POLICY STUDY

HOW STATES CAN PUSH BACK AGAINST THE

DESTRUCTIVE EXPANSION OF INDUSTRIAL SOLAR POWER

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Introduction

U.S. industrial solar development has increased dramatically in recent years, spurred by aggressive governmental regulations, subsidies, and other incentives. In 2024, the U.S. solar industry installed a record-high 49.99 gigawatts direct current (GWdc) of solar capacity, an increase of 23 percent from 2023.[1] Industrial solar installation comprised more than 80 percent of this growth, increasing 33 percent from 2023.[2]

As opposed to residential solar installations, which are placed on rooftops and used primarily for property owners' electricity consumption, industrial solar installations are typically ground-mounted and designed for larger-scale electricity generation. Industrial solar projects, which can be considered synonymous with "utility-scale solar" for the purposes of this paper, sell the electricity they generate directly to utilities to provide power for the electric grid.[3]

This paper summarizes the myriad problems associated with industrial solar expansion—and the reliance upon solar energy more generally—and concludes with a set of concrete solutions policymakers should consider to protect their states.

Climate alarmists and their allies in government and the private sector herald the use of solar power and other renewable energy sources as critical to prevent or mitigate what they claim is an impending climate catastrophe caused by anthropogenic greenhouse gas emissions. Yet, the expansion of industrial solar capacity creates an analogous increase in significant economic and social costs, many of which are hidden or externalized. Further, industrial solar wreaks havoc upon the environment, destroying the very thing its adherents claim they desire to protect. Even if one accepts the nebulous theory that the planet is nearing an apocalyptic precipice, the costs associated with solar power far outweigh the marginal benefits.

As more states consider expanding their solar footprint, it is vital for policymakers to examine the full consequences of this energy source. This paper summarizes the myriad problems associated with industrial solar expansion—and the reliance upon solar energy more generally—and concludes with a set of concrete solutions policymakers should consider to protect their states.

1 Solar Energy Industries Association, "Solar Market Insight Report 2024 Year in Review," March 11, 2025, https://seia.org/research-resources/solar-market-insight-report-2024-year-in-review/

2 Solar Energy Industries Association, "Solar Market Insight Report 2024 Year in Review."

3 Definitions of industrial or utility-scale solar vary. Some organizations define such a project as generating greater than one megawatt of energy, while others use a five-megawatt threshold. Some markets use a threshold as high as 25 megawatts and up, while others use a much lower threshold. The common theme is that these installations all generate large-scale power for the electric grid. See: Urbangridsolar.com, "What Is Utility-Scale Solar? An Overview," August 18, 2019, https://www.urbangridsolar.com/what-is-utility-scale-solar-an-overview/

Major Problems Caused by Industrial Solar

From problems including the destruction of farmland and natural habitat to electric grid destabilization and increased costs to consumers, the expansion of industrial solar power is far from impact-free.

1 Land Use and Destruction of Productive Farmland

Industrial solar projects require vast swaths of land to accommodate thousands of ground-mounted solar panels. A conservative estimate for the footprint of industrial solar is approximately 10 acres for every megawatt of electricity produced.[4] To meet the renewable electricity goals established by global, national, and state-level authorities, a comprehensive study by the U.S. Department of Energy (DOE) estimated that industrial solar is projected to require 5.7 million acres of land by 2035, and 10 million acres by 2050—covering approximately 0.5 percent of the contiguous United States.[5]

Solar plants require substantially more land than other sources of energy to produce the same amount of power. One study estimated that when mining, disposal, and transmission are included alongside the overall footprint of the industrial solar facility, solar energy requires 43.5 acres of land per megawatt of electricity produced.[6] This overall land footprint is more than three times larger than what the same study found to be required by coal, natural gas, and nuclear plants, which each use between 12 and 13 acres.

Because hundreds or even thousands of acres are required for each project, most industrial solar facilities are built on agricultural land. This is often an attractive arrangement for landowners, as solar companies offer leases that are well above average property rental rates.[7] A recent study by the U.S. Department of Agriculture estimated that 70 percent of solar facilities constructed from 2009 to 2020 were installed on agricultural land—either cropland or rangeland.[8] A 2022 study by the

4 Solar Energy Industries Association, “Land Use & Solar Development,” accessed March 25, 2025, https://seia.org/initiatives/land-use-solar-development/

5 U.S. Department of Energy, *Solar Futures Study,* September 2021, https://www.energy.gov/sites/default/files/2021-09/Solar%20Futures%20Study.pdf

6 Landon Stevens et al., *The Footprint of Energy: Land Use of U.S. Electricity Production*, Strata, June 2017, https://docs.wind-watch.org/US-footprints-Strata-2017.pdf

7 Betty Resnick and Arica Hamilton, “Solar Energy Expansion and its Impacts on Rural Communities,” American Farm Bureau Federation, August 8, 2024, https://www.fb.org/market-intel/solar-energy-expansion-and-its-impacts-on-rural-communities

8 Karen Maquire et al., “Utility-Scale Solar and Wind Development in Rural Areas: Land Cover Change (2009-20),” U.S.

American Farmland Trust found that 83 percent of new solar energy development will be on farmland or rangeland, with "almost 50% placed on the most productive, versatile, and resilient land."[9]

When agricultural land is converted to a solar power generation facility, it almost always ceases to be used for crop or livestock production. The DOE explains that while it is possible to place solar and agriculture on the same land, such a scenario is rare, and most "large, ground-mounted solar photovoltaic (PV) systems are installed on land used only for solar energy production."[10] For example, Iowa's largest solar facility began operating in 2021, and covers approximately 1,000 acres. Ninety percent of that land had previously been used to grow crops such as corn and soybeans. It is now home to thousands of solar panels.[11]

Solar installations effectively remove land from agricultural use for decades, as solar panels typically last only 25 to 30 years.[12] As more productive farmland is converted for this purpose, local farming communities could be devastated, and overall food production and security could be threatened. Moreover, there is significant evidence that industrial solar projects harm the land they are situated upon by damaging the rich soil crucial for crop production.[13] This is only one aspect of the larger environmental degradation that industrial solar projects engender.

2 Environmental Degradation and Toxic Waste

Contrary to the supposed goals of green energy enthusiasts, industrial solar development is tremendously damaging to the environment and ecological habitats. Repurposing the vast amount of land industrial solar facilities require often destroys entire wildlands and wildlife habitat, disrupts migration patterns, and compromises animal and plant populations.[14] In more temperate regions, the clearing of forests or grasslands for solar arrays fragments ecosystems, reduces biodiversity, and contributes to erosion and runoff.[15] Similar problems are endemic within desert environments such as the American Southwest, where industrial solar has displaced native vegetation and threatened endangered species.[16]

Department of Agriculture, Economic Research Service, September 12, 2024, https://ers.usda.gov/sites/default/files/_laserfiche/publications/109209/ERR-330.pdf?v=78804

9 Ann Sorensen et al., *Potential Placement of Utility-Scale Solar Installations on Agricultural Lands in the U.S. To 2040,* American Farmland Trust, November 2022, https://farmlandinfo.org/wp-content/uploads/sites/2/2023/03/AFT_FUT2040-solar-white-paper.pdf

10 U.S. Department of Energy, "Agrivoltaics: Solar and Agriculture Co-Location," accessed March 27, 2025, https://www.energy.gov/eere/solar/agrivoltaics-solar-and-agriculture-co-location

11 Institute for Energy Research, "Solar Power's Future in the U.S. May Be in Jeopardy," February 10, 2025, https://www.instituteforenergyresearch.org/renewable/solar/solar-powers-future-in-the-u-s-may-be-in-jeopardy/

12 Coldwell Solar, "What is the life Expectancy of Solar Farms?" accessed March 27, 2025, https://coldwellsolar.com/commercial-solar-blog/what-is-the-life-expectancy-of-solar-farms/

13 P.J. Huffstutter and Christopher Walljasper, "Insight: As solar capacity grows, some of America's most productive farmland is at risk," Reuters, April 28, 2024, https://www.reuters.com/world/us/solar-capacity-grows-some-americas-most-productive-farmland-is-risk-2024-04-27/

14 Katherine Harmon Courage, "Solar farms are often bad for biodiversity—but they don't have to be," Vox, August 18, 2021, https://www.vox.com/2021/8/18/22556193/solar-energy-biodiversity-birds-pollinator-land

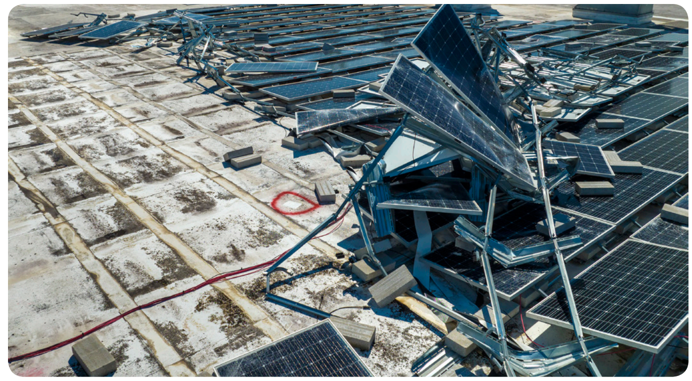
15 U.S. Department of Agriculture, "Conservation Considerations for Solar Farms," Natural Resources Conservation Service, *Fact Sheet,* accessed March 25, 2025, https://www.nrcs.usda.gov/sites/default/files/2024-03/Conservation_Considerations_Solar_Farms.pdf

16 USGS.gov, "Desert Tortoise Ecology and Renewable Energy Development," Southwest Biological Science Center, August 7, 2020, https://www.usgs.gov/centers/southwest-biological-science-center/science/desert-tortoise-ecology-and-renewable-energy?

The notorious and failed Ivanpah solar power project provides a clear illustration of such problems. Located on approximately 3,500 acres of California's Mojave Desert, Ivanpah has been plagued by problems since its opening in 2014, including its destruction of the surrounding ecosystem. Beyond the not-inconsiderable loss of 3,500 acres of natural habitat, Ivanpah killed or displaced possibly thousands of endangered desert tortoises,[17] in addition to incinerating an estimated 6,000 birds per year.[18]

Though Ivanpah will now reportedly be shut down 15 years prior to its expected closing,[19] its impact upon the environment is mirrored across the country. For instance, the U.S. government-funded Argonne National Laboratory estimated in 2016 that between 37,800 and 138,600 birds die annually due to solar facilities across the United States.[20] This was likely a conservative estimate and is undoubtedly outdated, considering the massive expansion of industrial solar over the past decade.

In addition to these problems, industrial solar panels and batteries create a substantial amount of highly toxic waste, which carries its own set of environmental impacts. Many of the materials contained within solar panels and batteries, such as lead and cadmium, are classified by the U.S. Environmental Protection Agency as hazardous waste.[21] Compared to electricity generated from



In addition to these problems, industrial solar panels and batteries create a substantial amount of highly toxic waste, which carries its own set of environmental impacts.

nuclear plants—an energy source much vilified for the waste it produces—solar panels create at least 300 times as much waste per unit of energy produced.[22]

Solar panels have an expected life span of 25–30 years. As early solar installations reach the end of their useful life, the United States faces a growing wave of solar waste. The International Renewable Energy Agency projects that global solar waste will exceed 78 million tons by 2050.[23] Because recycling

17 Michael R. Blood, "11 Years after a celebrated opening, massive solar plant faces a bleak future in the Mojave Desert," Associated Press, updated January 30, 2025, https://apnews.com/article/california-solar-energy-ivanpah-birds-tortoises-mojave-6d91c36a1ff608861d5620e715e1141c

18 Louis Sahagun, "This Mojave Desert solar plant kills 6,000 birds a year. Here's why that won't change any time soon," Los Angeles Times, September 2, 2016, https://www.latimes.com/local/california/la-me-solar-bird-deaths-20160831-snap-story.html

19 Sammy Roth, "Boiling Point: Farewell to Ivanpah, the world's ugliest solar plant," *Los Angeles Times,* January 27, 2025, https://www.latimes.com/environment/newsletter/2025-01-27/boiling-point-farewell-to-ivanpah-the-worlds-ugliest-solar-plant-boiling-point

20 Leroy J. Walston Jr. et al., "A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States," *Renewable Energy,* July 2016, Volume 92, https://www.sciencedirect.com/science/article/pii/S0960148116301422#!

21 U.S. Environmental Protection Agency, "End-of-Life Solar Panels: Regulations and Management," last updated October 4, 2024, https://www.epa.gov/hw/end-life-solar-panels-regulations-and-management

22 Jemin Desai and Mark Nelson, "Are we headed for a solar waste crisis?" Environmental Progress, June 21, 2017, https://environmentalprogress.org/big-news/2017/6/21/are-we-headed-for-a-solar-waste-crisis

23 Stephanie Weckend et al., "End-of-Life Management: Solar Photovoltaic Panels," IRENA, June 2016, https://www.irena.org/publications/2016/Jun/End-of-life-management-Solar-Photovoltaic-Panels

solar panels is very difficult and costly, they are typically sent to landfills. Most of these landfills are located in developing countries, which are then saddled with the burden of discarded solar panels' environmental risks.[24]

Solar panels that are disposed of in landfills or by other means pose significant environmental hazards. A study commissioned by Germany's Federal Ministry of Economic Affairs explains, "[e] nvironmental hazards certainly arise when [solar] modules or parts thereof (legally or illegally) end up in landfills or (possibly in finely ground form) in the substructure of roads via normal waste bins, glass containers or other means, and remain there for a long time or forever."[25] In these scenarios, pollutants are likely to leach into soil and water, damaging the environment and creating public-health risks.[26]

A study by the Manhattan Institute predicts that by 2050, "the quantity of worn-out solar panels—much of it non-recyclable—will constitute double the tonnage of all today's global plastic waste… By 2030, more than 10 million tons per year of batteries will become garbage."[27] Yet, neither the federal government nor many states have developed policies regulating comprehensive recycling or decommissioning requirements.[28] Of the states that do have such requirements in place, several do not require industrial solar facility owners or operators to take responsibility over decommissioning through financial assurance mechanisms such as bonds, letters of credit, or escrow.[29]

3 Slave and Child Labor

Yet another significant problem created by the expansion of industrial solar power is the slave and child labor used for solar panel and battery production. Nearly half the world's polysilicon—the most common material used to construct solar panels—comes from Xinjiang, China, where systemic forced labor is prevalent.[30] In Xinjiang, Uyghur Muslims and other ethnic minorities are coerced by the Chinese government to manufacture myriad products, including polysilicon. According to the Center for Strategic and International Studies, "between 2010 and 2020, China's share of global polysilicon production increased from 26 percent to 82 percent."[31] Today, nearly every solar panel made from silicon is likely to have been sourced from Xinjiang.[32]

Xinjiang is not the only problematic region the solar industry relies upon for its raw materials. As described in reports by the U.S. Department of

24 Joshua Antonini, "Bright Panels, Dark Secrets: The Problem of Solar Waste," Mackinac Center for Public Policy, June 2, 2022, https://www.mackinac.org/blog/2022/bright-panels-dark-secrets-the-problem-of-solar-waste

25 Daniel Wetzel, "Study warns of environmental risks from solar modules," Welt.de, May 13, 2018, https://www.welt.de/wirtschaft/article176294243/Studie-Umweltrisiken-durch-Schadstoffe-in-Solarmodulen.html

26 Daniel Wetzel, "Study warns of environmental risks from solar modules."

27 Mark P. Mills, "Mines, Minerals, and 'Green' Energy: A Reality Check," Manhattan Institute, July 9, 2020, https://manhattan.institute/article/mines-minerals-and-green-energy-a-reality-check

28 Atalay Atasu et al., "The Dark Side of Solar Power," Harvard Business Review, June 18, 2021, https://hbr.org/2021/06/the-dark-side-of-solar-power

29 North Carolina Clean Energy Technology Center, *The 50 States of Solar Decommissioning: 2023 Snapshot,* January 2024, https://nccleantech.ncsu.edu/wp-content/uploads/2024/01/50-States-of-Solar-Decommissioning-2023-Snapshot-NCCETC-2024.pdf

30 U.S. Department of Labor, "Shining a Light on Exploitation in the Solar Supply Chain," accessed March 25, 2025, https://www.dol.gov/agencies/ilab/reports/child-labor/list-of-goods/supply-chains/solar

31 William Alan Reinsch and Sean Arrieta-Kenna, "A Dark Spot for the Solar Energy Industry: Forced Labor in China," Center for Strategic and International Studies, April 19, 2021, https://www.csis.org/analysis/dark-spot-solar-energy-industry-forced-labor-xinjiang

32 William Alan Reinsch and Sean Arrieta-Kenna, "A Dark Spot for the Solar Energy Industry: Forced Labor in China."

Labor (DOL), child labor in the Democratic Republic of the Congo (DRC) and Madagascar is relied upon to mine cobalt and mica, both of which are critical for producing solar panels and batteries. In the DRC, children are forced to work under hazardous conditions in small-scale mines to extract cobalt used in lithium-ion batteries, which are essential for solar energy storage.[33] Similarly, mica mined in Madagascar—often by children—serves as an insulator for solar panels. The DOL estimates approximately 10,000 children as young as four-years-old are forced to mine mica without safety equipment and are often exposed to dust inhalation and physical injuries, with many suffocating each year due to oxygen deprivation.[34]

Despite growing awareness, major solar firms continue to rely on suppliers implicated in these abuses. A *New York Post* investigation uncovered that Hanwha Qcells—a South Korean solar company—sources its polysilicon from Xinjiang.[35] Qcells is the top supplier of solar panels to the United States and has received significant funding to expand its operational footprint across the country.[36] For example, Qcells was gifted $2 billion by the Biden administration to construct an industrial solar plant in Georgia, a project which was heavily promoted by former Vice President Kamala Harris as part of "the largest investment in solar energy in our nation's history."[37] Yet, the companies that produced Qcells' products have been directly linked to forced Uyghur labor, and some have been sanctioned by the United States under the Uyghur Forced Labor Prevention Act.[38]

Nearly half the world's polysilicon—the most common material used to construct solar panels—comes from Xinjiang, China, where systemic forced labor is prevalent. In Xinjiang, Uyghur Muslims and other ethnic minorities are coerced by the Chinese government to manufacture myriad products, including polysilicon. According to the Center for Strategic and International Studies, "between 2010 and 2020, China's share of global polysilicon production increased from 26 percent to 82 percent." Today, nearly every solar panel made from silicon is likely to have been sourced from Xinjiang.

33 U.S. Department of Labor, "Shining a Light on Exploitation in the Solar Supply Chain."

34 U.S. Department of Labor, "Eliminating Child Labor in Mica-Producing Communities and Promoting Responsible Mica Sourcing in Madagascar and Globally (MICA)," accessed March 25, 2025, https://www.dol.gov/agencies/ilab/eliminating-child-labor-mica-producing-communities-and-promoting-responsible-mica

35 Josh Christenson, "Kamala Harris boosted solar firm linked to Chinese slave labor with nerly $2B in handouts to set up US plant," *New York Post,* October 4, 2024, https://nypost.com/2024/10/04/us-news/kamala-harris-boosted-solar-firm-linked-to-chinese-slave-labor-with-nearly-2b-in-handouts-to-set-up-georgia-plant/

36 Josh Christenson, "Kamala Harris boosted solar firm linked to Chinese slave labor with nerly $2B in handouts to set up US plant."

37 Matthew Daly, "Harris promotes huge community solar deal in Georgia visit," Associated Press, April 6, 2023, https://apnews.com/article/harris-solar-georgia-climate-qcells-greene-5c14f4c4fcede63ff48c7ded36e26f5e

38 Josh Christenson, "Kamala Harris boosted solar firm linked to Chinese slave labor with nerly $2B in handouts to set up US plant."

4 Unreliability, Inefficiency, and Electric Grid Destabilization

Industrial solar power generation brings significant problems related to electric grid reliability, overall energy system efficiency, and the ability to meet consumer demand. Unlike dispatchable sources such as natural gas, nuclear, and coal, solar energy is inherently intermittent, generating power only when sunlight is available. Because of this, solar facilities only generate power approximately 25 percent of the time.[39] Even then, extremely high temperatures can reduce the power output of solar systems by up to 25 percent.[40] Overall, according to the U.S. Department of Energy (DOE), solar has the lowest capacity factor of any energy source, and stands in stark contrast to more reliable and efficient sources of energy such as coal (49.3 percent capacity factor), natural gas (54.4 percent), and nuclear (92.7 percent).[41]

As a result, when regulations and incentives force utilities to source significant amounts of their power from industrial solar—a common occurrence that will be referenced later in this paper—the electric grid is rendered unstable. To mitigate this problem, utilities must then rely upon backup power from dispatchable coal, natural gas, and/or nuclear generators, creating inefficient redundancies to buttress unreliable solar power generation. The supply of solar power typically peaks during midday when electricity demand is often moderate and then drops precipitously in the late afternoon and evening when demand tends to rise—creating volatile spikes in supply and demand. This phenomenon, known as the "duck curve,"[42] forces utilities to ramp up alternative sources of power to quickly fill the gap.[43]

The persistent mismatch between energy supply and demand caused by solar energy intermittency places significant strain on grid operators, who must continuously balance those forces to avoid energy blackouts or equipment failure—a process that is complex, inefficient, and costly.

The persistent mismatch between energy supply and demand caused by solar energy intermittency places significant strain on grid operators, who must continuously balance those forces to avoid energy blackouts or equipment failure—a process that is complex, inefficient, and costly.[44] For instance, adjusting the output of dispatchable power plants—known as ramping—requires additional fuel, increases maintenance needs, and raises operational costs. When grid operators must import or export electricity across regions, they incur transmission expenses and energy losses along power lines, which grow with distance and congestion. To ensure sufficient backup power, baseload plants are often kept in a reduced output

39 See: Energy Information Administration, "Electric Power Monthly," accessed March 28, 2025, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=table_6_07_b

40 World Economic Forum, "Why don't solar panels work as well in heatwaves?" August 9, 2022, https://www.weforum.org/stories/2022/08/heatwaves-can-hamper-solar-panels/

41 U.S. Department of Energy, "What is Generation Capacity?" May 1, 2020, https://www.energy.gov/ne/articles/what-generation-capacity

42 U.S. Department of Energy, "Confronting the Duck Curve: How to Address Over-Generation of Solar Energy," October 12, 2017, https://www.energy.gov/eere/articles/confronting-duck-curve-how-address-over-generation-solar-energy

43 See: California ISO, "What the duck curve tells us about managing a green grid," 2016, https://www.caiso.com/documents/flexibleresourceshelprenewables_fastfacts.pdf

44 The following paragraph discussing grid balancing costs draws primarily from the Federal Energy Regulatory Commission's 2020 Energy Primer. See: Federal Energy Regulatory Commission, *Energy Primer: A Handbook for Energy Market Basics,* April 2020, https://www.ferc.gov/sites/default/files/2020-06/energy-primer-2020.pdf

"spinning reserve" mode, operating below peak efficiency while still consuming fuel. These plants typically receive capacity payments to remain available, even when not actively supplying electricity. Although grid operators bear these balancing costs upfront, they are ultimately passed on to consumers through higher electricity rates.[45]

As reliable, dispatchable sources of electricity are phased out in favor of renewable energy such as solar, this places even more strain upon the grid. Further, electricity demand is projected to increase significantly over the next decade, driven largely by the rapid expansion of data centers and the growing computational needs of artificial intelligence. According to a 2024 report by McKinsey and Company, demand for AI-ready data center capacity is expected to grow at an average rate of between 19 and 22 percent each year.[46] The DOE estimated in a 2024 report that data centers are "expected to consume approximately 6.7 to 12% of total U.S. electricity by 2028," the upper limit of which would be nearly three times the current total of 4.4 percent.[47]

Because of this increased demand—as well as the politically driven decommissioning of reliable, hydrocarbon-based power plants—the North American Electric Reliability Corporation warned in its 2024 report that more than half of North America faces a risk of energy blackouts in the next five to 10 years, particularly in areas with a high reliance on renewable energy.[48]

Such blackouts have already become increasingly commonplace as the United States has transitioned towards renewable sources of energy. For instance, California's rolling blackouts in 2020 were at least partially the result of an overreliance on solar and insufficient dispatchable backup generation. In an analysis studying the causal factors driving these blackouts, the California Independent System Operator, California Public Utilities Commission, and California Energy Commission determined: "In transitioning to a reliable, clean, and affordable resource mix, resource planning targets have not kept pace to ensure sufficient resources that can be relied upon to meet demand in the early evening hours. This made balancing demand and supply more challenging under highly stressed conditions."[49]

Taken together, these realities clearly illustrate the structural incompatibility between industrial solar deployment and a reliable, affordable, and efficient electric grid.

45 ENODA, "Exactly What Are Balancing Costs?" accessed March 28, 2025, enodatech.com, https://enodatech.com/news-insight/exactly-what-are-balancing-costs

46 McKinsey and Company, "AI power: Expanding data center capacity to meet growing demand," October 29, 2024, https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/ai-power-expanding-data-center-capacity-to-meet-growing-demand

47 Energy.gov, DOE Releases New Report Evaluating Increase in Electricity Demand from Data Centers," December 20, 2024, https://www.energy.gov/articles/doe-releases-new-report-evaluating-increase-electricity-demand-data-centers

48 Robert Walton, " 'Explosive' demand growth puts more than half of North America at risk of blackouts: NERC," Utility Dive, December 18, 2024, https://www.utilitydive.com/news/explosive-demand-growth-blackouts-NERC-LTRA-reliability/735866/\

49 California ISO, *Root Cause Analysis: Mid-August 2020 Extreme Heat Wave,* January 13, 2021, https://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf

5 Public Cost Burden and Economic Waste

Industrial solar power is often proclaimed as one of the cheapest sources of energy, with a low levelized cost of electricity (LCOE) compared to traditional sources of electricity generation such as coal, natural gas, and nuclear.[50] Yet, the U.S. Energy Administration's official LCOE estimates only account for the capital cost of building and fueling individual facilities over the course of a facility's life cycle. As such, because these estimates do not consider the myriad "hidden" costs associated with industrial solar, they fail to provide an accurate overall cost. For example, as noted in the previous section of this paper, there are significant costs associated with the intermittency of solar, in addition to increased transmission costs and shorter operating life when compared to other sources of energy.

A 2016 study produced by the Institute for Energy Research found that when accounting for only the additional costs incurred from using natural gas as a backup energy source, the LCOE of a new solar plant is $140.30 per megawatt hour (MWh).[51] This number dwarfs the LCOE the report estimated for existing generators using coal ($39.9/MWh), combined cycle natural gas ($34.40), and nuclear ($29.19), as well as for new generators using combined cycle natural gas ($55.30) and nuclear ($90.10).[52]

A more recent study published in the peer-reviewed journal *Energy,* which accounted for real-world added costs imposed by intermittency, extended transmission line requirements, and other factors, found solar to have the highest LCOE by a wide margin compared to other energy sources. This study estimated solar to have a levelized full system cost of $413/MWh, compared to wind ($291), nuclear ($122), biomass ($117), coal ($90), and natural gas ($40).[53] Though these numbers were specific to western Texas and may not be fully externally valid for other areas of the United States, it is important to emphasize the study found the full system cost of industrial solar is more than three times greater than the cost of nuclear, four times greater than the cost of coal, and 10 times greater than the cost of natural gas.

The expansion of industrial solar power is clearly far from cost-effective compared to other sources of energy. The industry is only viable for two reasons. First, as already referenced, many of the hidden costs created by industrial solar—such as backup generation, transmission upgrades, and grid stabilization—are passed on to consumers through higher electric bills. Second, like other renewable energy sources, the expansion of industrial solar has been created and perpetuated by enormous governmental financial incentives and regulatory mandates at both the federal and state levels of government, courtesy of the American taxpayer.

For instance, the federal government provides extensive tax credits that benefit solar projects, such as the investment tax credit (ITC) and production

50 U.S. Energy Information Administration, "Levelized Costs of New Generation Resources in the Annual Energy Outlook 2022," accessed March 26, 2025, https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf

51 Thomas F. Stacy and George S. Taylor, "The Levelized Cost of Electricity from Existing Generation Resources," Institute for Energy Research, July 2016, https://instituteforenergyresearch.org/wp-content/uploads/2016/07/IER_LCOE_2016-2.pdf

52 Thomas F. Stacy and George S. Taylor, "The Levelized Cost of Electricity from Existing Generation Resources."

53 Robert Idel, "Levelized Full System Costs of Electricity," *Energy,* Volume 259, Issue 15, November 2022, https://www.sciencedirect.com/science/article/abs/pii/S0360544222018035

tax credit (PTC) recently renewed through 2022's Inflation Reduction Act. Solar project owners can pick between either the ITC—which subsidizes 30 percent of all capital investments in solar facilities—or the PTC—which subsidizes 2.5 cents per kilowatt-hour of electricity produced by solar.[54]

Moreover, the federal government provides substantial loans and grants to the industrial solar industry, in addition to other benefits.[55] For example, the Obama administration gave the aforementioned Ivanpah facility in California a $1.6 billion loan guarantee as well as a $535 million grant. As described by the American Enterprise Institute, these benefits were provided on top of "the 30 percent investment tax credit, the accelerated depreciation (assuming a plant life of five years), and a depreciation bonus of 50 percent in the first year."[56]

There are numerous other federal policies designed to disproportionately benefit the solar industry, as more thoroughly outlined elsewhere.[57] In addition, many states provide similar artificial mechanisms that incentivize and sustain the solar industry, in addition to regulatory mandates such as renewable portfolio standards. These state-level policies will be referenced in more detail in the next section of this paper.

Ultimately, in addition to the significant environmental and social costs incurred by the expansion of industrial solar power, the similarly substantial economic costs are borne almost entirely by the public.

Ultimately, in addition to the significant environmental and social costs incurred by the expansion of industrial solar power, the similarly substantial economic costs are borne almost entirely by the public. This subsidized and inefficient system creates a massive public-private partnership where the government effectively picks winners and losers, while shifting the burden of risk and cost from private solar developers and owners to taxpayers. Rather than delivering affordable, reliable energy, governmental solar policies have created an industry dependent on continued government intervention. The opportunity cost is considerable. Every dollar spent on supporting this unnecessary, harmful industry could be used to develop better technologies for reliable and beneficial energy sources and galvanize greater innovation in the energy sector or elsewhere.

54 Congressional Research Service, "Domestic Content Requirements for Electricity Tax Credits in the Inflation Reduction Act (IRA)," Congress.gov, January 16, 2025, https://www.congress.gov/crs-product/R48358

55 Institute for Energy Research, "Solar Power's Future in the U.S. May Be in Jeopardy," February 10, 2025, https://www.instituteforenergyresearch.org/renewable/solar/solar-powers-future-in-the-u-s-may-be-in-jeopardy/

56 Benjamin Zycher, "The Ivanpah Solar Power Monstrosity Bites the Taxpayers. Again," American Enterprise Institute, January 30, 2025, https://www.aei.org/domestic-policy/energy-policy/the-ivanpah-solar-power-monstrosity-bites-the-taxpayers-again/

57 For instance, see: U.S. Department of Energy, "Solar Energy Technologies Office," accessed March 25, 2025, https://www.energy.gov/eere/solar/solar-energy-technologies-office

Policy Recommendations

The extensive problems associated with the expansion of industrial solar power have incited growing resistance from the American people at local levels of government. For instance, at least 313 different communities have rejected or restricted solar projects in the past decade, the vast majority of which occurred in the past four years.[58]

Local policymakers cannot solve the problem on their own, however, and often do not possess the authority to do so, as opposed to state policymakers. Though the rapid growth of industrial solar power in the United States has been driven in part by federal regulations and incentives, state-level policies often play an equal or even more critical role in sustaining and expanding the solar industry. State policymakers interested in leveling the energy playing field, curbing industrial solar development, or eradicating the solar industry from their state altogether have several options they can consider.

Primary Solutions

State policies such as mandated renewable portfolio standards, direct subsidies and loans, preferential tax treatment, net metering requirements, and other financial incentives and regulations have together created an environment in which industrial solar development is not only encouraged but effectively guaranteed. These policies distort market signals, destabilize the electric grid, increase costs to consumers, waste resources, and incentivize ecological destruction on a massive scale.

As such, the most direct policy solutions for combating the problems posed by industrial solar entail eliminating the government-created incentives and regulations on which the entire solar industry is based.

1. Repealing Renewable Portfolio Standards

State-level renewable portfolio standards (RPS) require electric utilities to source a specified percentage of their electricity from renewable sources such as solar, at rates often far higher than the competitive market rate. These costs are ultimately passed on to ratepayers. For example, a study by the University of Chicago's Energy Policy Institute found states that passed an RPS program had 17 percent higher electricity prices than states that did not.[59] It has been estimated that more than half the renewable energy industry's growth is attributable to state-level RPS mandates.[60]

As of December 2023, 28 states and the District of Columbia have an RPS mandate in place, with seven other states having renewable portfolio goals. In 17 of these states and the District of Columbia, the requirement or goal is to achieve 100 percent renewable or clean electricity by 2050 or earlier.[61] Many RPS programs include specific solar carve-outs, quotas, and renewable energy credit

58 Robertbryce.com. "Renewable Rejection Database," accessed March 24, 2025, https://robertbryce.com/renewable-rejection-database/

59 Michael Greenstone and Ishan Nath, "Do Renewable Portfolio Standards Deliver?" Energy Policy Institute, University of Chicago, Working Paper, May 2019, https://epic.uchicago.edu/wp-content/uploads/2019/07/Do-Renewable-Portfolio-Standards-Deliver.pdf

60 National Conference of State Legislatures, "State Renewable Portfolio Standards and Goals," updated August 13, 2021, https://www.ncsl.org/energy/state-renewable-portfolio-standards-and-goals

61 U.S. Energy Information Administration, "Renewable energy explained: Portfolio standards," accessed March 20, 2025, https://www.eia.gov/energyexplained/renewable-sources/portfolio-standards.php

multipliers that further incentivize solar over other energy sources.[62] These mandates create artificial demand for solar energy, regardless of cost, grid reliability, or environmental trade-offs.

State policymakers should consider allowing RPS mandates to expire or repealing them entirely, following the lead of states such as West Virginia and Montana.[63]

2. Eliminating Special Financial Incentives for Solar Development

States offer a variety of special financial incentives to solar developers, including production-based payments, grants, rebates, loans, property tax abatements, and tax credits.[64] For example, Texas alone offers at least 67 different loan programs, grants, performance-based incentives, tax credits, rebates, and other policies incentivizing solar, according to NC State University's Database of State Incentives for Renewables & Efficiency.[65] Many states offer tax exemptions as well. According to the Solar Energy Industries Association, 36 states offer property tax exemptions for solar energy under certain conditions, and 25 states offer sales tax exemptions.[66]

State policymakers should consider eliminating all special financial incentives propping up the solar industry, allowing the market to dictate its success or failure.[67]

3. Taxing Farmland Used for Industrial Solar at the Industrial Rate

When owners of private farmland lease portions of their property to solar companies, they effectively convert that land into an industrial facility. All states have various laws that tax agricultural land at lower rates than other types of properties. These laws are designed to reduce the financial burden on farmers, disincentivize development, protect food production and the environment, and account for value provided to local communities.[68]

Some states have "current use taxation" policies in place that incentivize landowners to keep their land underdeveloped and used for a beneficial purpose, such as agriculture or forestry. Under such policies, landowners are subject to exit tax penalties and higher tax rates if they convert their land from beneficial use.[69] However, many other states have no such laws in place,[70] potentially allowing landowners to reap the benefits of lower tax rates while simultaneously receiving rent from solar companies that erect industrial facilities on their former farmland.

62 National Conference of State Legislatures, "State Renewable Portfolio Standards and Goals."

63 See: Center for Climate and Energy Solutions, "U.S. State Electricity Portfolio Standards," updated August 2024, https://www.c2es.org/document/renewable-and-alternate-energy-portfolio-standards/

64 For a comprehensive list, see: NC State University, "Database of State Incentives for Renewables & Efficiency," NC Clean Energy Technology Center, accessed March 20, 2025, https://www.dsireusa.org/

65 NC State University, "Database of State Incentives for Renewables & Efficiency."

66 Solar Energy Industries Association, "Solar Tax Exemptions," accessed March 20, 2025, https://seia.org/solar-tax-exemptions/

67 It should be noted that the solar industry should still be able to receive the same regular financial incentives that other industries do, such as tax deductions for certain expenses. It is only the special advantages not offered to other industries that should be eliminated.

68 See: Evin Bachelor & Peggy Kirk Hall, "Differential Tax Assessment of Agricultural Lands," The National Agricultural Law Center, accessed March 20, 2025, https://nationalaglawcenter.org/state-compilations/differentialtaxassessment/

69 Farm and Energy Initiative, "Understanding Current Use Taxation Policies," accessed March 21, 2025, https://farmandenergyinitiative.org/projects/farmland-solar-policy/policy-design-toolkit/current-use-taxation/

70 See: Jess Phelps, "A Working Guide to Current Use Taxation for Agricultural Lands," Vermont Law School Center for Agriculture & Food Systems, United States Department of Agriculture, November 2021, https://www.legalfoodhub.org/wp-content/uploads/2021/12/Current-Use-Brief.pdf

State policymakers should consider ensuring that all land converted from agricultural use to industrial solar use is taxed at the appropriate rate, including the application of exit tax penalties upon conversion. At minimum, this would deliver tax fairness relative to other property owners and the state's coffers, while still protecting farmers' rights to develop their property as they perceive most beneficial. Moreover, this policy would likely reduce the appeal of converting farmland for industrial solar use, thereby minimizing the negative environmental and economic effects of additional solar development.

4. Reforming Net-Metering Mandates

Though net-metering is more directly related to residential and commercial solar power rather than industrial solar, it is still important to discuss. Net-metering policies allow property owners to sell excess electricity their solar panels generate back to the electric grid. However, as the Institute for Energy Research explains, "customers are generally reimbursed for their electricity at the full retail rate. For utilities, this means they pay much more for electricity from net metering customers than they do for electricity from power plants."[71] In addition, because rooftop solar installations are two-way systems—both taking power from the electric grid and delivering it back to the grid at unpredictable times—there are added equipment costs and expenses for regulating energy flow.

Because utilities are forced to purchase energy at this higher, above-wholesale rate, they pass their increased costs off to other customers who do not use solar panels, severely disadvantaging those who have not adopted solar energy. Moreover, customers with solar panels tend to have higher incomes, meaning that lower-income households end up subsidizing the energy consumption of higher-income households.[72]

State policymakers should consider updating their net-metering policies to require homeowners and businesses that install rooftop solar systems to pay for the costs associated with the installation, maintenance, and regulation of their two-way systems. This would ensure that all electric power users pay their fair share to maintain and operate the grid, without socializing the burden of additional costs to other ratepayers. In addition, states can transition to a system in which utility companies pay solar customers for their excess generation at the wholesale rate, rather than the retail rate.

5. Enacting Strong Anti-ESG Policies

Though not technically a government-created regulation or incentive, the advent of environmental, social, and governance (ESG) systems has coerced much of the private sector into championing renewable energy sources such as solar. Oligarchic financial institutions working in tandem are using ESG frameworks to pressure states and companies into prioritizing renewable energy investments and adoption.[73] Their actions bypass democratic processes and can force state utilities and pension funds to pursue solar projects against the interests of their customers and bottom-line, as well as the interests of legislators' constituents. More generally, this insidious system often prevents companies and individuals from receiving access to investments, loans, insurance policies, and basic financial services if they do not adhere to ESG mandates.

71 Institute for Energy Research, "Net Metering 101," January 14, 2014, https://www.instituteforenergyresearch.org/renewable/solar/net-metering-101/

72 Thomas Tanton, "Net Metering in the States: A 2020 Update," State Government Leadership Foundation, December 2020, https://static1.squarespace.com/static/601df23633789301b053df7e/t/602b017cab0deb12bbbc5029/1613431166276/SGLF-Net-Metering-in-the-States.pdf

73 For a comprehensive examination of what ESG is, the problems it causes, and the solutions to the problem, see: Jack McPherrin, "Environmental, Social, and Governance (ESG) Scores: A Threat to Individual Liberty, Free Markets, and the U.S. Economy," *Policy Study,* The Heartland Institute, April 2023, https://heartland.org/wp-content/uploads/2023/04/2023-ESG-ReportvWeb-1-4.27.23.pdf

There are three primary ways state policymakers can counteract ESG's influence. First, they can restrict state pension funds from investing in ESG funds or using ESG criteria in their risk assessments. Second, they can prohibit state or local government contracts with companies that boycott hydrocarbon-based energy sources or pressure utilities to pursue solar energy sources. Third, they can prevent financial institutions from discriminating against customers based on political considerations, thereby ensuring fair access to financial services.[74]

Secondary Solutions

If states are unwilling or unable to eliminate the incentives and regulations driving the industrial solar industry, there are still other ways state and local policymakers can slow or mitigate the negative impacts of solar projects.

6. Prohibiting Procurement of Solar Energy Sourced Through Child or Slave Labor

Many components used to create solar panels and batteries are sourced through child and slave labor. State policymakers can enact laws that require any energy source constructed and/or used in the state be certified as child-labor and slave-labor free by a qualified government or non-partisan, non-governmental agency.[75]

7. Preventing Preferential Permitting and Imposing Siting Requirements

State and local policymakers can eliminate preferences and exemptions for solar companies throughout the permitting process. Policymakers can require all industrial solar projects to submit full environmental impact statements as a condition of permitting any industrial solar facility. Further, policymakers can require such projects to undergo an analysis of whether they inflict tangible harms upon the community as a condition of permitting. All energy sources should be treated equally; prospective solar developments should be subject to the same types of environmental and fiscal impact analysis as every other source of energy.

8. Mandating Decommissioning and Disposal Plans

State and local policymakers can require decommissioning plans as a condition of permitting any industrial solar facility. Policymakers can make developers and any subsequent owners or operators financially responsible for restoring land to environmentally safe and usable conditions. They can also ensure solar materials are disposed of properly through specific, approved recycling or disposal plans backed by financial assurance mechanisms such as bonds, letters of credit, or escrow requirements.

74 Jack McPherrin, "Environmental, Social, and Governance (ESG) Scores: A Threat to Individual Liberty, Free Markets, and the U.S. Economy."

75 Similar legislation has been proposed to ensure components for electric vehicles are not sourced through child or slave labor. See: American Legislative Exchange Council, "Act to Prohibit State Procurement of Electric Vehicles with Forced Labor Components," Model Policy., August 28, 2023, https://alec.org/model-policy/act-to-prohibit-state-procurement-of-electric-vehicles-with-forced-labor-components/

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