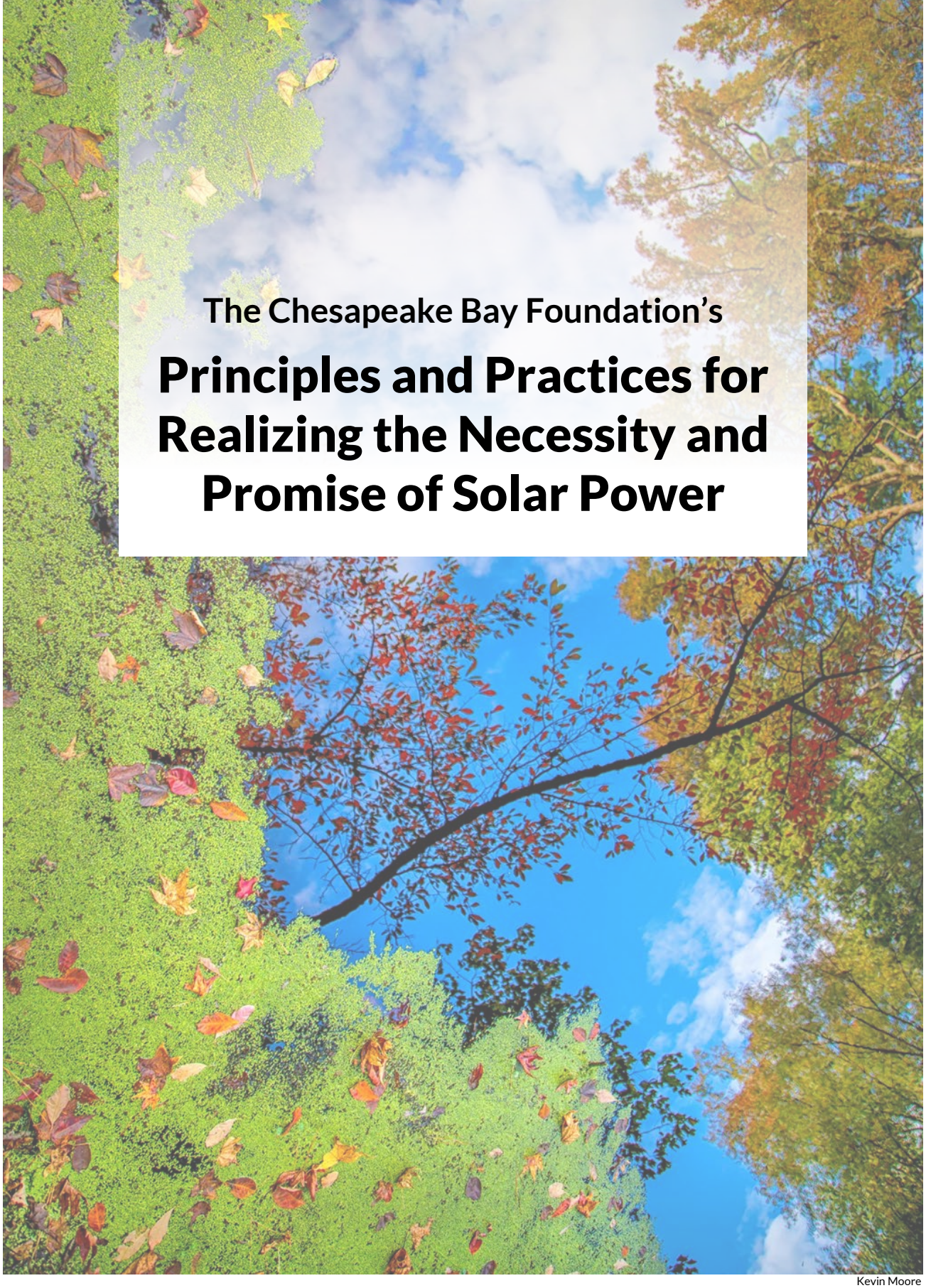
The Chesapeake Bay Foundation's

Principles and Practices for Realizing the Necessity and Promise of Solar Power



Kevin Moore

CHESAPEAKE BAY FOUNDATION

Saving a National Treasure

Introduction

First, CBF is fully supportive of solar power. As a renewable resource, using the sun's energy to produce electricity in lieu of fossil fuels like coal, oil and gas, is nearly unbeatable.

Solar power will be essential to the United States' moving forward into a zero-carbon future, as the nation and the world must do to reduce the extent of climate change. It is self-evident that this energy source (the sun) need not be mined, refined, piped, trucked, or carried on rail cars or ships, and there are no emissions of pollutants that occur during the production of electric power from the sun. While certain coatings on solar panels may be of concern, panels need not be produced using them; while some of the components of these panels, and the production of frames and hardware, are industrialized and may both require some mining and produce pollutants during manufacture, that pollution can be controlled, and the overall environmental balance still favors solar over fossil fuel power sources.

Maryland, Pennsylvania and Virginia have either passed renewable power legislation[1] or have instituted Executive Orders[2] for achieving certain percentages of renewable or carbon-free energy by 2030, 2045 and 2050. In Maryland, the 2019 bill which became law even went so far as to specify that 14.5 percent of electric power should be supplied by solar sources by 2030.[3] Pennsylvania's 2004 legislation (active since 2007) set alternative energy portfolio standards, which gradually increase over 15 years and include small but specific percentages for solar contributions.[4]

Chesapeake College, Wye Mills, Maryland ©Matt Kane/The Nature Conservancy

[1] Maryland Senate Bill 516, Clean Energy Jobs Act (2019); Pennsylvania Act 213, Alternative Energy Portfolio Standards Act, P.L. 1672 et seq. (November 30, 2004)

2 Virginia Executive Order No. 43 (September 16, 2019); Virginia Clean Economy Act, SB 851 (March 5, 2020).

3 Id at footnote 1.

4 Id at footnote 1.

Solar facilities can produce positive economic impacts at the local and state level, at the same time as they eliminate the emissions of the nitrogen oxides (NOx) and other greenhouse gases (GHGs) that are created when electricity is produced in fossil-fueled power plants—which emissions adversely affect the Chesapeake Bay and its local rivers. On solar "farms," it is *possible* for the solar panel deployment to be friendly to certain ground covers and pollen-producing and water-infiltrating vegetation beneath the panels, providing the type of panel and system is so designed.

Second, improper location or design of solar farms can have negative environmental consequences. A solar facility's purpose is to to harvest energy from the sun and convert it to electric power. While in some places and forms such arrays can be mostly benign, they are, nevertheless, like commercial or industrial land uses. *Depending upon their design, and where and how they are developed, solar farms can have positive or negative environmental consequences.* Among the latter impacts can include the loss of numerous ecosystem services from the complete removal of high-quality forests, wetlands, and prime farmland; mass grading, total vegetative and soil stripping/compaction of a site; treatment of the land with herbicides; and, absent assiduous planning and execution of best management practices, stormwater discharges into nearby waterways.

Since the production of power from solar sources currently requires a substantial dedication of space (5-10 acres per megawatt (MW) produced), the *where* and the *how* of creating this important clean energy must be a crucial element in any official decision-making concerning its deployment.

CBF's Principles for Developing Solar Power

1. **Either conduct a *statewide* or, as appropriate under state law and custom, conduct *local* solar facility siting studies.**

Siting a solar installation is both a land use matter, and an energy transmission matter. This means that both its location as a local land use, *and* the location of transmission facilities which may accept the power (i.e. the "injection capacity" of those facilities for the produced solar power), must be taken into account.[5] To the extent possible, solar farms should evaluated as a land use by either state or local officials, depending upon state law; the capability of the transmission system to accommodate such facilities must also be evaluated.

In states where *Public Utility, Public Service, or State Corporation Commissions* (PUC's, PSC's, or SCC's) have primacy or preemptive authority for permitting this kind of facility, the Commissions

[5] The regional transmission organization covering Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia (among other states) is PJM Interconnection (Pennsylvania, Jersey, Maryland Power Pool). This is the entity which controls the electricity wholesale market and the generated electricity which contributes to it. It determines whether local transformers and transmission lines can accept the produced power, and at what cost. Given limited transmission capacity, solar power is put into PJM's "queue" for acceptance over time.

should undertake a thorough and detailed statewide land use study to determine in general where solar farms/facilities might best be located and, on the other hand, where sensitive or natural resources occur that solar farms should generally avoid—while accounting for the need for proximity to grid/transmission facilities which may be able to accept and transmit the produced power.[6]

In states where *local governments or regional planning agencies* have primary planning authority and/or the authority to accept or reject the placement of solar facilities, the same kind of work should be done at the local level.

The resulting maps and guidance should then be used for informed decision-making by the decision-making government body, whenever the state commission or a local government (as appropriate) is approached for a permit, zoning/land use approval, or state-issued certificate.

Note: In the Chesapeake Bay watershed, we are blessed with excellent, "wall to wall" (i.e. all 64,000 square miles of the six-state-plus D.C. watershed), satellite-based land cover, mapped at the scale of one square meter. By next year, satellite-based LiDAR (light detection and ranging) mapping will begin to spread watershed-wide, allowing even higher accuracy concerning topography, stream locations and buffers, tree canopy, impervious surfaces and more precise land covers. In combination, this rich data set will provide states and localities with access to vast information about their land, which can be used (among other purposes) to help determine areas where solar arrays should preferentially be located or avoided.

2. Certain locations for solar facilities should be strongly preferred.

- "Distributed" solar generation is a good thing. Encouraging and diversifying the location of solar panels onto the rooftops of homes and businesses is one way to reduce the impact of widespread power interruptions; it is also a good way to meet those properties' own energy needs. In some states, there are limitations as to how much power can be so supplied or how much net-metering may be allowed.[7] These amounts should be enlarged, while recognizing that a balance is necessary for calibrating net-metering rates/incentives or the amount of distributed power, to avoid stress on the overall

[6] New Jersey is an example, having used statewide data on land cover to determine "preferred", "not preferred," and so-called "indeterminate" lands for solar application. In NJ, the resulting maps and designations are meant to be used as tools, not as a regulatory mandate. https://static1.squarespace.com/static/546d61b5e4b049f0b10b95c5/t/5ac649be70a6ad82bf6d8b8c/1522944447411/NJ+Solar+Siting+Analysis+2017.pdf

In Oregon, energy developers have the choice as to whether to go through the state siting council, which has established guidelines including siting (https://www.oregon.gov/energy/facilities-safety/facilities/Documents/Fact-Sheets/EFSC-Standards-in-OAR.pdf); or pursue permission from local authorities. In either case, however, local authorities are involved.

[7] Net-metering refers to the ability of a distributed power source to provide power back into the grid and obtain compensation or financial credit for such contributions.

distribution grid and significant increases of electric rates/pricing[8] by electric power utilities. Incentives should always favor developed sites and disfavor undeveloped forests and good farmland.[9] Other incentives can be used to encourage distributed solar power generally, including, for example, solar rebates for solar arrays on already developed land.[10]

- "Community solar" facilities may also be acceptable, if they meet local land use standards for screening, avoid high quality environmental resources (see below), and are not placed on prime farmland or replace forest and woodlands. Community solar refers to projects of 2MW or less.

- Site solar farms on large industrial and commercial rooftops (e.g. warehouses, flat-roofed production facilities, enclosed malls), as well on large open parking lots (see picture on p.1), where they can provide shade as well as power. Seven years ago, the National Renewable Energy Laboratory (NREL) determined that PA had 20 gigawatts (GW) of rooftop solar potential, MD had 13 GW, and VA had 19 GW[11]. These amounts are very significant and such locations are highly preferred.

- Utilize brownfields, major landfills, and other disturbed or degraded land (there are ballast-type solar panel support structures for areas where penetration of the soil is unwise or unavailable)—examples include Hartford, CN's landfill solar array, and a 2.6MW facility in North Providence, RI, owned and operated by Captona (shown at right). Another location and facility type to be further explored is floating systems: China has deployed a very large solar array on a huge fish farm, and a deployment here, for example on reservoirs or utility cooling ponds which might benefit from shading, might work equally well.[12] Note that while the cost of these projects may

[8] Vermont's experience with net metering may be instructive: https://puc.vermont.gov/sites/psbnew/files/doc_library/18-0086-INV_Final_Order.pdf .

[9] New Jersey's credit system of incentives for placing facilities in the right locations may be instructive: https://www.njcleanenergy.com/renewable-energy/programs/solar-renewable-energy-certificates-srec/new-jersey-solar-renewable-energy

[10] E.g., California's solar rebate program for distributed solar: https://www.gosolarcalifornia.ca.gov/about/csi.php

[11] *U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis*, National Renewable Energy Labora-tory, July 2012, available at http://www.nrel.gov/docs/fy12osti/51946.pdf

[12] The NREL in 2018 found that facilities sited on the latter could supply up to 10 percent of current U.S. electricity generation: Robert S. Spencer, Jordan Macknick, Alexandra Aznar, Adam Warren, and Matthew O. Reese, "Floating Photovoltaic Systems: Assessing the Technical Potential of Photovoltaic Systems on Man-Made Water Bodies in the Continental United States," Environmental Science and Technology 53, no. 3 (December 11, 2018): 1680-1689, https://pubs.acs.org/doi/full/10.1021/acs.est.8b04735 .

be slightly higher than on-farm or on specifically deforested areas, the price differential to retail electric customers may be relatively small. The NREL determined in 2014 that there was a sufficient amount of uncontaminated brownfield land available to provide all of the federal government's then-determined solar energy goals.[13]

- Site solar facilities within the boundaries of large public institutional uses (airports, prisons, major public sector office complexes, public schools, hospitals, and universities), and along public rights of way, as long as public safety is not compromised.
- Generally, allow and encourage solar farms in industrial, commercial, or institutional land use zones (see below), so long as such zones do not include substantial amounts of farm or forestland, and such resource lands in those districts are not the primary chosen locations.
- Solar farms may be sited on marginal or fallow farmland with low quality soils where local governments have permitting authority, as special or conditional uses per local zoning codes. Locations for these kinds of solar farms may be places where the design should include appropriate low maintenance vegetative planting beneath the panels, with a panel design that promotes light penetration and water infiltration (such designs currently exist). Compatible, agriculturally-related activities in/around solar facilities could include beekeeping (when pollen-producing vegetation is grown around or beneath panels), cultivation of shade-loving harvestable crops, and even compatible animal husbandry with sufficient spacing between rows of panels.[14] Solar panels near water should use low reflectance and include non-polarizing white grids between panels to reduce impacts on insects and waterfowl.

3. **In general, avoid inappropriate locations for solar facilities designed to produce greater than 2MW, or that cover more than 20 acres of resource land for any one project or for several such projects in close proximity which are part of a single or related solar development plan.**
    - Avoid close proximity to residential areas, unless there is adequate screening.

---

[13] *Solar Development on Contaminated and Disturbed Lands*, National Renewable Energy Laboratory, December 2013, available at http://www.nrel.gov/docs/fy14osti/58485.pdf The federal objective at the time was for the U.S. to produce 632GW of photovoltaic electricity by 2050. The estimates in this document are based on a conservative formula where one MW of photovoltaic generation needs 10 acres. (In 2017, installed solar produced 50+ GW of power.)

[14] These are so-called "agrivoltaics." Stefano Amaducci, Xinyou Yin, and Michele Colauzzi, "Agrivoltaic systems to optimize land use for electric energy production," Applied Energy 220 (June 15, 2018): 545–561, https://www.sciencedirect. com/science/article/abs/pii/S0306261918304197 ; Greg A. Barron-Gafford, Mitchell A. PavaoZuckerman, Rebecca L. Minor, Leland F. Sutter, Isaiah Barnett-Moreno, Daniel T. Blackett, Moses Thompson, Kirk Dimond, Andrea K. Gerlak, Gary P. Nabhan and Jordan E. Macknick, "Agrivoltaics provide mutual benefits across the food-energy-water nexus in drylands," Nature Sustainability 2 (September 2, 2019): 848-855, https://www.nature.com/articles/s41893-019-0364-5

- Avoid federal, state or locally declared cultural or historic sites, designated state scenic areas, or sites with significant adverse impact to environmental justice communities.
- Avoid location of solar facilities on prime agricultural soils. Any solar operations on lesser quality agricultural fields must not negatively affect the land and soil that could prevent active farming in the future. Solar arrays on poor-quality or fallow farmland may exceed 20 acres unless other relevant circumstances (e.g., state or locally designated conservation or agricultural conservation area, special wildlife habitat, adjacency or close proximity to wetlands or waterbodies, extremely erodible soils or steep slopes) pertain. Permitting agencies should consider whether facilities on any farmland exceeding 49 acres within an area of one square mile will have an adverse effect on farming in the area.[15]
- Avoid removing/displacing forestland of 20 contiguous acres or more.
- Avoid placement in, or disruption of wetlands. In Maryland's Chesapeake Bay Critical Areas and Virginia's Chesapeake Bay Preservation Areas, solar facilities should avoid Resource Protection Areas and instead favor developed areas.
- Avoid development in sub-watersheds with high quality or Tier II streams (in Pennsylvania, "Special Protection Waters"); in watersheds with assigned "total maximum daily loads" where there is little or no capacity to accept new stormwater-based pollutant loads; or immediately adjacent to tidal or non-tidal waters without adequate vegetative buffers.
- Avoid harm to federal or state endangered or threatened species and their habitat.

4. **State PUC's/PSC's or local governments should utilize a transparent, open process for decision-making with respect to solar facilities, which invites citizen participation and adequately considers the public's views.**
    - Just as for certain state environmental permits, individuals or organizations should be able to sign up for automatic direct electronic notification of new/pending solar farm applications.
    - Require the submission of an environmental impacts report as part of an application process for solar farms at any level of government responsible for decision-making on such application. An examination of reasonable alternative locations for the solar facility should be a required component of the environmental report.
5. **At the local level (where appropriate under state law), list solar facilities as, and use the review and approval process for, conditional or special exception uses.**

[15] Standards are based on, but not the same as, those stated in Oregon law intended to protect agricultural land uses. https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=3083

6. **Incentivize solar installation being placed in appropriate locations (see #1, above) and with appropriate designs, by using state credits, incentives, and preferences for such locations (noted above), or through state/local regulatory relief and enhanced application processing speeds for preferred locations. Provide no state incentives to locate such facilities on forestland exceeding 20 acres. (Note: Where authorized under state law, local codes could also *require* the use of rooftop solar or other renewable power for certain large new multi-family residential, commercial or industrial facilities.)**

7. **Incorporate all relevant state and local environmental requirements into the state or local permitting/certification process, and create special new requirements, as below.**

    - The implementation and enforcement of strong sediment and erosion control practices during construction, and strong post-construction stormwater management practices is essential.
    - Extensive grading and cut/fill operations to prepare solar fields should be avoided to the maximum extent possible, and otherwise minimized.
    - Green infrastructure stormwater management practices are preferred wherever they can be used, with special attention to effective vegetated stream buffers and bio-infiltration, preservation of topsoil, and maintenance of pervious cover for accessways.
    - The use of herbicides to control vegetation beneath or beside solar panels should be heavily disfavored, but where herbicides are allowed, strict adherence to usage and application directions and any federal or state standards must be undertaken, with special attention to proximity to waterbodies.
    - Adequate protection must be assured for on-site or off-site proximate natural resources of special significance.
    - A complete plan for decommissioning of the site should be required, engineer-stamped and reviewed as part of the local approval or state certificate process, with the major objective being a return of the site, soils, and vegetation to pre-construction conditions at the end of the useful life of the facility. The decommissioning plan should be secured with a bond.

Annapolis, Maryland
April 2020