PennFuture

Solar Development in Pennsylvania

Policy Recommendations

June 2023

Table of Contents

01
Executive Summary

03
Background: Solar Benefits for Individuals and Communities in PA

05
Setting the Record Straight on Solar: Addressing Common Myths

11
Obstacles to Solar Development in Pennslyvania

15
Moving Forward: Solar Policy Recommendations

18
Conclusion

19
Refernces

24
Appendix: Additional Resources

Executive Summary

This paper offers a comprehensive overview of the status of solar development in the state of Pennsylvania. Beginning with a brief background of potential benefits to individuals and communities from residential and utility scale solar, barriers to realizing these opportunities are then discussed.

Common myths and misconceptions about solar energy are some of the most significant roadblocks for widespread support of this solar development, as constituents' attitudes and beliefs are clearly linked to their elected officials' actions.

Additional obstacles to solar energy deployment in PA are discussed in the following section, which covers inadequate legislation, lacking solar regulation in municipal zoning ordinances, and high upfront costs for homeowners.

Finally, this paper provides policy recommendations, including more ambitious solar energy targets, encouragement of siting on brownfields and use of agrivoltaics, and the passage of pro-solar legislation. In the appendix, additional resources can be found for both homeowners and local government officials.

Summary: Solar Development Policy Recommendations

1

Increase solar energy goals through higher AEPS targets.

The Alternative Energy Portfolio Standards (AEPS), is a law establishing alternative energy goals for Pennsylvania. Senate Bill 230 & House Bill 1467 would increase the renewable energy goal to 30% by 2030 (7.5% from large-scale solar projects and 2.5% from distributed solar) and permit community solar projects

2

Encourage solar power development on brownfields and through use of agrivoltaics.

BLPA should deploy tax incentives or other financial motivators for the siting of large solar arrays on brownfields and on farms through agrivoltaics (the co-location of solar panels on farmland).

3

Implement legislation supporting residential solar access, community solar, and more equitable bonding requirements.

BLPA officials must focus on expanding the ability of residents and utilities to capitalize on solar energy potential by overriding homeowners' associations restrictions and providing more support for solar.

Background: Solar Benefits for Individuals and Communities in PA

Solar energy is a clean power source that provides economic, environmental, and health benefits. As solar is a renewable and resilient energy source, it will provide security to the energy grid, a welcome change from the failures of fossil fuels during recent winter storms.(1) Although this renewable energy source is increasing throughout Pennsylvania, solar generation still contributes less than 1% of the state's net electricity generation.(2) Pennsylvania ranks 23rd in the nation for solar installations, but the state is considered solar friendly due to existing solar incentives and low prices: the average cost per watt for residential solar panels in PA is $2.55, but is $2.66 in the rest of the US.(3) Aggregate costs for residential solar end up being much lower after the 30% investment tax credit (ITC) is applied.

Residential solar energy pays for itself within an average of 11 years.(4) With decreasing solar panel production costs and increasing fossil fuel mining costs, solar will likely pay for itself even more quickly in coming years. Fossil fuel (for instance, coal) must be purchased constantly at an average of $0.05-$0.17 per kilowatt-hour, whereas solar power is free once the system cost is covered. Homeowners should also factor in the higher home value gained by investing in solar.(5) Additionally, PA's net metering policy allows homeowners to be credited for the energy they add to the grid, effectively removing their electric bills and saving about $1,379 annually on power. Over its designed lifespan, solar can save homeowners $23,634 more after the payback period, as well as increasing property value by approximately 4.1%.(6) While the Commonwealth currently hosts 1,002 MW of solar (enough to power 121,000 houses), the Solar Energy Industries Association (SEIA) projects that Pennsylvania solar installation will expand to 3,092 MW over the next five years.(7) Investments in solar of all forms—rooftop, community, utility-scale—provide Pennsylvania with most importantly clean generation, but also

significant economic opportunities. For example, the utility-scale Dover Solar Project in York County has recently been approved, which will create 330 jobs during construction, $1.7 million in tax revenue, and 75 MW of renewable energy to power 12,000 local homes.(8) With better solar policies, PA legislators could encourage more projects funded through the Inflation Reduction Act.(9)

Pennsylvania has plenty of space for solar, especially since solar panels can co-exist with agriculture and contribute to farmland preservation. In fact, solar panels are preferable investments for farms instead of more permanent-conversion developments, such as housing. According to studies conducted for Pennsylvania's Solar Future Plan, land use needs for the target of 10% solar-generated electricity by 2030 would require between 89-124 square miles: less than 0.3% of the state's total land area.(10) Solar panels can also occupy the numerous brownfields, or abandoned industrial land, in PA. The Eastern Pennsylvania Coalition for Abandoned Mine Reclamation has found that there are greater than 200,000 acres of abandoned mine land in PA, which could potentially host solar farms.(11) While this solution is not always feasible, some abandoned mines likely already have access roads and connections to the electricity grid that could be used for solar interconnections instead.

With regard to larger-scale utility solar, environmental, economic, and health benefits are even more widespread. Solar energy use reduces reliance on energy sources that emit fossil fuel-derived pollutants such as sulfur dioxide, particulate matter, and nitrous oxides, which are known to cause various respiratory and cardiovascular problems.(12) The National Renewable Energy Laboratory (NREL) found that by 2035 solar could comprise up to 40% of the US electricity supply and that the solar energy industry is expected to employ between 500,000 and 1.5 million workers. In Pennsylvania, the NREL forecasts that solar jobs could range from 8,287 to 12,335 by 2030.(13)

As of 2021, PA was one of the top ten states with the highest number of clean energy jobs (92,773) and has potential for even more growth in this sector.(14)

The urgently needed energy transition should be advanced in Pennsylvania through policy interventions, including financial incentives, clearer regulation, solar-friendly legislation, and community engagement.(15) While residential solar panels will benefit homeowners through adding value to their homes and avoiding the rising costs of polluting fossil fuels, utility scale solar projects will also provide health benefits, economic opportunities, and reliable energy to all Pennsylvanians.

Setting the Record Straight on Solar: Addressing Common Myths

Some anti-solar groups and citizens have voiced concerns about large renewable energy projects being built in rural communities, including those in Pennsylvania. In particular, there is strong opposition to solar being built on farmland and previously forested land. Claims have also been made that large-scale solar projects damage land, worsen the impacts of climate change, and provide "unreliable energy."(16) While concerns about any poorly designed infrastructure project are valid, misinformation about solar development is swaying landowners' and other stakeholders' opinions about solar energy. These misconceptions will be addressed in the following section to set the record straight on solar development.

Pennsylvania receives ample sunshine to make solar generation effective.

Despite the commonly repeated claim that solar is only worthwhile in warm, sunny regions such as the Southwest, modern solar systems are still effective even on cloudy days. While peak generation is reduced, solar radiation still penetrates clouds and panels can generate electricity even on less-than-ideal days.(17) Rain can increase panels' efficiency by washing away any debris that has collected on the panels, increasing their ability to absorb sunlight.(18) Moreover, as energy

storage continues to be improved and installed, solar variability can be beneficial: on sunny summer days when solar supplies peak generation, energy can be stored for use during times of lower generation (such as overnight or during cloudy days).

Solar arrays are not displacing working farms.

According to the USDA, agriculture is a key industry in Pennsylvania, which in 2017 yielded over $7.7 billion in direct sales from 59,000 farms. While PA farmland is undoubtedly declining, the industry's viability is primarily threatened by low-density housing development rather than solar.(19) Between 2001 and 2016, 70% of the 347,000 acres of lost farmland in Pennsylvania was developed for residential housing.(20) As a result of developed farmland, surrounding communities may face detrimental impacts including altered viewsheds, additional traffic, new infrastructure construction, and loss of the environmental benefits associated with farmland.(21)

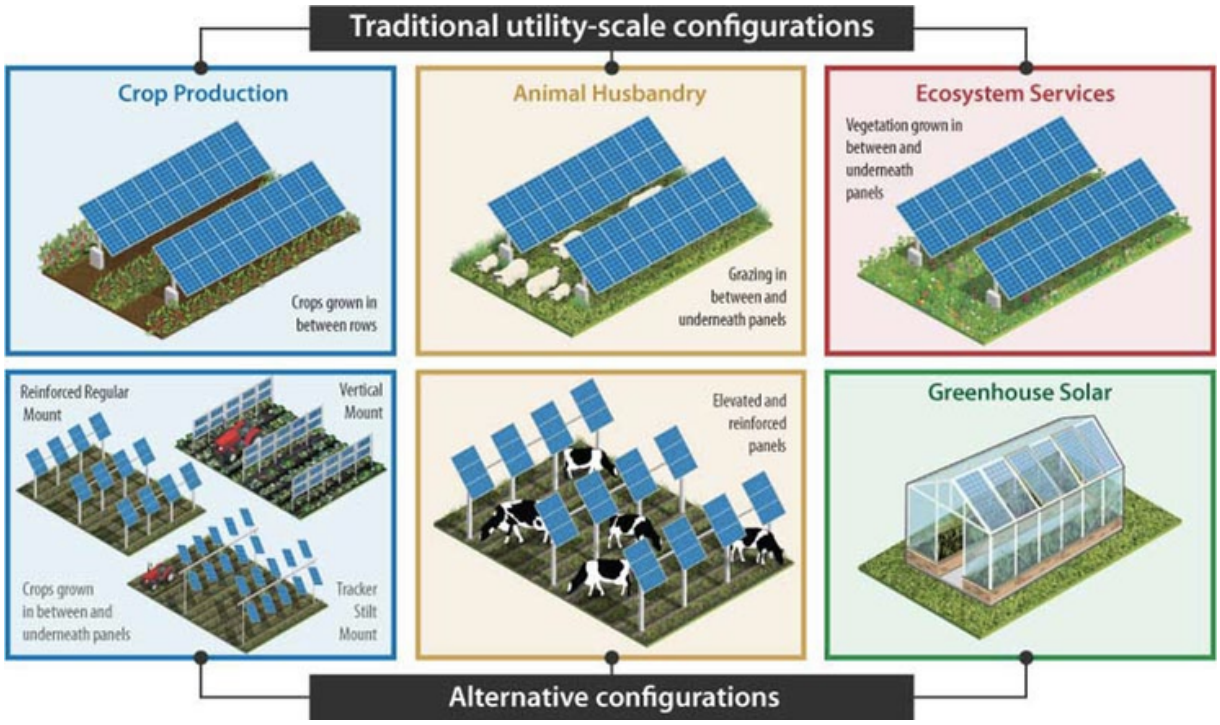
Decreasing farm incomes and retiring farmers with no one to continue their work are the primary reasons for the loss of farmland in Pennsylvania. Many farmers may feel they have no other option besides selling their farm for development.(22) However, solar development on just a fraction of the farm offers farmers a consistent income stream that need not be permanent, and siting on most productive soils can often be avoided. Solar development is simply not displacing working farms; housing developments are. Instead of selling their land, investing in a solar system offers farmers a way to maintain farming operations while producing clean energy. In fact, solar arrays can be co-located with agriculture, further increasing profit possibilities.

Land used for solar can still be used for farming.

Solar development and agricultural land use are not mutually exclusive. There exist many opportunities for agrivoltaics, or the dual use of land for solar panels and agriculture. One way that farmers can implement agrivoltaics is through growing crops under solar panels, which offer farmers capacity to grow more shade-

tolerant crops, lengthen growing seasons, and even reduce water demand.(23) For example, plants such as lettuce, spinach, peppers, and carrots thrive more under the shade of solar panels than in conventional fields.(24) Soil nutrient quality can also be increased during the period of solar installation through growing crops such as legumes underneath the panels.(25) Another possible solution involves allowing sheep to graze under the panels, providing natural mowing, or planting pollinator-friendly habitats under and around the panels.(26)

Additionally, after decommissioning of a solar installation, land can be reverted back to agricultural purposes. Without renewal, the design lifespan of a solar installation is around 20-25 years. This period of time can benefit future agricultural production by allowing the soil time to regenerate; as a result, soil quality improves. Because of decommissioning and budget plans, the long-term, minor impacts of solar installations on agricultural land are manageable and do not prevent future farming. Importantly, leasing a part of their land for solar gives farmers an extra source of income — ultimately keeping the land within the family — which in some cases may be crucial for ensuring the sustainability of their operations.(27)



(https://www.nrel.gov/news/program/2022/growing-plants-power-and-partnerships.html)

Solar panels will also not cause warming or drying out of the land underneath or surrounding the array, nor release toxic materials into soil, as modules are sealed and most commonly silicon-based. However, if farmers are still hesitant to lease land for solar, they could still benefit from installing panels on the roofs of their barns, chicken coops, or other farm buildings.(28)

Solar panels can and should be designed in a way that minimizes effects on wildlife and habitat.

While concern about the impacts of solar panels on wildlife should be addressed, the harm caused to animals is minimal when panels are installed correctly and with precautions. Minimizing the land cleared for solar panels is one of the most impactful ways solar development can avoid affecting wildlife, which is why building on residential rooftops, brownfields, or leased farmland is especially important.(29) Similarly, careful consideration of the placement of solar farms is vital to minimize damage to wildlife habitat. However, it is important to recognize that all types of energy development have some effect on wildlife and their habitats, while climate change presents a much greater threat to animals' livelihoods than that posed by individual renewable energy projects, continued efforts to conserve energy are also needed.(30)

Solar panel installations can be designed and managed to prevent erosion.

Well-designed solar panel installations address potential stormwater runoff concerns. Stormwater management plans to reduce erosion could include planting appropriate vegetation, regular monitoring of topsoil erosion and compaction, using temporary erosion and sedimentation control solutions such as mulch or surface netting, or installing of an engineered membrane in the case of a contaminated brownfield site.(31) Solar panel installers can also use other methods such as applying geotextiles, fabric that trap sediment while allowing water to flow through, or erosion control blankets.(32) Ultimately, erosion concerns from solar panels can be mitigated through proper management plans.

There is no risk of materials from solar operations contaminating groundwater.

As new solar projects are under consideration, another common worry is expressed: the hazardous materials used to construct solar panels will run off into groundwater, contaminating stormwater drainage systems and well water.(33) There is virtually no risk of this threat during the construction or operation of a solar array. It is important to keep in mind that the most common type of solar panels, comprising 95% of the market, are made using non-toxic crystalline silicon. Additionally, all of the materials within solar panels are enclosed using a weatherproof seal and cannot vaporize into the air nor combine with water.(34) According to the US Environmental Protection Agency, some solar panels may pass the Toxicity Characteristic Leaching Procedure (TCLP) while others fail due to manufacturing variations.(35) In normal operation, solar panels do not cause water pollution, and the minimal existing risk is diminutive when compared to water pollution generated by fossil fuels.(36)

Moreover, there is a low risk of the few toxic chemicals used in solar manufacturing, such as lead and cadmium, contaminating groundwater as result of a spill or being thrown away in landfills (a risk more familiar to the fossil fuel industry, as exemplified by the 2022 leachate contamination from Westmoreland landfill).(37) Photovoltaic (PV) manufacturers and operators take care to ensure that these very valuable and rare materials are recycled rather than improperly disposed of.(38) Various efforts supported by the US Department of Energy are underway to improve end-of-life concerns associated with solar technologies, including material recovery and recycling, and many states have implemented legislation that promotes PV panel recycling.(39)

Solar panels can be recycled and responsibly decommissioned.

The ability to recycle solar panels is critically important, especially considering the growth of solar panels and their 25-year design lifespan.(40) For example, in 2018 the US hosted a total of 44.5 million tons of installed solar panels.(41) Fortunately,

according to the US Department of Energy, 90% of a solar panel's components are recyclable at the end of its lifetime.(42) The majority of the panel is made from glass and aluminum, materials for which there exist large and established recycling markets. Moreover, the solar industry is still rapidly developing and the number of retired solar panels is increasing—meaning that there will be growing markets for recycling other components of panels.(43)

While other materials are used in solar panels, including some toxic metals, they exist in very small quantities and are sealed to prevent leaching.(44) Racking components can often be recycled with other scrap metals, inverters with electronic waste recycling, and battery grid storage systems with battery recycling programs.

Better options than recycling or disposal of solar panels include reuse and refurbishment. Solar panels can be reused for generating additional renewable energy at a new location – often long after their design life. Since there are some regulatory concerns with electrical grid connections, reused panels can instead be used independently of the electrical grid, such as powering electric vehicle or bike charging stations. Solar panels can even supply a portable power source for disaster relief, on boats, and in campers.(45)

Recycling solar panels is feasible and sustainable; increasingly, more components of the panel are able to be recycled. This recycling market is forecast to be quite profitable; by 2050, the International Renewable Energy Agency (IRENA) predicts that recyclable parts of retired solar panels will "be worth $15 billion in recoverable assets."(46) The US can learn how to expand solar panel recycling infrastructure from the more mature market of its European counterparts.(47)

Solar panels do not cause glare problems.

Solar panels are designed to absorb rather than reflect sunlight. Research reviewed by the National Renewable Energy Laboratory (NREL) affirms that solar panels produce less glare than water and windows. The reflectivity of solar panels, therefore, does not pose a hazard to air traffic. Increasingly, anti-reflective coating is applied to panels and will be even less reflective in the future.(48)

Obstacles to Solar Development in Pennsylvania

Obstacle 1: Looming threat of anti-solar bills.

With 95.25% of the state's energy derived from non-renewable energy sources, namely gas, coal, and nuclear, Pennsylvania has a long way to go in developing clean energy, an effort that must be supported by policy incentives.(49) Instead, a few different bills awaiting action in the legislature could further dampen the opportunities of solar power in Pennsylvania. For example, energy choice legislation would prevent the ability of local officials to restrict gas use in buildings, thus removing communities' ability to enact clean energy policies in their jurisdictions. (50) These bills would maintain Pennsylvania's dependence on gas and prohibit efforts to incentivize solar and energy efficiency standards at the local level.(51)

Another problematic barrier to solar energy in Pennsylvania is a bill that would encumber solar development with more burdensome bonding and decommissioning requirements than those imposed on the dirtier fossil fuel industry.(52) Additionally, a different bill proposes restrictions of solar energy projects that utilize any components made or assembled abroad. This bill aims to increase the cost of solar when compared to oil and gas — especially since nearly all electric generation sources have components made in other countries.(53) While solar manufacturing in PA and the United States should be supported, legislation should not generate additional obstacles to solar development in PA. If passed, any of these bills would disincentivize solar investments by making this energy source more expensive, preventing Pennsylvania from achieving renewable targets pursued much more successfully by its neighbors.

Obstacle 2: Lack of solar access and community solar legislation.

As a result of incentives in the new Inflation Reduction Act, the White House forecasts that 610,000 additional Pennsylvania homes will install solar panels, but inadequate support for community solar and Homeowners association (HOA) restrictions could limit this possibility.(54) Community solar legislation would allow projects enabling those who cannot invest in rooftop solar for a variety of reasons (ie. renters, those who have old roofs or shaded roofs, or cannot afford solar) to subscribe to solar energy from a large, centralized array. Also known as shared solar, community solar gives customers the opportunity to purchase or lease part of an off-site solar PV system so that they do not have to install their own system. Subscribers typically receive the same benefits as those with on-site solar systems, including a monthly bill credit for the electricity produced by their section of the solar array. As of December 2021, 22 states and Washington, D.C., have community solar policies.(55) Pennsylvania is unfortunately behind many of its neighboring states in passing community solar legislation; although bills have been introduced over the past several sessions to allow for community solar facilities, it too remains in committee.(56)

Furthermore, HOAs all too often prohibit installation of solar panels on their members' rooftops. Even when they lack solar bylaws, HOAs can be reluctant to have conversations with their members about the possibility of solar in their neighborhood. Restrictions can sometimes be unfair or illogical: solar panels may only be allowed on the side of the roof that is not visible from the street— thus often disregarding the fact that solar panels are more effective on south-facing roofs. Preventing homeowners from installing solar on their own properties also limits potential benefits such as higher property values, lower electricity costs, and non-polluting renewable energy. As of 2022, Pennsylvania had 6,870 HOAs, housing approximately 1.32 million people.(57) In fact, homes with installed solar can, on average, sell for 4 percent more than properties without solar systems, according to a national survey by Zillow.(58) These reasons are why many are calling for changes to solar-restricting practices.

Neighboring states have passed solar access laws that counter HOA restrictions on residential solar panels.(59) Yet in PA, many homeowners remain restricted in reaping the environmental and economic benefits of installing solar on their rooftops and solar businesses are losing business. Legislation expanding solar access to overcome this barrier is urgently needed in PA.

Obstacle 3: Lack of solar regulation in municipal ordinances.

Local zoning is arguably the most important piece of regulations for solar projects, as municipal guidance can decrease regulatory costs, raise policy concerns and generate solutions, and establish a consistent framework for developers. This process should be streamlined to encourage solar development; when "... considering variations not only in permitting practices, but also in other local regulatory procedures, price differences grow to $0.64-0.93/W between the most-onerous and most favorable jurisdictions."(60)

A recent review of Pennsylvania's local zoning ordinances, conducted by Penn State Dickinson Law School, found that solar development guidance is severely lacking. Of over 2,500 examined local ordinances, 87% supplied no guidance on solar energy developments; of the 13% that did address solar, only 5% contained utility-scale solar energy system guidance.(61) Part of this issue stems from the fact that many municipal ordinances are outdated, having been drafted around 2008-2009. Zoning regulations implemented by most municipalities are likely already compatible with solar, but need basic provisions in place to specify solar guidelines including location, glare, screening, noise, height, setback, lot size, decommissioning, and any special concerns unique to the community.

After basic requirements are in place, developers will rise to the challenge of meeting each stipulation. In addition, municipalities should be careful in implementing certain limitations, though; for example, limiting the size of a solar project may reduce its economic feasibility. Additionally, municipalities should not place more restrictive requirements or conditions on solar energy uses than they would on other forms of energy production, particularly those associated with much

higher levels of pollution. Municipalities are also advised to consider inserting forward-looking language in solar guidance, as this rapidly changing industry will likely experience advancements in categories such as storage and decommissioning.

To keep up with the increasing demand both for residential and utility-scale solar energy, municipalities need to enact relevant regulation that encourages and appropriately sites solar in their zoning ordinances. Without municipality-defined solar requirements in zoning ordinances, developers will lack guidance on how to capitalize on the opportunity to develop solar. Although the sun shines everywhere in PA, solar investments will flow to those areas with clearly defined guidelines, where the zoning rules are navigable by developers and ambiguity does not dissuade new projects.(62) Consistency in solar regulations is critical to ensure adequate governance of and support for this fast-growing industry. To aid municipalities in implementing these important regulations, resources including model solar ordinances are included in the appendix of this document.

Obstacle 4: Lack of access to capital and lending at attractive rates.

Another obstacle to residential solar development is the relatively high upfront cost of solar panel installation. While solar panels are proven to provide a lucrative return on investment and increase property value, the immediate installation fees can be prohibitive for some. The average gross price for solar in PA is $15,173 after the ITC, which although lower than the national average, is too high of an upfront fee for some homeowners.(63) While technological innovations are expected to continue lowering this price, solar finance options could provide a solution. Homeowners without sufficient access to capital could benefit from lending programs at more attractive rates so that they, too, can invest in solar. Perhaps more favorable to homeowners would be the option to participate in a more affordable community solar project, for which legislation is urgently needed.

Moving Forward: Solar Policy Recommendations

Recommendation 1: Increase solar energy goals through higher AEPS targets.

The Alternative Energy Portfolio Standards (AEPS), passed in 2004, is a law establishing alternative energy goals for Pennsylvania. In 2021, the state finally reached its solar target— 0.5% of the 8% renewable energy goal.(64) Pennsylvania is ranked 45th in the country for percent increase in total solar, wind, and geothermal energy production since 2012; clearly, more ambitious goals and investments are needed to harness PA's renewable energy potential. One way to do so is to update the state's AEPS and increase incentives for clean energy growth. (65) Although bills have been introduced to update AEPS targets, which include updated targets for in-state grid scale and distributed solar, Pennsylvania's proposed AEPS aims fall short of targets set by nearby states' goals; Maryland, for instance, plans to achieve 100% renewable power by 2040.(66)

Recommendation 2: Encourage solar power development on brownfields and through use of agrivoltaics.

Pennsylvania should deploy tax incentives or other financial motivators for the siting of large solar arrays on brownfields, as mentioned in the background section. These abandoned sites offer favorable components for solar development, especially those located in close proximity to public roads and power lines. These benefits will reduce construction costs while transforming previously unused land into a space for economic opportunity and new renewable energy jobs.(67) Solar development on the over 200,000 acres of brownfields should be prioritized over using forested lands or other usable lands.(68)

Solar development can also coincide with farming in a mutually profitable enterprise known as agrivoltaics. To be clear, solar arrays will not displace active, profitable farms in PA, but can be a way for struggling farms to keep their land. According to the NREL, both solar and shade-tolerant crop production can be improved when paired, resulting in economic and ecological advantages.(69) Solar grazing, or the practice of allowing sheep to graze underneath solar panels, keeps farmland in production through eliminating the need for mowing while providing pasture area for the sheep.(70)

Planting pollinator-friendly habitats under and around solar panels is another beneficial co-use of land, as butterflies, bees, and other insects are crucial for the successful growth of about 35% of crops. This type of meadow around solar panels offers a unique opportunity for honey bee apiaries, as solar beekeeping further increases benefits from multi-purposed land use. Situating beehives on or near solar systems yields renewable energy, honey, pollination services, lower maintenance costs (less need for herbicides and mowing), and improved soil health. Soil health is enhanced from native vegetation because these deep root systems increase organic matter, soil porosity and filtration, fungi, soil microbes, and nutrient content.(71) Importantly, agrivoltaics also provides an opportunity for farmland to lie fallow, replenishing nutrients in soils and increasing its productivity in the following years.(72)

Farmers could greatly benefit from leasing just a fraction of their land for agrivoltaics, as they will receive an extra steady stream of income, increasing the sustainability of their operations. Ultimately, policy tools and educational programs should therefore encourage the advantageous siting of solar projects on farmland where it will have the lowest impact as well as on suitable brownfields.

Recommendation 3: Implement legislation supporting residential solar access, community solar, and more equitable bonding requirements.

As discussed above, Pennsylvania has not yet passed legislation protecting solar access rights for homeowners or allowing community solar. Instead, legislation imposing strict bonding and decommissioning requirements, limiting use of solar components manufactured abroad, and preventing local governments' ability to restrict fossil fuel use await voting in the Senate. Pennsylvania officials must instead focus on expanding the ability of residents and utilities to capitalize on solar energy potential by increasing AEPS targets, overriding homeowners' associations restrictions, permitting community solar for those unable to install rooftop solar, and removing financial barriers to developers' installation of solar projects. Adequate, pro-solar legislation is necessary to increase Pennsylvania's current sourcing of solar energy from one half of one percent to much more impactful numbers.(73)

However, Pennsylvania officials continue to demonstrate strong support and funding through subsidies for dirty energy. This same tact should be applied with solar energy: something that can benefit our environment, our communities, and our economy. Thus, solar energy should not only be more meaningfully incentivized, but normalized and funded as a sustainable path forward for Pennsylvania's energy future.

Conclusion

Solar energy is an up-and-coming industry that increasingly offers affordable, clean, and secure electricity. Despite significant potential for solar energy, obstacles to widespread solar adoption in Pennsylvania remain pervasive, from threats of anti-solar legislation to HOA restrictions to inadequate municipal guidance to prevailing beliefs in solar myths. Pennsylvania urgently needs to overcome these challenges through enacting much more ambitious solar energy goals, prioritizing solar development on brownfields and through colocation on agricultural land, and implementing pro-solar legislation.

This massive economic opportunity, augmented by recent Inflation Reduction Act incentives, will pass Pennsylvania by unless swift action is taken. Solar energy development need not conflict with agricultural land use, threaten job loss, harm the environment, nor cause insufficient electricity supply. A much cleaner alternative than current reliance on fossil fuels, solar energy offers vast opportunities in the form of agrivoltaics, ample new jobs, economic savings for homeowners, reduced greenhouse gas emissions, and quickly improving storage and recycling programs. Pennsylvania citizens must urge their elected officials to pave the way for solar development, officials must act now to incentivize solar, and local governments must include solar regulations in their zoning ordinances. Without policy and attitude change, Pennsylvania will find itself falling even further behind the renewable energy transition and its associated economic, health, and environmental benefits.

References

(1)Rob Altenburg, "What We Learned from the December 2022 Deep Freeze: Don't Rely on Natural Gas When It's Fracking Cold (Part 1)," PennFuture, last modified January 24, 2023, https://www.pennfuture.org/Blog-Item-What-We-Learned-from-the-December-2022-Deep-Freeze-Dont-Rely-on-Natural-Gas-When-Its-Fracking-Cold-Part-1.

(2)Department of Environmental Protection, "Finding Pennsylvania's Solar Future," Department of Environmental Protection, https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/SolarFuture/Pages/Finding-Pennsylvania%E2%80%99s-Solar-Future.aspx.

(3)Dan Simms, "Is Solar Worth It in Pennsylvania? (2023 Homeowner's Guide)," EcoWatch, last modified January 26, 2023, https://www.ecowatch.com/solar/worth-it/pa.

(4)Simms, "Is Solar," EcoWatch.

(5)Vincent Battaglia, "The Cost of Solar vs Coal," Renova Energy, last modified March 21, 2022, https://www.renovaenergy.com/energy-insights/articles/the-cost-of-solar-vs-coal-1/#:~:text=It%20is%20no%20surprise%20that,to%20%240.06%20per%20kilowatt%2Dhour.

(6)Simms, "Is Solar," EcoWatch.

(7)"Pennsylvania Solar," Solar Energy Industries Association, last modified 2022, https://www.seia.org/state-solar-policy/pennsylvania-solar.

(8)Jared Foreman, "Dover Solar Project, USA," Enel Green Power, https://www.enelgreenpower.com/our-projects/in-development/dover-solar-project.

(9)Dana Nuccitelli and Jon Clark, "Clean Energy Permitting Reform Needed for Pa. to Boost Economy, Protect Climate and Burn Less Coal," York Dispatch, last modified January 11, 2023, https://www.yorkdispatch.com/story/opinion/contributors/2023/01/11/clean-energy-permitting-reform-needed-for-pa-to-boost-economy-protect-climate-and-burn-less-coal/69798464007/.

(10)PA DEP, Pennsylvania's Solar Future Plan, [Page #], November 2018, https://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/Pollution%20prevention%20and%20Energy%20assiatance/SolarFuture/Pennsylvania's%20Solar%20Future%20Plan.pdf.

(

11)Kathy Cook, "Advocating For Solar Energy Projects On Abandoned Mine Lands," ed. David E. Hess, Pennsylvania Environment Digest Blog, last modified January 25, 2022, http://paenvironmentdaily.blogspot.com/2022/01/advocating-for-solar-energy-projects-on.html.

(12)Dana Staats, "The Benefits of Utility-Scale Solar," Alliant Energy, https://www.alliantenergy.com/alliantenergynews/illuminate/030722-utilitybenefits#:~:text=Utility%2Dscale%20solar%20creates%20jobs,It%20helps%20the%20environment.

(13)"Pennsylvania's Clean Energy Jobs Potential Through 2030," National Renewable Energy Laboratory, last modified March 2022, https://www.nrel.gov/docs/fy22osti/82213.pdf.

(14)"Report: PA Surges to Top 10 in Clean Economy," E2, last modified March 13, 2023, https://e2.org/releases/report-pa-surges-to-top-10-in-clean-economy/.

(15)Solar Energy Technologies Office, "Solar Futures Study," Office of Energy Efficiency and Renewable Energy, https://www.energy.gov/eere/solar/solar-futures-study.

(16)Miranda Green and Michael Copley, "An Activist Group Is Spreading Misinformation to Stop Solar Projects in Rural America," NPR, last modified February 18, 2023, https://www.npr.org/2023/02/18/1154867064/solar-power-misinformation-activists-rural-america.

(17)SunPower, "Do Solar Panels Work on Cloudy Days," SunPower, https://us.sunpower.com/home-solar/do-solar-panels-work-on-cloudy-days#:~:text=Anyone%20who%27s%20gotten%20sunburned%20on,produce%20electricity%20on%20cloudy%20days.

(18)Josh Hurst, "Do Solar Panels Work on Cloudy Days? What About at Night?," EcoWatch, last modified January 27, 2023, https://www.ecowatch.com/solar/do-solar-panels-work-cloudy-days.

(19)Peter Wulfhorst, "Mitigating the Impact of Declining Farms in Pennsylvania," PennState Extension, last modified July 13, 2022, https://extension.psu.edu/mitigating-the-impact-of-declining-farms-in-pennsylvania.

(20)Julia Freedgood et al., Farms under Threat: The State of the States, [Page #], 2020, https://farmlandinfo.org/wp-content/uploads/sites/2/2020/09/AFT_FUT_StateoftheStates_rev.pdf.

(21)Wulfhorst, "Mitigating the Impact," PennState Extension.

(22)Rick Dandes, "Pennsylvania Loses 6,156 Farms over 5 Year Stretch," The Daily Item, last modified April 22, 2019, https://www.dailyitem.com/news/pennsylvania-loses-6-156-farms-over-5-year-stretch/article_90d87036-64eb-11e9-8377-7f803f0fec61.html.

(23)Solar Energy Technologies Office, "Farmer's Guide to Going Solar," Office of Energy Efficiency & Renewable Energy, https://www.energy.gov/eere/solar/farmers-guide-going-solar#:~:text=Land%20can%20be%20reverted%20back,for%20agriculture%20in%20the%20future.

(24)"Agrivoltaics: How Solar and Farmland Can Fight Climate Change," Solar Reviews, last modified May 12, 2022, https://www.solarreviews.com/blog/all-about-agrivoltaics.

(25)Solar Energy Technologies Office, "Farmer's Guide," Office of Energy Efficiency & Renewable Energy.

(26)Tom Daniels and Hannah Wagner, "Regulating Utility-Scale Solar Projects on Agricultural Land," Kleinman Center for Energy Policy, last modified August 11, 2022, https://kleinmanenergy.upenn.edu/research/publications/regulating-utility-scale-solar-projects-on-agricultural-land/.

(27)"Myths and Facts about Solar Energy," Center for Energy Education, last modified 2020, https://center4ee.org/debunking-solar-myths/.

(28)Sara Wolf, "Solar's Impact on Your Farm's Land and Animals," Paradise Energy Solutions, https://www.paradisesolarenergy.com/blog/solars-impact-on-your-farms-land-and-animals.

(29)"Do Solar Panels Harm Wildlife?," Solarworks, last modified July 14, 2021, https://solarworksenergy.com/do-solar-panels-harm-wildlife/.

(30)Lynsy Smithson-Stanley and Liz Bergstrom, "Why Solar Power Is Good for Birds," Audubon, last modified January 9, 2017, https://www.audubon.org/news/why-solar-power-good-birds#:~:text=Cutting%20carbon%20pollution%20is%20essential,without%20releasing%20any%20carbon%20pollution.

(31)Todd Greene, Nichole Murawski, and Ryan DaPonte, "Solar and Stormwater," Stormwater Solutions, last modified September 9, 2020, https://www.stormh2o.com/home/article/21148549/solar-and-stormwater.

(32)Emily Folk, "How Renewable Energy Professionals Can Reduce Erosion," Green Clean Guide, last modified July 22, 2020, https://greencleanguide.com/how-renewable-energy-professionals-can-reduce-erosion/.

(33)Christine Lee, "Residents Oppose Proposed Greenfield Twp. Solar Farm," The Bradford Era, last modified January 17, 2023, https://www.bradfordera.com/news/state/residents-oppose-proposed-greenfield-twp-solar-farm/article_d015c07c-a294-533e-9028-1fa194984b11.html.

(34) "Myths and Facts," Center for Energy Education.

(35)"End-of-Life Solar Panels: Regulations and Management," United States Environmental Protection Agency, last modified August 28, 2022, https://www.epa.gov/hw/end-life-solar-panels-regulations-and-management#:~:text=While%20heavy%20metals%20are%20present,the%20TCLP%20while%20others%20fail.

(36)Richard Gaughan, "Can Solar Energy Cause Water Pollution?," Seattle PI, last modified 2021, https://education.seattlepi.com/can-solar-energy-cause-water-pollution-3905.html.

(37)Jeff Himler, "Westmoreland Sanitary Landfill Cited for Leachate Leak into Speers Run," TribLive, last modified August 26, 2022, https://triblive.com/local/westmoreland/westmoreland-sanitary-landfill-cited-for-leachate-leak-into-speers-run/.

(38)"Environmental Impacts of Solar Power," Union of Concerned Scientists, last modified March 5, 2013, https://www.ucsusa.org/resources/environmental-impacts-solar-power#.Vs2CCfl97IU.

(39)"Solar Energy and the Environment," U.S. Energy Information Administration, https://www.eia.gov/energyexplained/solar/solar-energy-and-the-environment.php.

(40)"The Positive and Negative Environmental Impacts of Solar Panels," Kuby Renewable Energy, https://kubyenergy.ca/blog/the-positive-and-negative-environmental-impacts-of-solar-panels.

(41)Tom Schoder, "Can Solar Panels Be Recycled?," Greentech Renewables, last modified January 2021, https://www.greentechrenewables.com/article/can-solar-panels-be-recycled.

(42)U.S. Department of Energy, Solar Photovoltaics: Supply Chain Deep Dive Assessment, [Page #], February 24, 2022, https://www.energy.gov/sites/default/files/2022-02/Solar%20Energy%20Supply%20Chain%20Report%20-%20Final.pdf.

(43)"Solar Panel Recycling," United States Environmental Protection Agency, last modified 2022, https://www.epa.gov/hw/solar-panel-recycling.

(44)"The Positive," Kuby Renewable Energy.

(45)"Solar Panel," United States Environmental Protection Agency.

(46)Schoder, "Can Solar," Greentech Renewables.

(47)Schoder, "Can Solar," Greentech Renewables.

(48)Megan Day and Benjamin Mow, "Research and Analysis Demonstrate the Lack of Impacts of Glare from Photovoltaic Modules," NREL, last modified July 31, 2018, https://www.nrel.gov/state-local-tribal/blog/posts/research-and-analysis-demonstrate-the-lack-of-impacts-of-glare-from-photovoltaic-modules.html.

(49)Ellie Kerns, "Pennsylvania 4th Worst in the Nation for Percent Growth in Solar Power, as Clean Energy Booms Nationwide," PennEnvironment, last modified October 6, 2022, https://environmentamerica.org/pennsylvania/media-center/new-dashboard-finds-us-wind-solar-tripled-over-past-decade/.

(50)Kelly Flanigan, "Some Pennsylvania Legislators Are Trying to Block Clean Energy Options," PennLive, last modified February 9, 2022, https://www.pennlive.com/opinion/2022/02/some-pennsylvania-legislators-are-trying-to-block-clean-energy-options-opinion.html.

(51)Kelly Flanigan, "Some Pennsylvania Legislators Are Trying to Block Clean Energy Options," PennLive, last modified February 9, 2022, https://www.pennlive.com/opinion/2022/02/some-pennsylvania-legislators-are-trying-to-block-clean-energy-options-opinion.html.

(52)Mark Szybist, "PA Bill Would Block Local Efforts to Clean Up Buildings," NRDC, last modified May 10, 2021, https://www.nrdc.org/experts/mark-szybist/pa-bill-would-block-local-efforts-clean-buildings-2.
(53)Hess, "Sen. Yaw Plans," PA Environment Digest.

(54)Quinn Glabicki, "Only Partly Sunny? Solar Backers Say Federal Action Isn't Enough," PublicSource, last modified September 6, 2022, https://www.publicsource.org/pa-solar-power-energy-inflation-reduction-biden-pittsburgh/.

(55)NREL, "Community Solar," NREL, last modified 2021, https://www.nrel.gov/state-local-tribal/community-solar.html.

(56)Quinn Glabicki, "To Turn up the Solar Power, PA Needs New Laws. One Bill Is Poised to Move, but Here's Why Others Seem Stalled," PublicSource, last modified September 20, 2022, https://www.publicsource.org/solar-power-pennsylvania-general-assembly-community-portfolio-renewable-legislation/.

(57)"HOA Statistics," iProperty Management, last modified October 9, 2022, https://ipropertymanagement.com/research/hoa-statistics.

(58)Sarah Mikhitarian, "Homes With Solar Panels Sell for 4.1% More," Zillow, last modified April 16, 2019, https://www.zillow.com/research/solar-panels-house-sell-more-23798/.

(59)Ohio has recently passed Senate Bill 61, which permits homeowners to install solar panels unless explicitly prohibited by their HOA declaration; yet Pennsylvania still lacks a similar bill. (Lauren M. Zidones, "Ohio S.B. 61 Adds Protections for Solar Panels on Condominium and Planned Community Homes," The National Law Review, last modified August 18, 2022, https://www.natlawreview.com/article/ohio-sb-61-adds-protections-solar-panels-condominium-and-planned-community-homes.)

(60)Mohamed Rali Badissy, "PA Solar Ordinances: Local Regulation and National Trends," n.d., PowerPoint Presentation.

(61)Rachel Wagoner, "Majority of Local Zoning Codes in Pa. Lack Guidance on Solar," Farm and Dairy, last modified June 2, 2021, https://www.farmanddairy.com/news/majority-of-local-zoning-codes-in-pa-lack-guidance-on-solar/666604.html.

(62)"Utility Scale Solar: Land Use, Policy and Emerging Ordinances - An Interactive Q and A," video, PennState Extension, September 23, 2020, https://extension.psu.edu/utility-scale-solar-land-use-policy-and-emerging-ordinances-an-interactive-q-and-a.

(63)Simms, "Is Solar," EcoWatch.

(64)Glabicki, "Only Partly," PublicSource.

(65)Ellie Kerns, "Pennsylvania 4th Worst in the Nation for Percent Growth in Solar Power, as Clean Energy Booms Nationwide," PennEnvironment, last modified October 6, 2022, https://environmentamerica.org/pennsylvania/media-center/new-dashboard-finds-us-wind-solar-tripled-over-past-decade/.

(66)Quinn Glabicki, "To Turn up the Solar Power, PA Needs New Laws. One Bill Is Poised to Move, but Here's Why Others Seem Stalled," PublicSource, last modified September 20, 2022, https://www.publicsource.org/solar-power-pennsylvania-general-assembly-community-portfolio-renewable-legislation/.

(67)"Brownfields Redevelopment," Encore Renewable Energy, https://encorerenewableenergy.com/services/brownfields-redevelopment/.

(68)Cook, "Advocating For Solar," Pennsylvania Environment Digest Blog.

(69)"Agrivoltaics," National Renewable Energy Laboratory, https://www.nrel.gov/solar/market-research-analysis/agrivoltaics.html.

(70)"What Is Solar Grazing?," American Solar Grazing Association, https://solargrazing.org/what-is-solar-grazing/.
(71)"Fact Sheet: Making the Case for Solar Beekeeping," AgriSolar Clearinghouse, last modified January 4, 2023, https://www.agrisolarclearinghouse.org/wp-content/uploads/2023/01/AgriSolar_FactSheet_Making-the-case-for-solar-beekeeping-Reduced.pdf.

(72)Darcy Larum, "What Is Fallow Ground: Are There Any Benefits of Fallowing Soil," Gardening Know How, last modified March 4, 2021, https://www.gardeningknowhow.com/garden-how-to/soil-fertilizers/what-is-fallow-ground.htm.

(73)Glabicki, "To Turn," PublicSource.

Appendix: Additional Resources

Model Solar Ordinances

- Renewable Energy Ordinance Framework - Solar | DVRPC
  - https://www.dvrpc.org/energyclimate/modelordinance/solar
- Bucks County Model Alternative Energy Ordinance
  - https://www.buckscounty.gov/DocumentCenter/View/3811/Model-Sustainability-and-Renewable-Energy-Ordinance-pdf
- Cumberland County Solar Energy Systems Model Ordinance
  - https://www.ccpa.net/DocumentCenter/View/7947/final-solar-4-19-11?bidId=
- York County Solar Energy Systems Model Ordinance
  - https://www.ycpc.org/DocumentCenter/View/316/Model-Solar-Energy-Systems-Ordinance-PDF?bidId=
- Model Ordinance for Large-Scale Solar Electric Energy Facilities in PA
  - https://www.psats.org/wp-content/uploads/2020/09/Solar-Model-Large-Scale-Facility.doc

Other Resources

- Solar Energy: SolSmart's Toolkit For Local Governments
  - https://solsmart.org/solar-energy-a-toolkit-for-local-governments/
- Municipal Officials' Guide to Grid-Scale Solar Development in Pennsylvania
  - https://marcellus.psu.edu/solar-energy/
- Solar Developer Resources (DEP)
  - https://www.dep.pa.gov/Citizens/solar/Pages/Developers.aspx
- PA Solar Future Plan (DEP)
  - http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=1413595&DocName=PENNSYLVANIA%26%2339%3bS%20SOLAR%20FUTURE%20PLAN.PDF%20%20%3cspan%20style%3D%22color:blue%3b%22%3e%28NEW%29%3c/span%3e
- Is Solar Worth It in Pennsylvania? (2023 Homeowner's Guide)
  - https://www.ecowatch.com/solar/worth-it/pa
- HOA Solar Action Guide
  - https://www.solarunitedneighbors.org/wp-content/uploads/2019/01/SUN_HOA-Guide_FINAL.pdf

PennFuture

Acknowledgements

PennFuture would like to thank **Caroline Weiss**, our 2023 Policy Intern, for her research and drafting of this report.

Thank you also to Rob Altenburg, Senior Director of Climate and Energy, and Abby Jones, Vice President of Legal and Policy, for their review and contributions.

PennFuture
610 North Third Street
Harrisburg, PA 17101
info@pennfuture.org
www.pennfuture.org