-growing.htm.
[386] Mariel Lutz, Alia Hidayat & Kate Petosa, *The Trump Administration and Congress' Attacks on Wind Power Are Killing Thousands of Jobs and Risk Thousands More*, Center for American Progress (July 24, 2025), https://www.americanprogress.org/article/the-trump-administration-and-congress-attacks-on-wind-power-are-killing-thousands-of-jobs-and-risk-thousands-more/
[387] FAQ: Economics, NATIONAL WIND WATCH, https://www.wind-watch.org/faq-economics.php (last visited March 25, 2024).
[388] Ben Hoen, Eric Brunner & David Schwegman, Uplifting Winds: The Surprisingly Positive Community-Wide Impact of Wind Energy Installations on Property Values, 127 ENERGY RESEARCH & SOCIAL SCIENCE 104331 (2025), https://doi.org/10.1016/j.erss.2025.104331; U.S. Department of Energy, Office of Scientific and Technical Information, *Uplifting Winds: The Surprisingly Positive Community-Wide Impact of Wind Energy Installations on Property Values* (2025), https://www.osti.gov/pages/biblio/3010047.
[389] Id.
[390] Wei Guo et al., The visual effect of wind turbines on property values is small and diminishing in space and time, PNAS, March 2024, at 2, https://www.pnas.org/doi/epdf/10.1073/pnas.2309372121..
[391] Id. at 3.
[392] Id. at 3-4.

a home, prices decline by up to 11% compared to homes three to five miles away.[393] However, home prices return to within 2% of inflation-adjusted pre-announcement levels roughly five years after the project enters operation.[394] The study found that the population of the county mattered: the decrease was roughly 15% in counties with over 250,000 people but statistically insignificant in counties with fewer than 250,000 people.[395] The study also found no statistically-significant adverse impacts on home sale prices outside of 1.25 miles from the nearest turbine.[396]

An earlier study from 2021 testing how turbine size affects property values at varying distances found that, on average, nearby turbine installation decreases home value by 1.8%.[397] The study also found that the farther a turbine was placed from a home, the less impact it had on property value.[398] The greatest impact, a price drop of 8.3%, occurred when a large turbine (>150 meters) was placed within 750 meters of a home.[399] The greatest impact from a medium sized turbine (50–150 meters) was 3.4%.[400] Beyond 2,250 meters, moreover, the 2021 study found no discernible price impact from turbines.[401]A separate study found no impact beyond 3 km.[402] The figure below shows how, for the 2021 study, size and distance of a turbine impacted property value.[403]

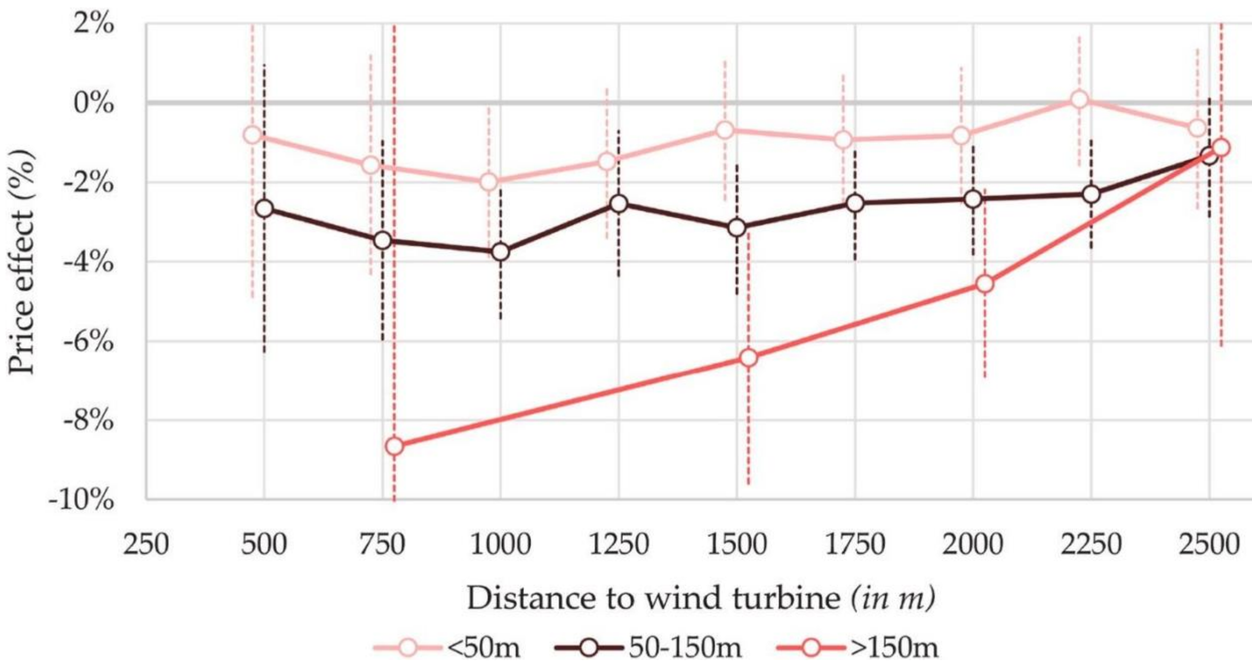

Figure 16: Graph shows how different size of wind turbines, and distance from property, affects home value. Turbine height is calculated as axis height plus half of the rotor blade diameter.
Source: Martijn Dröes et al.[404]

[393]Eric J. Brunner et al., Commercial wind turbines and residential home values: New evidence from the universe of land-based wind projects in the United States, 185 ENERGY POLICY 113837, at 1 (2023), https://www.sciencedirect.com/science/article/pii/S0301421523004226?via%3Dihub..

[394] Id. at 1.

[395] Id. at 9-10.

[396] Id. at 7, 10.

[397]Martijn Dröes et al., Wind Turbines, Solar Farms, and House Prices, 155 ENERGY POL'Y, 2 (2021), https://doi.org/10.1016/j.enpol.2021.112327..

[398] Id. at 8.

[399] Id.

[400] Id.

[401] Id.

[402]Cathrine Jensen et al., The Impact of On-Shore and Off-Shore Wind Turbine Farms on Property Prices, 116 ENERGY POL'Y 54, 50-59 (2018), https://doi.org/10.1016/j.enpol.2018.01.046.

[403] Martijn Dröes et al., supra note 397, at 8.

[404] Id.

Another academic study of roughly 50,000 Rhode Island single-family home transactions located within 5 miles of a turbine site found no statistically significant price impact.[405] While yet another academic study of roughly 50,000 home transactions (spread across nine states) within 10 miles of a turbine site likewise found no statistically significant evidence of a price change.[406] By contrast, a 2011 paper found that the presence of a fossil fuel fired power plant within 2 miles of one's home decreased its value by 4–7%.[407] Among the fossil fuel power plants in the study sample, 92% were natural gas plants.[408]

Importantly, these impacts can be mitigated. For example, multiple studies recommend clustering turbines within wind farms.[409] One of these studies found that adding a turbine within two kilometers of an existing turbine had a statistically insignificant impact on house prices.[410] It bears noting, however, that turbines must be spaced in such a way as to minimize wake interference, the phenomenon where an upstream wind turbine interferes with the production of a downstream turbine.[411]

False Claim 28: Wind energy is unreliable.

> "[B]ecause of the wind's intermittency and high variability, they do next to nothing to reduce the need for other fuels."[412]

As with solar energy, complete reliance on wind energy would pose intermittency challenges. However, wind, solar, and storage together can provide the majority of the country's electricity without compromising reliability,[413] and energy efficiency and grid flexibility mechanisms can support a renewable energy-based grid.[414] Hydropower has also been found to support wind and solar by compensating for intermittency in those sources.[415] Moreover, building more long-distance transmission infrastructure can enable greater reliance on wind and solar generation spread across larger areas,[416] and linking offshore wind projects through offshore transmission networks is also expected to enhance grid reliability.[417] A National Renewable Energy Laboratory report concluded that "wind power can support power system reliability" by providing "active power controls,"[418] which are mechanisms for balancing the power generated by wind farms with the power

[405] Corey Lang et al., The Windy City: Property Value Impacts of Wind Turbines in an Urban Setting, 44 ENERGY ECON. 413, 420-421 (2014), https://doi.org/10.1016/j.eneco.2014.05.010.

[406] Lucas Nelsen, Are Property Values Affected by Wind Farms?, CENTER FOR RURAL AFFAIRS (July 19, 2018), https://www.cfra.org/blog/are-property-values-affected-wind-farms.

[407] Lucas Davis, The Effect of Power Plants on Local Housing Value and Rents, 93 REV. ECON. STAT. 1391 (2011), https://doi.org/10.1162/rest_a_00119.

[408] Id. at 1400.

[409] Cathrine Jensen et al., supra note 402, at 51; Martijn Dröes et al., supra note 392, at 7.

[410] Martijn Dröes et al., supra note 397, at 7.

[411] See Daniel R. Houck, Review of wake management techniques for wind turbines, 25 Wind Energy 195, 195-96 (2022), https://onlinelibrary.wiley.com/doi/epdf/10.1002/we.2668.

[412] Wind Watch, *The Facts About Wind Power, Wind Energy, Wind Turbines, Wind Farms*, https://www.wind-watch.org/ (last visited July 22, 2026)

[413] See Eric Larson et al., supra note 115, at 88 (noting that, "[t]o ensure reliability, all cases maintain 500-1,000 GW of firm generating capacity through all years," compared to 7,400-9,900 GW for wind and solar in net-zero scenarios for 2050).

[414] See Amory B. Lovins, Reliably integrating variable renewables: Moving grid flexibility resources from models to results, supra note 206.

[415] Rui Shan et al., Complementary relationship between small-hydropower and increasing penetration of solar photovoltaics: Evidence from CAISO, 155 RENEWABLE ENERGY 1139, 1140 (2020).

[416] See id. at 97 (noting that "[l]imiting inter-regional transmission capacity to a maximum of 2x current capacity . . . leads to slightly more gas w/ [carbon capture] and less wind").

[417] OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, U.S. DEP'T OF ENERGY, ATLANTIC OFFSHORE WIND TRANSMISSION STUDY, at vii (March 2024), https://www.nrel.gov/docs/fy24osti/88003.pdf.

[418] Erik Ela et al., Active Power Controls from Wind Power: Bridging the Gaps at xi, NAT'L RENEWABLE ENERGY LABORATORY, Jan. 2014, https://www.nrel.gov/docs/fy14osti/60574.pdf; see also NREL Report Redefines Wind as a Grid Stabilizer, Not a Liability, NAT'L RENEWABLE ENERGY LABORATORY, Jan. 2014, https://www.nrel.gov/docs/fy14osti/60993.pdf; Weihang Yan et al., Synchronous Wind: Evaluating the Grid Impact of Inverterless Grid-Forming Wind Power Plants, NAT'L RENEWABLE ENERGY LABORATORY, 2023 (preprint),

consumed on the electricity grid.[419] And although the reliability of wind and solar energy was questioned following Texas' widespread power outages in the winter of 2021, Texas' grid failure was primarily caused by freezing natural gas infrastructure, rather than failures at wind and solar farms, though nuclear, coal, and wind also experienced disruptions at a smaller scale.[420]

Wind energy has already been successfully incorporated into the United States' electric grid at significant scale.[421] Domestic energy production from wind more than tripled between 2011 and 2022, from 120 billion kilowatt-hours (2.9% of total energy production) to 435 billion kilowatt-hours (10.3% of total energy production).[422] The U.S. Energy Information Administration reports that wind supplied approximately 11% of total U.S. utility-scale electricity generation in 2025 and accounted for 43% of utility-scale electricity generated from renewable sources.[423] Some states rely on wind at much higher shares. In 2024, wind energy accounted for 63% of Iowa's electricity net generation, the highest wind-power share of any state.[424] In South Dakota, wind energy accounted for 59% of electricity net generation in 2024, the second-highest wind-power share of any state.[425] In Kansas, wind energy accounted for 52% of electricity net generation in 2024, the third-highest.[426]

Wind power has enabled states not only to reduce energy costs, but to generate additional revenue by selling excess power to neighboring states during shortages.[427] For example, today, Iowa – one the nation's leaders in wind generation -- is considered one of the states with the most reliable energy systems.[428] In California, electricity generated from wind power increased from roughly 3% in 2009, to roughly 7% in 2022. Electricity generated from natural gas declined from roughly 56% in 2009, to roughly 47% in 2022.[429] Yet even with this increased reliance on wind power, California's grid reliability has remained consistent, and largely above national averages.[430] California has even been able to briefly meet 103% of its energy demands exclusively from renewable sources, demonstrating that a large economy can by powered by renewable energy.[431]

https://www.nrel.gov/docs/fy23osti/84609.pdf

419 Jan-Willem van Windergarden et al., Active Power Control of Waked Wind Farms, 50 IFAC 4484, 4484, (July 2017), https://www.sciencedirect.com/science/article/pii/S240589631730722X.

420 Joshua W. Busby et al., Cascading risks: Understanding the 2021 winter blackout in Texas, 77 ENERGY RESEARCH AND SOCIAL SCIENCE 102106 (2021), 1-4, https://www.sciencedirect.com/science/article/pii/S2214629621001997; Adriana Usero & Salvador Rizzo, 'Frozen windmills' aren't to blame for Texas's power failure, WASH. POST, Feb. 18, 2021, https://www.washingtonpost.com/politics/2021/02/18/frozen-windmills-arent-blame-texass-power-failure-neither-is-green-new-deal/; Dionne Searcey, No, Wind Farms Aren't the Main Cause of the Texas Blackouts, N.Y. TIMES, Feb. 17, 2021 (updated May 3, 2021), https://www.nytimes.com/2021/02/17/climate/texas-blackouts-disinformation.html.

421 Wind Explained: Electricity Generation from Wind, U.S. ENERGY INFORMATION ADMINISTRATION, https://perma.cc/VYR6-3C7C (archived Feb. 25, 2025).

422 Id.

423 U.S. Energy Information Administration, Electricity in the United States, https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php (last visited June 18, 2026).

424 U.S. Energy Information Administration, Iowa State Energy Profile, https://www.eia.gov/states/IA/analysis (last visited June 18, 2026).

425 U.S. Energy Information Administration, South Dakota State Energy Profile, U.S. Energy Information Administration (last visited June 18, 2026), https://www.eia.gov/states/SD/analysis.

426 U.S. Energy Information Administration, Kansas State Energy Profile, https://www.eia.gov/states/KS/overview (last visited June 18, 2026).

427 Chazz Allen, Iowa Leads in Homegrown, Reliable, Renewable Energy, GAZETTE (November 12, 2022) https://www.thegazette.com/guest-columnists/iowa-leads-in-homegrown-reliable-renewable-energy/.

428 Energy Rankings: Measuring States' Energy Infrastructure, U.S. NEWS AND WORLD REPORT, https://www.usnews.com/news/best-states/rankings/infrastructure/energy (last visited March 25, 2024).

429 California Energy Comm'n, Total System Electric Generation 2009-2022 with totals, CALIFORNIA ENERGY COMMISSION, (2022), https://www.energy.ca.gov/media/7311.

430 California Energy Comm'n, Electric System Reliability Annual Reports, CALIFORNIA ENERGY COMMISSION, (2022), https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/electric-reliability/electric-system-reliability-annual-reports.

431 Lauren Sommer, California Just Ran on 100% Renewable Energy, but Fossil Fuels Aren't Fading Away Yet, NPR (May 13, 2022), https://www.npr.org/2022/05/07/1097376890/for-a-brief-moment-calif-fully-powered-itself-with-renewable-energy.

International experience points in the same direction. The United Kingdom has integrated large amounts of wind power while continuing to maintain electric system reliability. In 2024, wind became Britain's largest source of electricity for the first time, accounting for about 30% of generation and surpassing gas.[432] In 2025, U.K. renewable generation reached a record 152.5 TWh, equal to 52.5% of total U.K. electricity generation, with wind generation rising to a record 87.1 TWh.[433]

False Claim 29: Wind turbines are very noisy.

> "Noise created by commercial-scale wind turbines has become a major concern around the world as wind power development continues to proliferate."[434]

In a 2021 environmental impact statement for the 120-turbine, 500-MW Rail Tie Wind Project in Wyoming, a project which serves the energy needs of 180,000 households, the DOE found that noise generated by site operations likely would not exceed 55 A-weighted decibels (dBAs),[435] except in a worst-case scenario in which noise "might reach slightly above 55 dBA."[436]

When measured from inside a building located 124–330 meters from a wind turbine, noise produced by the turbine's motion has ranged from 30.7–43.4 decibels.[437] When measured from outside at the same distance, noise level has ranged from 38.2-50.0 decibels in summer, and 38.9–44.6 decibels in winter.[438] For context, a soft whisper is 30 decibels, a refrigerator hum is 40 decibels, and a typical conversation takes place at 60 decibels.[439] The CDC has set 70 decibels as the cutoff at which prolonged exposure can cause annoyance and hearing damage.[440] Also, noise has substantially decreased with turbine innovation: while earlier turbines created a steady noise from gears turning, modern turbines have been designed to insulate these sounds.[441]

A related claim is that wind turbines cause health problems through infrasound, or sound below the normal range of human hearing. The scientific evidence does not support that claim. A 2023 double-blind randomized study found no evidence that 72 hours of simulated wind turbine infrasound affected sleep, cognitive performance, or physiological or psychological measures.[442] Another study in 2019 similarly found no evidence of a link between exposure to wind turbine noise and the self-reported or measured health endpoints examined, although it did find that increasing turbine noise levels were

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432 Reuters, Wind Britain's Top Electricity Source in 2024, Jan. 7, 2025, https://www.reuters.com/world/uk/wind-britains-top-electricity-source-2024-2025-01-07/.

433 U.K. Department for Energy Security and Net Zero, Energy Trends: March 2026, Mar. 2026, https://www.gov.uk/government/statistics/energy-trends-march-2026.

434 Noise Complaints on Rise with New Industrial Wind Power Projects, NATIONAL WIND WATCH, https://www.wind-watch.org/faq-noise.php (last visited March 25, 2024).

435 A-weighted decibel measurements factor into their assessment how the human ear actually perceives sound. See Fundamentals of Noise and Sound, FEDERAL AVIATION ADMINISTRATION, https://www.faa.gov/regulations_policies/policy_guidance/noise/basics (last visited March 25, 2024).

436 RAIL TIE WIND PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT, Nov. 2021, at ES-vi, https://www.energy.gov/sites/default/files/2021-11/final-eis-0543-rail-tie-wind-wyoming-2021-11.pdf.

437 Chun-Hsiang Chiu et al., Effects of Low-Frequency Noise from Wind Turbines on Heart Rate Variability in Healthy Individuals, 11 SCI. REP. 17817, 17822 (2021), https://doi.org/10.1038/s41598-021-97107-8.

438 Id.

439 What Noises Cause Hearing Loss?, CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC), https://www.cdc.gov/nceh/hearing_loss/what_noises_cause_hearing_loss.html (last visited March 25, 2024).

440 Id.

441 Wind Turbines, ENVIRONMENTAL PROTECTION AGENCY, MINISTRY OF ENVIRONMENT OF DENMARK, https://eng.mst.dk/air-noise-waste/noise/wind-turbines/noise-from-wind-turbines/ (last visited March 25, 2024).

442 Nathaniel S. Marshall et al., The Health Effects of 72 Hours of Simulated Wind Turbine Infrasound: A Double-Blind Randomized Crossover Study in Noise-Sensitive, Healthy Adults, Environmental Health Perspectives, Vol. 131, No. 3, 2023, https://doi.org/10.1289/EHP10757.

associated with annoyance.[443]

False Claim 30: Offshore wind farms pose national-security threats from radar interference.

> "[Pausing Offshore Wind Leases] addresses emerging national security risks, including the rapid evolution of the relevant adversary technologies, and the vulnerabilities created by large-scale offshore wind projects with proximity near our east coast population centers…."[444]

The claim that offshore wind development poses a national security threat is not supported by credible public evidence. Indeed, in evaluating Trump Administration's claims regarding alleged national security risks imposed by the *Vineyard Wind* project, a federal judge concluded that "the record, including [a classified Department of Defense report] provided to the court, fails to adequately explain or justify the decision to halt construction."[445]

Wind turbines can interfere with some radar systems by creating clutter, false targets, or reduced detection sensitivity. But multiple reviews have found that these impacts can be managed and mitigated. Federal agencies have studied the impact of wind turbines on radar for years through the Wind Turbine Radar Interference Mitigation Working Group, which includes agencies such as the Department of Defense (DoD), FAA, NOAA, BOEM, and DOE.[446] The group's 2024 progress report describes ongoing work to assess offshore wind impacts on Navy and Coast Guard radar systems and, importantly, to develop mitigation solutions, including radar modernization, improved signal processing, adaptive beam steering, and other hardware and software measures.[447] The National Academies has similarly identified options for mitigating the impact of wind turbines in marine vessel radar.[448]

Presenting wind turbines as a national-security threat is also inconsistent with the Defense Department's own climate-risk assessments. The Defense Department has repeatedly identified climate change as a national-security and military-readiness threat because it damages installations, disrupts training and operations, increases disaster-response demands, and contributes to instability abroad.[449] Offshore wind helps diversify domestic electricity supply and reduce fossil-fuel combustion, which is the underlying driver of climate-related security risks.

[443] Health Canada, Wind Turbine Noise and Health Study: Summary of Results, Sept. 5, 2019, https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/everyday-things-emit-radiation/wind-turbine-noise/wind-turbine-noise-health-study-summary-results.html.

[444] U.S. Dep't of the Interior, The Trump Administration Protects U.S. National Security by Pausing Offshore Wind Leases (Dec. 22, 2025), https://www.doi.gov/pressreleases/trump-administration-protects-us-national-security-pausing-offshore-wind-leases.

[445] Benjamin Storrow, Judge Stays Feds' Vineyard Wind Stop Order, E&E News by POLITICO (Jan. 27, 2026), https://subscriber.politicopro.com/article/eenews/2026/01/27/judge-stays-feds-vineyard-wind-stop-order-00750031.

[446] Sandia National Laboratories, Wind Turbine Radar Interference Mitigation, https://energy.sandia.gov/programs/renewable-energy/wind-power/national-security/siting-wind-turbineradar-interference-mitigation-tspear-ifte/ (last visited: Jul. 26, 2026).

[447] Id.

[448] National Academies of Sciences, Engineering, and Medicine, Wind Turbine Generator Impacts to Marine Vessel Radar (2022).

[449] U.S. Department of Defense, 2014 Climate Change Adaptation Roadmap, Oct. 2014; U.S. Department of Defense, *2021 Climate Adaptation Plan* (Sept. 2021), https://www.sustainability.gov/pdfs/dod-2021-cap.pdf.

PART C: FALSE CLAIMS ABOUT ELECTRIC VEHICLES

PART C: FALSE CLAIMS ABOUT ELECTRIC VEHICLES

False Claim #31: Electric vehicles have a net harmful effect on climate change.

"Contrary to vociferous assertions, EVs are no friends of the environment."[450]

EVs are essential to reducing greenhouse gas (GHG) emissions and the use of fossil fuels that cause those emissions.[451] The Environmental Protection Agency has found that EVs typically have lower lifecycle emissions than traditional gasoline-powered cars, even when taking into account the emissions released when manufacturing EVs and generating power to charge them.[452] The Intergovernmental Panel on Climate Change has further explained that "[t]he extent to which EV deployment can decrease emissions by replacing internal combustion engine-based vehicles depends on the generation mix of the electric grid although, even with current grids, EVs reduce emissions in almost all cases."[453] The key reason why EVs reduce emissions in almost all cases is that they are inherently more efficient than conventional gasoline-powered vehicles: EVs convert over 87-91% of electrical energy to power at the wheels, whereas conventional vehicles only convert roughly 16%–25% of the energy in gasoline to power at the wheels."[454]

A 2021 study from the Argonne National Laboratory study found that the average lifecycle GHGs associated with a gasoline-powered car that gets 30.7 miles per gallon are more than twice as high as those of an EV with a 300-mile range, assuming average U.S. grid emissions.[455] As U.S. grid emissions reduce with increased renewable energy generation, this delta will only increase. The figure below from the EPA shows that the lifecycle GHGs for the gasoline-powered car under this scenario are between 350 and 400 grams/mile, whereas the lifecycle GHGs for the EV are only slightly above 150 grams/mile.[456]

[450] Steve Forbes, The Expensive and Harmful Truth About Electric Vehicles, FORBES, Jan. 6, 2023, https://www.forbes.com/sites/steveforbes/2023/01/06/the-expensive-and-harmful-truth-about-electric-vehicles/.

[451] See Divya Singh et al., Does electric vehicle adoption (EVA) contribute to clean energy? Bibliometric insights and future research agency, 8 Cleaner & Responsible Consumption 100099, 1 (2023), https://www.sciencedirect.com/science/article/pii/S2666784322000535#bib4; Electric Vehicle Benefits and Considerations, ALTERNATIVE FUELS DATA CENTRE, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, US DEPARTMENT OF ENERGY, https://perma.cc/VN3M-HAEJ (archived Feb. 25, 2025).

[452] Electric Vehicle Myths, supra note 21.

[453] IPCC, Climate Change 2022: Mitigation of Climate Change (2022), 271, https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf.

[454] Electric Vehicle Myths, supra note 21.

[455] Id.

[456] Id.

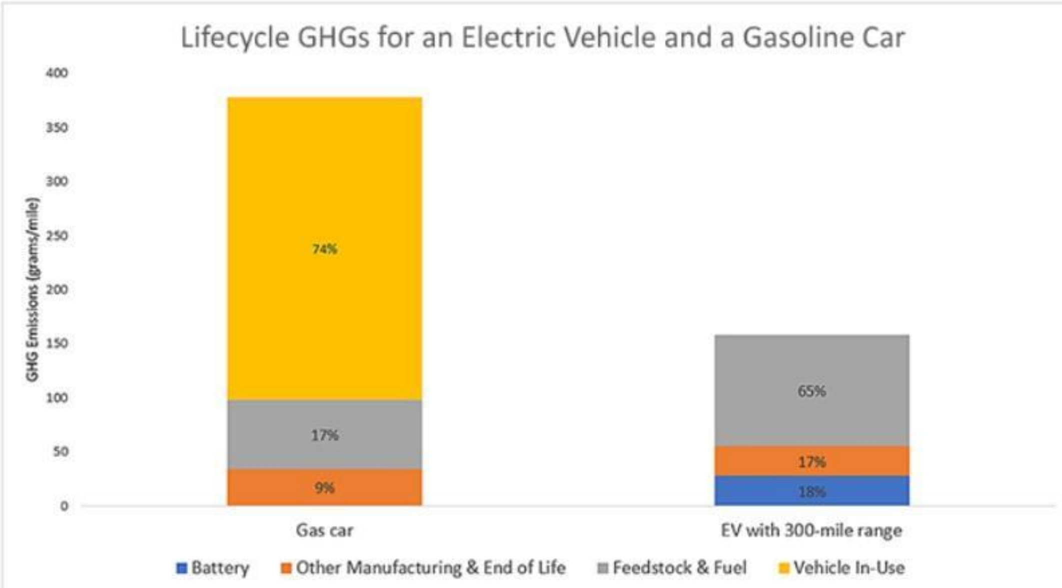

Figure 17: Break down of lifecycle emissions for electric and gasoline cars. This figure is based on the following assumptions: a vehicle lifetime of 173,151 miles for both the EV and gas car; a 30.7 MPG gas car; and U.S. average grid emissions.
Source: EPA.[457]

Most importantly, EVs' lack of tailpipe emissions and heightened efficiency more than offset the emissions required to manufacture EV batteries: these emissions are offset within 1.4-1.5 years for electric sedans, and within 1.6-1.9 years for electric SUVs.[458] These reduced tailpipe emissions not only help to stabilize our climate, but also improve air quality, bringing multiple health benefits including reduced rates of childhood asthma, particularly in urban areas. Indeed, one study found that study found that the regenerative braking used in EVs reduced brake wear by 64–95%, and that electric powertrains reduced urban brake-wear particulate matter emissions by an average of 68%.[459]

The emissions offset by transitioning to EVs vary based on the carbon intensity of the energy grid. A study from Munich's Universität der Bundeswehr found EVs to have reduced emissions by 72% when powered by Germany's electric grid, which drew 23% of its electricity from renewable energy in 2021.[460] But the researchers projected that a 100% renewable energy grid would have allowed EVs to reduce emissions by as much as 97%.[461] And the U.S. grid is getting cleaner over time, with a 44% reduction in power sector emissions from 2005 to 2023, meaning that EVs are having an increasingly positive impact on U.S. emissions.[462]

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[457] Id.

[458] Maxwell Woody et al., The Role of Pickup Truck Electrification in the Decarbonization of Light-Duty Vehicles, 17 ENVIRON. RES. (Mar. 1, 2022), https://iopscience.iop.org/article/10.1088/1748-9326/ac5142. These figures assume "a business-as-usual scenario which includes policies in place as of June 2020 with no projected policy changes, resulting in a grid that is 50% less carbon intensive in 2035 compared to 2005."

[459] William Hicks, David C. Green & Sean Beevers, "Quantifying the change of brake wear particulate matter emissions through powertrain electrification in passenger vehicles," 336 Environmental Pollution 122400 (2023).

[460] Johannes Buberger et al., Total CO2-Equivalent Life-Cycle Emissions from Commercially Available Passenger Cars, 159 RENEWABLE & SUSTAINABLE ENERGY REV, 10 (2022), https://doi.org/10.1016/j.rser.2022.112158.

[461] Id.; see also Paul Wolfram et al., Pricing Indirect Emissions Accelerates Low—Carbon Transition of US Light Vehicle Sector, 12 NATURE COMMC'NS, (2021), https://doi.org/10.1038/s41467-021-27247-y.

[462] Power Sector Carbon Index, SCOTT INSTITUTE FOR ENERGY INNOVATION, https://emissionsindex.org/ (last visited March 25, 2024).

False Claim #32: Electric vehicles will cost the United States many automobile industry jobs.

> "By most estimates under Biden's electric vehicle mandate, 40 percent of all U.S. auto jobs will disappear—think of this—in one or two years."[463]

EV manufacturing need not result in fewer jobs in the U.S. automobile industry.[464] A 2022 study found that manufacturing battery EV [BEV] powertrain components is more labor intensive than manufacturing powertrain components for internal combustion engine vehicles [ICEVs], which suggests that vehicle electrification may lead to powertrain manufacturing job growth.[465] In addition, an Economic Policy Institute report concluded that "if the shift to BEVs is accompanied by strategic investments in manufacturing and job quality in the U.S. auto sector, then the number and quality of jobs can rise together with BEV production."[466]

Electric vehicle production already has created thousands of new jobs in the United States. From 2015 to 2023, there were over 179,000 announced U.S. jobs related to EVs and EV batteries.[467] In 2021, the domestic EV industry employed roughly 106,000 workers, more than a 90% increase from 2016 (roughly 55,000 jobs).[468] In 2021 alone, the number of domestic jobs in the EV industry grew by over 26%.[469] In 2023, employment in clean vehicles—including battery-electric, plug-in hybrid, and hydrogen/fuel-cell vehicles— increased again by 11.4%.[470] Employment specifically in battery-electric vehicles grew by 12.9% in 2023, substantially outpacing the 2.0% growth in gasoline- and diesel-powered vehicle employment.[471]

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[463] Angelo Fichera, Trump Autoworkers Speech Fact Check: What of Electric Vehicles?, N.Y. TIMES (Sept. 28, 2023, last updated Oct. 9, 2023), https://www.nytimes.com/2023/09/28/us/politics/trump-fact-check-electric-vehicles.html (quoting Donald Trump).

[464] See Emily Pontecorvo, There's Surprisingly Little Evidence That EVs Will Require Fewer Workers, HEATMAP (Oct. 6, 2023), https://heatmap.news/electric-vehicles/evs-trump-uaw-jobs-evidence.

[465] Turner Cotterman et al., The transition to electrified vehicles: Evaluating the labor demand of manufacturing conventional versus battery electric vehicle powertrains at 1 (June 4, 2022), https://ssrn.com/abstract=4128130.

[466] Jim Barrett & Josh Bivens, The Stake for Workers in How Policymakers Manage the Coming Shift to All-Electric Vehicles, ECONOMIC POLICY INSTITUTE (Sept. 22, 2021), https://www.epi.org/publication/ev-policy-workers/ .The study authors focused on vehicle powertrains, "the automotive system responsible for generating the kinetic power to move the vehicle forward," because the powertrain is the least similar aspect between EVs and ICEVs. Id. At 3.

[467] ENVT'L DEFENSE FUND, U.S. ELECTRIC VEHICLE MANUFACTURING INVESTMENTS AND JOBS: CHARACTERIZING THE IMPACTS OF THE INFLATION REDUCTION ACT AFTER 1 YEAR at 2 (2023), https://www.edf.org/sites/default/files/2023-08/EDF%20WSP%20EV%20report%208-16-23%20FINAL%20FINAL.pdf.

[468] BW Research Partnership, Energy Employment by State – 2020, 147 (2020), https://www.usenergyjobs.org/s/USEER-Energy-Employment-by-State-2020.pdf; David Keyser et al., United States Energy and Employment Report 2022, OFFICE OF POLICY, OFFICE OF ENERGY JOBS, U.S. DEPARTMENT OF ENERGY, 141-143 (2022), https://perma.cc/2Z58-UX2F (archived Feb. 25, 2025).

[469] DOE Report Finds Energy Jobs Grew Faster Than Overall U.S. Employment in 2021, U.S. DEPARTMENT OF ENERGY (June 28, 2022), https://perma.cc/6CQX-S4CN (archived Feb. 25, 2025).

[470] U.S. Dep't of Energy, United States Energy & Employment Report 2024 (2024), https://www.energy.gov/sites/default/files/2024-10/USEER%202024_COMPLETE_1002.pdf

[471] Id.

False Claim #33: Electric vehicles are impractical due to range restrictions.

"Here's the problem with an electric car: they don't go far. Very simple."[472]

The majority of EVs can travel roughly 200 miles on a single charge and some models can travel over 400 miles on a single charge.[473] Although the median range of a gasoline vehicle (403 miles) is roughly 40% higher than that of an EV (283 miles),[474] the range of a standard EV is more than enough to meet the daily needs of median U.S. households.[475] A 2016 study found that the travel requirements of 87% of vehicle-days could be met by existing, affordable electric vehicles.[476] The average range of electric vehicles has only increased since then, from roughly 145 miles in 2016 to roughly 217 miles in 2021 and to roughly 283 miles in 2024.[477] Because most EV drivers charge their vehicles overnight at their home, most of these drivers can go about their daily driving with no need to stop to recharge.[478]

EV range is also benefiting from the build-out of charging infrastructure. The United States is rapidly building electric charging ports, more than tripling those in operation, from approximately 52,500 in 2017 to approximately 250,000 in 2026.[479] For comparison, there are approximately 150,000 gas stations in the United States, which likely include about 900,000 to 1.8 million individual pumps.[480] In addition, the United States installed 6,300 fast chargers in 2022, which brought the national total to 28,000 fast chargers.[481] The next year, in 2023, the United States installed 10,651 public fast chargers, 56% more than in 2022.[482] In 2026, there are now 73,000 fast chargers.[483] Notably, states can still receive funding through the National Electric Vehicle Infrastructure (NEVI) Formula Program to strategically deploy electric vehicle (EV) charging infrastructure.[484]

Public charging infrastructure has continued to grow globally as well. The International Energy Agency reported that nearly

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472 Donald Trump, Campaign Speech in Ankeny, Iowa, CSPAN (Dec. 2, 2023), https://www.c-span.org/video/?532073-1/president-trump-delivers-remarks-ankeny-iowa.

473 Electric Vehicle Myths, supra note 21; Model Year 2021 All-Electric Vehicles Had a Median Driving Range about 60% That of Gasoline Powered Vehicles, DEP'T OF ENERGY, Jan. 17, 2022, https://www.energy.gov/eere/vehicles/articles/fotw-1221-january-17-2022-model-year-2021-all-electric-vehicles-had-median; Evolution of average range of electric vehicles by powertrain, 2010-2021, IEA (last updated May 19, 2022), https://www.iea.org/data-and-statistics/charts/evolution-of-average-range-of-electric-vehicles-by-powertrain-2010-2021.

474 DEP'T OF ENERGY, supra note 473; U.S. Dep't of Energy, *FOTW #1375: Median EV Range in Model Year 2024 Reached a Record High of 283 Miles per Charge* (Dec. 30, 2024), https://www.energy.gov/cmei/vehicles/articles/fotw-1375-december-30-2024-median-ev-range-model-year-2024-reached-record.

475 Electric Vehicle Myths, supra note 21.

476 Zachary A. Needell et al., Potential for Widespread Electrification of Personal Vehicle Travel in the United States, NATURE ENERGY 1, 16112 (2016). https://doi.org/10.1038/nenergy.2016.112.

477 Evolution of average range of electric vehicles by powertrain, 2010-2021, supra note 473; DEP'T OF ENERGY, supra note 488.

478 Charging Electric Vehicles at Home, U.S. Dep't of Energy, https://perma.cc/9RYP-FS93 (archived Feb. 25, 2025).

479 FCW Team, U.S. Reaches 250,000 Public EV Charging Ports, Fuel Cells Works (June 23, 2026), https://fuelcellsworks.com/2026/06/22/battery/us-reaches-250-000-public-ev-charging-ports.

480 Service Station FAQs, AMERICAN PETROLEUM INSTITUTE, https://www.api.org/oil-and-natural-gas/consumer-information/consumer-resources/service-station-faqs (last visited March 25, 2024); What is the future of gas stations vs EV chargers?, Enel X Way, Nov. 21, 2022, https://www.enelxway.com/us/en/resources/blog/what-is-the-future-of-gas-stations-vs-ev-chargers.

481 INTERNATIONAL ENERGY AGENCY, GLOBAL EV OUTLOOK 2023, 45 (2023), https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf.

482 Michael Thomas, American Is Finally Building a Nationwide EV Charging Network, DISTILLED, Mar. 27, 2024, https://www.distilled.earth/p/america-is-finally-building-a-nationwide.

483 Eric Loveday, Average EV Range Has Increased Dramatically Over the Past Decade, (Dec. 2024), InsideEVs, https://insideevs.com/news/746799/average-ev-range/.

484 Alternative Fuels Data Center, Nat'l Elec. Vehicle Infrastructure (NEVI) Formula Program, U.S. Dep't of Energy, https://afdc.energy.gov/laws/12744 (last visited Aug. 26, 2026).

1.8 million public charging points were added worldwide in 2025, bringing the global public charging stock to more than 7 million by the end of 2025.[485]

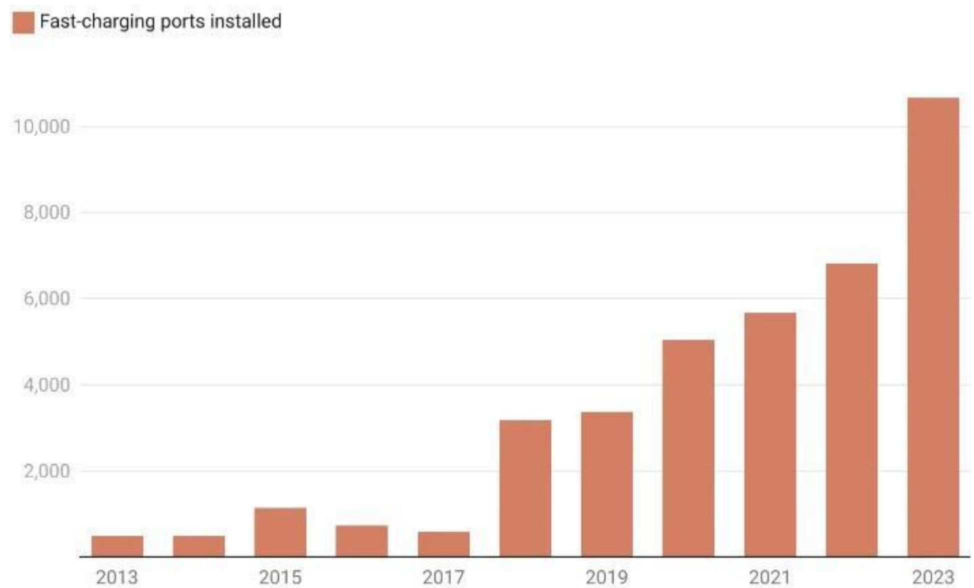

Figure 18: Representation of fast-charging ports installed in the United States each year from 2013 to 2023. **Source: Michael Thomas, Distilled.[486]**

False Claim #34: Electric vehicles cannot function in hot or cold weather.

"Temperature affects EVs in bad ways."[487]

Extreme temperatures can decrease EV range, particularly extreme cold, but this issue is not unique to EVs. According to a 2019 American Automobile Association report, when compared to conditions of 75°F with the Heating, Ventilation, and Air Conditioning set to Off, a typical EV's range decreased by 12% at 20°F, and by 4% at 95°F.[488] When comparing conditions with the HVAC set to Auto, a temperature drop from 72°F to 20°F decreased a typical EV's range by 41%, and a temperature rise from 72°F to 95°F decreased range by 17%.[489] However, EV models are increasingly adopting heat pump technology in place of traditional electric resistance heating, which can minimize the electricity consumption associated with heating an

[485] International Energy Agency, *Global EV Outlook 2026: Electric Vehicle Charging*, https://www.iea.org/reports/global-ev-outlook-2026/electric-vehicle-charging-chap-6-and-10.
[486] Michael Thomas, supra note 482 (reproduced with permission).
[487] Federico Alcala, 15 Disadvantages of Electric Cars, TOPSPEED (Jul. 6, 2023), https://www.topspeed.com/disadvantages-of-electric-cars/#charging-times-are-still-not-on-par-with-filling-up-gas.
[488] AAA Electric Vehicle Range Testing, AMERICAN AUTOMOBILE ASSOCIATION, 32, 51 (2019), https://www.aaa.com/AAA/common/AAR/files/AAA-Electric-Vehicle-Range-Testing-Report.pdf.
[489] Id.

electric vehicle in extreme cold.[490]

Traditional gasoline-powered cars are likewise susceptible to extreme weather conditions. Fuel economy tests have also shown a decrease in mileage per gallon for conventional gasoline cars due to temperature drops, with mileage roughly 15% lower at 20°F than at 72°F.[491] As with EVs, decreased fuel efficiency for conventional gasoline cars in extreme weather is partially attributable to increased reliance on HVAC systems.[492] Both EVs and gasoline-powered cars are likewise susceptible to cold temperatures lowering tire pressure.[493]

Data from a roadside assistance company in Norway suggests that, by one metric, EVs may actually be more reliable than gasoline-powered cars in the cold.[494] In particular, whereas internal combustion engines sometimes have trouble starting in the cold, this problem appears to be less common for EVs: while 23% of cars in Norway are EVs, only 13% of reported cases involving cars that failed to turn on in the cold were EVs.[495]

False Claim #35: Electric vehicles are prohibitively expensive and make cars unaffordable.

> "The Biden-Harris Administration rush-to-green agenda is … forcing people to buy unaffordable EVs they don't want."[496]

EVs can still have higher upfront prices than comparable gasoline vehicles, but the price gap has narrowed substantially in recent years. Kelley Blue Book/Cox Automotive reported that the average new EV transaction price fell to $54,532 in May 2026, down 4.0% year over year and marking the eleventh consecutive month of annual EV price declines.[497] S&P GlobalMobility likewise found that EV monthly payments are equal to or below comparable gasoline vehicles in several vehicle categories.[498] The International Energy Agency also found that the average U.S. battery-electric vehicle retail price fell nearly 2% in 2025, largely because of

[490] Carolyn Fortuna, Why Heat Pumps Are Essential for EVs When the Weather Is Cold, CLEANTECHNICA, Jan. 22, 2024, https://cleantechnica.com/2024/01/22/why-heat-pumps-are-essential-for-evs-when-the-weather-is-cold; Shannon Osaka, Why you might want a heat pump in your electric car, WASHINGTON POST, Jan. 7, 2023, https://www.washingtonpost.com/climate-solutions/2023/01/07/electric-vehicles-cold-winter-range/.

[491] Fuel Economy in Cold Weather, U.S. DEP'T. ENERGY, https://www.energy.gov/energysaver/fuel-economy-cold-weather (last visited March 25, 2024).

[492] Id.; Fuel Economy in Hot Weather, U.S. DEP'T ENERGY, https://www.energy.gov/energysaver/fuel-economy-hot-weather (last visited March 25, 2024).

[493] See Sydnie Gjerald, Winter Range: ICE vs EV, UTILMARC, Jan. 4, 2022, https://www.utilimarc.com/blog/winter-range-ice-vs-ev/; Fuel Economy in Cold Weather, supra note 491.

[494] Fred Lambert, Electric vehicles fail at a lower rate than gas cars in extreme cold, ELECTREK, Jan. 17, 2024, https://electrek.co/2024/01/17/electric-vehicles-fail-lower-rate-than-gas-cars-extreme-cold/ (noting that EVs are newer on average than other types of cars). The relatively strong performance of EVs in cold weather in Norway may be influenced by the more frequent use of home charging, more extensive charging port distribution, and drivers that are more accustomed to managing EVs in the cold. See Emily Schmall & Jenny Gross, Electric Car Owners Confront a Harsh Foe: Cold Weather, N.Y. TIMES, Jan. 17, 2024 (updated Jan. 18, 2024), https://www.nytimes.com/2024/01/17/business/tesla-charging-chicago-cold-weather.html.

[495] Id.

[496] Matthew Daly, House Backs Measure to Overturn Biden Auto Emissions Rule That Republicans Say Would Force EV Sales, Associated Press (May 1, 2024), https://apnews.com/article/epa-tailpipe-emissions-electric-vehicles-republicans-1a1e4f817f21b593d8573a2bc8582474 (quoting former U.S. representative Cathy McMorris Rodgers).

[497] Cox Automotive, Kelley Blue Book Report: New-Vehicle Price Increases Moderate in May, Incentive Spending Grows (June 9, 2026), https://www.coxautoinc.com/insights/may-2026-atp-report/.

[498] Tom Libby, Electric Vehicle Prices Now Match or Beat Gas Cars, Mobility Global (July 10, 2025), https://www.mobilityglobal.com/en-us/automotive-insights/blog/electric-vehicle-prices-match-or-beat-gas-cars.

declining battery costs.[499]

Furthermore, the claim that electric vehicles are too expensive to buy also ignores the fact that they have significantly lower operating costs than gasoline vehicles. EVs are more efficient than gasoline vehicles and typically cost less to fuel and maintain. DOE's Alternative Fuels Data Center states that EVs can "reduce fuel costs dramatically," with many light-duty EVs exceeding 130 MPGe and consuming only 25–40 kWh per 100 miles.[500] A 2025 Atlas Public Policy analysis found that electric cars and trucks cost significantly less to own over seven years than comparable top-selling gasoline vehicles — the savings range from $2,000 for compact sedans, up to more than $8,000 for a mid-size SUV.[501]

Notably, the Trump Administration ended federal clean-vehicle credits, which were designed to reduce EV purchase costs, including up to $7,500 for qualifying new clean vehicles and up to $4,000 for qualifying used clean vehicles.[502] Those credits are not available for vehicles acquired after September 30, 2025. End of the credits made EVs more expensive for consumers, even as the administration cited EV affordability as a reason to roll back EV-supportive policies.[503]

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[499] International Energy Agency, Global EV Outlook 2026, Trends in Electric Cars, https://www.iea.org/reports/global-ev-outlook-2026/trends-in-electric-cars (last visited: July 28, 2026).

[500] U.S. Department of Energy, Alternative Fuels Data Center, Electric Vehicle Benefits and Considerations, https://afdc.energy.gov/fuels/electricity-benefits (last visited: July 28, 2026).

[501] Daniel Wilkins, Nick Nigro, Comparing the Total Cost of Ownership of the Most Popular Vehicles in the United States: 2025 Update, Atlas Public Policy (July 2025), https://atlaspolicy.com/comparing-the-total-cost-of-ownership-of-the-most-popular-vehicles-in-the-united-states-2025-update/.

[502] Internal Revenue Service, Credits for New Clean Vehicles Purchased in 2023 or After, https://www.irs.gov/credits-deductions/credits-for-new-clean-vehicles-purchased-in-2023-or-after (last visited: July 28, 2026).

[503] Internal Revenue Service, Used Clean Vehicle Credit, https://www.irs.gov/credits-deductions/used-clean-vehicle-credit (last visited: July 28, 2026).

PART D: FALSE CLAIMS ABOUT BATTERY STORAGE

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False Claim #36: Battery storage cannot provide a reliable source of power.

> "Batteries cannot deliver power continuously and must be recharged, often via the same intermittent power they were meant to buffer. They do not provide reliable backup."[504]

Although battery energy storage systems ("BESS") have finite discharge durations and must eventually be recharged, that limitation does not make them inherently unreliable. BESS are designed to provide targeted reliability services that strengthen grid performance during periods of peak demand and accommodate renewable energy intermittency.[505] BESS can enhance grid reliability by storing excess electricity when supply exceeds demand and dispatching it when demand rises or renewable output declines.[506] They provide rapid-response frequency regulation, voltage stabilization, reactive power support, and outage mitigation that help maintain grid stability and restore service following disruptions.[507]

Studies have demonstrated that the reliability benefits of BSEE have significant economic value. One study found that BESS provides measurable benefits across multiple use cases, with median values ranging from less than $10/kW-year for voltage support to approximately $100/kW-year for capacity and frequency regulation services.[508] The value of avoiding outages could be substantially higher: up to $719/kW-year for outage mitigation in cases involving costly power interruptions.[509]

These benefits are increasingly reflected in grid operations. The North American Electric Reliability Corporation ("NERC") reports that recent BESS deployments in Texas, California, and the western United States have markedly improved the ability to manage energy shortfall risks during challenging summer periods, particularly during evening hours when solar generation declines but electricity demand remains high.[510] Thus, while BESS are only intended to provide limited-duration backup power, they provide valuable reliability services that strengthen the resilience of modern electric grids.

False Claim #37: Battery storage facilities pose substantial fire risks to surrounding communities.

> "The stored energy in larger 1-GWh lithium-ion systems is comparable to hundreds of tons of TNT, and thermal runaway events have caused fires and explosions in battery facilities, ships, and aircraft. The larger and more densely packed these systems become, the greater the risk."[511]

Although lithium-ion battery energy storage systems can experience thermal runaway that may result in fires or explosions, available evidence indicates that such events are rare and have become less frequent as deployment of BESS has increased.

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[504] Lars Schernikau, The Battery Storage Delusion: Utility-Scale Batteries Are No Silver Bullet, Nat'l Ctr. for Energy Analytics (Dec. 3, 2025), https://energyanalytics.org/research/the-battery-storage-delusion.
[505] N. Am. Elec. Reliability Corp., *2025 Summer Reliability Assessment* (2025), https://www.nerc.com/globalassets/programs/rapa/ra/nerc_sra_2025.pdf
[506] Habib et. al., *Role of battery energy storage systems:* A comprehensive review on renewable energy zones integration in weak transmission networks, 128 J. OF ENERGY STORAGE 117223 (2025).
[507] Id.
[508] Patrick Balducci, Kendall Mongird & Mark Weimar, Understanding the Value of Energy Storage for Power System Reliability and Resilience Applications, 8 CURRENT SUSTAINABLE/RENEWABLE ENERGY REPORTS 131 (2021).
[509] Id.
[510] N. Am. Elec. Reliability Corp., supra note 505.
[511] Schernkiau, supra note 504.

According to the Electric Power Research Institute ("EPRI"), only 0.3% of BESS projects experienced a failure leading to a fire with potential safety concerns in 2024.[512] Moreover, while cumulative global BESS deployment increased from approximately 11 GWh in 2018 to more than 300 GWh in 2024, failure rates declined by more than 98% over the same period, reflecting improvements in battery design, manufacturing, and operational practices.[513]

The available evidence likewise suggests that BESS fires have rarely resulted in casualties or significant off-site health impacts. A review of EPRI failure database found that reported casualties were very rare.[514] Additionally, a study from New York State Energy Research & Development Authority (NYSERDA) found that, while battery energy storage fires do release some toxic gases, their average toxicity level is similar to or lower than common household and office plastic fires.[515] Similarly, a review of post-fire environmental samples conducted after multiple BESS fire events found no airborne, water, or groundwater contaminant concentrations that posed a public health concern or required further remediation.[516]

Finally, modern BESS are subject to extensive safety requirements designed to prevent thermal runaway and mitigate its consequences. Widely adopted fire safety standards and best practices, such as NFPA 855,[517] require hazard analyses, large-scale fire testing, battery management systems, gas detection, ventilation, thermal management, and other engineering controls to reduce the likelihood of thermal runaway.[518]

False Claim #38: Battery storage creates an unsustainable amount of waste.

> "Battery energy storage is a dirty business… [t]he waste created by battery production is not easy to recycle"[519]

Although lithium-ion battery recycling rates still remain relatively low, commercial recycling processes for lithium-ion batteries are already available. After collection and sorting, batteries can be shredded into a material known as "black mass," which contains valuable materials such as lithium, cobalt, nickel, manganese, graphite, and other critical minerals.[520] These materials can then be recovered through established hydrometallurgical and pyrometallurgical processes and reused in manufacturing.[521]

The DOE has invested in expanding and improving these recycling capabilities through initiatives led by Argonne National

[512] Rahul Rao, Are Grid Battery Storage Systems Fire-Prone? Early Data Suggests Their Fires Are Rare, Sci. Feedback (Dec. 2, 2025), https://science.feedback.org/are-grid-battery-storage-systems-fire-prone/
[513] Id.
[514] Mylenbusch, Ian S., Kieran Claffey, and Benjamin N. Chu, Hazards of lithium-ion battery energy storage systems (BESS), mitigation strategies, minimum requirements, and best practices, PROCESS SAFETY PROGRESS 42.4 (2023): 664-673.
[515] Considerations for ESS Fire Safety: Final Report, DNVGL (Feb. 2017), https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Research/Energy-Storage/20170118-ConEd-NYSERDA-Battery-Testing-Report.pdf, (prepared for Consol. Edison Co. of N.Y. & N.Y. State Energy Rsch. & Dev. Auth., Rep. No. OAPUS301WIKO(PP151894).
[516] Assessment of Potential Impacts of Fires at BESS Facilities, Fire & Risk All., LLC (2025), https://cdn.prod.website-files.com/666b00bb91a866df89c4f469/67e44e5991dada623fd2e8f0_Assessment-of-Potential-Impacts-of-Fires-at-BESS-Facilities.pdf, (prepared for the Am. Clean Power Ass'n).
[517] Am. Clean Power Ass'n, NFPA 855: Improving Energy Storage System Safety (2025), https://cleanpower.org/wp-content/uploads/gateway/2024/01/NFPA855_Safety_240111.pdf (NPFA 855 is a widely adopted standart which outlines comprehensive safety provisions for the installation of energy storage systems).
[518] Francisco Joglar, Landscape of Battery Energy Storage System Hazards & Mitigation Strategies, Nat'l Fire Prot. Ass'n Rsch. Found. (Dec. 2023), https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/landscape-of-battery-energy-storage-system-hazards--mitigation-strategies
[519] Salman Zafar, Why Battery Energy Storage Is an Unsustainable Solution in a Zero Carbon Future, EcoMENA (Apr. 19, 2025), https://www.ecomena.org/why-battery-energy-storage-is-an-unsustainable-solution
[520] Lithium Batteries and the Circular Economy, Nat'l Inst. Standards & Tech., https://www.nist.gov/circular-economy/lithium-batteries-and-circular-economy (last visited Aug. 6, 2026).
[521] Elec. Power Rsch. Inst., Guidelines for Assessing End-of-Life Management Options for Renewable and Battery Energy Storage Technologies (2024), https://www.epri.com.

Laboratory. For example, DOE established a Battery Recycling Center at Argonne to develop cost-effective recycling technologies with the goal of capturing 90% of lithium-based battery technologies in the United States and recovering 90% of key materials from collected batteries.[522] As of August 2025, there were a total of 39 lithium battery recycling plants in the United States, though collection infrastructure remains underdeveloped.[523] DOE and other federal research programs could support the development of improved recycling technologies and enhanced material recovery.[524]

[522] Energy Department Announces Opening of Battery Recycling Center at Argonne National Lab, U.S. Dep't Energy (Feb. 15, 2019), https://www.energy.gov/articles/energy-department-announces-opening-battery-recycling-center-argonne-national-lab.

[523] U.S. Int'l Trade Comm'n, USMCA Automotive Rules of Origin: Economic Impact and Operation, 2025 Report, Pub. No. 5642, Inv. No. 332-600 (July 2025), https://www.usitc.gov/publications/332/pub5642.pdf

[524] Taylor Curtis et al., A Circular Economy for Lithium-Ion Batteries Used in Mobile and Stationary Energy Storage: Drivers, Barriers, Enablers, and U.S. Policy Considerations, Nat'l Renewable Energy Lab. (Dec. 2020), https://www.nrel.gov/docs/fy21osti/77045.pdf