SOLAR TODAY

An American Solar Energy Society Magazine
Expert Perspectives on Achieving a 100%-Renewable Energy Society

Summer 2025
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Prairie-Voltaics:

Harnessing Solar Power and Agriculture to Revitalize Rural Economies

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Navigating Solar Energy Growth with Innovative Supply Chain Solutions

Empowering Farms, Ranches, and Rural Communities: The Promise of Agrivoltaics

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SOLAR TODAY

Summer 2025
Vol. 39, No. 2
solartoday.org

IN EVERY ISSUE

Cover image and this page: Native prairie grows beneath solar panels at the Aurora Solar Project in Minnesota. © Dennis Schroeder, NREL

As we step into summer and experience the sweet smells, sounds and sights of nature in full swing, I am filled with pride in our community's remarkable accomplishments.

Together, we have taken meaningful steps toward environmental stewardship – advocating for greener policies and increasing awareness about the urgent need to protect our planet.

However, challenges lie ahead. The climate crisis grows more urgent with each passing day, and we are losing valuable resources in science, research, education, and environmental protection. Tariffs will at least temporarily raise the cost of solar in most cases and will cause challenges, but in the long term, clean energy will prevail. See page 38 for *Navigating Solar Energy Growth with Innovative Supply Chain Solutions.*

Threats to the solar Investment Tax Credit (ITC) could cause havoc to the industry. Because at the end of the day, if solar doesn't provide the best price, it is not going to win in the market. Fossil fuel energy has been propped up with many advantages over decades, making it hard for solar to compete. The ITC helps to even the playing field.

Meanwhile, farmers are sowing solar seeds on their own fields. This issue explores agrivoltaics as the economic and environmental solution for large swaths of prairie lands and other farms. By using the sun's energy to support your sustainable lifestyle, solar farming is the epitome of energy independence.

True progress demands a fundamental shift in how we live, consume, and care for our environment. Protecting the planet starts right here, in our own neighborhoods. It means rethinking our daily habits, supporting local and sustainable businesses, conserving water and energy, and encouraging our leaders to prioritize environmental action. It means fostering a culture where every small act of stewardship is valued and multiplied.

Let us continue to lead by example, inspiring others to join us in this essential mission.

Join us in August at SOLAR 2025, our National Solar Conference, back in Boulder. And join the National Solar Tour for its 30th year this fall in a neighborhood near you and on our app! Our neighborhoods are a beacon of hope, demonstrating that real change begins at the grassroots level.

Here at ASES, we are the bridge between science, policy, finance, and community. We celebrate our award winners on page 38, and tireless volunteers on page 42, thank you for your service to the environment.

With our new section, the Young Professional corner, we are inviting more young renewable energy enthusiasts to join our mission and give us feedback. Share it with the ones you know!

All of us, together, must protect our communities. The road ahead may be rough, but together we can create a future where our neighborhoods and our planet thrive for generations to come.

Stay tuned for the fall issue themed the Circular Economy, and our upcoming announcement for ASES SOLAR 2026 in Austin, Texas, in October 2026!

With hope and determination,
Carly Rixham

Solar Today Editor-in-Chief
ASES Executive Director

SOLAR TODAY
the power of community

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Solar Today (ISSN: 1042-0630) is published four times per year by the American Solar Energy Society, 2525 Arapahoe Ave., Suite E4-253, Boulder, CO 80302, (303) 443-3130, ases.org.

To pitch op-ed explainers to Solar Today, email two paragraphs about each story, one paragraph about each author's relevant background, and two writing samples to editor@ases.org.

We also welcome ideas for themed issues.

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Solar farm at the University of California, Davis.

Solar Continues to Dominate New Additions to U.S. Generating Capacity

By Ken Bossong

It is still too early to fully assess the potential impact of regulatory changes, tariff policy, and withdrawal of funding and tax incentives for solar, wind, and other renewable energy sources being pursued by the Trump White House and Republican-controlled Congress. However, while they may slow growth, it seems unlikely they will stop or reverse it. In fact, studies by the Federal Energy Regulatory Commission (FERC), U.S. Energy Information Administration (EIA) and others all project continued strong growth by solar as well as by wind and storage in the coming year and beyond.

Solar Will Soon be the Second Largest Source of U.S. Generating Capacity

In its "Energy Infrastructure Update for March" report, FERC reveals that net "high probability" additions of solar between April 2025 and March 2028 total 89,452 megawatts (MW) – an amount more than four times the forecast net "high probability" additions for wind (22,109-MW), the second fastest growing resource. FERC also foresees net growth for hydropower (596-MW) and geothermal (92-MW) but a decrease of 130-MW in biomass capacity.

Taken together, the net new "high probability" capacity additions by all renewable energy sources would total 112,119-MW.[1]

On the other hand, there is no new nuclear capacity in FERC's three-year forecast while coal and oil are projected to contract by 24,372-MW and 2,108-MW respectively. Natural gas capacity would expand by 1,738-MW.

Thus, adjusting for the different capacity factors of gas (59.7%), wind (34.3%), and utility-scale solar (23.4%), electricity generated by the projected new solar capacity to be added in the coming three years should be at least 20 times greater than that produced by the new natural gas capacity while wind's new electrical output would eclipse gas by over seven-fold.

If FERC's current "high probability" additions do materialize, by April 1, 2028, solar will account for nearly one-sixth (16.3%) of the nation's installed utility-

scale generating capacity. Wind would provide an additional one-eighth (12.6%) of the total. Thus, each would be greater than coal (12.4%) and substantially more than either nuclear power or hydropower (7.3% and 7.2% respectively).

In fact, assuming current growth rates continue, the installed capacity of utility-scale solar is likely to surpass coal and wind within the next two years, placing solar in second place for installed generating capacity – behind only natural gas.

The Combined Capacities of All Renewables, Including Small-Scale Solar, are on Track to Exceed Natural Gas Within Three Years

The mix of all utility-scale (i.e., >1-MW) renewables is now adding about two percentage points each year to its share of generating capacity. At that pace, by April 1, 2028, renewables would account for three-eighths (37.5%) of total available installed utility-scale generating capacity - rapidly approaching that of natural gas (40.2%) - with solar and wind constituting more than three-quarters of the installed renewable energy capacity. If those trendlines continue, utility-scale renewable energy capacity should surpass that of natural gas in 2029 or sooner.

However, FERC's data do not account for the capacity of small-scale solar systems. If that is factored in, within three years, total U.S. solar capacity (i.e., small-scale plus utility-scale) could approach 330 gigawatts (GW). In turn, the mix of all renewables would then exceed 40% of total installed capacity while natural gas' share would drop to about 37%.

Moreover, FERC reports that there may actually be as much as 223,620-MW of net new solar additions in the current three-year pipeline in addition to 66,368-MW of new wind, 9,059-MW of new hydropower, 201-MW of new geothermal, and 39-MW of new biomass. By contrast, net new natural gas capacity potentially in the three-year pipeline totals just 29,912-MW. Consequently, renewables' share could be even greater by early spring 2028.

Like FERC, EIA Foresees Continued, Strong Growth by Solar

In its "Preliminary Monthly Electric Generator Inventory" report issued in late February, EIA noted that it expected 32.5-GW of new utility-scale solar capacity to be added to the grid in 2025 along with 7.7-GW of new wind capacity and 18.2 GW of utility-scale battery storage.[2]

Similarly, in early spring EIA released its "Annual Energy Outlook 2025" report which explores potential longer-term U.S. energy trends. In it, the agency foresees a nearly 50% increase in installed solar capacity between the end of 2024 and the end of 2028 – i.e., the term of the current Trump Administration. Moreover, electrical generation by grid-connected PV solar during that time would more than double from 201.1 billion kilowatt-hours (bKwH) to 420.1 bKwH.[3]

Finally, in its "Short-Term Energy Outlook" report issued in early May, EIA projected 26.3% growth in solar installations in 2025, increasing from 121-GW of installed capacity at the end of 2024 to 153-GW by the end of this year. It expects another 19.5% growth in cumulative capacity next year, reaching 182-GW by the end of 2026. Battery energy storage capacity is also expected to grow 70% in 2025 alone.[4]

Other Studies Also Project Future Growth by Solar as Well as Wind and Storage

A recent study by S&P Global Market Intelligence states that the U.S. is expected to add about 97-GW of new electricity capacity in 2025. About 90% of this growth will come from solar, wind, and energy storage. Specifically, 48,826-MW of solar power is in line to connect to the electric grid in 2025 - enough to power more than 35 million homes for a year - along with over 31-GW of energy storage.[5]

Meanwhile, Wood Mackenzie has projected that average annual U.S. solar capacity installations could range between 41-GWdc and 50-GWdc from 2025 to 2035. In total, the U.S. solar industry will add about 502-GWdc of capacity to the market in the next 10 years. This represents a near tripling of the total cumulative solar capacity (236-GW) installed in the U.S. through the end of 2024.[6]

Likewise, the "New Energy Outlook 2025" report from Bloomberg New Energy Finance concludes that strong fundamentals underpin growth in renewables as well as electric vehicles. In its base-case Economic Transition Scenario, BNEF foresees solar more than tripling to 692-GW by 2035 while installed wind capacity doubles to 321-GW. The installed base of battery storage also rises from 29-GW in 2024 to 175-GW by 2035.[7]

Initial 2025 FERC and EIA Data are Consistent with the Projections

First quarter 2025 data released by FERC confirm that solar continued to dominate new U.S. generating capacity additions as well as increases in electrical production during the last weeks of the Biden Administration and the first months of the Trump Administration.

The combination of solar and wind accounted for almost 98% of new U.S. electrical generating capacity added in the first three months of 2025 and 100% in March alone. Solar provided nearly three-quarters (72.3%) of the new utility-scale (i.e., >1-MW) capacity during the quarter with most of the balance (25.5%)

provided by wind. Moreover, March was the nineteenth consecutive month in which solar was the largest provider of new capacity from any energy source.[8]

The installed capacities of solar (10.7%) and wind (11.8%) are now each more than a tenth of the nation's total. Taken together, they constitute almost one-fourth (22.5%) of the U.S.'s total available installed utility-scale generating capacity.

Moreover, approximately 30% of U.S. solar capacity is in the form of small-scale (e.g., rooftop) systems that is not reflected in FERC's data.[9] Including that additional solar capacity would bring the share provided by solar + wind to about one-fourth of the nation's total.

With the inclusion of hydropower (7.7%), biomass (1.1%) and geothermal (0.3%), renewables currently claim a 31.5% share of total U.S. utility-scale generating capacity. If small-scale solar capacity is included, renewables are approximately one-third of total U.S. generating capacity.

For perspective, a year earlier, the mix of utility-scale renewables accounted for 29.4% of total installed generating capacity, including solar (8.3%) and wind (11.8%).[10] Five years ago, it was 22.7%; solar was 3.8% and wind was 9.0%.[11] Ten years ago, it was 16.9% with wind at 5.7% and solar at 1.0%.[12] Thus, over the past decade, wind's share of U.S. generating capacity has more than doubled while that of solar has increased by more than ten-fold.

EIA Also Reports that Solar Electrical Generation Began 2025 with a Record-Setting Expansion

In its latest monthly "Electric Power Monthly" report (with data through March 31, 2025), EIA says utility-scale solar thermal and photovoltaic expanded by 43.9% while "estimated" small-scale (e.g., rooftop) solar PV increased by 11.1%. The combination of utility-scale and small-scale solar increased by over a third (33.7%) during the first quarter of 2025 compared to same period in 2024.[13]

Thus, solar remained among the fastest growing sources of electricity and was almost 6.8% of total U.S. electrical generation for January through March – up from 5.3% a year earlier – and greater than the output of the nation's hydropower plants (5.7%).

Wind Also Got Off to a Strong Start in 2025

Wind turbines across the U.S. produced 9.5% more electricity in the first three months of 2025 than they did a year before.

That output was nearly one-eighth (12.2%) of total U.S. electrical generation and more than double that produced by the nation's hydropower plants.

Electrical generation in the first quarter of 2025 by wind plus utility-scale and small-scale solar was 17.0% greater than a year ago and provided nearly a fifth (19.0%) of the U.S. total, up from 17.0% in early 2024.

For the quarter, the combination of wind and solar provided 6.8% more electricity than did coal and 6.0% more than the nation's nuclear power plants. In March alone, the gap increased significantly when solar + wind outproduced coal and nuclear power by 66.5% and 31.0% respectively.

Electrical Output by the Mix of Renewables Continues to Outpace Coal and Nuclear Power

The mix of all renewables (i.e., wind and solar plus hydropower, biomass and geothermal) produced 10.5% more electricity in January-March than they did a year ago (12.5% more in March alone) and provided over a quarter (26.1%) of total U.S. electricity production compared to 24.8% twelve months earlier.

Electrical generation by the combination of all renewables in March alone reached a new record and provided almost a third of total U.S. electrical generation (31.9%). Moreover, for the first time, it came close to that of natural gas: 109,199 gigawatthours (GWh) vs. 118,920 GWh.

Consequently, the mix of renewables strengthened their position as the second largest source of electrical generation, behind only natural gas.

In Conclusion

If the current projections by FERC, EIA, and others materialize, solar, wind, and storage plus the mix of other renewables will surpass natural gas capacity before the end of President Trump's time in the White House while continuing to expand their share of total U.S. electrical generation. ■

About the Author

Ken Bossong is the director of the SUN DAY Campaign, a non-profit research and educational organization founded in 1992 to support a rapid transition to 100% reliance on sustainable energy technologies as a cost-effective alternative to nuclear power and fossil fuels and as a solution to climate change.

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Navigating Solar Energy Growth with Innovative Supply Chain Solutions

By Stuart Love, *Director, Global Supply Chain at DSV IMS*

As solar energy production surged by 26.9% in the U.S. last year, the industry faces new challenges amid its rapid growth. According to the U.S. Energy Information Administration, renewable energy now accounts for nearly a quarter of the country's electricity generation. This total includes wind energy, which generates 10.2% of the nation's electricity, solar power contributing 3.9%, and hydroelectric sources providing 5.7%. This impressive expansion highlights the increasing reliance on sustainable energy sources. However, the path forward is not without obstacles. Economic uncertainties and potential policy changes pose significant threats to the continued growth of solar energy.

Renewable energy projects continue to attract global investors, yet face new legislative and economic challenges. Sunraycer Renewables, for example, recently secured a $475 million project financing facility to develop solar-plus-storage projects in Texas. These projects will add 241 MW AC of solar and 125 MW AC of battery storage to the Texas grid, proving solar's rapid scalability. However, the Texas Senate's recent passage of Senate Bill 819 introduces significant hurdles for solar and wind projects, mandating new permits, fees, and regulatory requirements. This will slow development and increase utility costs in a state that boasts the nation's largest utility-scale solar market.

Adding to these challenges, the U.S. Department of Commerce has determined that solar cell imports from four Southeast Asian countries should face tariffs of up to 3,521%.[1] This decision, stemming from an investigation into alleged dumping practices supported by Chinese subsidies, will raise costs for U.S. solar manufacturers who rely on these imports. While the tariffs aim to protect domestic manufacturers, they may also lead to higher prices for solar power in the U.S. and prompt overseas factories to relocate to avoid the fees. Despite these obstacles, the investment in Sunraycer's projects reflects a broader trend of international confidence in the U.S. renewable energy sector, highlighting the resilience and adaptability of the solar industry.

Innovative Supply Chain Solutions for Solar Energy

To combat these challenges, companies should focus on innovative supply chain solutions. Optimizing inventory levels in fluctuating markets is essential. Companies must prepare for potential policy impacts, such as the repeal of IRA incentives, on solar logistics. Ensuring cost-effective delivery of solar components to remote sites is crucial. By implementing strategies that support firms during economic downturns, the solar industry can enhance resilience and sustain growth.

Transporting solar energy panels requires specialized logistics expertise. Companies must develop comprehensive solutions to transport solar panels and components safely and efficiently. This includes planning, execution, and monitoring, utilizing air, sea, or intermodal freight services. With dedicated heavy-lift engineers and expertise in regulatory compliance, firms can ensure that solar components reach their destinations without delay.

The solar industry must remain agile in the face of potential policy changes. Recent investments, like Excelsior Energy Capital's $1 billion fund, highlight the role of overseas investors in the U.S. renewable energy transition. This fund aims to invest in solar, energy storage, and other energy transition projects across the United States, showcasing the global confidence in the U.S. clean energy sector.

Anticipating policy changes is vital for the solar industry. Companies need to be prepared for shifts in regulations that could affect logistics and supply

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Crescent Dunes Solar Power Plant Project in Nevada.

chains. Expertise in regulatory compliance and contract bid assistance positions firms as valuable partners in navigating these complexities.

Tariffs on solar cell imports from Southeast Asia present a significant hurdle. The U.S. Department of Commerce has finalized steep tariffs on solar cells from countries like Malaysia, Cambodia, Thailand, and Vietnam, following accusations of unfair trade practices. These tariffs, which vary widely, have already caused a shift in global solar trade, with imports from these countries declining and shipments from nations like Laos and Indonesia on the rise. Critics argue that these tariffs could raise prices on imported cells, impacting U.S. solar producers who rely on these components. As the International Trade Commission prepares to vote on the matter, the solar industry braces for disruptions. Despite these challenges, innovation and strategic partnerships remain crucial in maintaining a resilient and sustainable energy infrastructure.

Cost-Effective Delivery and Risk Management

Efficient delivery of solar components to remote sites is essential for cost management. A global network of carriers provides tailored logistics solutions, whether for oversized cargo or standard solar panels. Integrated IT systems offer transparency, allowing businesses to track shipments and manage their supply chains effectively. In times of economic downturns, strategic supply chain management supports firms by optimizing operations and reducing risks.

In addition to logistics, companies must focus on risk management strategies. By leveraging data analytics and predictive modeling, firms can anticipate disruptions and adjust their supply chains accordingly. This proactive approach minimizes risks and ensures the continuous flow of solar components to their destinations.

Global Context and Future Outlook

As the solar industry grows, sustainability remains a priority. Green logistics services help companies reduce their carbon footprint through CO2 reporting, supply chain optimization, and sustainable fuel offerings. By fostering long-term relationships and

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Consultants
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Manufacturers
Solar Enthusiasts
Students

understanding clients' needs, logistics providers offer more than transport solutions—they provide ways to improve overall operations.

The commitment to sustainability extends beyond logistics. Companies are increasingly adopting circular economy principles, focusing on recycling and reusing materials to minimize waste. This approach not only benefits the environment but also enhances the industry's reputation as a leader in sustainable practices.

The United Nations emphasizes that energy is central to addressing climate challenges. Fossil fuels, which trap the sun's heat, are major contributors to climate change. As the nation with the largest population and carbon footprint,[2] China's commitment to renewable energy is clear. China's efforts to replace nonrenewable energy with renewables have set a global example; wind and solar now account for just over 37% of the total power capacity in the country. By 2024, China had already surpassed its 2030 goal of 1,200 gigawatts from renewables, demonstrating the potential for rapid growth in clean energy.

China's increase in renewable energy, along with its manufacturing and exporting of clean energy equipment, has lowered the cost of solar and wind power. This shift is crucial for reducing reliance on fossil fuels and achieving carbon neutrality by 2060. As the world transitions to clean energy, the solar industry must continue to innovate and adapt to maintain its momentum.

The solar industry's growth is a testament to the increasing reliance on renewable energy. By leveraging innovative supply chain solutions, companies can overcome challenges and sustain growth. Expertise in logistics and a commitment to sustainability are key to navigating the future of solar energy. As the industry continues to evolve, collaboration and innovation will drive the transition to a cleaner, more sustainable energy future. ■

About the Author

Stuart Love recently joined DSV Inventory Management Solution in 2024 as the Director, Global Supply Chain. He brings a wealth of knowledge and experience from his 19-year career at Intel Corporation. During his tenure at Intel, Stuart held various leadership roles throughout the Global Supply Chain, ranging from Global Planning of Assembly Materials, Assembly Equipment Sourcing leadership, Business Intelligence Systems development, Global Sourcing, Inventory optimization / procurement and most recently as the Director of Memory Sourcing & Strategy for Intel.

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Empowering Farms, Ranches, and Rural Communities:

The Promise of Agrivoltaics

By Catie Field

In the race to meet renewable energy goals as demand rises across the United States, farm and ranch land is increasingly becoming a target for solar development. According to the American Farmland Trust's (AFT) Farms Under Threat: 2040 analysis, there is potential that 83% of solar built by 2040 will be sited on farmland within the United States.[1]

Without intervention, this landscape-scale change could have major impacts on the future of farming and food security in the U.S.

The emerging field of agrivoltaics – the intentional combination of solar energy generation and agricultural production on the same area of farmland – offers a promising solution that could help farmers and ranchers build long-term farm viability, reduce loss of farmland, and contribute to clean, affordable energy produced domestically in the United States.

As this is a complex and rapidly evolving field, there are currently a variety of definitions of agrivoltaics that are released or under development. To ensure benefits for farmers and long-term agricultural viability, AFT defines agrivoltaics as a "ground-mounted photovoltaic solar energy system that:

- Has been intentionally planned and designed with agricultural producers and/or experts, and
- Is constructed, installed, and operated to achieve integrated and simultaneous production of both solar energy and marketable agricultural products by an agricultural producer:
  - On land beneath and/or between rows of solar panels
  - As soon as agronomically feasible and optimal for the agricultural producer after the commercial solar operation date and continuing until decommissioning."[2]

AFT's definition emphasizes the importance of maintaining the "ag" in agrivoltaics, requiring that the solar project is designed and operated to enable the production of one or more agricultural products throughout the lifespan of the project. This farmer-centered approach ensures that the land under the solar array is actively used for agriculture, helping to mitigate the loss of farmland.

One notable benefit of agrivoltaics is that it provides farmers and ranchers with a diversified income, contributing to greater farm viability. Landowners can count on steady income from lease payments, in addition to marketing agricultural products (crops and livestock) grown or raised beneath the solar array.

Furthermore, access to farmland has been a challenge for tenant farmers, and agrivoltaics could create more opportunities for them to secure affordable land to grow their businesses.

A key factor driving the growth of agrivoltaics is vegetation management through solar grazing. Traditionally, diesel-powered mowers are used to maintain vegetation under an array. Utilizing sheep not only serves as an alternative to mechanical methods for managing vegetation but also provides additional grazing land, builds soil health, and can be more cost-effective for asset owners.

Both new and experienced graziers can offer their services to developers, helping to increase the U.S. sheep inventory.[3]

The shade provided by solar arrays offers shelter to sheep, cattle, and other livestock, protecting them from heat and various weather conditions. For crops, solar panels can also provide beneficial shade, which helps reduce a plant's response to drought and heat stress while minimizing evaporation under the panels. This leads to improved soil moisture and lessens the need for irrigation.[4]

One notable benefit of agrivoltaics is that it provides farmers and ranchers with a diversified income, contributing to greater farm viability.

As a result, farmers can manage water more efficiently, conserving resources and minimizing the risk of nutrient runoff and leaching beneath the array.[5] Additionally, there is ongoing research to assess how solar panels and design types affect the growth of different crop varieties and crop yields.

However, there are some considerations and challenges in pursuing an agrivoltaics project both by the developer and the farmer/rancher. Ground-mounted dual-use systems have additional costs associated with both the structural changes needed to accommodate farming and grazing as well as the additional costs for design and collaboration with stakeholders.

The National Renewable Energy Lab

Sheep grazing at the Gold Tree Farm in San Luis Obispo, CA

© American Farmland Trust

Tomatoes growing under the array at the Rutgers Agricultural Research and Extension Center.

estimates that agrivoltaics systems have a premium of $0.07/Watt to $0.80/Watt in comparison to conventional ground-mounted systems.[6] This can be expensive for both the farmer and developer.

Despite the potential benefits, successful implementation and widespread adoption of agrivoltaics will require funding mechanisms and policies that incentivize developers and support farmers.

Some states have already taken this initiative and developed programs and grants to help fund individual projects, provide property tax exemptions, create standardized siting and permitting for solar projects, and create compensation rate adders for dual-use projects.

Other states are just starting the process by creating statewide definitions for agrivoltaics, hopefully to build off of in the future.

Leading states in the agrivoltaics movement include Colorado, Massachusetts, Maryland, New Jersey, and New York, among others. Colorado state legislature passed Senate Bill 23-092 in 2023 to appropriate $500,000 for agrivoltaics grants to be used to "conduct a new or ongoing demonstration or research project as a means to study the potential, benefits, and tradeoffs of agrivoltaics in the state".[7]

This funding was renewed again for the same amount in 2024, and then for $300,000 in 2025. American Farmland Trust was among the recipients in 2024 and helped produce a guide entitled "Funding Opportunities for Agrivoltaics in Colorado: A Guide for Producers, Landowners, and Service Providers" to help those pursuing agrivoltaics in Colorado.[8]

In addition to the grant program, Colorado has created a personal property tax exemption for machinery and equipment used in agrivoltaics to produce an agricultural product.[9] This also includes the solar array equipment and machinery, benefiting both the farmer and the developer of a project.

Additionally, the code indicates that agricultural land will maintain its status as such when paired with a qualifying agrivoltaics array in property tax assessments. Maryland has a similar tax regulation providing a personal property tax exemption related to agrivoltaics.[10] Both of these tax exemptions could lead to lower property tax rates for developers or landowners.

Taking a different approach to incentives, Massachusetts was one of the first states to incentivize agrivoltaics by creating the Solar Massachusetts Renewable Target (SMART) Program. It includes a feed-in tariff which provides a premium price for surplus energy sold back to the grid for Agricultural Solar Tariff Generation Units (ASTGUs) established in 2018.

The state's goal for the ASTGUs, or agrivoltaics systems that comply with the SMART program, is to generate 80 MW AC capacity for the state. Qualifying ASTGUs can receive an additional $0.06 per kWh adder in addition to the base compensation rate set forth by the program.[11]

Several developers have taken advantage of this opportunity with more projects for the state in the pipeline.

Understanding that the initial development cost of projects can be inhibitive, both New Jersey and New York developed funding programs for projects. New Jersey's stems from the Dual-Use Solar Energy Act of 2021 that created a 3-year pilot program at Rutgers University that will "lay the groundwork for a permanent Dual-Use program."

The program will create incentives specifically for dual-use solar utilizing their preexisting mechanism of Solar Renewable Energy Certificates IIs (SREC-IIs), which gives additional value to the energy produced by the system.[12] This would result in a higher bonus reward for participating in agrivoltaics.

Last year, New York created a $5 million competitive solicitation through the New York State Energy Research and Development Authority (NYSERDA) to fund projects up to $750,000 that "[integrate] both new or retrofitted solar and farm operations such as those with cattle grazing, forage, or specialty crop production."[13]

This solicitation was in collaboration with the New York Department of Agriculture and Markets with ongoing efforts to collect data on projects funded to inform other agrivoltaics projects in the state.

These are just some of the current, leading state-level actions in agrivoltaics. State-level action will be more important than ever to propel the field of agrivoltaics forward through policy and state-funded actions in light of the uncertainty surrounding federal funding.

These states will hopefully set an example for others to follow suit and recognize that agrivoltaics is a future worth incentivizing.

The future of agrivoltaics requires investment in thoughtful policy, collaborative research, and strategic partnerships that prioritize agricultural production and renewable energy.

Designing systems in coordination with farmers and ranchers, offering clear financial incentives, and replicating effective state-led programs on a national scale will be crucial for widespread adoption. By pursuing this approach, agrivoltaics can become the solution to strengthen rural economies, protect farmland, and help power the country sustainably. ■

About the Author

Catie Field, Smart Solar Program Coordinator, supports American Farmland Trust's Smart Solar Program and its work nationally promoting farm viability, safeguarding soils and farmland, and uplifting agrivoltaics. She has an M.S. in Agricultural Science with a focus on animal science and livestock systems.

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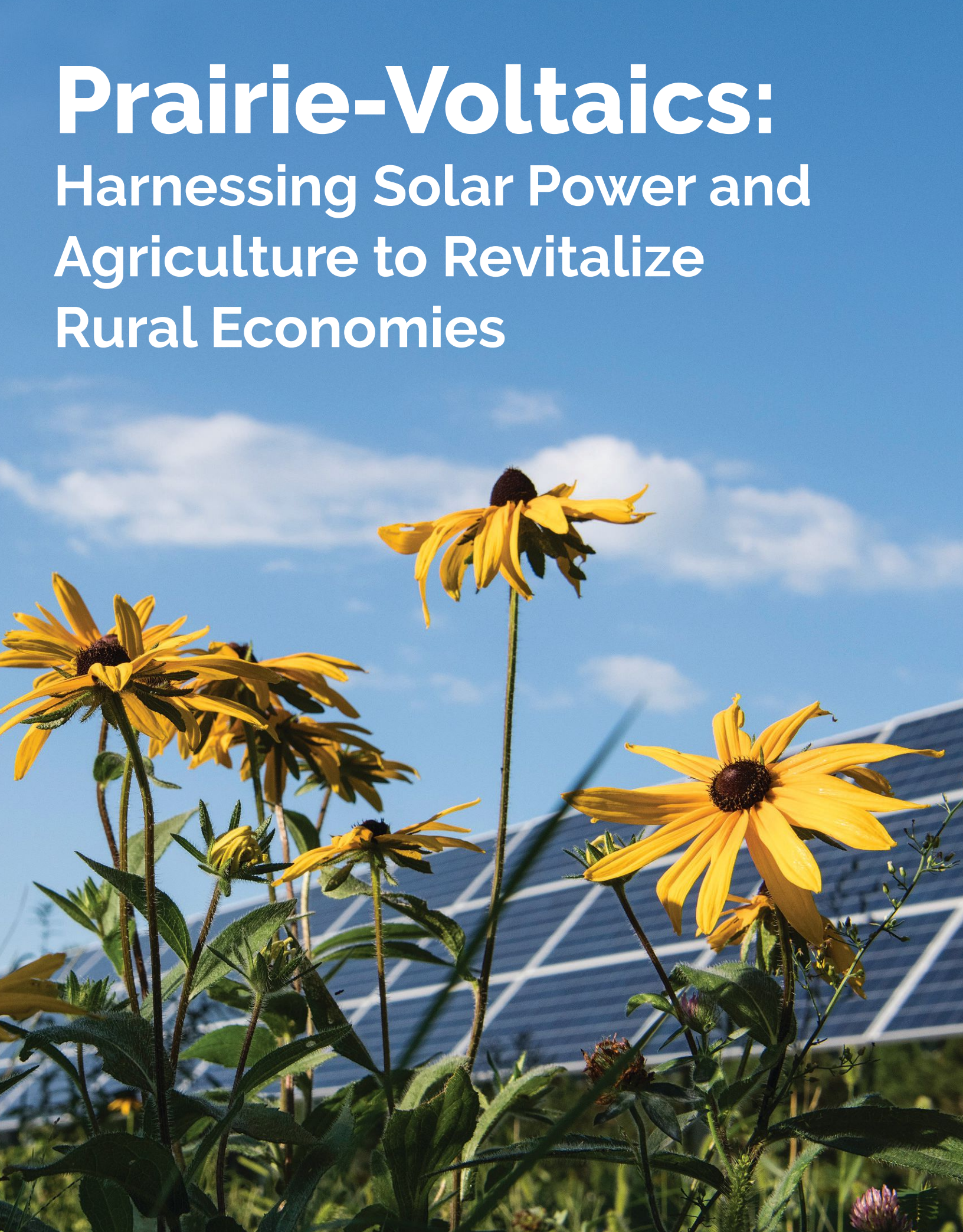
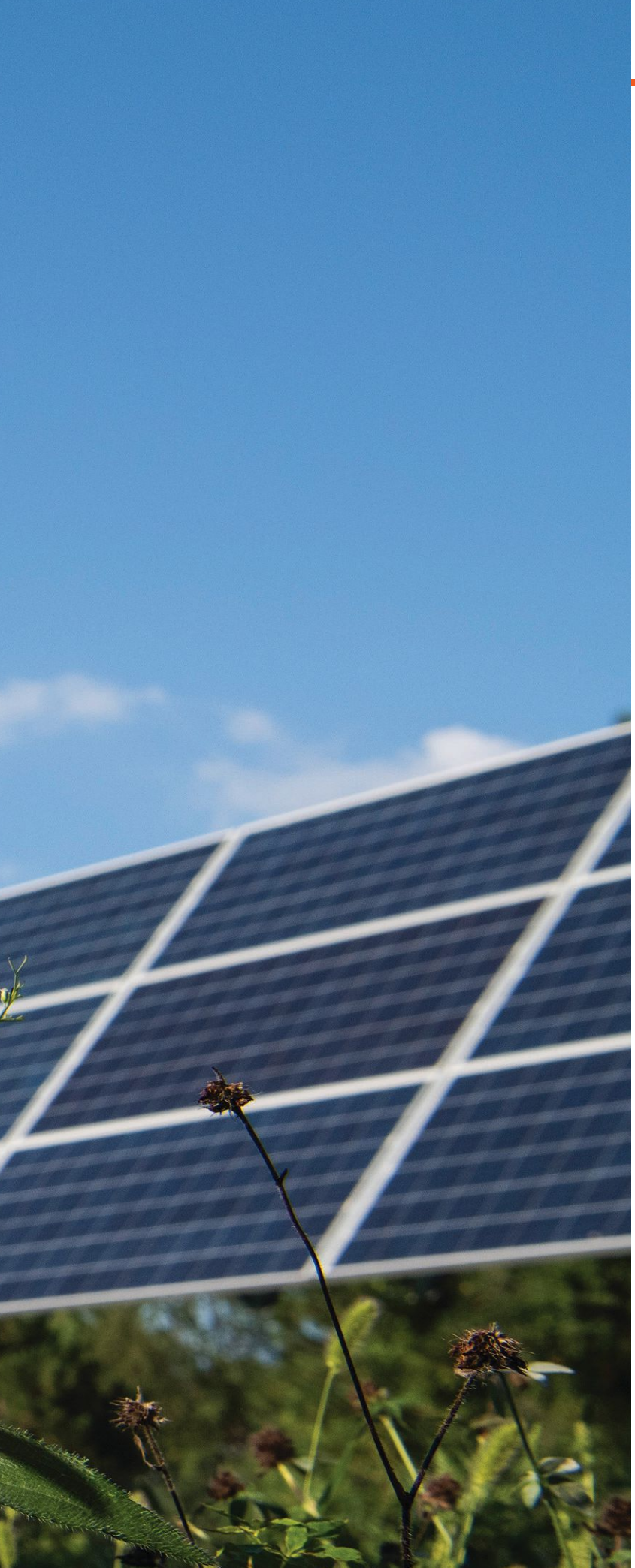
Prairie-Voltaics:

Harnessing Solar Power and Agriculture to Revitalize Rural Economies





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By Saxon Metzger, *MBA*

Agrivoltaics – co-locating solar panels with agriculture or ecological restoration – has won traction within the last decade, offering a win-win for developers and communities by allowing energy production and farming to work hand in hand.[1]

Yet prairie ecosystems, despite stretching far beyond the Great Plains into states from California to Illinois, are not always highlighted as key opportunities for this trend. Prairie environments function as effective water management systems for some of America's most iconic species, like bison and bald eagles, serving as a key driver of regional tourism, and they are also responsible for soil health and crop yields.

Research on agrivoltaic and similar prairie-voltaic (adding solar to prairie land) projects is promising. Whether over traditional farming operations in non-prairie environments or for prairie-specific designs, shading from solar panels can reduce plant heat stress and retain soil moisture. One U.S. study found that cherry tomato yields *doubled* under solar panels, with 65% higher water-use efficiency compared to open-sun cultivation.[2]

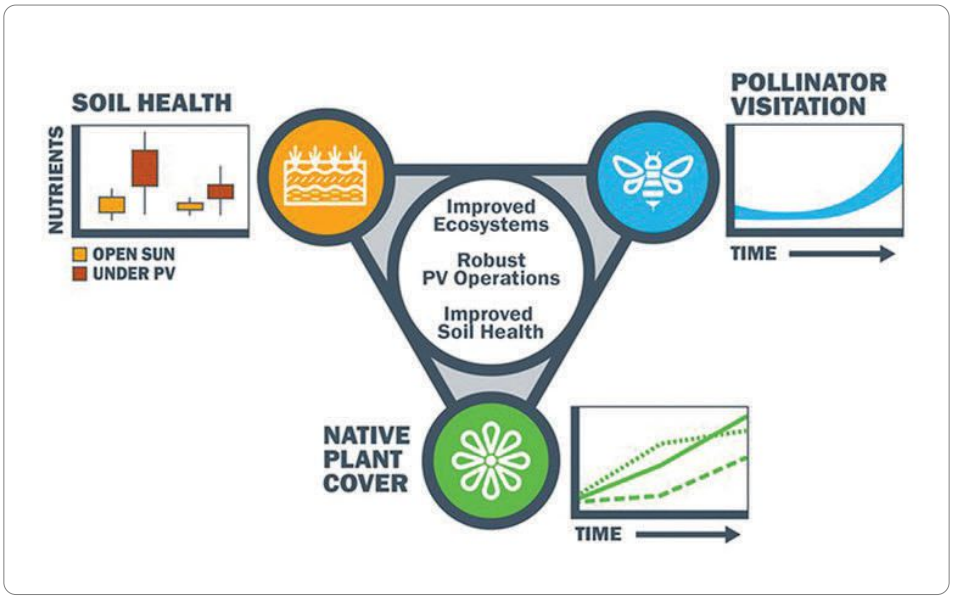
Cooler microclimates under panels mean less evaporation – preserving soil moisture for longer, and requiring less irrigation.[1] In semi-arid grassland trials, even a sudden and significant 38% reduction in sunlight due to solar cover had minimal impact on plant productivity, as vegetation quickly adapted to the partial shade.[3] These findings show that prairie-voltaics boost land productivity and conserve water, turning harsh sun into an asset,

Native prairie grows beneath solar panels at the Aurora Solar Project in Minnesota.

© Joe DelNero, NREL

Representation of the extent of prairie and grassland coverage in North America.

Research infographic summarizing how planting native prairie beneath solar panels improves soil nutrients, increases pollinator visits, and expands plant cover over time, all without harming energy output.



© NREL

allowing more consistent prairie agricultural operations, and creating electricity.

Biodiversity Blooms Under Solar Panels

Solar farms clearly don't have to be barren fields; they can host vibrant ecosystems right in the heart of the prairie. Research in Minnesota demonstrated that it's possible to re-establish native prairie plants under solar arrays, yielding ecological benefits.[4] Restored prairie solar sites supported pollinators *as robustly as dedicated conservation lands:* plant and insect abundance and diversity increased significantly once native wildflowers and grasses were planted.[4]

Over several years, these "little prairies" under the panels saw native plant cover and pollinator visits steadily rise.[4] NREL's six-year study at three commercial solar farms recorded a 5- to 8-fold increase in native plant species beneath the arrays.[5] Soil health also improved – soil under the panels had higher nutrient levels and organic content than adjacent tilled land exposed to full sun.[4]

Crucially, long-term monitoring showed that reestablishing prairie takes patience: it required 3–4 years for prairie vegetation to fully take hold after construction (with certain species only appearing in years 5–6).[4] Once matured, these solar-prairie habitats can also aid nearby farms. By providing habitat for bees and butterflies, solar sites can enhance pollination of neighboring crops, potentially boosting yields on those lands.[4]

In short, prairievoltaics turns underutilized space into a biodiversity haven – prairie flowers, insects, birds, and other wildlife can thrive alongside solar panels, rather than being displaced.

© Joe DelNero, NREL

Cows leisurely graze beneath a solar array, using the installation as both a source of shade and sustainable fodder production in a prairie-voltaic farm.

Grazing and Agriculture Under Arrays

Prairie-voltaics isn't limited to plants – it can integrate livestock grazing as well. Many solar farms now partner with local farmers to graze sheep (and sometimes cattle) on the grass growing under and around panels.

This "solar grazing" yields mutual benefits: the animals get forage, and the solar operator gets natural lawnmowers. Using sheep for vegetation management has been shown to dramatically cut maintenance costs. One utility reported paying $250–$750 per acre for sheep grazing – a 75% cost savings compared to traditional mowing.[6] Major solar companies with sheep programs across dozens of sites have seen notable reductions in annual operating costs from these practices.[6]

For farmers, it's a new income stream (grazing leases or contracts) and additional pasture without needing to buy land.[1] Grazing also reduces wildfire risk and direct and indirect costs of land management.

Importantly, the animals themselves benefit: in summer, solar panels provide much-needed shade in open prairie pastures. Research in Minnesota found that dairy cows with access to solar-panel shade had afternoon body temperatures about 1°F lower than unshaded cows, and their respiratory rates dropped from 78 to 66 breaths per minute in the heat.[1] This indicates less heat stress, which can translate to better animal health and potentially improved weight gain and milk production.

Overall, integrating grazing makes solar farms more akin to multi-use rangeland, supporting agricultural livelihoods and animal welfare alongside energy production.

Dual-Use Efficiency and Economics

By stacking functions, prairie-voltaics improves the land-use efficiency of this key ecosystem. Even on prime farmland, a well-designed solar-agriculture system can continue to generate farm revenue while producing power. Studies estimate that combining solar with farming or pollinator habitat can

In essence, dual-use solar makes economic sense – the land works harder and better; both food and energy outputs grow.

raise the total productivity of land well above what either use would achieve alone. Solar panels also add electrical infrastructure to rural communities to support emergency response and land management efforts key to wildfire risk reduction.[1]

Analysis in dryland regions showed that certain crops yielded 2–3 times more produce under PV panels during hot summers (thanks to reduced heat and water evaporation, lowering plant stress). While such dramatic gains vary by crop and climate, many cool-season or shade-tolerant crops experience higher yields or quality under partial shade, all while the same acres yield electricity.[1]

The economic implications are compelling. Farmers hosting prairie-voltaics can diversify their income without abandoning agriculture – leasing land for solar, cutting their energy bills, and/or earning fees for grazing or apiary placement. For solar developers, co-location can streamline project permitting and community acceptance. One survey in the U.S. Midwest found 81.8% of residents were more likely to support a solar project if it also produced agricultural benefits.[6]

Likewise, policies in several states (e.g., pollinator-friendly solar farm scorecards) incentivize designs that restore soil and habitat, which can ease the approval process. In dollar terms the synergy is huge: a Department of Energy study estimated that solar built near pollinator-dependent crops over about 1.1 million hectares could provide $1.5–3.2 billion in combined benefits to energy producers and farmers (by improving crop yields and reducing management costs).[7]

In essence, dual-use solar makes economic sense – the land works harder and better; both food and energy outputs grow. This integrated approach can help prairie communities see solar not as competition for farmland, but as an ally that bolsters rural economies.

Prairie-Specific Challenges and Considerations

Deploying solar in prairie ecosystems comes with unique challenges and planning considerations. Prairies often feature fertile farmland or remnant native grasslands, but there is often local resistance to converting land for solar use.

In the American Midwest, for instance, residents have opposed projects that would temporarily take hundreds of acres of cropland out of production.[8] They worry about industrializing prime agricultural land and losing farm-related jobs and outputs. Prairie-voltaic designs directly address these concerns by ensuring the land continues to provide agricultural or ecological value.

As one Iowa farmer involved in a solar project noted, planting the site with prairie grasses and wildflowers effectively lets the soil "rest and rejuvenate for 35 years", building up organic matter and fertility for future generations.[8] Still, careful site selection and management are crucial.

Truly undisturbed native prairie remnants are rare and ecologically precious – stakeholders often stress that those should be preserved or used only if the project includes robust restoration plans. Indeed, some see an opportunity: using solar installations to restore degraded prairie land.

In California, a 160 MW project on a former nuclear site is doubling as a prairie restoration pilot, to help recover some of the 98% of California's native prairie habitat that has been lost.[9] Such projects require collaboration with ecologists and native plant experts, as well as a willingness to invest time in establishing deep-rooted perennials.

Land-use policy can pose hurdles or add safeguards. Many jurisdictions mandate vegetation management plans. For example, Minnesota encourages pollinator-friendly seed mixes under solar arrays, and some areas require that topsoil not be degraded so the site can revert to farming later.[8] Planners must consider panel height and spacing too – raising panels higher (or using wide row spacing) allows farm machinery or tall grasses underneath, but can increase costs.[6]

Finally, long-term maintenance and conflict resolution are considerations: e.g., controlling invasive weeds in a prairie solar meadow, protecting panels from large wildlife, or coordinating grazing schedules. None of these challenges is insurmountable, but they require that solar developers adopt a mindset of land stewardship in addition to energy production.

With thoughtful planning, prairie solar farms can avoid land-use conflicts by blending in with the rural landscape, acting as prairie restorations or pastureland, rather than simply covering

© Werner Slocum, NREL

Gathering of samples of vegetables that are being grown at the at the Photovoltaic Central Array Testing Site (PV-CATS) and agrivoltaics/solar garden near NREL's parking garage.

productive ground with infrastructure.

Conclusion: A New Paradigm for Prairie Land Use

Real-world pilot projects and research trials across the Great Plains and prairie regions are validating that solar panels need not displace agriculture or ecosystems – they can enrich them.

Agrivoltaics in prairie ecosystems has demonstrated concrete ecological gains (improved soil moisture and health, greater biodiversity of plants and pollinators, habitat for wildlife) alongside economic benefits (additional farm income, reduced solar maintenance costs, sustained or improved agricultural yields). These dual-use projects turn solar development from a land competitor into a land enhancer.

Instead of the monoculture of gravel or turf grass, solar farms can host native flowers buzzing with pollinators and livestock trimming the grass. They can recharge soils that were depleted by intensive row-cropping, regenerating soil health, and preventing erosion. Early data even suggests nearby crop farms may see higher yields thanks to the pollinator boost – illustrating the wider landscape benefit of prairie-voltaics.[4]

Moving forward, scaling up prairie-voltaics will require continuing to refine best practices for different prairie climates and community needs. Researchers are developing tools like pollinator-friendly seed mix guides and cost-benefit calculators specific to solar-agriculture systems.[9] With 5.7 million acres of land potentially needed to meet U.S. solar goals by 2035 the stakes are high for getting dual-use right.[9]

The evidence so far is encouraging: prairie solar installations can be more than power plants – they can be pollinator sanctuaries, grazing pastures, and springboards for prairie restoration. Embracing prairie-voltaics offers a path to unite stakeholders who might otherwise clash over land use, creating projects that harvest sunshine while cultivating the ecological and economic vitality of prairie landscapes. ■

About the Author

Saxon Metzger, MBA (Osage Nation): The President of Eighth Generation Consulting, Metzger specializes in full lifecycle solar and storage installations. Eighth Generation delivers full turnkey project installation, operations and maintenance, and decommissioning, along with grant writing and consulting services. A member of ASES, Metzger teaches graduate-level sustainable business and economics courses at Wilmington University.

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AGRIVOLTAICS: A SOCIAL STUDY

What Reddit Can Tell Us About Opposition To Solar Farming and What it Takes to Change Minds

By Carly Rixham

In dry conditions with wet winters and shade-loving crops, combining solar and farming can create a synergistic effect where both energy and crop production are enhanced. Agrivoltaics, pairing solar energy with farming and ranching–vegetation and livestock–can boost production and control wind and soil erosion, increase pollinator habitat, and promote soil health. Crops are sheltered from intense rain or hail, a common problem on traditional farms. They are also protected from an overabundance of sunlight. Excess sunlight, not required in certain growing conditions, can be harvested for energy generation.

If properly sited, solar panels partner well with farming. They can be more efficient on farmland, especially with trackers, and shade-loving crops will have improved growing conditions. Rainwater is directed to crops planted below the bottom edge of the solar panels. While you may not be able to pack in as many panels per acre as on a rooftop, the soil and vegetation below the panels cool the panels due to evapotranspiration, which also enhances panel production efficiency. Solar panels provide pollinator habitat as well as grazing and shade for some farm animals, an added benefit, especially in the U.S., where 35% of farmland is used for grazing.[1]

I recently saw a sign in the Lafayette/Erie rural suburbs of Boulder, Colorado, that said, "Say NO to solar panels on our farms." I was surprised to see this–was solar being forced on farms?

Though not a traditional research source, I found Reddit useful in distilling the nuanced sentiments of the debate, based on socio-economics and policy. One commenter on Reddit addressed the issue: "It amuses me that people who are strongly into property rights believe they can tell farmers what they can do with their property. The whole world isn't a HOA."[2]

Those opposed to solar argue the economics of land use and property values. Opposition to solar farms is primarily due to misinformation, conflicts in property rights, land use, economic uncertainties, and cultural values. Cultural value conflicts are generally rooted in a community's identity as rural.

Despite the strong sentiment of disapproval of solar power in rural America, credible research

organizations and farmers are pairing solar and farming as a win-win. The agriculture industry needs innovative solutions like agrivoltaics to make the industry more sustainable by addressing its often-criticized high carbon footprint and energy consumption.[3]

Opposition to Solar Farming

While much of the debate over solar farms is about land use and straightforward NIMBY (Not in my back yard) -ism, a lot of it is also linked to political "culture wars" where the opposition is getting their information from oil and gas proponents who have vested interests against renewable energy, no matter how and where it is produced.

Rural America doesn't want to lose its agricultural identity. This is part of

their culture. Solar development is akin to modernization and industrialization, which are seen by some as fundamentally opposed to a rural way of living. Using the sun as fuel however, is inherent to farming.

Economics

The economic value of each acre of farmland is directly tied to the cost of food. Solar can add more revenue than "cash crops" alone, raising the value of the land. However, land use for energy is still just a drop in the bucket, accounting for just 0.4% of ice-free land globally. And yet, almost 50% of the world's habitable land is dedicated to agriculture.[4]

Comparing growing corn for energy to solar production is no contest– it takes about 31 hectares of corn ethanol to produce the same amount of energy generated by one hectare of land covered in solar panels.[5]

Some of the opposition is not against solar entirely, but feel it should be limited to rooftops and parking lots. Their stance is more of an "either/or" approach, instead of "and/along with." This sentiment highlights some of the nuances of the public debate. Agrivoltaics can offer a bridge, providing the best of both worlds to farming and clean energy.

Propaganda

There is also a lot of misinformation being spread out there, such as solar panels contribute to global warming by reflecting heat into the atmosphere, and solar panels leach chemicals into the ground below them, both of which are completely untrue. A North Carolina town rejected a solar farm project out of fears that they 'suck energy from the sun', and cause cancer, both of which are also not true.[6] More likely, this concern stems from an overall anti-development sentiment.

Residents were also concerned that a nearby solar farm would decrease their property values. Often, the opposite is true, or developers can make small adjustments to improve outcomes. "The folks concerned about property value are generally referring to home value, if they live nearby. Studies have been consistent in showing that nearby property values may be slightly increased or decreased, but it is a wash. Impacts on the value of nearby farmland is little more complicated. Adjacent farmland that is near interconnection points, may become more valuable for further solar development or for mixed-use agrivoltaics. Its value for conventional farming is likely to remain unchanged, but we've heard of cases where rapid solar development can erode traditional rural economies. Community dialog–without panic–is key," according to Jill Cliburn, who consults with utilities and solar planners on community engagement.[7]

Teasing apart anti-progress from an "anything new" sentiment can quickly become political. It is a difficult situation because, for example, it is easy not to want a data center in or near your backyard; therefore not a far stretch not to want the energy production near you to power it.

People express fear of fires, but they do not seem to be well informed about how fires might start or why they are, in fact, extremely rare. The rise in battery energy storage systems has created a storm of controversy in some states. This is especially true when a fire does break out in an outdated, substandard battery plant or in a facility used for car battery-related manufacture.

Politics

There is and is going to be a continuously expanding need for more energy production due to the increased demand for and by data centers.

Let's be clear - no one is being forced to produce solar. However, there is concern that legislation in many states allows power producers to overrule local zoning decisions on major energy facilities.

Many of the voices in these rural areas are voices of opposition. Bedford County (Virginia) Board of Supervisors

A misinformed Reddit thread discussed the micro-economics of farming land use:
"The tenant farmers do get shafted, which is sad. At the end of the day, though, the landowner has to protect their investment. We are talking about generational wealth here. Corn prices are not going up."

Others disagreed:
"Shift enough land away from growing corn (aka reduce supply) and prices will go up."

Picture a farmer who "can't milk his back 40 for solar income" and therefore had to sell his land to a developer who turned it into Walmart. Is this any better?

Walmart was brought up again in another post:
I've run into all sorts of roadblocks in upstate New York. Some people just don't like seeing them because "we moved up here to look at green fields and mountains". They said that while the Walmart box store was visible down the hill."

said, "I'm going to suggest right now that we make it clear that Bedford County — we have a great economy made up of recreation, tourism, and agriculture, and putting solar panels here would do nothing but destroy the character of this county. And I'll tell you right now, before those sons of b— come in here and put solar panels in, I will fight to the death."[8]

The irony of this conservative viewpoint is that it runs against a long-held conservative principle: property rights. The complications over government power and its imposition over both how you can and can't use your land provide a nuanced discussion with many viewpoints that are sometimes conflicting. Some counties have imposed caps on how much land they'll allow for solar development or set up other rules that make solar development difficult.

The objections to solar vary from place to place, but one objection is consistent. Many people in rural areas see solar farms — a term that is sadly coming to be regarded as propaganda — as industrial development, incompatible with a rural community. If people wanted to look out on an industrial site, they wouldn't be living in (fill in the blank with whatever community is involved).

Solutions

As the Native Americans taught us, farming is part of our sustenance, our survival. There is a connection between the economic and energetic need for farmers to be responsible for their carbon footprint. Agrivoltaic systems can help farms diversify income, provide energy, and reduce carbon footprint.

Agrivoltaics can help nurse our disturbed lands back to life. In November of 2024, NREL published

© Jack's Solar Garden

Byron Komenik, founder and director of Jack's Solar Garden, rides a tractor below solar panels that are mounted 8 feet high and tilted on trackers to follow the sun throughout the day.

Opposition to Solar Farming Posts on Reddit:[2]

"I will never support covering acre upon acre of the world's best farmland with solar panels. It's a stupid idea. The rich black dirt in Iowa will grow any seed you plant in it. It's quite amazing, really. Iowa farmers will tell you that on a hot day, you can actually HEAR the corn grow. It can grow 3-4 inches per day when conditions are right. Same for all the surrounding states. Let's be smart and use this land for its best productive purpose - to grow food, graze cattle, raise hogs, so I can put baby backs on my smoker."

"I saw a sign in a county near me that said basically, "You can't feed people with solar farms. Stop energy companies from purchasing farmland."

"As the population continues to grow, if viable farmland is being bought and turned into solar farms, that could be an issue."

Reading between the lines: Opposition appears to be to large solar farms in general, not necessarily agrivoltaic operations that have traditional farming practices.

Pro Solar Farming Commentary on Reddit:[2]

"If a landowner wants to put a solar farm on their land... suddenly everybody else has a big opinion about it. What happened to respecting property rights?"

"Please tell me how large-scale, intensive hog or poultry farming is LESS disruptive than solar."

"This is all ground that we own, grow crops on, and have been for 50 years so it doesn't affect anyone but us. I understand if you're shorting someone else by signing solar leases, but that isn't the case with us."

"There's a 'no solar on farmland' sign about a quarter mile from a farm field that was sold for 4 McMansions near Plain City. Apparently, that's ok."

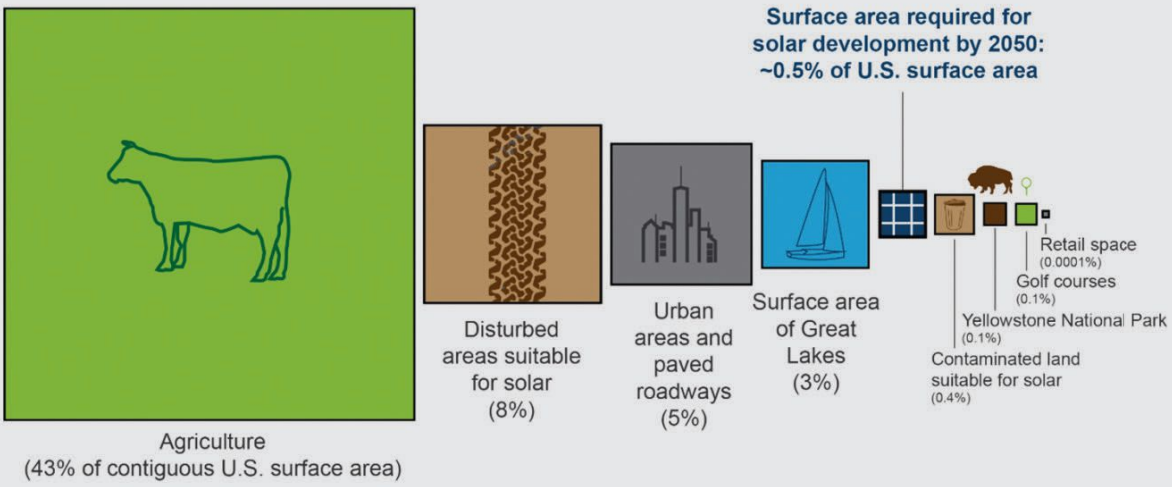

Figure 8 - 7. Maximum land use required for solar in 2050 in the *Solar Futures* scenarios compared with solar-suitable disturbed and contaminated areas and examples of other U.S. areas

Amounts of disturbed and contaminated lands depicted here represent the amounts suitable for solar energy development calculated in the *Solar Futures Study*. Sources: (EPA 2020; USDA 2014; LANDFIRE, n.d.).

the longest-run, most comprehensive assessment of interactions between solar, soil, habitat, and pollinators to date. The research found that prairie restoration activities can occur underneath solar panels, with observed increased abundance and diversity of both vegetation and pollinators.[9]

How much land is needed? By 2050, ground-based solar could require about 0.5% of the land in the contiguous U.S., according to the EPA's Solar Futures Study. The study suggests prioritizing disturbed lands (8% of land) and dual-use land opportunities such as agriculture.[10]

Pairing ground mounts with single-axis trackers as well as bifacial solar fencing uses an even smaller footprint.

NREL estimates that the U.S. would meet its renewable energy goals if one million acres of farmland were covered in solar.[11] Agriculture, food, and related industries in the United States total over $1 trillion, or about 5% of the country's GDP. Almost half (44%) of U.S. land is used for agriculture, and the direct output of America's farms contributes $134.7 billion, or about 0.6% the the country's GDP. Food and solar energy are not at odds; in fact, they are complementary.

I spoke to farmers who voiced their concerns. "What do we do when they don't work anymore?" By educating that the panels and electronics are replaced in 25 years or so, citizens can be empowered to be part of the solution. Others expressed fears of wasted land, not knowing the secret lives of leafy greens, tomatoes and peppers who thrive in partial shade.

Internal champions and advocates are needed in rural areas so that the sentiment is one of choice and less of forced change. Emphasizing the dual use of solar as an adjunct to farming instead of competition is central to this conversation.

The more we can listen to each other, the better we can work together to meet our energy needs sustainably. And as technology, education, and public support increase, the better options we will have, and the more agrivoltaics will be embraced and deployed on our farmlands to secure a clean living future. ■

About the Author

Carly Rixham is the Executive Director for American Solar Energy Society (ASES) and Editor in Chief of Solar Today magazine. She received her Masters in Ecology and Evolutionary Biology at University of Colorado at Boulder. In her free time she enjoys art, gardening, beekeeping, and skiing.

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Agrivoltaics in Texas: Integrating Solar Power with Agriculture

By Raina Tillman Hornaday

As Texas leads the nation in solar deployment, its family farms face a looming generational cliff: only 2% of farms are passed down intact. Agrivoltaics offers a powerful solution, allowing farmers to maintain their land, diversify income, and build climate resilience.

Recent United States Department of Agriculture (USDA) funding, including $2.2 million for the University of Texas Rio Grande Valley (UTRGV)'s VANGUARD project, provides an opportunity for Texas to support rural producers through clean energy.

What Is Agrivoltaics?

According to the American Farmland Trust (AFT) agrivoltaics involves the strategic co-location of agricultural and solar energy infrastructure on the same land, maximizing land use while supporting farm viability and producing clean energy.

While sheep grazing is common, agrivoltaics shines brightest with high-value crops like leafy greens, berries, tomatoes, melons, and grapes. It also supports agroforestry, pollinator habitats, and it diversifies income streams.

Grapevines thrive under solar panels in the Rio Grande Valley.

© Fortress Microgrid

A Booming Market with Texas at the Forefront

In 2023, the global agrivoltaics market, driven by crop production and power generation, was valued at $3.31 billion, projected to surpass $13.3 billion by 2033.[1] Agrivoltaics could represent 10% of global solar capacity by 2030.[2] In the U.S., over 500 solar sites generate nine gigawatts of renewable energy, powering farms and urban areas.

Texas is poised to lead the way with 135 million acres of private land and a projected 35,324 MW of solar capacity by 2028. The Inflation Reduction Act (IRA) and USDA[3] programs are drivers of this growth, allocating $820.25 million to support renewable energy in rural areas.

High-Value Crops: The Economic Engine of Agrivoltaics

By combining energy and agriculture, agrivoltaics can increase total land productivity by 35-70%.[4] Shade-tolerant crops, such as lettuce, have shown significant yield increases,[5] while microclimates beneath panels improve water retention and reduce stormwater runoff.

Economic returns are substantial: lettuce revenue can increase by 30%, and tomato revenue can rise by 36% in the Southeast.[6] Cornell University models demonstrate that combining solar panels and crops on one acre of land can yield over four acres of high-value crops grown without panels, generating higher revenue.

While sheep grazing is common, agrivoltaics shines brightest with high-value crops like leafy greens, berries, tomatoes, melons, and grapes.

Pollinators: Boosting Biodiversity and Farm Profits

Pollinator habitats beneath solar arrays support 75% of food crops and cut maintenance costs by 20%.[7] Pollinators, such as bees, butterflies, and other insects, are necessary for the success of a large portion of food production from crops. and cut maintenance costs by 20%.[8]

Native vegetation cools soil, boosts PV efficiency, and improves biodiversity. These ecosystems serve as organic infrastructure, supporting resilience and long-term soil health.

© Fortress Microgrid

At C&J Farms in the Rio Grande Valley, solar panels shade vibrant herb gardens, providing fresh, healthy seasoning blends while harnessing clean energy.

Vineyards: A Texas Opportunity

Solar panels in Portugal have reduced irrigation by 30%, improved grape yields by up to 30%, and enhanced quality by 15%.[9] Texas vineyards can adopt similar approaches, as demonstrated by the Dos Rios Winery project in Rio Grande City, Texas.

In partnership with UTRGV,[10] Fortress Microgrid implemented an agrivoltaic system at the 15-acre Dos Rios Winery, shading grape varieties like Blanc Du Bois and Chardonnay. Solar panels provide power for wine production and tasting rooms, lowering electricity costs while improving grape quality and water efficiency by 20-30%.

UTRGV monitors crop yields, soil carbon, and emissions to develop best practices and support broader adoption.

Texas Innovating Through Implementation

CleanTX co-hosted an Earth Day event focused on agrivoltaics in Austin with Solar Austin, a local Texas Solar Energy Society (TXSES) chapter. The 2025 event brought together farmers, developers, researchers, and policymakers to explore Texas opportunities and innovations in agrivoltaics. More information is available at CleanTX.org.

UTRGV's VANGUARD initiative addresses current troubling rates of agricultural land loss and food insecurity in the Rio Grande Valley. The project aims to address the loss of both land and food by promoting agrivoltaics to increase resilience, diversify farm income, and support sustainable food production.

In March 2025, the "We Are Women in Ag" event at Dos Rios included an agrivoltaic ribbon cutting and tour, Texas Cottage Law education, canning workshops, and business planning to build awareness and adoption. These efforts are a proactive pro-economic approach to addressing these challenges while building resilience and supporting long-term food security.

Regional Momentum: Oklahoma's Legislative Push

Neighboring Oklahoma advanced agrivoltaics through the Oklahoma Agrivoltaics Act (HB 2157), which passed the House with a 73–20 vote. The bill aims to harmonize renewable energy development with agricultural productivity by establishing a 17-member Agrivoltaics Advisory Committee.

This committee will advise on policies promoting the coexistence of renewable energy and agriculture, develop educational materials, and recommend research areas. The act also creates the Oklahoma Agrivoltaics Cash Revolving Fund to finance these initiatives.[11]

Challenges to Overcome

High upfront costs, local zoning challenges, and public resistance remain barriers to agrivoltaic adoption. Farmers express concern about land use and long-term productivity, while Texas-specific issues like mineral rights

and REAP funding freezes complicate progress. Clearer regulations and targeted policy incentives similar to Oklahoma's are essential for scaling.

Policy Path Forward

Policymakers can act by adopting American Farmland Trust's Smart SolarSM siting principles, prioritizing marginal lands and bundling agrivoltaics into the Environmental Quality Incentives Program (EQIP), a U.S. government initiative administered by the USDA's Natural Resources Conservation Service (NRCS).

Education through REAP, the Sustainable Agriculture Research and Education program, and InSPIRE tools will empower farmers. Pilots led by UTRGV could serve as replicable models throughout the state. The American Farmland Trust recently outlined additional policy recommendations supporting national and state strategies for scaling adoption.

A Sunlit Future for Texas

Agrivoltaics offers a powerful bridge between agriculture and energy, preserving family farms while powering rural economies. The success of Dos Rios Winery illustrates what's possible. With collaboration, policy support, and continued innovation, Texas can lead the nation in this dual-use development strategy, where the sun powers homes, harvests, and heritage. ■

About the Author

Raina Tillman Hornaday, a fifth-generation landowner, has 20 years of renewable energy development experience including the Caprock Wind Project in Eastern New Mexico that is currently being decommissioned. She has developed utility-scale wind and solar projects in ERCOT and SPP markets. Dedicated to responsible renewable development, Raina advocates for solutions that support landowners, communities, and the land itself. She serves as Thought Leadership Chair for CleanTX, sits on the boards of the Texas Solar Energy Society and Powerhouse Texas, and earned an M.S. in Energy from Texas Tech University.

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New Laws Curbing Utility Political Spending Saving Ratepayers Millions of Dollars

By Itai Vardi,*The Energy and Policy Institute, energyandpolicy.org*

Gas and electric customers in Connecticut have been spared from footing the bill for up to $10 million of their utilities' political spending on lobbying, advocacy, and advertising activities since the state passed a law prohibiting recovery of such costs.

The legislation, which went into effect in June 2023, prohibits utilities from using money they collect from ratepayers for various political influence expenses such as lobbying, advertising, and marketing, and contributions to trade associations and groups incorporated under Section 501 of the Internal Revenue Code. Additionally, the bill bars the recovery from ratepayers of perks and extravagant spending for the companies' board of directors, corporate aircraft expenses, and the costs of investor relations. The law also prohibits charging ratepayers for costs associated with utilities' attendance and participation in any rate proceeding before the state utility regulatory authority.

According to an analysis by EPI, recent disclosures by Eversource and Avangrid, the state's investor owned utilities, show that since the law went into effect both companies spent a total of at least $9,738,302 on the costs prohibited from recovery. The law required utilities to file the annual, line-item disclosures of these expenses. Eversource's disclosures do not include the entire sum, since the company redacted the salary figures of its internal employees' labor on lobbying, advertising, and investor relations, and instead provided only the hours they spent on these tasks. According to Eversource's tally, their employees spent a total of 7,889 hours on these

EVERSOURCE CONNECTICUT (CL&P & YANKEE GAS)
Political Costs Prohibited June '23-September '24

	Lobbying or legislative Action	Advertising& Marketing	Rate Case Attendance	Board of Directors & Investor relations	Membership & Contribution to Groups	Total
Cost	$921,482	$399,608	$207,665	$457,405	$2,289,831	**$4,275,991**
Hours spent internally*	3,222	9	3,445	1,213		**7,889**

*Eversource detailed the hours its employees spent on these activities instead of the dollar amounts they received as compensation.

AVANGRID CONNECTICUT (UI, SCG, CNG)
Political Costs Prohibited June '23-September '24

	Lobbying or legislative Action	Advertising& Marketing	Rate Case Attendance	Board of Directors & Investor relations	Membership & Contribution to Groups	Total
Cost	$350,030	$1,329,945	$1,574,408	$923,492	$1,284,436	**$5,462,311**

three activity categories since the accountability bill passed.

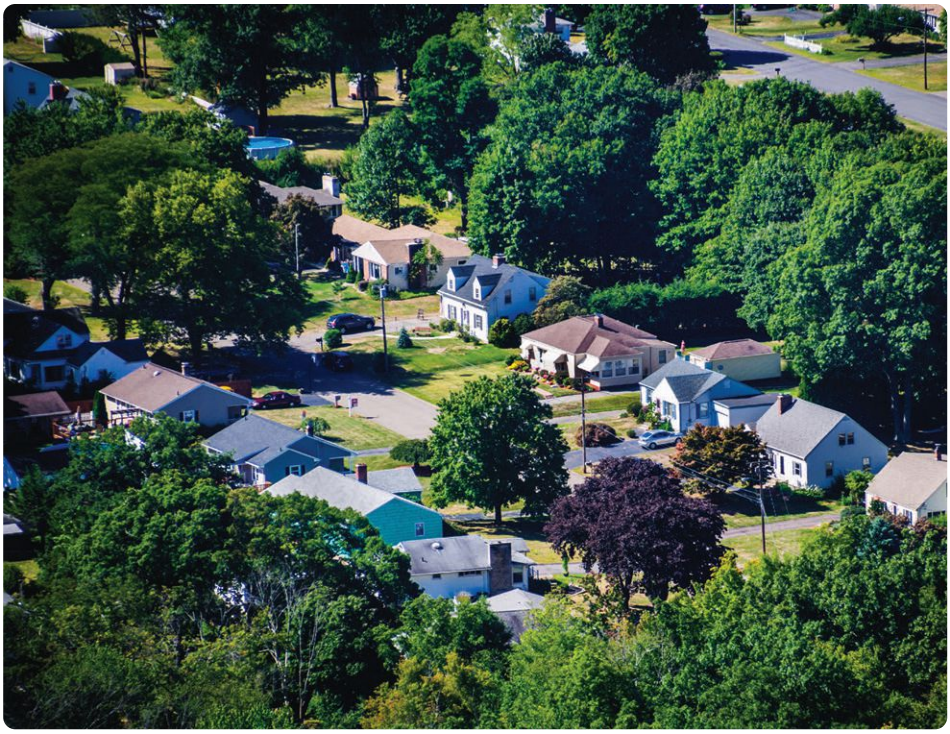
It's not certain that the utilities would have sought to recover all of these costs in rates, absent the state's landmark 2023 law. But the law prohibits them from doing so and requires the utilities to disclose the expenses in detail.

These latest disclosures detail a myriad of costs that do not benefit ratepayers. Yankee Gas, Eversource's gas subsidiary in Connecticut, spent tens of thousands of dollars last year on extravagant Board of Directors meetings, including in Florida's EAU Palm Beach Resort and LaPlaya Beach Resort and Wequasset Resort in Massachusetts. Other notable Eversource recent expenses in Connecticut include:

- Eversource paid Boathouse Group, Inc, a Massachusetts-based marketing agency, nearly $400,000 for "Strategic Corporate Advertising Campaigns."
- Connecticut Light & Power, Eversource's electric company in the state, paid over $1.6 million to various trade associations and charities, including $245,021 to the Edison Electric Institute, $83,740 to the MetroHartford Alliance, and $39,777 to the Connecticut Business & Industry Association.
- CL&P spent $149,971 under the category "Benefits Overheads" for internal lobbying.

Avangrid paid over $52,000 to the Mason Marketing Agency for such campaigns as "Energy CT Needs" Meta ads, "UI Powers CT," and "UI IG Likes Ad," UI FB Page Likes." Other notable Avangrid expenses in Connecticut in the past year include:

- Over $1.2 million to various trade associations and charities, including $508,961 to the Electric Power Research Institute, $65,294 to the American Gas Association, and $83,376 to the Bridgeport Regional Business Council.
- Over $750,000 for attendance and participation in rate cases.
- Over $100,000 to Garrand Moehlenkamp LLC, a Portland, Maine-based branding agency.
- Over $163,000 on corporate aircraft costs.



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Overview of a quiet suburban neighborhood in central Connecticut.

Connecticut's regulator, the Public Utilities Regulatory Authority, and intervenors in the companies' rate cases can use the annual data to query the utilities about any irregularities or signs that the company may be charging customers for activities prohibited for cost recovery.

As EPI detailed in a recent report, the utility accountability bill that passed in Colorado in 2023 is also beginning to make a difference on ratepayers' pockets. In a current gas rate case in the state, the Public Utilities Commission has disallowed more than $775,000 in annual costs for lobbying fees, trade association dues, and investor relations that Xcel Energy tried to recover. The PUC made clear that these costs were prohibited for recovery by the accountability law and criticized Xcel for applying its lobbying prohibition too narrowly. ■

This article originally appeared on The Energy and Policy Institute's website, energyandpolicy.org.

About the Author

Itai Vardi is a Research and Communications Manager at the Energy and Policy Institute, focusing on natural gas build-up, power generation, and pipelines. Prior to joining the Energy and Policy Institute, he was an investigative journalist focusing on the fossil fuel industry and utilities, climate change denial and industry front groups, money in politics, and regulatory capture. He has a PhD in sociology from Boston University.

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Solar Industry: A Driving Force for Economic Growth, Job Creation

By Jonathan Fenoll

The solar industry is not just about clean energy – it is an economic powerhouse that drives investment, job creation, and technological innovation across the U.S.

With over $70 billion in private investment flowing into the sector and more than 280,000 Americans employed in solar-related jobs, the industry's rapid expansion demonstrates its critical role in the nation's economic future.[1]

A Booming Sector with Expansive Job Growth

According to the Solar Energy Industries Association (SEIA), the number of solar businesses in the U.S. now exceeds 10,000, contributing to job growth across multiple fields, including research and development, manufacturing, installation, and maintenance. In 2023 alone, solar industry jobs grew by 5.9%, with utility-scale solar employment seeing a 6.8% increase.

SEIA also reports that In 2024, the U.S. solar industry installed nearly 50 gigawatts direct current (GW DC) of capacity, a 21% increase from 2023.[2]

Also, domestic module manufacturing capacity grew an unprecedented 190% year-over-year, from just 14.5 GW at the end of 2023 to 42.1 GW at the end of 2024.

Notably, jobs in solar installation are projected to surge by 48% from 2023 to 2033, according to the U.S. Bureau of Labor Statistics, making it one of the fastest-growing professions in the country.[3]

This economic impact extends across nearly all 50 states, with significant employment gains in key markets such as Florida, Texas, Arizona, and Nevada. The industry provides crucial opportunities for both urban and rural communities, diversifying local economies and offering stable, well-paying careers.

Federal Incentives Propel U.S. Solar Manufacturing Growth

Government policies, particularly the Inflation Reduction Act (IRA), have accelerated the U.S. solar market's expansion. According to the American Clean Power Association, at least 160 clean energy manufacturing facilities or expansions have been announced since August 2022, driven by tax credits in the IRA, with 47 announced in 2024 alone.[4]

Prior to these incentives, the U.S. ranked seventh globally in module manufacturing capacity. Today, it has risen five-fold to reach third place, demonstrating the impact of strategic investments in clean energy infrastructure. This growth extends beyond just solar panels; the industry supports a robust supply chain that includes storage solutions, mounting systems, power electronics, and other key components.

Through this expansion comes innovation in the solar field. Companies in the U.S. are now creating leading edge technology for key solar elements such as high-efficiency modules, solar energy storage, and AI-driven smart grids. The support from policies such as the IRA allows companies to mature and invest at a faster rate, protecting the American industry by creating an encouraging atmosphere for U.S-made solutions to compete with industry rivals in China and others.

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Economic Engine for Local Communities

With traditional manufacturing sectors, such as automotive and industrial, facing potential declines in the coming years, solar energy presents a promising alternative for economic stability. BNEF projects a 76% increase in global energy storage installations in 2025, reinforcing the industry's long-term viability.[5]

A Bright Future for U.S. Solar Energy

The solar industry accounted for 66% of all new electricity-generating capacity additions in 2024 according to SEIA, marking it as a dominant force in the energy sector.[6] As technology advances and solar adoption continues to rise, the industry will further cement its position as a cornerstone of the American economy.

The ongoing actions on tariffs present challenges and will have an impact on the global supply chain, and by extension the solar market in the U.S. But companies that remain resilient and focused on delivering high-quality products and services, stay in close communication with global partners, and continue to adapt as the tariff situation unfolds, will be the most prepared to weather the storm.

By continuing to invest in domestic manufacturing, workforce development, and supportive policies, the U.S. can solidify its position in the global renewable energy market. The solar industry is more than an environmental solution – it is a crucial driver of economic growth, job creation, and energy independence. ■

About the Author

Jonathan Fenoll is Director of Solar Utility-Scale Business Line for ARaymond, a global leader in fastening and assembly systems serving the automotive, energy, agriculture, healthcare, and construction markets.

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UC Merced Founding Faculty Roland Winston Remembered for Pioneering Solar Energy

By Lorena Anderson

Distinguished Professor Emeritus Roland Winston, a pioneer in solar energy, engineering and physics, died February 8 at the age of 88 at his home in Merced. A founding faculty member in the schools of Natural Sciences and Engineering at the University of California Merced, Winston also founded and directed the intercampus collaborative Advanced Solar Technologies Institute, known as UC Solar. His research and teaching focused on concentrating solar energy systems. Winston published hundreds of articles in scientific journals, co-wrote several books and held more than 60 patents.

More than 50 years ago, as a junior faculty member in the University of Chicago Physics Department, he published a paper introducing a new field he called non-imaging optics, describing the compound parabolic solar concentrator (CPC), a highly efficient device that collects and concentrates light, and introducing "Winston Cones," non-imaging light collectors that by their design maximize the amount of light that can be focused from large areas into smaller photodetectors or photomultipliers. All solar-concentrating research that has followed has been based on that landmark 1966 paper.

"Professor Winston was a distinguished scholar and a widely respected researcher whose work elevated the national and international profile of UC Merced." Chancellor Juan Sánchez Muñoz said.

Because of the publication and his inventions, Winston is widely considered to be the father of non-imaging optics, a field concerned with the optimal transfer of light radiation between a source and a target.

Non-imaging solar collectors — once thought to be impossible — don't need to track the sun and can function well under cloudy or hazy skies. They revolutionized solar energy use by providing the widest possible acceptance angles. They offer higher solar concentrations in smaller cells and generate higher temperatures with less thermal loss. They improve the reliability and efficiency of the solar cells in concentrated photovoltaics and improve heat transfer in concentrated solar thermal.

International experts continue to highlight the importance of Winston's breakthrough. Professor Aldo Steinfeld of ETH Zurich University cited Winston's work when his campus's president asked him to present an example of basic research that led to a highly practical application comparable to Albert Einstein's photoelectric effect that led to the development of photovoltaics.

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Professor Winston with his research team and a solar collector.

His inventions were recognized with a variety of awards and honors. He was a Guggenheim Fellow, won the Joseph Fraunhofer Award for "significant accomplishments in optical engineering" from the Optical Society of America and was elected as a U.S. delegate to the International Solar Energy Society. In 1988, using a new mirror-based technique, Winston and his team set a record for concentration of solar energy, concentrating sunlight to more than 60,000 times its normal intensity.

Winston was born Feb. 12, 1936, in

> **"Roland's brilliance and innovative mind were matched by a rare gift: the ability to find pure joy in life's simplest moments. On our journeys together, I often saw him marveling at the world with the unfiltered wonder of a child—whether it was savoring local delicacies or delighting in life's eccentricities. He taught us that curiosity wasn't solely the domain of science but a philosophy for living."**
>
> – Gilbert Cohen, ASES Member

Moscow, USSR, the son of an American engineer who was helping the Soviets design towns and build an industrial base. The family evacuated the Soviet Union in 1943 during World War II, as the German military got within artillery range.

He attended the Bronx High School of Science in New York City for two years, earning early entrance to Shimer College in Illinois before transferring to the University of Chicago, where he earned a bachelor's degree, a master's degree and a Ph.D.

After a short stint as an assistant professor at the University of Pennsylvania, Winston returned to the University of Chicago and was appointed chair of the Department of Physics. He conducted research at CERN (European Organization for Nuclear Research) in Geneva, Switzerland, and at Argonne National Lab and the Enrico Fermi Institute, both in the Chicago area. He was also a visiting professor at the Weizmann Institute in Rehovot, Israel.

He joined UC Merced in 2003 as one of the original eight founding faculty members. Over his nearly 20 years at UC Merced, he guided many undergraduate and graduate students, and when he retired in 2022 at the age of 86, his work didn't stop. He founded Winston Cone Optics, a company dedicated to his research in solar technologies and to making solar energy more efficient and less expensive so it could be available to more people. Professor Sarah Kurtz, whom Winston greatly esteemed, worked with him on several projects with students. "Roland always supported his team members with great enthusiasm, focusing on what they could do rather than on their shortcomings," she said. Professionally, she said, Winston made a profound contribution to the world.

Winston was a fellow with the American Physical Society, the American Optical Society, the American Association for the Advancement of Science, the American Solar Energy Society, the International Solar Energy Society and SPIE, the International Society for Optics and Photonics.

He won many awards throughout his career, including the *Franklin Institute C. Raymond Kraus Gold Medal; the Farrington Daniels Award of the International Solar Energy Society; the University of Chicago's Alumni Award for Professional Achievement;* and *UC Merced's first Chancellor's Award,* which included the *Professor Roland Winston Endowed Scholarship*, available to an entering first-year physics or engineering student who demonstrates financial need and/or is a DREAM Act student.

Winston is survived by his sons John and Joe, half-brothers Eugene and Vanya Loroch, grandsons Milo and Beckett Winston, and step-grandchildren Zoe and Alex Leuba. He is predeceased by his wife, Patricia, and son Gregory. Services will be held privately by the family. ■

> **"What always impressed me was that Dr. Winston (Roland), despite his exceptional scientific intellect, was such a humble, down-to-earth person. He listened to everyone and was open to hearing anyone's opinion. While Roland received numerous awards from the scientific community for his groundbreaking discoveries, he found the greatest pride in seeing his life's efforts have practical impacts on the lives of people. He clearly saw solar energy as the way he could contribute to society and saw ASES/ISES as a key vehicle for moving from theoretical to practical applications. Throughout the history of ASES and ISES there are very few who have done more to advance solar energy than Dr. Roland Winston."**
>
> – Mike Nicklas, Past Chair ASES, Past President ISES

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ASES is proud to offer the following solar trainings in partnership with Heatspring.

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http://bit.ly/2ci6DtA

SHORT COURSES: *(all start anytime)*

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Enroll to access advice from a $20MM solar tax equity investor. Master nonprofit PPAs and how to find and manage investors.
http://bit.ly/2cnZZE1

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Involved in solar operations and maintenance? Enroll to learn about infrared imaging (IR) technology and how you can use it to greatly improve solar PV O+M.
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Young Professional Corner

Evan Barker is an undergraduate at Penn State University, majoring in Energy Policy, and a member of the ASES National Organizing Committee for SOLAR 2024 and 2025. Evan is actively engaged in developing real-world renewable energy experience.

He attended the RE+ Southeast event in Atlanta thanks to ASES' partner affiliation with the event sponsor, the Solar Energy Industries Association (SEIA). Evan networked with industry executives, met exhibitors offering innovative products and services supporting renewable energy growth, and attended sessions outlining current industry concerns about the regulatory environment related to tariffs and Investment Tax Credits (ITC). Evan noted that the after-hours events sponsored by industry partners provided a relaxing atmosphere to build his network and learn more about the diverse sectors of the renewable energy industry. RE+ Southeast was held April 22-23 in the Georgia World Congress Center in the heart of Atlanta, Georgia. Organized by the Solar Energy Industries Association (SEIA) and the Smart Electric Power Alliance (SEPA), the event attracted over 1,000 renewable energy professionals and 100 regional and national firms. Conference sessions focused on market trends, energy policy, and technological advances.

Although there was common concern among attendees and presenters regarding tariffs and the future of IRA tax credits, the consensus was that the industry's future would continue to be bright. Business lab sessions provided insight into current challenges and innovative solutions for future growth. Numerous after-hours events sponsored by SEIA and industry firms provided a relaxing setting for colleagues to reconnect and build new network connections. ■

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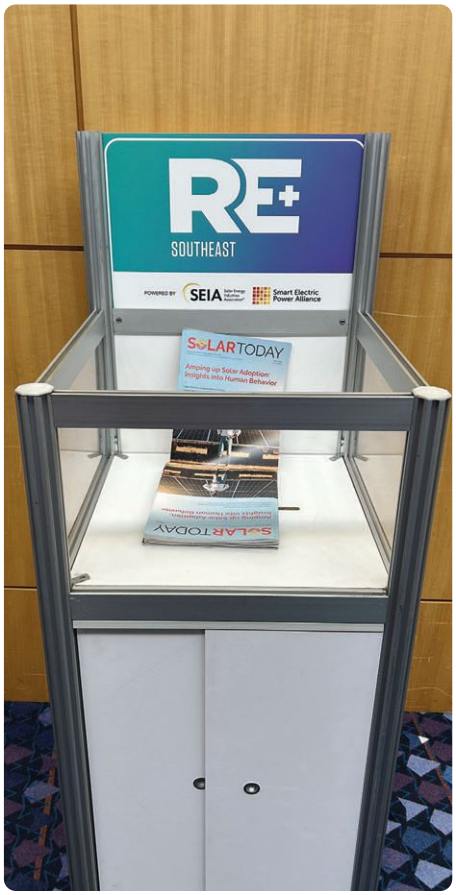
Evan and his mom, Mary Ellen Barker, ASES Board Member, and owner of Solar Land Agent, LLC.

Opening reception at RE+.

© Evan Baker

Opening reception at RE+.



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The 2025 ASES Awards Banquet Celebrates Unstoppable Innovation and Leadership

By Jill K. Cliburn

The 12 months preceding the upcoming ASES Awards Banquet in Boulder, Colorado, this coming August 5, saw unprecedented progress toward achieving the ASES vision for a world equitably and sustainably transformed to 100% renewable energy. In 2024, the U.S. achieved a cumulative solar generating capacity of nearly 240 gigawatts. That is almost 500 times the solar capacity of the U.S. just 20 years before. In addition, the past year marked milestones toward achieving "solar for all," such as stakeholder-inclusive policies, new solar programs for low-income and underserved households, and 150,000 new clean energy jobs. With all this in mind, the ASES Awards committee anticipated a celebration around the theme of a job well done.

But recent months also brought news of frozen federal funding, tariffs, job cuts, and uncertainty around the future of climate and justice work. Figurative dark clouds threatened celebratory plans. Our saving grace? We are honored to present a full roster of ASES awardees for 2025, who demonstrate inspiring achievements, unstoppable leadership, and a dose of good humor. These are the ingredients for solar success and–parenthetically–for a great party at the ASES Awards Banquet in Boulder this August. Tickets for the event and the full conference are still available, but going fast. Our celebration kicks off with the ASES Fellows Reception and will open to all after a brief private meeting to induct three new fellows: solar designer **Jeff Peterson,** architect **Jennifer Rennick**, and longtime editor of Solar Today, **Seth Masia**. Current ASES Fellows and Circle of the Sun members in attendance will also be recognized at the event. The banquet will follow, providing more time for shared memories, high hopes, and fun.

"Despite the Society's ever-present need for donations, this year's program will focus less on our needs and more on our appreciation of ASES members' contributions through all of the work they do," ASES Executive Director Carly Rixham notes. Specifically, ASES will honor 10 new awardees, who represent every major discipline in the solar field and every stage of a successful career, from the imaginative solutions of top graduate students, to the achievements of careers in full bloom, to the wisdom and generosity of solar leaders who have made their mark and continue in essential volunteer roles.

ASES has honored its solar heroes since 1975. An early focus on lab research was broadened to include research and application of passive solar design in 1979. Over the years, ASES added more awards to reflect the diversity of its membership. ASES was one of the first associations in the energy field to honor the benefits of diverse professional leadership, instituting the Women in Solar Energy (WISE) award in 2004. The most recently added award, honoring those who advance solar training, codes, and standards, was introduced in 2023.

We offer a short introduction to some of the 10 **2025 ASES Award Winners** below. Join us in Boulder August 5th to meet these solar heroes and to share your own stories of achievement toward our indomitable vision.

Innovative Solar Research and Development Award in Honor of Charles Greeley Abbot

Dr. David Ginley

For research in developing next-generation materials critical for a clean-energy future, for outstanding leadership at the National Renewable Energy Laboratory, and for voluntary service that has inspired achievements across the solar field.

Applied Solar Technology Award in Honor of Hoyt Clarke Hottel
William (Bill) Guiney
For pioneering work in the application of solar thermal technologies as high-value, clean energy solutions. This includes Bill's recent leadership of Artic Solar, a Florida-based company that manufactures a high-temperature solar collector incorporating evacuated tube and reflective energy technologies for commercial and industrial use.

Leadership in Solar Policy and Market Transformation Award
Karl Rábago
For collaborative research, conceptual innovation and policy advancement focused on the value of solar and its relevance to both large-scale and distributed PV within a 21st-century grid. Rábago has served as a public utility commissioner, utility executive, attorney, and fierce climate advocate.

Volunteer Service Award in Honor of Rebecca Vories
Robert Foster
For exemplary service toward the equitable development of solar energy across the globe, including leadership of ASES chapters in Texas and New Mexico and leadership on the ASES Board of Directors. He serves as International Programs Manager for the U.S. Department of Energy Southwest Regional Solar Experiment Station.

Leadership in Solar Architecture and Design Award
Margot McDonald
For dedication in promoting passive solar design and sustainable building practices across the profession and for leadership in education to advance solar architecture and design. McDonald is a professor of architecture at Cal Poly-San Luis Obispo.

John and Barbara Yellott Award for Graduate Solar Research
Mohammad Elmi,
Pennsylvania State University
Elmi is being recognized for excellence in doctoral research focused on architectural engineering, coupled with his inspiring leadership of an ASES student chapter.

John and Barbara Yellott Award for Graduate Solar Research
Fernanda Silva Pimenta,
University of South Florida
Pimenta is being honored for excellence in doctoral research focused on chemical engineering, including work towards net-zero carbon emissions in air transportation. She also leads an ASES student chapter.

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Women in Solar Energy Award (WISE)
Mary Alice Werner
For leadership of solar energy technology research throughout pivotal decades of industry growth, advocating for excellence, innovation, and opportunity among staff at the National Renewable Energy Laboratory and among its national and international solar partners. Mary serves as Solar Technologies Program Manager, overseeing PV and concentrating solar power (CSP) research and development for the Lab.

Code Development, Innovation, and Training Award in Honor of Claudia Hansen Wentworth
Bill Brooks
Bill Brooks is being recognized for longstanding leadership and service in the field of PV codes and standards development and for exceptional work in educating solar installers, inspectors, and operational troubleshooting staff. He works primarily in North Carolina and California, where he leads Brooks Engineering, LLC.

Code Development, Innovation, and Training Award in Honor of Claudia Hansen Wentworth
Sean White
Sean White is being recognized for excellence in training in PV system design, electrical codes, and code compliance, with humor and clarity. Based in California, he is beloved for his teaching around the U.S. and abroad, online and in person.

Help Support the ASES Solar Awards Program

ASES members can help to keep our awards program strong by submitting nominations for next year's awards. Watch for the announcement in early 2026.

We also welcome new Awards Program Committee members. Some leadership roles will have vacancies in 2026, and most subcommittees are expanding. They meet several times during the awards season and review the candidates for each award, based on criteria that are published on the ASES website. Award subcommittees also plan to take a more active role in assisting members who would like to make nominations, so that the Awards Banquet remains a highlight of the ASES National Solar Conference each year.

2025 Awards Committee Program Leaders

Awards Program Committee Chair:
Jill Cliburn, awards@ases.org

Solar Research and Development:
Wyldon Fishman

Applied Solar Technology:
Dave Renné

Leadership in Solar Policy and Market Transformation:
Elaine Hebert and Gilbert Michaud

Leadership in Solar Architecture and Design:
Julian Wang

Rebecca Vories Award for Volunteer Service:
Paulette Middleton

Code Development, Innovation and Training (Wentworth):
Elaine Hebert

Women in Solar Energy – WISE:
Marlene Brown

John and Barbara Yellott Award for Graduate Solar Research:
Yogi Goswami

We Thank ASES Volunteers!

See Committee Organization Chart and Descriptions at ases.org/governance.

ASES Awards Committee

Jill Cliburn, *Awards Chair*
Marlene Brown, *Women in Solar Energy Award Chair*
Wyldon Fishman, *Innovative Research and Development Award in honor of Charles Greeley Abbot Chair*
Yogi Goswami, *John and Barbara Yellott Award for Graduate Solar Research Chair*
Elaine Hebert, *Code Development, Innovation, and Training Award in honor of Claudia Hansen Wentworth Chair*
David Hill, *Fellows Chair*
Gilbert Michaud and Elaine Hebert, *Leadership in Solar Policy and Market Transformation Award Chairs*
Paulette Middleton, *Volunteer Service Award in honor of Rebecca Vories Chair*
Dave Renne, *Applied Solar Technology Award in honor of Hoyt Clarke Hottel Chair*
Julian Wang, *Leadership in Solar Architecture and Design Award Chair*

Applied Solar Technology Award in honor of Hoyt Clarke Hottel

Dave Renne, *Chair*
Yogi Goswami
David Panich

Fellows Subcommittee

David Hill, *Chair*
Jill Cliburn
Gilbert Cohen
Scotte Elliot
Randy Gee
Gabriela Martin
Margot McDonald
Paulette Middleton
Carly Rixham
Mark Thornbloom

Code Development, Innovation, and Training Award in honor of Claudia Hansen Wentworth Subcommittee

Elaine Hebert, *Chair*
Rebekah Hren
Mario Monestario

Innovative Research and Development Award in honor of Charles Greeley Abbot Subcommittee

Wyldon Fishman, *Chair*
Richard Perez
Daniel Simon

John and Barbara Yellott Award for Graduate Solar Research Subcommittee

Yogi Goswami, *Chair*
Sarah Kurtz

Leadership in Solar Architecture and Design Award Chair

Julian Wang, *Chair*
Alfredo Fernandez-Gonzalez
Walter Grondzik
Bruce Haglund

Leadership in Solar Policy and Market Transformation Subcommittee

Elaine Hebert, *Co-Chair*
Gilbert Michaud, *Co-Chair*
John Essig
Sampson Hao
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ASES SOLAR 2025

August 4-6 | University of Colorado Boulder | Boulder, CO

SCHEDULE AT-A-GLANCE

REGISTRATION: **University of Colorado Boulder**
University Memorial Center, Glenn Miller Ballroom
(1669 Euclid Ave, Boulder, CO)
Monday: 3:30 pm - 7:30 pm
Tuesday: 7:30 am - 6:00 pm
Wednesday: 7:30 am - 3:00 pm

Note: All times are Mountain Time (MDT)

Exhibitor/Poster Set Up
Special Event
Plenary
Workshop/Course
Session
Networking Break

Monday, August 4

8:45am - 11:30am	**NREL Flatirons Campus Tour** *(additional ticket required)*	Meet Outside Glenn Miller Ballroom
9:30am - 2:30pm	**NABCEP Course: PV & the NEC** *(additional ticket required)*	East Ballroom
12:30pm - 2:30pm	**ASES Chapter Forum** *(open to all conference attendees)*	Center Ballroom
2:30pm - 5:30pm	**Boulder Local Solar Tour** *(additional ticket required)*	Meet Outside Glenn Miller Ballroom
3:00pm - 5:30pm	**NABCEP Course: Energy Storage Intensive** *(additional ticket required)*	East Ballroom
3:00pm - 4:00pm	**Volunteer Training** *(invite only)*	Center Ballroom
3:30pm - 5:30pm	**Poster (East Ballroom) & Exhibitor (West Ballroom) Set Up**	Glenn Miller Ballroom
4:00pm - 5:30pm	**ASES Divisions Forum and Meet & Greet** *(open to all conference attendees)*	Center Ballroom
6:00pm - 9:00pm	**Opening Plenary Reception:** Integrated Energy Systems for a 100% Renewable Future	Center Ballroom

Tuesday, August 5

7:45am - 8:15am	**Networking Coffee Chats**	Center Ballroom
8:30am - 9:45am	**Plenary Panel:** Sustainable Solutions for Low-Income Communities & Households	Center Ballroom
9:45am - 10:00am	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
10:00am - 11:15am	**Oral Session 1:** Enabling the Energy Transformation	Center Ballroom
10:00am - 11:15am	**Poster Session 1:** Technology Research & Applications	East Ballroom
11:15am - 11:30am	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
11:30pm - 12:45pm	**National Solar Tour Luncheon** *(open to all conference attendees)*	Center Ballroom
12:45pm - 1:00pm	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
1:00pm - 2:15pm	**For Employers:** Career Fair set up	Center Ballroom
1:00pm - 2:15pm	**Plenary Panel:** Building the Future Workforce: How Education Enables Sustainability	East Ballroom
2:00pm - 5:00pm	**ASES Career Fair:** Powering A Bright Future *(open to all conference attendees)*	Center Ballroom
5:00pm - 6:00pm	**Fellows Reception** *(open to all conference attendees)*	East Ballroom
6:00pm - 9:00pm	**ASES** *Annual Awards Banquet (additional ticket required)*	Center Ballroom

Wednesday, August 6

7:45am-8:30am	**Networking Coffee Connections**	Center Ballroom
8:30am - 9:45am	**Plenary Panel:** Innovative Strategies: Region-Specific Policies & Technology	Center Ballroom
9:45am - 10:00am	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
10:00am - 11:15am	**Oral Session 2:** Technology Research & Applications	Center Ballroom
10:00am - 11:15am	**Poster Session 2:** Enabling the Energy Transformation	East Ballroom
11:15am - 11:30am	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
11:30am -12:45pm	**Women in Solar Energy (WISE) Luncheon** *(open to all conference attendees)*	Center Ballroom
12:45pm - 1:00pm	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
1:00pm - 2:15pm	**Oral Session 3:** Converging Technologies and Strategies	Center Ballroom
1:00pm - 2:15pm	**Spirit & Sustainability Forum**	East Ballroom
1:00pm - 5:00pm	**Solar Village & EV Demos** *(open to conference attendees & the public)*	Outside Glenn Miller Ballroom
2:15pm - 2:30pm	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
2:30pm - 5:30pm	**NABCEP Course: PV & the NEC** *(additional ticket required)*	East Ballroom
2:30pm - 3:45pm	**Industry Showcase:** Meet the SOLAR 2025 Conference Sponsors	Center Ballroom
3:45pm - 4:00pm	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
4:00pm - 5:15pm	**Systems Symposium:** Large-Scale Renewable Energy Integration into Electricity Grids	Center Ballroom
5:15pm - 5:30pm	**Networking Break with Sponsors & Posters**	Lobby / Glenn Miller Ballroom
5:30pm - 6:00pm	**Closing Ceremony**	Center Ballroom
6:15pm - 8:30pm	**Climate Ride / Walk & Happy Hour**	Meet Outside Glenn Miller Ballroom

ASES SOLAR 2025

Innovation for Universal Renewable Energy Access

August 4-6, 2025
University of Colorado, Boulder

AMERICAN SOLAR ENERGY SOCIETY

AMERICAN SOLAR ENERGY SOCIETY

Have any questions? Email **conference@ases.org**
For more information: **ases.org/conference**

ASES Divisions

Want to learn more about ASES Divisions and how you can get involved? Visit **community.ases.org**. Updates from some of our divisions are below.

Energy Economics Division

Chair: Wyldon Fishman, wyldon1@gmail.com

The economics of energy efficiency comes before renewable energy therefore we say "EE/RE". The exception to demand for more energy is to decrease the very demand first. Why and how we use all sorts of energy touches everything in many different ways. The business of auditing buildings and manufacturing processes will save a business money. How to fix a building or thermal processes in manufacturing is key. Join us and the related divisions as we explore the old tricks and the new possibilities.

Grid Modernization and Storage Division

Chair: Bill Guernsey, guernseyrb@verizon.net

The Grid Moderniation and Storage Division focuses on municipal and regional grids, interconnections, microgrids, and storage: evolution of the grid to deliver significantly more energy from intermittent renewable energy sources such as solar and wind. Here's what we've been up to:

- Reviewing technical media postings for useful grids and renewable content, catching up with the latest developments, thoughts and ideas
- Identifying potential authors for ASES content (e.g. Solar Today; Online Community articles and postings, webinars)
- Learning how the ASES webinars are developed and executed
- Supporting SOLAR 2025 Technical Review Committee (TRC)
- Supporting SOLAR 2025 Local Organizing Committee (LOC) (e.g. local solar tour)
- And, of course, participating in the Divisions Leaders monthly meetings

Resource Applications Division

Vice Chair: Remi Akinwonmi, aremi@ases.org

The Resource Applications Division focuses on how we gather, model, and apply solar resource data to support everything from siting and design to grid operations and market participation. As solar technologies scale, our work becomes more essential for ensuring reliable, equitable, and data-driven energy systems.

At this year's conference in Boulder, I'm looking forward to a few sessions that align closely with our mission. On Tuesday, August 5, the Poster Session on Technology Research & Applications will include work on solar resource modeling. Then Wednesday, there's an oral session on grid integration, followed by the systems symposium on large-scale renewable grid integration covering storage, demand-side management, and more!

Looking ahead, we're planning a July webinar: "Exploring the Potential of Foundation Models for Power and Energy Forecasting." As solar forecasting becomes increasingly critical, this session will explore how emerging AI tools can support more reliable and efficient solar operations. Stay tuned for more details, we'd love to see many of you there!

Solar Buildings Division

Vice Chair: Debbie Coleman, debbie@sunplans.com

The Solar Building Division presented Down to Earth Affordable Housing in April. View at ases.org/webinars.

We are again coordinating the National Solar Tour, now in its 30th year with both in-person and virtual tours. The theme of Big Solar encourages listing large projects on the free portal at nationalsolartour.org.

SOLAR 2025 in August will have a more engaging format this year with Posters and other activities, so we look forward to your attendance.

Finally, Julian Wang, Solar Buildings Division Vice-Chair, and ASES member Keith Sharp, P.E., are Project Co-directors for a Research Symposium in September 2025: National Ambient Energy for Buildings (engineering.louisville.edu/naebrs).

Solar Thermal Division

Chair: Bill Guiney, bill@articsolar.com

The ASES Solar Thermal Division is actively working to advance solar thermal technologies and their applications. They focus on areas like solar heating, cooling, thermal energy storage, swimming pool heating and efficient energy distribution.

The Division regularly holds online meetings, seminars and participates in ASES conferences to discuss developments and share knowledge. Members and non-members are encouraged to contribute articles to Solar Today and submit abstracts for presentations at upcoming conferences. We are always looking for Solar Thermal entities to develop a seminar or training program for our members.

The American Solar Energy Society (ASES) plays a significant role in shaping solar energy policies and initiatives. It achieves this by:

- **Advocacy and Education:** ASES promotes renewable energy by educating policymakers, industry professionals, and the public about the benefits of solar energy. This includes hosting conferences like SOLAR 2025 to foster collaboration and innovation.
- **Policy Support:** ASES Solar Thermal Division is aligned with and collaborates with the Solar Thermal Alliance within the national Solar Energy Industries Association to advocate for policies that encourage sustainable development and reduce reliance on fossil fuels and promote U.S. Solar Thermal technology and manufacturing.
- **Research and Resources:** ASES provides valuable resources and insights to support the adoption of solar technologies, including studies on policy effectiveness and market development by our diverse membership.

Our efforts will contribute to advancing solar energy adoption and addressing climate challenges by integrating Solar Thermal into existing heating technologies and systems.

These initiatives aim to strengthen the role of solar thermal energy in achieving energy independence, increasing manufacturing, jobs and an easier and more cost effective way of reducing carbon emissions.

Sustainability Division

Chair: Paulette Middleton, paulette@panoramapathways.net

Participants in the Sustainability Division's webinar "Getting Out the Vote for R Join us at SOLAR 2025 for the Divisions Meetup, many presentations on sustainability topics, and the Spirit and Sustainability Forum. The focus of the Forum this year is supporting each other through effective action. Now more than ever, individuals and organizations are called to action.

- Climate crisis is accelerating.
- Energy transformation is under attack.
- Fundamental human decency is being challenged.

Join this year's Spirit & Sustainability Forum to share specific actions, build support for each other, and celebrate the successes we are seeing. As the ASES Call to Action states, we must be attentive, informed and proactive. enewables" shared inspiring stories to help make this huge election year a huge win for renewables. Join the conversations with the American Solar Energy Society (ASES) online community (community.ases.org) and watch for ASES email notices about future meetups on being a renewable energy/sustainable living advocate.

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WEST VIRGINIA

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WISCONSIN

Midwest Renewable Energy Assoc.**
P: 715.592.6595
Contact: Nick Hylla
info@midwestrenew.org
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***This chapter has sub-chapters.**
****Associate Chapter**
‡Student Chapter

Intern Spotlight

Naveen Panditharatne, Data Analyst Intern, is passionate about integrating renewable energy solutions with advanced data analytics and computational techniques. With a Master's in Computer Science from the University of Wisconsin-Whitewater and a Bachelor's in Mechanical Engineering from the University of Hong Kong, Naveen likes to combine his mechanical and computational insights. His master's project focused on developing Physics-Informed Neural Networks (PINNs) to address complex heat transfer and fluid dynamics problems, demonstrating the advantages of machine learning over traditional engineering methods.

Previously at Lalan Group, Naveen managed the operations and maintenance of a biomass boiler and steam turbine, deepening his practical experience in renewable energy systems. Currently, as a data engineer, he utilizes Azure cloud solutions and advanced analytics to drive energy efficiency and sustainability projects.

Naveen enjoys networking and is eager to stay updated on evolving trends in renewable energy, particularly the integration of data science and machine learning in energy systems. During his free time, he enjoys working out, badminton, playing the guitar, and listening to podcasts.

AD INDEX

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