

# Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection with the Protection of Land and Communities

Jennifer Barrie, MS  
Research Director



David Lewis, MA  
Research Director



Madison Moffitt, PSM  
Research Associate



Matthew Owen, PhD  
Director of Policy



Presley Powers, MA, MPA  
Senior Research Associate



Jack Duncan  
Intern



Teresa Gibson  
Web Development & Publications Manager

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## Summary and Recommendations: The Tools to Balance Private Property Rights and Community Interests for Utility-Scale Solar Already Exist. Increased Consumer Protection for Residential Solar May Be Beneficial.

When a private developer began leasing land in Fayette County to construct a 2,600-acre solar facility, the development represented a potential revenue stream both for the landowners as lessors and for the county through property taxes. But some community members opposed the project because of concerns about the loss of agricultural land and the rural nature of the county, leading to a lawsuit that delayed construction for several years. According to the publication *Farm Progress*,

As applications for new solar farms in the county continue to roll in, solar energy has divided local residents and even fellow farmers—sparking debates over property rights, effectiveness of green energy, and preservation of natural space. Then there is the growing concern among producers and policy makers that solar farms are eating away at traditional farmland at an unsustainable pace.

Property rights, land use—including the loss of prime farmland and undeveloped land—aesthetics, environmental effects, and the desire to protect landowners are driving disputes and raising questions among stakeholders about utility-scale solar development across Tennessee and the country as utilities look to add more large solar facilities to their energy portfolios. Even the expansion of residential solar has led to concerns—though for different reasons—as the Office of the Tennessee Attorney General has taken legal action against two solar installation companies for defrauding customers. In light of these concerns, the General Assembly passed Public Chapter 1043, Acts of 2022 (appendix A), directing the Commission to examine 14 points:

1. Short-term and long-term projections on the amount of acreage needed to accommodate utility-scale solar development
2. Hazardous waste, as defined in Tennessee Code Annotated, Section 68-212-104, that may exist in photovoltaic modules, energy storage system batteries, or other equipment used in utility-scale solar energy development
3. Federal regulatory requirements regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development

Property rights, land use, aesthetics, environmental effects, and protection of property owners are driving disputes and raising questions about utility-scale solar development in Tennessee. The expansion of residential solar has led to concerns about some installation companies possibly defrauding customers.

Many of the issues and concerns about solar development are not unique to that industry but are applicable to development in general.

4. Statutory and regulatory requirements in other states regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development
5. Financial assurances and responsibilities of owners and operators in the event of natural disasters, pollution from solar energy system failures, decommissioning of a solar energy system, and end-of-life management of photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar development
6. Which federal and state regulatory agencies are responsible for certification and oversight to determine the proper installation and operation of utility-scale solar energy systems
7. The needed state infrastructure to facilitate the collection, transport, and disposal of utility-scale solar energy systems
8. Implications of utility-scale solar energy systems on the local property tax base
9. Local zoning and regulatory templates to ensure consistency throughout the state regarding local siting of utility-scale solar energy development
10. The importance of private property rights and the ability of a landowner to use or transfer interests in property
11. The importance of a variety of energy sources in this state's economic and community development recruiting efforts
12. The efforts of the Tennessee Valley Authority and local power companies to offer utility-scale sustainable power options
13. Required lease terms and conditions to protect future property use and rights of lessors in the event of default or termination of a lease
14. For the purpose of determining any necessary consumer protections, the installation of solar energy generation and storage on the property of residential electric customers

Through its investigation of the 14 points, the Commission has found that many of the issues and concerns raised about solar development are not unique to that industry but are more broadly applicable to development in general. For example, as with other types of development, the construction of utility-scale solar facilities involves the disturbance of land and installation of new infrastructure. But just as with other development, utility-scale solar is subject to local land-use requirements in communities with zoning and is subject to federal, state, and local environmental requirements. In some states, there have been contractors on utility-scale solar projects who failed to properly follow stormwater rules, leading to stormwater issues. But staff of the Tennessee Department of Environment and Conservation

(TDEC) Division of Water Resources say that solar projects generally minimize soil disturbance and have better environmental outcomes compared to other types of large construction sites. Between January 2009 and June 2023, the Division received a total of seven complaints about four solar sites out of the 42 known sites in construction or operation. Unlike other developments, the likelihood exists that land can be returned to agricultural production after a solar facility reaches the end of its useful life. Tennessee has enacted a solar energy decommissioning law intended to help ensure that land can be returned to its prior condition, as some other states have done. Additionally, the Commission has found that while they are operating, solar facilities generate revenue for landowners and tax revenue for local governments.

Currently, solar power is a relatively small part of the Tennessee Valley Authority's (TVA) energy generation mix—TVA is the public utility that serves almost all local power companies in Tennessee. But TVA and some local power companies it serves have programs to support solar development, and the Tennessee Department of Economic and Community Development (ECD) and TVA staff say that solar power is an important part of economic development. For specific answers to each of the 14 points, see appendix B, and for a general discussion, see the analysis section of this report.

***Local governments have the authority to address issues related to land use and utility-scale solar through zoning.***

Tennessee law authorizes local governments to regulate development in their jurisdictions through zoning to promote the health, safety, morals, convenience, order, prosperity, and public welfare. Zoning gives communities a say in how and where different types of development can happen by allowing local governments to set standards including but not limited to the use, location, size, and height of buildings and structures; amount of open space; and the percentage of a lot that can be occupied. For example, to preserve aesthetics in a community, zoning can require a buffer of trees around a development or that structures be set back a minimum distance from roads or property lines. As a result, zoning is among the primary tools local governments have to balance property rights with community interests regarding land use. Forty of the state's 95 counties and 271 of its 345 cities have adopted zoning.

Local governments can use zoning authority to regulate utility-scale solar development. At least nine counties and one city in Tennessee that adopted zoning already do, and one county and a city within it have created a unified development code that includes solar regulations. Some common elements regulated by Tennessee local governments' solar zoning ordinances include required setbacks, perimeter buffers, and fencing.

The adoption of zoning ordinances, including for solar development, is one of the primary tools local governments have to balance property rights with community interests, including land use.

Solar facilities are unlikely to be the primary driver of agricultural and undeveloped land loss in Tennessee in the coming decades.

Local government representatives say that model ordinances and examples of existing ordinances from other local governments and states would help them make decisions about solar development in their jurisdictions. A model ordinance for utility-scale solar development is available to Tennessee local governments—it was created by the University of Tennessee Municipal Technical Advisory Service (MTAS) and County Technical Assistance Service (CTAS) in coordination with the Tennessee Chapter of the Solar Energy Industries Association (TenneSEIA)—the organization that represents solar companies in the state—and includes required fencing, setbacks, landscape buffering, and submission of the decommissioning plan to the local planning commission. See appendix C for a copy of the model ordinance.

***Loss of farmland and undeveloped land is a concern that can be addressed using several existing tools.***

Some stakeholders are concerned solar development could lead to the loss of agricultural land, including prime farmland where soils are best suited for growing crops, and undeveloped land, both of which can also serve as habitat for wildlife. Tennessee has land that is well-suited for utility-scale solar, especially in the western part of the state where there are many acres of flat agricultural land that are near a connection to the electric grid, such as a substation. But solar facilities are unlikely to be the primary driver of agricultural and undeveloped land loss in the coming decades. Currently, TVA plans to add 10,000 megawatts (MW) of solar power generation by 2035 throughout its service area—which includes parts of seven states, not just Tennessee. Even if all these facilities were developed on Tennessee farmland, they would account for approximately 100,000 acres taken out of production, 1% of farmland in the state. In comparison, the amount of farmland in Tennessee decreased by 1.1 million acres (9.3%) from 1997 through 2017. Moreover, it is possible to develop utility-scale solar facilities without taking farmland out of production. Often referred to as agrivoltaics or dual-use solar, this approach involves grazing animals or growing crops between or under the panels and can involve raising panels higher off the ground—examples of animals and crops include sheep and shade-tolerant plants such as tomatoes or blueberries. This is sometimes done in other states; in Tennessee, there are currently at least nine agrivoltaics projects on approximately 1,900 acres of land.

Although utility-scale solar is unlikely to be the primary cause of agricultural and undeveloped land loss in Tennessee, existing tools are available to protect farmland and undeveloped land from development. These tools are not necessarily solar-specific, but all can be applied to solar development. They include putting land in trusts, zoning, and the state’s new Brownfield Redevelopment Area Fund. Additionally, the state’s decommissioning law sets requirements for returning agricultural



or other land to a condition suitable for its former use once a solar project has reached the end of its effective life.

Putting land in a trust is a way to preserve and protect it from any type of development. An example of a trust is the Land Trust for Tennessee, a private nonprofit organization that works with landowners to protect their land by creating conservation easements that permanently limit how the land can be developed and subdivided. The Land Trust holds the easement—which is recorded with the register of deeds in the county where the property is located—and is responsible for ensuring that the agreement is upheld in perpetuity. Another resource is the state’s Heritage Conservation Trust Fund, which was established to permanently conserve land for promoting tourism and outdoor recreation, conserving natural and cultural resources, and preserving “working landscapes.” Tennessee has appropriated \$30 million for fiscal year 2023-24 “to revitalize the Heritage Conservation Trust to support public-private partnerships through a matching grant program,” and money from the fund could be used to protect land from any type of development, including solar development.

As previously discussed, local governments can adopt zoning and use it to limit the location and other aspects of utility-scale solar. They can also use zoning to encourage certain types of development in certain areas, for example encouraging solar on land that is not prime farmland or undeveloped land. Because of concerns about aesthetics and the best use of land, one local government—Bedford County—looked at vistas, excessive slope, and areas where infrastructure investments had already been made for other uses and established a “renewable energy development zone.” This zone is intended to encourage developers to locate solar facilities only in specific areas of the county by streamlining the approval process for projects inside the zone and setting stricter standards, such as larger setbacks, outside the zone. See appendix D.

The General Assembly passed Public Chapter 86, Acts of 2023, authorizing TDEC to create a new revenue source to help local governments—the Brownfield Redevelopment Area Fund. According to TDEC Division of Remediation staff, the intent of the program is to provide funding to local governments to encourage the identification, investigation, and remediation of potential brownfield sites to redevelop. Solar facilities are one potential option for redevelopment, and Division of Remediation staff say they could likely be more cost-effective compared to redeveloping for commercial and residential uses because they would generally require less remediation. The new program will rely on local government participation, and Division of Remediation staff acknowledge the need to publicize it in collaboration with other agencies, such as ECD, MTAS, and CTAS.

For land used for utility-scale solar, the state’s solar facility decommissioning law, Public Chapter 866, Acts of 2022, seeks to ensure

Existing tools available to protect farmland and undeveloped land from all development include placing land in a trust, zoning, and the state’s Brownfield Redevelopment Area Fund.

Tennessee’s solar facility decommissioning law, Public Chapter 866, Acts of 2022, sets requirements for returning agricultural or other land to a condition suitable for its former use once a solar project has reached the end of its effective life.

that the land can be returned to its prior condition (see appendix E). The law requires the agreements between the solar developers and the landowners leasing them the land for the facilities—solar power facility agreements—to include a decommissioning plan with financial assurance to secure that the solar developer removes components and restores the land to as close to the condition it was in before construction as reasonably as possible. Financial assurance must be provided to the landowner and cover the decommissioning cost, which is defined as “the estimated cost of performing the removal and restoration obligations . . . less the estimated salvage value of the components of the solar power facility as of the date of removal.” Currently, 23 states, including Tennessee, have solar facility decommissioning laws. These laws share similarities, but unlike Tennessee’s law, some specify how the decommissioning cost is calculated, and most provide government oversight authority, including allowing penalties for noncompliance.

***Information about utility-scale solar exists that can be shared and made more easily available to stakeholders.***

There is abundant information about solar development from multiple sources including nonprofit organizations and federal and state government agencies. Stakeholders agree that more resources and guidance, including model ordinances like the one developed by CTAS, MTAS, and TenneSEIA, would help local governments and landowners make decisions based on their needs, issues, and resources regarding the development of large-scale solar facilities. Solar developers could also benefit from guidance on best practices. Stakeholders and researchers agree on a few basic practices that are described in table 1 found at the end of this summary and recommendations section.

But there is currently no one-stop shop for information on utility-scale solar development that is specific to Tennessee. Resources exist in separate locations, and stakeholders might not know the resources exist or how to access them. For example, the Tennessee model ordinance described previously, TDEC permitting requirements, and best practices are available online but not in one central place. Other states, in particular Kentucky, maintain websites that aggregate information and resources regarding utility-scale solar development for local governments and the public. The TDEC Office of Energy Programs (OEP) has a website with information about renewable energy, and OEP staff agree that working with other agencies to expand the website to be more comprehensive would be beneficial. **The Commission recommends that the TDEC Office of Energy Programs continue to expand and maintain its existing website with additional guidance and resources on utility-scale solar for local governments, landowners, developers, and the public, like Kentucky. Representatives of that office say they are willing to do so.**

### ***Consumers would benefit from easier access to resources about residential solar.***

Like utility-scale solar, there is abundant information about best practices to help consumers with residential solar; however, stakeholders agree that more guidance would help consumers make better decisions and protect themselves from fraud. Resources about residential solar are available in different places (see table 1 for examples of best practices for homeowners). TVA’s Green Connect website helps consumers find quality solar installers, and some local electric companies and the TDEC Office of Energy Programs have information for consumers on their websites. Other states, in particular Georgia, maintain a central website with information regarding residential solar installations for the public. **The Commission recommends that the TDEC Office of Energy Programs continue to expand and maintain its webpage that provides guidance and resources on residential solar for the public. Representatives of that office say they are willing to do so.**

### ***Most of the fraud in the solar industry occurs in the residential market, and Tennessee has consumer protection laws to help protect homeowners.***

Stakeholders generally agree that most of the fraud committed in the solar industry is happening in the residential solar market not the utility-scale market. The Division of Consumer Affairs in the Tennessee Office of the Attorney General and Reporter received complaints associated with nine residential solar companies between 2020 and 2023. Of the 498 complaints, 477 were directed at two companies. Residential solar installations by these two companies were often expensive—sometimes approaching \$100,000—and often included long-term interest payments to a finance company. According to *Forbes*, the average cost of residential solar panels in Tennessee is \$10,293, and the national average is \$16,000. For some homeowners, adding a non-functioning solar system led to a decreased home value.

Consumers who contract with a company to install solar on their residence are protected by Tennessee’s consumer protection laws—the Consumer Protection Act and Home Solicitations Sales Act. The maximum civil fine for violations of the Tennessee Consumer Protection Act is \$1,000, which is on the low end of civil fine maximums compared to other states. A review of other states’ laws finds their maximum penalties generally range from \$1,000 to \$50,000 per violation. **Recognizing that care would need to be taken to avoid undermining the intent of the General Assembly’s past efforts at tort reform, the Commission recommends that the state consider raising the penalty for violations of the Consumer Protection Act if the good or service involved has a value greater than a monetary threshold set by the state.**

There is abundant information about both utility-scale and residential solar development to help local and state governments, landowners, developers, and homeowners make decisions, but there is no one-stop shop for the information that is specific to Tennessee.

Most complaints about the solar industry in Tennessee are in the residential solar market and are primarily directed at two companies.

Table 1. Examples of Best Practices for Utility-Scale and Residential Solar Development

Entity	Best Practices	Resource Examples	Sources
<b>Utility-Scale Solar</b>			
<b>State Government</b>	Implement solar decommissioning law	Solar Energy Industries Association (SEIA) "Model Solar Energy Facility Decommissioning Legislation" (see appendix M)	Curtis et al. 2021b
	Develop model ordinances to guide local governments	Georgia Model Solar Ordinance (see appendix I)	Gomez and Morley 2022
	Educate about common issues with regulations for permitting solar development	North Carolina Department of Environmental Quality "Stormwater Design Manual"	Virginia Department of Wildlife Resources 2022; and interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023
	Create a resource document or webpage for solar development in the state, including but not limited to applicable environmental permits and zoning guidelines	Kentucky Solar Toolkit	Kentucky Energy and Environment Cabinet "Kentucky Solar Toolkit"; and Fekete et al. 2023
	Incentivize the use of disturbed or degraded lands with little vegetation or poor soil quality, such as brownfields and former mining sites	The Nature Conservancy "Power of Place National: Executive Summary"	Email received from Lindsay Hanna, director of government relations & climate policy, Tennessee Chapter, The Nature Conservancy, July 18, 2023
<b>Local Governments</b>	Use authority to adopt zoning	Tennessee Model Solar Zoning Ordinance (see appendix C)	Coffey 2019; Skehan 2020; and Tennessee Code Annotated, Sections 13-7-101 and 13-7-201
	Establish solar zoning ordinances with guidelines for permitting, siting, setbacks, panel height, buffering, and decommissioning plans	Haywood County Zoning Resolution (see appendix D)	Gomez and Morley 2022
	Identify and redevelop brownfields, parking lots, and non-prime farmland with solar	US Environmental Protection Agency (EPA) and National Renewable Energy Laboratory (NREL) "Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills"	Tennessee Code Annotated, Section 68-212-220; Tennessee Department of Environment and Conservation "Brownfield Voluntary Cleanup Oversight and Assistance Program"; and US Environmental Protection Agency 2023m

Entity	Best Practices	Resource Examples	Sources
<p><b>Developers</b></p>	<p>Use established templates and guidelines for power purchase agreements and solar leases</p>	<p>US EPA "Understanding Third-Party Ownership Financing Structures for Renewable Energy"</p>	<p>US Environmental Protection Agency 2023i; Solar Energy Industries Association "Model Leases and PPAs"; and Solar Energy Industries Association 2016</p>
	<p>Thoroughly evaluate site selection, facility design, and permit and licensing requirements</p>	<p>US EPA "On-Site Project Development Process"</p>	<p>Doyle et al. 2015</p>
	<p>Communicate and coordinate early in the planning and design process with community stakeholders such as state environmental offices, like Tennessee Department of Environment and Conservation (TDEC), and local governments</p>	<p>TDEC Division of Water Resources</p>	<p>Lumby et al. 2015; University of Massachusetts Clean Energy Extension 2022; and interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023</p>
	<p>Seek to avoid effects on wildlife and habitat by consulting with the Tennessee Wildlife Resources Agency (TWRA) to identify sensitive habitats and species of Greatest Conservation Need</p>	<p>TWRA "Tennessee State Wildlife Action Plan"</p>	<p>Email received from Lindsay Hanna, director of government relations &amp; climate policy, Tennessee Chapter, The Nature Conservancy, July 18, 2023</p>
	<p>Use land for solar and agriculture or pollinator habitats (dual use, agrivoltaics, or agrisolar)</p>	<p>NREL "Agrivoltaics Primer"</p>	<p>Macknick et al. 2022; The Nature Conservancy 2023; and University of Maine "Cooperative Extension: Maine Wild Blueberries"</p>
	<p>Allow for wildlife connectivity with wildlife-friendly fencing methods and retain or plant vegetation or trees in buffers for streams, wetlands, and perimeters</p> <p>Follow ethical guidelines</p>	<p>The Nature Conservancy "Power of Place National: Executive Summary"</p> <p>SEIA "Solar Business Code"</p>	<p>Katies 2023</p> <p>TenneSEIA "Code of Ethics"</p>

Entity	Best Practices	Resource Examples	Sources
<b>Landowners</b>	Consult with an attorney, if possible, one with expertise in solar facility leases	National Agricultural Law Center "Understanding Solar Energy Agreements"	Branan 2022; and Hannum et al. 2022
	Understand the long-term implications of leasing or selling land	Cornell College of Agriculture and Life Sciences "Considerations when Leasing Agricultural Lands to Solar Developers"	American Farmland Trust "Smart Solar <sup>SM</sup> on Farmland and Ranchland: Strengthening Farm Viability and Soil Health While Growing Renewable Energy"; and US Environmental Protection Agency 2023n
	Understand property tax implications and any rollback taxes associated with changes in property use designation	Tennessee Comptroller of the Treasury "Greenbelt Manual"	Nuckols 2020; and interview with Greg Moody, director, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, February 28, 2023
	Talk with neighbors and other landowners who are considering leasing or who are leasing their land for solar development	American Farmland Trust "Solar Leasing: A Guide for Agricultural Landowners in the Pacific Northwest"	Hannum et al. 2022
	Put land in a conservation easement or trust to preserve it	Tennessee Department of Agriculture "Land Protection Options"	Conservation Easement Act of 1981, Tennessee Code Annotated, Section 66-9-303
	Understand the limitations of easements and conservation programs for solar development	WeConservePA "Solar Energy Development and Land Conservation"	Conservation Easement Act of 1981, Tennessee Code Annotated, Section 66-9-303; Tennessee Department of Agriculture "Land Protection Options"; and Land Trust for Tennessee "Protect Your Land"

Entity	Best Practices	Resource Examples	Sources
State Government	Create a resource webpage with information for consumers	Georgia "Solar Power for Your Home"	Interview with David Callis, executive vice president and general manager, and Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, September 9, 2022
	Speak with local electric company regarding cost-effectiveness and return on investment	Middle Tennessee Electric "ProSolar"	Interview with Brian Solsbee, executive director, Jeremy Elrod, director of government relations, and Savannah Gilman, government relations assistant, Tennessee Municipal Electric Power Association, August 30, 2022
	Evaluate residential solar companies for legitimacy and cost	TVA "Green Connect"	Interstate Renewable Energy Council (IREC) 2016
Homeowners	Call the TDEC Office of Energy programs to answer questions regarding residential solar development and any active incentive programs	TDEC "Office of Energy Programs"	Interview with Molly Cripps, director, Ben Bolton, senior energy programs administrator, and Taylor Tavormina, executive administrative assistant, Office of Energy Programs, Tennessee Department of Environment and Conservation, December 19, 2022
	Consider using providers certified by the North American Board of Certified Energy Practitioners and companies that are members of TenneSEIA, as they are bound by a code of ethics	TenneSEIA "Membership"	Solar Energy Industries Association 2015; and North American Board of Certified Energy Practitioners "NABCEP Board Certifications"

Note: These examples of best practices are discussed in multiple resources from other states, government agencies, and organizations and TACIR staff interviews with stakeholders.

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## Analysis: Like Other Types of Development, Solar Development Needs to Be Managed, and Tennessee Already Has Laws, Policies, and Regulations in Place to Do So.

The development of solar power generation in Tennessee—both utility-scale and residential—has been slow compared to many other states, but it is likely the pace of utility-scale solar development in the state will increase in coming years.<sup>1</sup> Utility-scale solar developments are built to produce substantial amounts of electricity (millions of watts, referred to as megawatts or MW) to sell to the power grid or to provide electricity directly to a large facility, such as a manufacturing plant.<sup>2</sup> While there is no universal definition of utility-scale solar based on the amount of power (in MW), it generally ranges from at least one MW to at least 20 MW.<sup>3</sup> Residential solar systems, on the other hand, are smaller and are usually installed either on a roof or mounted on the ground, with the smaller amount of electricity (thousands of watts, referred to as kilowatts or KW) generated by the system sold back to the local power company or used solely to provide electricity to the residence. Both utility-scale and residential solar generate electricity using the same basic technology—photovoltaic (PV) cells (see figure 1). The Commission’s report focuses solely on photovoltaic solar.

### Figure 1. Photovoltaic Solar Technology

Photovoltaic (PV) cells date to the 1950s in the US. The PV cells have special material—which varies depending on the panel type and manufacturer—inside them that absorbs the energy from light and transfers it to electrons that flow through the material, generating electricity. That electricity can then be used to power buildings, equipment, and the electric grid. The first utility-scale facility was developed in California in the early 1980s, and residential solar dates from the 1970s, though development and mainstream adoption have varied by region of the country.

Note: Tennessee law defines a solar energy system more broadly as “any device, mechanism, structure, apparatus, or part thereof, whose primary purpose is to collect solar energy and convert and store it for useful purposes including heating and cooling buildings or other energy saving processes, or to produce generated power by means of any combination of collecting, transferring, or converting solar generated energy.” Tennessee Code Annotated, Section 66-9-203.

Source: Solar Energy Technologies Office “Solar Photovoltaic Cell Basics”; and US Department of Energy “The History of Solar.”

<sup>1</sup> Tennessee Valley Authority 2022.

<sup>2</sup> Solar Energy Industries Association “Utility-Scale Solar.”

<sup>3</sup> According to the Solar Energy Industries Association (SEIA)—the national trade association for the US solar industry—utility-scale solar facilities generate at least one megawatt (MW) of power, while TVA and the National Renewable Energy Laboratory (NREL)—a US Department of Energy research agency focusing on the science and engineering of energy—the amount is at least five MW. Some stakeholders consider 20 MW to be the most common threshold. Solar Energy Industries Association “Utility-Scale Solar”; Ramasamy et al. 2021; interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022; and email received from Jeremy Elrod, director of government relations, Tennessee Municipal Electric Power Association, April 27, 2023.

The Yum Yum Solar Project in Fayette County, Tennessee, provides an example of how the prospect of new utility-scale solar facilities brings with it the potential for competing priorities.

Stakeholders have expressed concerns about both types of solar power generation. For utility-scale solar, stakeholders—including landowners, local community decision-makers, and state leaders—have questions and concerns that generally relate to land use, property values and local tax base, and protection of landowners. The prospect of new utility-scale solar facilities brings with it the potential for competing priorities. For example, a decade ago, when a private developer began leasing land in Fayette County to construct a 150-megawatt, 2,600-acre solar facility—the Yum Yum Solar Project—the development represented a potential revenue stream both for the landowners as lessors and for the county through property taxes.<sup>4</sup> Some residents opposed the project because of concerns about the loss of agricultural land and the rural nature of the county, leading to a lawsuit that delayed construction for several years.<sup>5</sup> According to the publication *Farm Progress*,

As applications for new solar farms in the county continue to roll in, solar energy has divided local residents and even fellow farmers—sparking debates over property rights, effectiveness of green energy, and preservation of natural space. Then there is the growing concern among producers and policy makers that solar farms are eating away at traditional farmland at an unsustainable pace.<sup>6</sup>

For residential solar, stakeholders—including consumers, local power company officials, solar industry representatives, and representatives of state agencies seeking to protect residential solar customers—have concerns focused on residential solar installation companies misleading customers and committing fraud. Some stakeholders are also concerned about the safety of residential installations.

To answer questions and provide information about solar development—both utility-scale and residential—the General Assembly passed Public Chapter 1043, Acts of 2022 (see appendix A), directing the Commission to study 14 points related to solar development—13 of which relate to utility-scale solar, and one addresses consumer protection in the market for residential solar:

1. Short-term and long-term projections on the amount of acreage needed to accommodate utility-scale solar development
2. Hazardous waste, as defined in Tennessee Code Annotated, Section 68-212-104, that may exist in photovoltaic modules, energy storage

<sup>4</sup> Rowsey 2022; and Tennessee Valley Authority 2019b. A watt is the basic unit of electrical power equal to one ampere under the pressure of one volt. A megawatt is one million watts. US Energy Information Administration 2022.

<sup>5</sup> Tapp v. Fayette Cnty. Tenn., No. W2021-00856-COA-R3-CV (Tenn. Ct. App. Jul. 11, 2022); and Joseph Tapp et al. v. Fayette County Tennessee et al., No. W2021-00856-SC-R11-CV, 2022 Tenn. LEXIS 450 (Supreme Court of Tennessee Nov. 17, 2022).

<sup>6</sup> Rowsey 2022.

system batteries, or other equipment used in utility-scale solar energy development

3. Federal regulatory requirements regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development
4. Statutory and regulatory requirements in other states regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development
5. Financial assurances and responsibilities of owners and operators in the event of natural disasters, pollution from solar energy system failures, decommissioning of a solar energy system, and end-of-life management of photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar development
6. Which federal and state regulatory agencies are responsible for certification and oversight to determine the proper installation and operation of utility-scale solar energy systems
7. The needed state infrastructure to facilitate the collection, transport, and disposal of utility-scale solar energy systems
8. Implications of utility-scale solar energy systems on the local property tax base
9. Local zoning and regulatory templates to ensure consistency throughout the state regarding local siting of utility-scale solar energy development
10. The importance of private property rights and the ability of a landowner to use or transfer interests in property
11. The importance of a variety of energy sources in this state's economic and community development recruiting efforts
12. The efforts of the Tennessee Valley Authority and local power companies to offer utility-scale sustainable power options
13. Required lease terms and conditions to protect future property use and rights of lessors in the event of default or termination of a lease
14. For the purpose of determining any necessary consumer protections, the installation of solar energy generation and storage on the property of residential electric customers

For specific answers to each of the 14 points, see appendix B.

While Tennessee has land well-suited for utility-scale solar, many variables affect the size of a facility and its economic viability.

### ***Tennessee has land that is suitable for utility-scale solar facilities.***

Tennessee has land well-suited for utility-scale solar facilities, especially in the western part of the state.<sup>7</sup> Large areas of open, flat land are ideal, and a nearby connection to the electric grid is critical. For utility-scale facilities, solar panels are typically attached to racks held up by metal posts in the ground and require between 5 and 10 acres of land—roughly the size of four to eight football fields—per MW of generating capacity. As a result, agricultural land is often well-suited for large solar facilities, but they could also be built on other types of land, such as industrial areas, parking lots, and abandoned land.<sup>8</sup> Many variables, such as the interconnection cost, required studies, zoning, and whether the panels are roof or ground mounted or fixed or tracking affect the size of a facility and its economic viability.<sup>9</sup>

There are already a number of utility-scale facilities in Tennessee, and that number is likely to increase in the future. Table 2 shows utility-scale solar facilities identified in Tennessee that are in construction or operation as of August 2023. The Tennessee Valley Authority (TVA), the federal utility responsible for providing electricity to almost every community in the state, plans to add 10,000 MW of new solar capacity in its seven-state service area by 2035.<sup>10</sup> And staff with the Tennessee Department of Economic and Community Development say that solar and renewable energy is at the forefront of conversations with many companies that consider relocating or expanding operations in Tennessee.<sup>11</sup>

<sup>7</sup> Email received from Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, March 22, 2023.

<sup>8</sup> A standard football field is 1.32 acres. Solar Energy Industries Association 2022; Silicon Ranch “Solar Farms: What Communities Need to Know”; and interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022.

<sup>9</sup> Email received from Gil Hough, executive director, TenneSEIA, July 19, 2023.

<sup>10</sup> Tennessee Valley Authority 2022. According to TVA staff, TVA typically enters into agreements with private solar developers and plans to continue this approach, rather than acquiring land either by purchasing it or using eminent domain to develop and operate its own solar facilities. Interviews with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022; and Stuart Pickrell, senior consultant, Business Development & Renewables, Commercial Energy Solutions, Tennessee Valley Authority, July 31, 2023.

<sup>11</sup> Solar Energy Industries Association 2023; Tennessee Valley Authority 2022; email received from Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, March 22, 2023; and interview with Chassen Haynes, senior director of business development, Tennessee Department of Economic and Community Development, January 24, 2023.

**Table 2. Utility-Scale Solar Facilities in Construction or Operation in Tennessee as of August 2023**

Utility or Company Name	Facility Name	Megawatts (MW)*	County	Estimated Acreage <sup>#</sup>	Status
Silicon Ranch	Bell Buckle Vanderbilt I	35.0	Bedford	350	operating
Nashville Electric Service	Music City Community Solar	1.6	Davidson	16	operating
Somerville Solar, LLC	Somerville Solar	2.3	Fayette	closed landfill	operating
Adapture Renewables, Inc.	Wildberry	15.0	Fayette	150	operating
Silicon Ranch	Canadaville	16.0	Fayette	160	construction
Invenergy	Yum Yum Solar Energy Center	147.0	Fayette	1,470	construction
Silicon Ranch	Pulaski 1, 2, 3, 4, 5, and 6	2.0	Giles	20	operating
Silicon Ranch	Greeneville I	4.8	Greene	48	operating
Silicon Ranch	Greeneville II	4.8	Greene	48	operating
Electric Power Board	Oak and Greenwood Helioscope	1.1	Hamilton	11	operating
Chattanooga Metropolitan Airport	Chattanooga Metropolitan Airport Solar (power used on-site)	2.7	Hamilton	27	operating
Silicon Ranch	Volkswagen Chattanooga Solar Farm (power used on-site)	7.6	Hamilton	76	operating
Silicon Ranch	Bolivar	3.3	Hardeman	33	operating
CD Arevon USA, Inc.	Latitude Solar Center	15.0	Hardeman	150	operating
Silicon Ranch	Brownsville	3.0	Haywood	30	construction
Silicon Ranch	Haywood Brownsville	3.4	Haywood	34	operating
UT West Tennessee Solar Farm	West Tennessee Solar Farm	4.2	Haywood	42	operating
Silicon Ranch	Paris Solar Farm - Clearloop	6.8	Henry	68	operating
Appalachian Electric Cooperative	Appalachian Community Solar	1.2	Jefferson	12	operating
Silicon Ranch	White Pine - Clearloop	2.0	Jefferson	20	construction
Silicon Ranch	Ripley 1, 2, 3, and 4	3.3	Lauderdale	33	operating
NextEra	Elora Solar Energy Center	150.0	Lincoln	1,500	operating
Silicon Ranch	Jackson	1.5	Madison	15	operating
Silicon Ranch	Jackson II	1.0	Madison	10	operating
Silicon Ranch	Providence	16.1	Madison	161	operating
Silicon Ranch	McKellar	70.0	Madison	700	operating
Silicon Ranch	Selmer North II	8.5	McNairy	85	operating
Onward Energy	Mulberry Farm LLC	15.8	McNairy	158	operating
Onward Energy	Selmer Farm LLC	15.8	McNairy	158	operating
Silicon Ranch	Selmer North I	16.1	McNairy	161	operating
Silicon Ranch	Clarksville	2.0	Montgomery	20	construction
Silicon Ranch	Clarksville II	4.8	Montgomery	48	construction

Utility or Company Name	Facility Name	Megawatts (MW)*	County	Estimated Acreage <sup>#</sup>	Status
Origis Energy	Skyhawk Solar Facility	100.0	Obion	1,000	operating
Silicon Ranch	Marion and Marion II	2.0	Sequatchie	20	construction
Silicon Ranch	Sequachee Valley EC II	8.0	Sequatchie	80	construction
Silicon Ranch	Memphis Agricenter Solar Farm	1.0	Shelby	10	operating
Silicon Ranch	Innovation - Nike	1.4	Shelby	14	operating
Silicon Ranch	Millington I	55.2	Shelby	552	operating
Silicon Ranch	Millington II	74.9	Shelby	749	construction
Silicon Ranch	BrightRidge Solar Learning Lab	unknown	Washington	unknown	construction
Silicon Ranch	Jonesborough - Telford Solar Farm	5.0	Washington	50	operating
Silicon Ranch	Washington 1 - Martin Solar Farm	11.0	Washington	110	operating
<b>Total</b>	<b>42</b>	<b>842.1</b>	<b>19</b>	<b>8,421</b>	

Note: This list includes known solar facilities that generate at least one MW.

\* Nameplate MW capacity listed by the solar developer, TVA, or US Energy Information Administration.

<sup>#</sup>TACIR staff estimated 10 acres per MW, which is typically the high end of the range for acres needed.

Source: BrightRidge 2023; DeLong et al. 2023; Flessner 2017; Hexagon Energy 2019; Origis Energy “TN Solar 1 - Skyhawk Solar”; Silicon Ranch “Projects”; US Energy Information Administration 2023; Vanderbilt University 2023; email received from Madison Haynes, co-chair, State and Local Policy Committee, Tennessee Solar Energy Industries Association, August 1, 2023; and email received from Stuart Pickrell, senior consultant, Business Development & Renewables, Commercial Energy Solutions, Tennessee Valley Authority, July 31, 2023.

### ***Utility-scale solar offers potential benefits to property owners and local governments.***

Utility-scale solar facilities come with several potential benefits for property owners and local governments. For property owners, there are both financial benefits and potential intrinsic benefits from solar, and for local governments, there are fiscal benefits. However, solar leases are complicated and have long-term implications.

Property owners benefit financially from utility-scale solar projects. By leasing some or all their land to a solar developer, property owners can generate more income per acre than by leasing it for farming or farming it themselves—it varies widely, but landowners could receive up to 10 times more per acre.<sup>12</sup> Additionally, some Tennessee landowners sell their land for utility-scale solar development.<sup>13</sup>

<sup>12</sup> American Farmland Trust “Smart Solar<sup>SM</sup> on Farmland and Ranchland; Strengthening Farm Viability and Soil Health While Growing Renewable Energy.”

<sup>13</sup> Interview with Matt Beasley, chief commercial officer, Matt Kisber, co-founder and chairman of the board, and Luke Wilkinson, senior vice president of project development, Silicon Ranch, August 3, 2022.

Property owners can also gain intrinsic benefits from allowing utility-scale solar projects on their land. Some issues farmers consider when contemplating leasing their property for solar energy development include the general hardships of farming,<sup>14</sup> the difficult economics for many family farms,<sup>15</sup> and the farmer's age. The average age of a farmer in the United States is 58,<sup>16</sup> and many farmers report that their children don't want to take over the family farm. Leasing to a solar developer could be an option to generate revenue for retirement while keeping the farm or land in the family.<sup>17</sup> However, it is important that landowners understand solar leases and how projects are implemented over time (see figure 2).

### Figure 2. Phases of Solar Projects

The operational phase of a utility-scale solar lease is the most important for lease income because it can last from 20 to 45 years. The four general phases of a solar lease are described by *Solar Leasing: A Guide for Agricultural Landowners in the Pacific Northwest*:

Solar leases often provide different payment terms based on the project phase. Generally, solar projects are divided into four phases:

1. "option," "development," or "pre-construction" phase (when the project's viability is being assessed)
2. construction phase (once the project is approved and the "option to lease" has been exercised but before energy production has begun)
3. operational phase (when the project is generating energy)
4. decommissioning phase (when all materials are removed, and the land is cleaned up)

Source: Hannum et al. 2022.

A local government will receive more property tax revenue from a utility-scale solar facility than from the same land if used for farming, even when only real property taxes are considered.<sup>18</sup> Land is classified for property tax purposes as utility, commercial/industrial, residential, or agricultural based on its use. Land with a solar facility selling power to TVA or a local power company is assessed as a utility at 55% of fair market value.<sup>19</sup> If the power from a utility-scale facility is not sold but is instead used on-site, the land is assessed as commercial/industrial property at 40% of its fair market value. In contrast, farm property is assessed at only 25% of fair market

<sup>14</sup> Crowell 2015.

<sup>15</sup> Semuels 2019.

<sup>16</sup> Halvorson 2023.

<sup>17</sup> Marshall-Chalmers 2023.

<sup>18</sup> Interview with Jason Stewart, senior specialist, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, November 4, 2022.

<sup>19</sup> Tennessee Constitution, Article II, Section 28; and interviews with Greg Moody, director, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, February 28, 2023; and Roger Woolsey, county attorney, Amy Tweed, county planner, and Chuck Jeffers, county property assessor, Greene County, January 23, 2023.

value at most.<sup>20</sup> As a result, regardless of whether electricity from a utility-scale solar facility is sold or used on-site, the local government would receive more real property tax revenue from the land alone than it would if the same land were used for farming.<sup>21</sup>

Additionally, local governments would receive more personal property tax revenue from a utility-scale solar facility than from the same land used for farming. Individuals owning farm-classed property do not pay tangible personal property taxes on farm equipment.<sup>22</sup> In contrast, the equipment (e.g., solar panels, mounts, etc.) at a utility-scale solar facility is subject to personal property tax. Solar equipment at a facility selling power is appraised at 12.5% of its original cost—the original cost of solar equipment can be many millions of dollars<sup>23</sup>—and assessed at 55% of its appraised value, with the resulting amount reduced by 15% pursuant to *Northwest Airlines v. Tennessee State Board of Equalization*.<sup>24</sup> For utility-scale facilities where all power is used on-site, equipment is appraised at 12.5% of its original cost and assessed at 30% of its appraised value if the facility has received a green energy certification from Tennessee Department of Environment and Conservation (TDEC)—which means TDEC has documented that it is producing or storing electricity using clean energy technology. If the facility has not received a green energy certification, the equipment is assessed at 30% of its market value.<sup>25</sup> Figure 3 shows how solar facilities are appraised and assessed, and appendix F provides hypothetical examples of assessments of and tax revenue generated by solar facilities compared to agricultural land with the same land appraisal value. For example, a 10 MW solar facility on 100 acres of land could potentially generate \$14,681 in tax revenue for a county compared to \$2,445 if that same land was used for farming.

<sup>20</sup> Farm property without a greenbelt designation is assessed at 25% of fair market value. Farm property with a greenbelt designation is assessed at 25% of greenbelt value. According to Tennessee Farm Bureau, “the fair market value reflects what a willing buyer would give a willing seller for the property in an open market under normal conditions. The greenbelt value is the value of the land derived from a formula which attempts to determine the land value if it were sold strictly on a farm to farm basis.” In practice, the greenbelt value is less than the fair market value for any given property. Tennessee Farm Bureau Federation “Understanding Tennessee’s Greenbelt Law.”

<sup>21</sup> Payment-in-lieu of tax (PILOT) agreements are used for economic development but typically are not used for encouraging utility-scale solar development. Economic development PILOTS are different than TVA’s overall PILOT. TVA’s PILOT is based on its gross proceeds from power sales to municipal utilities, electric cooperatives, and industries, excluding sales to federal agencies. Electricity purchased by TVA from solar facilities and then sold by TVA to local power companies and the industries that TVA serves directly would contribute to TVA’s gross proceeds and would therefore count toward TVA’s overall PILOT and the portion of it distributed to Tennessee. TVA also makes direct payments in lieu of taxes to counties in which it owns power property. If TVA were to own a solar facility, it would count as power property and would be subject to these direct payments, which are based on the two-year average of property taxes paid for the facility for the two years prior to its purchase by TVA. Tennessee Advisory Commission on Intergovernmental Relations 2023; and interviews with Jason Stewart, senior specialist, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, November 4, 2022; Roger Woolsey, county attorney, Amy Tweed, county planner, and Chuck Jeffers, county property assessor, Greene County, January 23, 2023; Chassen Haynes, senior director of business development, Tennessee Department of Economic and Community Development, January 24, 2023; and Jake Bynum, mayor, Weakley County, January 17, 2023.

<sup>22</sup> Email received from Greg Moody, director, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, May 26, 2023.

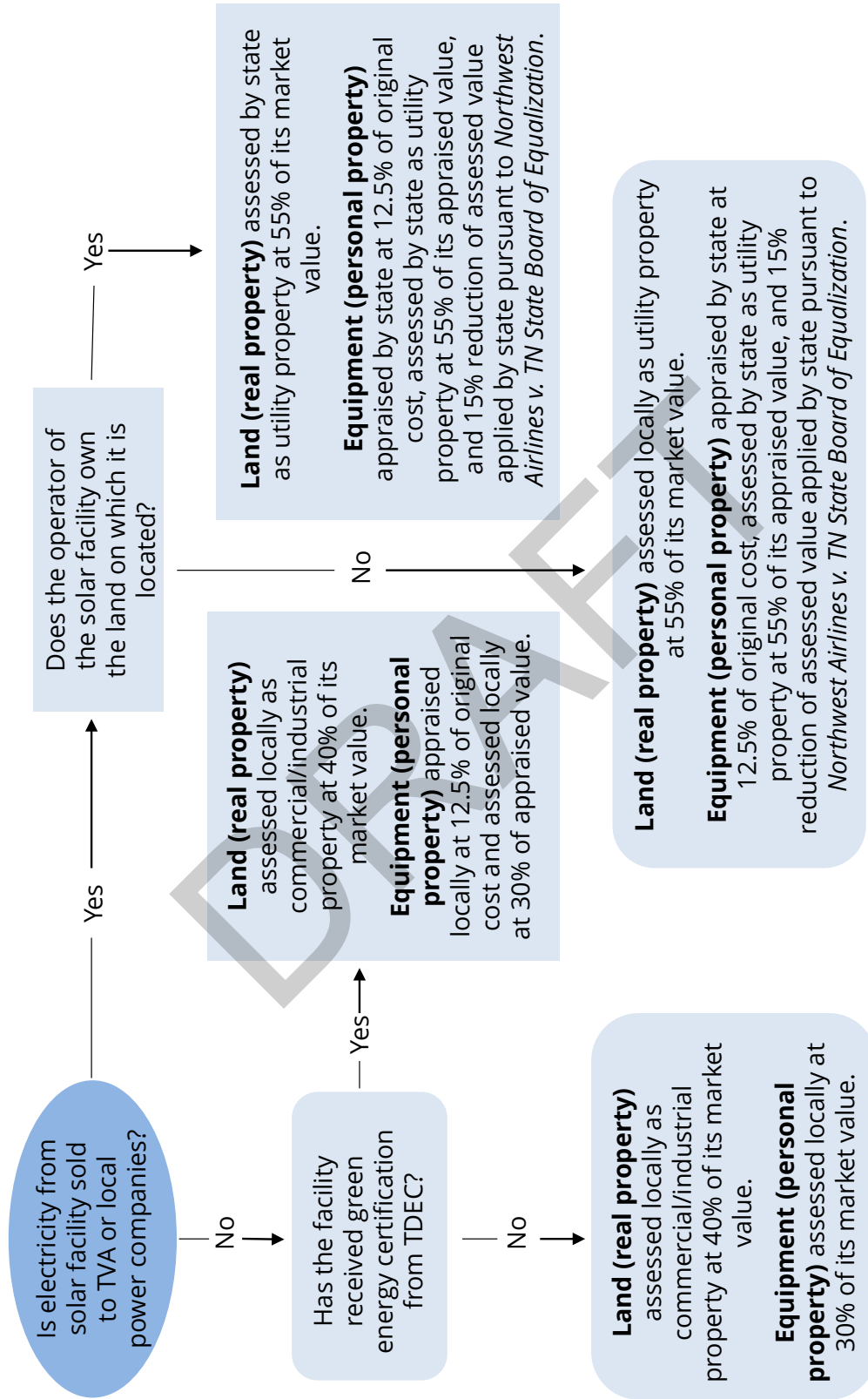
<sup>23</sup> Hyder 2022.

<sup>24</sup> Tennessee Code Annotated, Section 67-5-601(e)(1); and Tennessee Comptroller of the Treasury 2020. The 12.5% appraisal also applies to solar equipment at facilities that have been approved by TDEC as a Certified Green Energy Production Facility regardless of whether they sell electricity off-site. Tennessee Code Annotated, Section 67-5-601 requires the property owner to provide either a Green Energy Production Facility Certification from TDEC or a public utility filing to the Comptroller to document eligibility for the 12.5% assessment rate. See also Tennessee Department of Environment and Conservation 2023a. The Tennessee General Assembly has found that green sources of electricity production are generally capable of producing less electricity than traditional sources and in 2013, passed a law directing that “the sound, intrinsic, and immediate value of solar source property should not initially exceed twelve and one-half percent (12.5%) of total installed costs.” Solar equipment at facilities that generate power to use on-site that do not have the certification is assessed at 30% of its fair market value.

<sup>25</sup> TDEC says “Clean energy technology is technology used to generate energy from geothermal, hydrogen, solar, and wind sources.” Tennessee Department of Environment and Conservation 2023a.



Figure 3. Solar Facility Property Assessment Process



Source: Tennessee Constitution, Article II, Section 28; Tennessee Code Annotated, Sections 67-5-101 et seq., 67-5-601(e), and 67-5-1301 et seq.; *Northwest Airlines et al. v. Tennessee State Board of Equalization* settlement agreement (1996); and interview with Greg Moody, director, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, February 28, 2023, and email received March 23, 2023.

Some stakeholders are concerned that large-scale solar facilities will damage land and pollute waterways, potentially harming crops, livestock, and wildlife habitat.

### **Most issues raised about utility-scale solar development are common to development in general.**

Stakeholders raise several issues about utility-scale solar development, and most of them are issues common to other types of development. They include concerns about environmental damage from stormwater runoff and hazardous materials, land use issues such as aesthetics, and what happens to properties when solar facilities reach the end of their useful life and are decommissioned.

### **The primary environmental concerns about utility-scale solar development are stormwater runoff and potential leaking of hazardous materials from solar equipment.**

Some stakeholders have expressed concerns about stormwater runoff and the potential for solar facilities to leak hazardous materials into the environment. These environmental issues are not unique to solar, and they affect other types of development, whether agricultural, residential, commercial, or industrial. Like other development, utility-scale solar projects are subject to federal, state, and local environmental requirements. Those solar facilities in Tennessee selling power to TVA are further subject to TVA oversight and the National Environmental Policy Act (NEPA), which mandates an even more comprehensive environmental review process.

#### *Stormwater Runoff*

A key concern of stakeholders is that large-scale solar facilities will damage the land and pollute waterways—particularly because of stormwater runoff—potentially harming humans, crops, livestock, and wildlife habitat.<sup>26</sup> The quality of stormwater runoff during construction can be an issue for all development if the proper erosion prevention and sediment control measures are not in place.<sup>27</sup> Between January 2009 and June 2023, TDEC Division of Water Resources (DWR) received over 20,000 water pollution control complaints across all types of development. Of these complaints, seven<sup>28</sup> were about four different sites being developed for solar facilities—out of the 42 known sites in construction or operation. **One complaint resulted in a notice of violation in 2023** (see appendix G, which

<sup>26</sup> Emails received from Lindsay Hanna, director of government relations & climate policy, Tennessee Chapter, The Nature Conservancy, July 18, 2023; and Lindsay Gardner, associate director of policy research/development and federal relations, Tennessee Wildlife Federation, July 21, 2023.

<sup>27</sup> Interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023.

<sup>28</sup> One complaint was for erosion/sediment, two were for stormwater-construction, one was for stream debris, one was for wetlands, and two were categorized as “other.”

includes the complaint year and outcome for the solar sites).<sup>29</sup> Notices of violation require action by the permit holder—usually the developer—to correct the damage or problem and can also include fines. In three states—Alabama, Idaho, and Illinois—the same contractor on four utility-scale solar projects failed to properly follow stormwater rules, leading to serious stormwater issues.<sup>30</sup> But Tennessee DWR staff have not found anything specific to solar development in the state that would make the projects less compliant than other previously permitted developments.<sup>31</sup> In fact, they say solar projects generally minimize soil disturbance and the effect on the environment compared to other types of projects with heavy construction. Solar facilities also typically require less new infrastructure, such as water, sewer, and roads, reducing disturbance to the site and surrounding area.<sup>32</sup>

The Clean Water Act (CWA) outlines the primary federal requirements for stormwater management and applies equally to solar as to all other types of development. The Act “establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.”<sup>33</sup> It is implemented through the US Environmental Protection Agency’s (EPA) National Pollutant Discharge Elimination System (NPDES) permit program. Under the CWA and NPDES, state governments are authorized to carry out many permitting, administrative, and enforcement aspects of the program.<sup>34</sup>

In Tennessee, the Tennessee Department of Environment and Conservation’s (TDEC) DWR implements the CWA and administers the NPDES program by enforcing water quality and stormwater regulations and permits.<sup>35</sup> Any planned development project in the state that will disturb at least one acre of soil is required to get an NPDES stormwater construction permit, referred to as the construction general permit (CGP).<sup>36</sup> Decommissioning a solar facility (i.e., deconstructing the facility and returning the land to its prior condition) also requires a CGP because more than one acre would be disturbed during the process. Before developers obtain their CGP, they

Tennessee Department of Environment and Conservation (TDEC) Division of Water Resources staff have not found anything specific to solar development in the state that would make the projects less compliant than other previously permitted developments.

<sup>29</sup> TDEC’s DataViewer shows complaints received as early as 2009. Tennessee Department of Environment and Conservation “DataViewer - Division of Water Resources (DWR).”

<sup>30</sup> US Environmental Protection Agency 2022a.

<sup>31</sup> Interviews with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023; and Ann Morbitt, integrated water resources consultant, and Karina Bynum, integrated water resources engineer, Division of Water Resources, Tennessee Department of Environment and Conservation, March 10, 2023.

<sup>32</sup> Interview with Michael Banks, former county attorney, Haywood County, January 17, 2023.

<sup>33</sup> US Environmental Protection Agency 2023j.

<sup>34</sup> US Environmental Protection Agency 2023d. In states that have not received approval from the EPA to implement the program—Massachusetts, New Hampshire, and New Mexico—the EPA issues permits. US Environmental Protection Agency 2023e.

<sup>35</sup> Tennessee Code Annotated, Section 69-3-101 et seq.; 33 U.S.C. Section 1342; Rules of the Tennessee Department of Environment and Conservation 0400-40; and Tennessee Department of Environment and Conservation 2023d.

<sup>36</sup> Tennessee Department of Environment and Conservation 2021a.

Tennessee has requirements, in addition to federal requirements, for the protection of water resources.

develop a stormwater pollution prevention plan, which is a site-specific plan that describes how issues of water quality will be addressed and includes engineering designs.<sup>37</sup>

Tennessee has requirements, in addition to the federal requirements, for the protection of water resources. If a project will alter a stream, river, lake, or wetland, an aquatic resource alteration permit (ARAP) is also required, and according to DWR staff, many projects in the state affect water resources and require an ARAP.<sup>38</sup> The ARAP is a Tennessee-specific permit—not all states have a separate aquatic permitting process like the ARAP permit in addition to the NPDES permit.

To enforce these federal and state requirements, DWR staff review compliance reports, conduct inspections, and enforce permits. Although penalties can be assessed when a permit is violated, the focus is on taking corrective action and repairing the damage. For example, if DWR staff find that sediment has escaped beyond a containment pond, they issue a notice of violation and require the contractor to repair the pond or install and maintain appropriate sediment control measures within a defined time period.<sup>39</sup> The permit applicant—usually the developer—is liable for violations and civil penalties of up to \$10,000 per day.<sup>40</sup> The process is the same for all development—there is no permit specifically for solar development. If the land is leased for a solar facility, the developer is required to obtain permits—not the landowners or TVA.<sup>41</sup>

A few states have solar-specific stormwater guidance or policies.<sup>42</sup> As of 2021, seven states have policies for determining whether solar facilities are considered impervious surfaces for purposes of environmental regulation based on factors including slope, soils, vegetation, and the spacing of the solar panels, according to the Great Plains Institute and the National Renewable Energy Laboratory (NREL).<sup>43</sup> Impervious surfaces, such as parking lots, paved streets, and rooftops, prevent water from absorbing into the soil. If solar facilities are determined to be impervious, these states could subject those facilities to additional regulations, such as requiring more space between panels, a larger setback around the site, or certain types of vegetation under the panels. Virginia began considering regulations in 2022 to treat ground-mounted panels like impervious parking lots

<sup>37</sup> Interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023.

<sup>38</sup> Ibid.

<sup>39</sup> Tennessee Department of Environment and Conservation 2021a.

<sup>40</sup> Tennessee Code Annotated, Section 69-3-115.

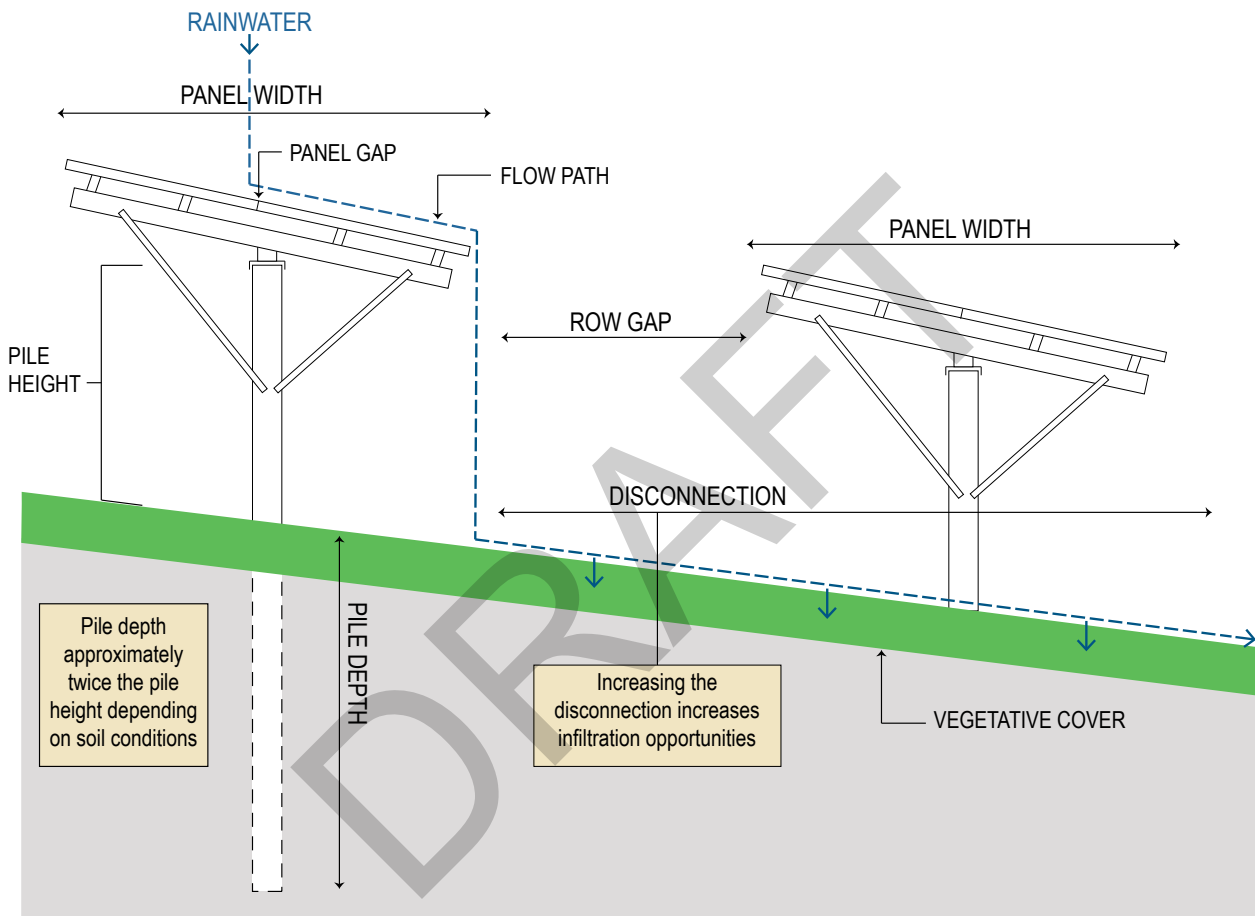
<sup>41</sup> Interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023.

<sup>42</sup> Hanson et al. 2021.

<sup>43</sup> Connecticut, Maryland, Massachusetts, Minnesota, North Carolina, Ohio, and Pennsylvania.

when accounting for stormwater runoff.<sup>44</sup> However, NREL says “rather than acting like a paved surface, rainwater can generally infiltrate under elevated PV arrays.”<sup>45</sup> New Jersey, one of the only states with solar-specific stormwater policies, exempts solar panels from impervious surface standards.<sup>46</sup> Figure 4 illustrates how stormwater runs off solar panels.

Figure 4. Solar Panel Stormwater Runoff



Note: Disconnection “refers to the practice of directing runoff from impervious areas, such as roofs or parking lots, onto pervious areas, such as lawns or vegetative strips, instead of directly into storm drain.” Hanson et al. 2021.

Source: Hanson et al. 2021; and Ross et al. 2023.

Tennessee does not consider solar facilities to be impervious surfaces, and DWR staff said they do not perceive increased water quality issues resulting from solar development during operation. If the site has grass, setbacks, and stable roads, staff don’t anticipate any water quality issues

<sup>44</sup> McGowan 2022.

<sup>45</sup> National Renewable Energy Laboratory “Photovoltaic Stormwater Management Research and Testing.”

<sup>46</sup> Hanson et al. 2021.

Stakeholders suggest more coordination and communication between developers and regulatory agencies to improve the permitting and planning process for all development.

after construction is complete, and on those sites, nothing further needs to be done. If they receive a complaint, they visit the site and investigate it.<sup>47</sup>

Local governments in Tennessee can also regulate stormwater, and many do. Approximately 100 municipalities have additional requirements they enforce to manage the quality of stormwater runoff from their storm sewer systems.<sup>48</sup> Additionally, local governments, rather than TDEC, address issues about the quantity of stormwater runoff because local drainage and infrastructure determine the amount of water that can be managed.<sup>49</sup> Solar developers are required to comply with any existing local regulations in addition to state and federal regulations. However, because utility-scale solar facilities are usually developed in rural areas, regulations enforced by cities often don't apply to them.

To improve the permitting and planning process for all development, stakeholders suggest more coordination and communication. Although the state regulates development, some state and local government officials say that some developers—particularly out-of-state companies—might not understand or be familiar with Tennessee's laws and regulations. For example, Tennessee's ARAP may be required in addition to the federal NPDES process,<sup>50</sup> and companies might not be aware of the additional permit because not all states require this type of permit. Additionally, projects that will disturb more than 50 acres at one time must comply with additional permit requirements, including submission of additional data and more frequent site assessments, inspections, and monitoring.<sup>51</sup> According to DWR staff, communication and coordination between them, local governments, and developers early in the process of project siting and design would help avoid the need to redesign projects later in the process and save time and money for all types of development. DWR doesn't have dedicated staff and funds to focus on outreach, but staff will help educate anyone about regulations when guidance is requested.<sup>52</sup>

<sup>47</sup> Interview with Ann Morbitt, integrated water resources consultant, and Karina Bynum, integrated water resources engineer, Division of Water Resources, Tennessee Department of Environment and Conservation, March 10, 2023.

<sup>48</sup> Tennessee Department of Environment and Conservation 2023c; and email received from Ann Morbitt, integrated water resources consultant, Division of Water Resources, Tennessee Department of Environment and Conservation, March 23, 2023.

<sup>49</sup> Interview with Ann Morbitt, integrated water resources consultant, and Karina Bynum, integrated water resources engineer, Division of Water Resources, Tennessee Department of Environment and Conservation, March 10, 2023.

<sup>50</sup> Tennessee Department of Environment and Conservation "Aquatic Resource Alteration Permit (ARAP)."

<sup>51</sup> Tennessee Department of Environment and Conservation 2021a.

<sup>52</sup> Interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023; and email received from April Grippo, deputy director, Division of Water Resources, Tennessee Department of Environment and Conservation, June 20, 2023.

### *Hazardous Waste and Solid Waste Management*

Some stakeholders are concerned that solar equipment might contain hazardous materials that could harm people or the environment, with some especially concerned that panels could leak hazardous chemicals into the soil and water, and others are more concerned about the disposal of the panels. However, solar modules are unlikely to leach materials even if they are cracked or broken—they are designed and tested to endure harsh outdoor conditions for 25 years or more.<sup>53</sup> The modules are sealed, and only a small percentage—an estimated average of 0.04%—break each year.<sup>54</sup> Further, staff at TDEC Division of Solid Waste Management (DSWM), say the EPA has not yet released any information about leaching being a risk.<sup>55</sup> Research has found leaching from solar panels unlikely to be a significant risk.<sup>56</sup>

According to the US EPA, “Some solar panels are hazardous waste, and some solar panels are not hazardous waste, depending on the leachability of . . . toxic materials present in the solar panel.”<sup>57</sup> Leachability means leaking of a component material, such as a heavy metal, out of the panel. The only equipment in a solar PV system that would have any potentially hazardous materials are the PV panels—modules—and batteries, and the material composition of equipment varies by type and manufacturer. Potentially hazardous materials include, but are not limited to, lead, cadmium, arsenic, hexavalent chromium, copper, and selenium.<sup>58</sup> Batteries currently used for energy storage are lithium-ion, and the main risk associated with them is fire if they are damaged or crushed.<sup>59</sup> Lithium-ion batteries, which are also used in many household items such as power tools and small electronic devices, are treated as hazardous waste. The EPA issued a memorandum in 2023 that clarifies “how the hazardous waste regulations for universal waste and recycling apply to lithium-ion batteries.”<sup>60</sup>

Research has found that leaching from solar panels is unlikely to be a significant risk—they are designed and tested to endure harsh outdoor conditions for 25 years or more.

“Some solar panels are hazardous waste, and some solar panels are not hazardous waste, depending on the leachability of . . . toxic materials present in the solar panel.”

US Environmental Protection Agency 2022b.

<sup>53</sup> Sinha et al. 2019.

<sup>54</sup> Solar Energy Technologies Office “Farmer’s Guide to Going Solar”; Summers and Radde 2003; Sinha et al. 2019; and interview with Craig Almanza, deputy director, and Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, February 6, 2023.

<sup>55</sup> US Environmental Protection Agency 2023b; Tennessee Department of Environment and Conservation “Hazardous Waste Program”; interview with Craig Almanza, deputy director, and Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, February 6, 2023; and email received from Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, May 31, 2023.

<sup>56</sup> Robinson and Meindl 2019; and Summers and Radde 2003.

<sup>57</sup> US Environmental Protection Agency 2022b. See also US Environmental Protection Agency 2023a; and US Environmental Protection Agency 2023l.

<sup>58</sup> Association of State and Territorial Solid Waste Management Officials 2022; Sinha et al. 2020; and US Department of Energy 2022.

<sup>59</sup> US Environmental Protection Agency 2023o.

<sup>60</sup> US Environmental Protection Agency 2023c.

Solar equipment determined to be non-hazardous can be sent to an appropriately classified landfill. Any equipment determined to be hazardous, must be disposed of in compliance with the federal Resource Conservation and Recovery Act.

The disposal of solar equipment and materials is regulated in the same way as other types of solid or hazardous waste. TDEC DSWM has regulations in place for both solid waste and hazardous waste to “provide for safe and sanitary processing and disposal of solid wastes” and “safe storage, transportation, treatment, and disposal of hazardous wastes.”<sup>61</sup> It has authority to regulate disposal of all types of solid waste, including hazardous waste, through permitting and enforcement under the Solid Waste Management Act of 1991 and the Hazardous Waste Management Act of 1977.

Solar equipment determined to be non-hazardous is treated like other solid waste and can be sent to an appropriately classified landfill.<sup>62</sup> Landfills are classified in four categories: Class I takes non-hazardous municipal solid wastes such as household wastes, approved special wastes, and commercial wastes; Class II takes non-hazardous industrial wastes, commercial wastes, and fill; Class III takes Class IV wastes plus landscaping, land clearing, and farming wastes; and Class IV takes construction and demolition wastes, shredded tires, and waste with similar characteristics.<sup>63</sup> According to TDEC DSWM staff, solar equipment determined to be non-hazardous can go to Class I landfills, of which there are 30 in Tennessee.<sup>64</sup>

If part of solar equipment is determined to be hazardous, it is treated in compliance with the federal Resource Conservation and Recovery Act and sent to an appropriate hazardous waste facility depending on the materials contained in the equipment.<sup>65</sup> TDEC staff investigate any complaints they receive about solid waste and, like any type of solid or hazardous waste, requires that solar panels are disposed of properly. Because Tennessee doesn’t have any commercial hazardous waste landfills, hazardous materials from solar equipment are sent out of state to hazardous waste landfills or treatment facilities.<sup>66</sup>

When solar equipment reaches its end-of-life, it can be recycled, although solar panel recycling is a new and evolving industry.<sup>67</sup> The US Department of Energy’s NREL has researched the solar equipment recycling economy that would allow for the recovery and reuse of materials rather than disposing of them in landfills. NREL has found that future waste is both a

<sup>61</sup> Tennessee Code Annotated, Sections 68-211-101 et seq. and 68-212-101 et seq.; Tennessee Department of Environment and Conservation 2021b; and Tennessee Department of Environment and Conservation “Hazardous Waste Program.”

<sup>62</sup> Tennessee Department of Environment and Conservation 2021b.

<sup>63</sup> Tennessee Department of Environment and Conservation 2023b.

<sup>64</sup> Tennessee Department of Environment and Conservation 2021b; and email received from Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, July 27, 2023.

<sup>65</sup> Tennessee Department of Environment and Conservation “Hazardous Waste Program.”

<sup>66</sup> Interview with Craig Almanza, deputy director, and Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, February 6, 2023; and email received from Lisa Hughey, July 27, 2023.

<sup>67</sup> US Environmental Protection Agency 2023h; and Hicks 2019.



challenge and an opportunity to recover materials and reuse them, and more research, investment, and incentives are needed to implement a system.<sup>68</sup>

The Solar Energy Industry Association (SEIA) has been developing a PV recycling network across the US and is optimistic about the future of PV recycling. SEIA staff say more companies are starting to use recycled and refurbished materials, and the cost will decrease as demand increases.<sup>69</sup> For example, the First Solar company encourages its clients to return modules to its site in Ohio for recycling. Their customers pay a recycling fee and cover the shipping cost. However, a company representative said their clients report that it is cheaper to dispose of equipment in a landfill.<sup>70</sup>

At least five states have taken steps to address PV waste and recycling, including creating task forces and implementing new regulations and increased oversight. New Jersey and North Carolina have each created a statewide task force to evaluate disposal issues and available recycling infrastructure and make recommendations to address long-term concerns related to solar waste. California and Hawaii amended waste regulations to include PV modules as one of the waste streams that are subject to increased oversight, including training for landfill employees handling the waste and requiring facilities to document the generation, transportation, treatment, or disposal of waste. Washington adopted a statutorily required extended producer responsibility program for PV modules, making the manufacturers of products and materials responsible for the waste. Beginning in 2025, manufacturers in the state will not be allowed to sell solar panels if they don't have a stewardship plan—approved by the state's department of ecology—that provides “the public a convenient and environmentally sound way to recycle all modules.”<sup>71</sup>

In addition to the requirements for all types of development, solar facilities selling power to TVA are subject to the National Environmental Policy Act (NEPA) process.

### *National Environmental Policy Act (NEPA) and TVA*

Solar facilities selling power to TVA are subject to additional federal requirements and oversight because TVA is a federal agency—those facilities are required to go through the National Environmental Policy Act (NEPA) process. NEPA is a comprehensive environmental review required for projects involving a federal agency that is making a decision about a proposed major action that could have environmental effects.<sup>72</sup> Under NEPA, all executive federal agencies are required to prepare environmental assessments (EAs) and environmental impact statements

<sup>68</sup> Curtis et al. 2021a.

<sup>69</sup> Interview with members of utility committee and Gil Hough, executive director, TenneSEIA, and Evelyn Butler, vice president of technical services, and Robert Nicholson, senior manager of sustainability, Solar Energy Industries Association, February 9, 2023.

<sup>70</sup> Interview with Roger Bredder, vice president, business development, head of utility origination, First Solar, Inc., May 17, 2023.

<sup>71</sup> US Environmental Protection Agency 2023a; and Association of State and Territorial Solid Waste Management Officials 2022.

<sup>72</sup> US Environmental Protection Agency 2023k; and interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022.

The potential loss of land, including farmland, forests, grasslands, and wetlands, to utility-scale solar facilities is a concern for some stakeholders.

(EISs).<sup>73</sup> In addition to NEPA review, TVA checks developers' track records and completes performance and business reviews before entering into contracts, requires developers to obtain state and local permits, and inspects the projects before they begin operating.<sup>74</sup> According to TVA's 2019 Integrated Resource Plan, "Compared to most other energy resources, [solar facilities] have a relatively low level of impact to the land."<sup>75</sup>

### The primary land use concern about utility-scale solar development is the loss of farmland and undeveloped land.

The potential loss of land to utility-scale solar facilities is a concern for some stakeholders.<sup>76</sup> This includes agricultural land and especially prime farmland where soils are suited for growing crops—particularly in the western part of the state where there are many acres of flat agricultural land (map 1 shows the locations of utility-scale solar facilities in operation or construction and prime farmland in Tennessee). Some stakeholders also expressed concern about the potential loss of wildlife and habitat land, saying that solar development in Tennessee could affect forests, grasslands, wetlands, and other previously undisturbed lands and lead to habitat fragmentation (see appendix H for the Nature Conservancy's "Principles for Utility-Scale Solar Energy Development in Tennessee" that discusses such impacts and how to avoid them).<sup>77</sup>

While solar facilities require 5 to 10 acres per MW, the short-term and long-term projections on the amount of acreage needed to accommodate utility-scale solar development show that the amount of land developed for solar is likely to account for a comparatively small portion of the overall amount of land developed in the coming decades.<sup>78</sup> For farmland in particular, the American Farmland Trust projects that, if recent trends continue, between 2016 and 2040, 1,014,600 acres (8%) of farmland in Tennessee will be converted to other uses.<sup>79</sup> Currently, TVA plans to add 10,000 MW of solar power generation by 2035 throughout its seven-state service area, not just in Tennessee.<sup>80</sup> If all these facilities were developed on Tennessee farmland, they would account for approximately 100,000 acres taken out

<sup>73</sup> US Environmental Protection Agency 2023k.

<sup>74</sup> Interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022, and email received March 22, 2023.

<sup>75</sup> Tennessee Valley Authority 2019a.

<sup>76</sup> Interviews with Shelby Vannoy, assistant director, Kevin Hensley, director, and Kristen Walker, associate director of commodity and industry relations, Public Policy Division, Tennessee Farm Bureau Federation, May 16, 2023; Lindsay Hanna, director of government relations & climate policy, Tennessee Chapter, The Nature Conservancy, November 10, 2022; and Lindsay Gardner, associate director of policy research/development and federal relations, Tennessee Wildlife Federation, June 20, 2023.

<sup>77</sup> The Nature Conservancy 2023.

<sup>78</sup> Hunter et al. 2022; and American Farmland Trust 2022.

<sup>79</sup> The American Farmland Trust is a national nonprofit organization focused on preserving agricultural land and practices. American Farmland Trust 2022; and Hunter et al. 2022.

<sup>80</sup> Tennessee Valley Authority 2022.

of production, 1% of farmland in the state.<sup>81</sup> In comparison, the amount of farmland in Tennessee decreased by 1.1 million acres (9.3%) from 1997 through 2017.<sup>82</sup> In 2023, the University of Tennessee Institute of Agriculture conducted a study focused on how many acres are likely to be used for solar development in Tennessee and found the following:

If by 2035 TVA reached their sustainability goal and added an additional 10 GW of PV generation to the existing 344 MW of PV production in Tennessee, and assuming that TVA placed all PV developments in Tennessee, 57,514 to 103,443 acres of land would be required for utility-scale PV installments (i.e., an amount equivalent to 0.22 to 0.39% of Tennessee land or 0.53 to 0.96% of Tennessee farmland if exclusively placed on farmland). However, not all of this additional production would be located in Tennessee, which occupies a little more than half of TVA's 80,000 square mile service region.<sup>83</sup>

Although utility-scale solar is unlikely to be a primary driver of land loss in Tennessee, existing strategies are available to protect farmland and undeveloped land from development. These tools and strategies are not necessarily solar-specific, but all can be applied to solar development. They include zoning, agrivoltaics, putting land in trusts, and the state's new Brownfield Redevelopment Area Fund.

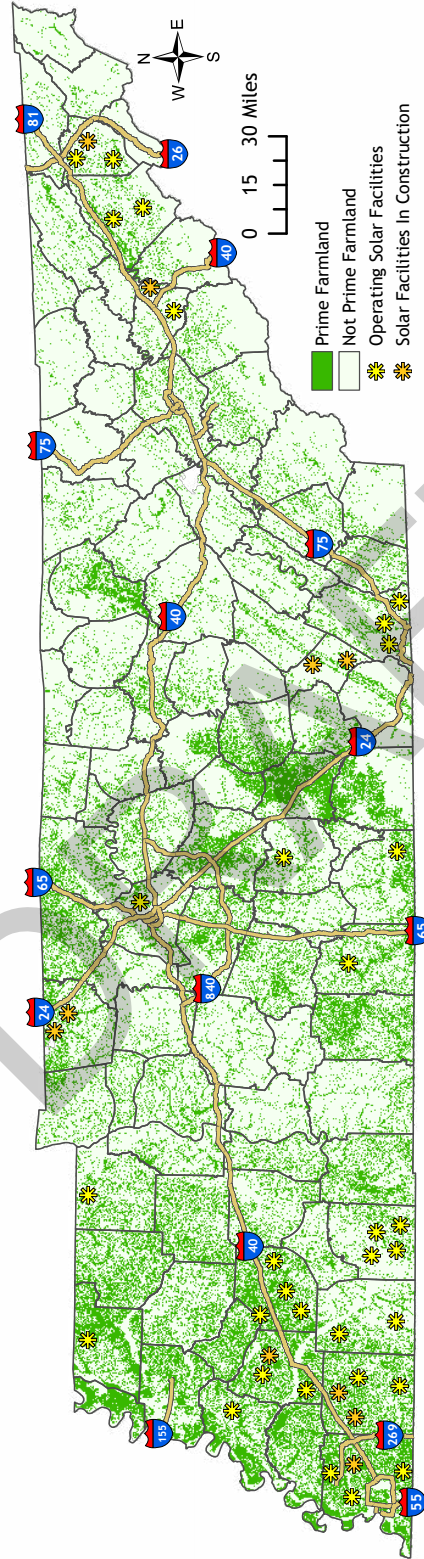
Although utility-scale solar is unlikely to be a primary driver of land loss in Tennessee, existing strategies are available to protect farmland and undeveloped land from development.

<sup>81</sup> US Department of Agriculture 2022a.

<sup>82</sup> US Department of Agriculture 2017.

<sup>83</sup> DeLong et al. 2023.

Map 1. Utility-Scale Solar Facilities in Operation or Construction and Prime Farmland in Tennessee as of August 2023



Source: TACIR staff map created from BrightRidge 2023; DeLong et al. 2023; Flessner 2017; Hexagon Energy 2019; Origis Energy “TN Solar 1 – Skyhawk Solar”; Silicon Ranch “Projects”; US Department of Agriculture 2023; US Energy Information Administration 2023; Vanderbilt University 2023; and emails received from Madison Haynes, co-chair, State and Local Policy Committee, Tennessee Solar Energy Industries Association, August 1, 2023; and Stuart Pickrell, senior consultant, Business Development & Renewables, Commercial Energy Solutions, Tennessee Valley Authority, July 31, 2023.

### Local Zoning

Local governments have the authority to address issues related to land use and development—including utility-scale solar—through zoning, which is one of their primary tools used to balance property rights with community interests regarding land use.<sup>84</sup> Zoning helps communities plan for and provide services, protect property values and lives, and prevent harmful land uses.<sup>85</sup> Without zoning, counties are limited to regulating nuisances—anything determined to be potentially detrimental to “the health, morals, comfort, safety, convenience, or welfare of the inhabitants” of the jurisdiction—only in unincorporated areas. The county legislative body must adopt both the authority to regulate nuisances and the nuisance regulations with a two-thirds vote of the legislative body.<sup>86</sup>

Tennessee law authorizes all local governments to adopt zoning regulations, and whether to do so is a local decision. As of May 2023, 40 of Tennessee’s 95 counties and 271 of its 345 cities have adopted zoning regulations.<sup>87</sup> Large-scale solar facilities are usually built in the unincorporated areas of counties because cities typically don’t have as much available land as counties; therefore, zoning for solar development plays a greater role for counties than cities. Map 2 shows the locations of utility-scale solar facilities in operation or construction and counties that have adopted zoning, and map 3 shows facilities in pre-construction development.

Local governments have the authority to address issues related to land use and development—including utility-scale solar—through zoning. As of May 2023, 40 of Tennessee’s 95 counties and 271 of its 345 cities have adopted zoning regulations.

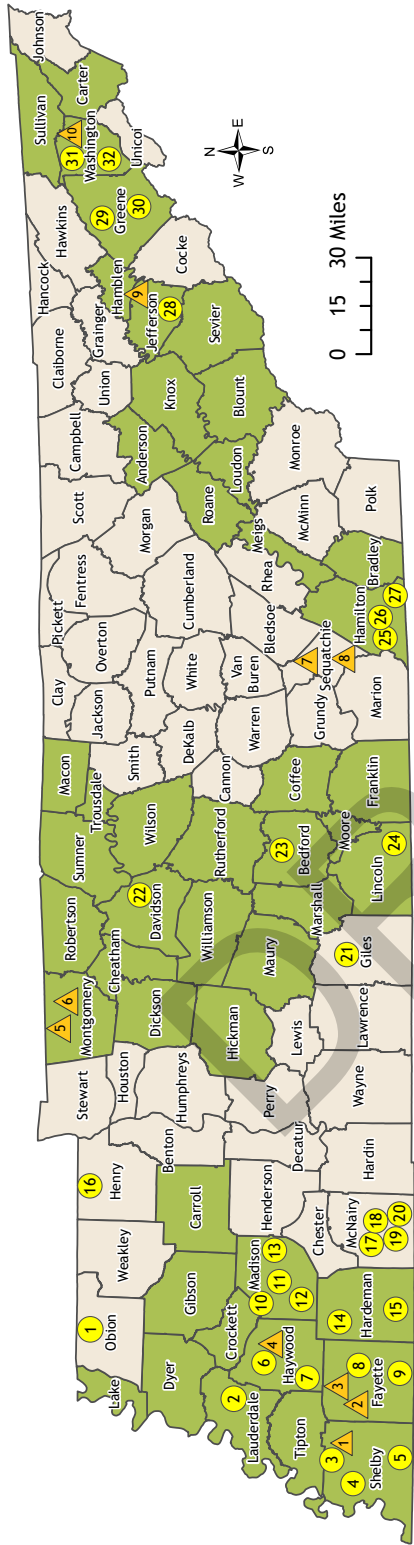
<sup>84</sup> Tennessee Code Annotated, Sections 13-7-101 and 13-7-201.

<sup>85</sup> Email received from Kristy Godsey Brown, manager of legal services, University of Tennessee County Technical Assistance Service, May 10, 2023.

<sup>86</sup> Tennessee Code Annotated, Sections 5-1-118 and 6-2-201; Skehan 2020; University of Tennessee County Technical Assistance Service “New Authority for Counties to Regulate Nuisances Introduction”; and email received from David Connor, executive director, Tennessee County Services Association, May 3, 2023.

<sup>87</sup> Skehan 2020.

Map 2. Utility-Scale Solar Facilities in Operation or Construction and Counties that have Adopted Zoning in Tennessee as of August 2023



**County Zoning Adopted**

- Yes
- No

**Operating Solar Facilities**

- 1 Skyhawk Solar Facility
- 2 Ripley 1, 2, 3, and 4
- 3 Millington I
- 4 Innovation - Nike
- 5 Memphis Agricenter Solar Farm
- 6 Haywood Brownsville
- 7 West Tennessee Solar Farm
- 8 Somerville Solar

**County Zoning Adopted**

- 9 Wildberry
- 10 Jackson
- 11 Jackson II
- 12 Providence
- 13 McKellar
- 14 Latitude Solar Center
- 15 Bolivar
- 16 Paris Solar Farm - Clearloop
- 17 Selmer Farm LLC
- 18 Selmer North I
- 19 Selmer North II
- 20 Mulberry Farm LLC
- 21 Pulaski 1, 2, 3, 4, 5, and 6

**County Zoning Adopted**

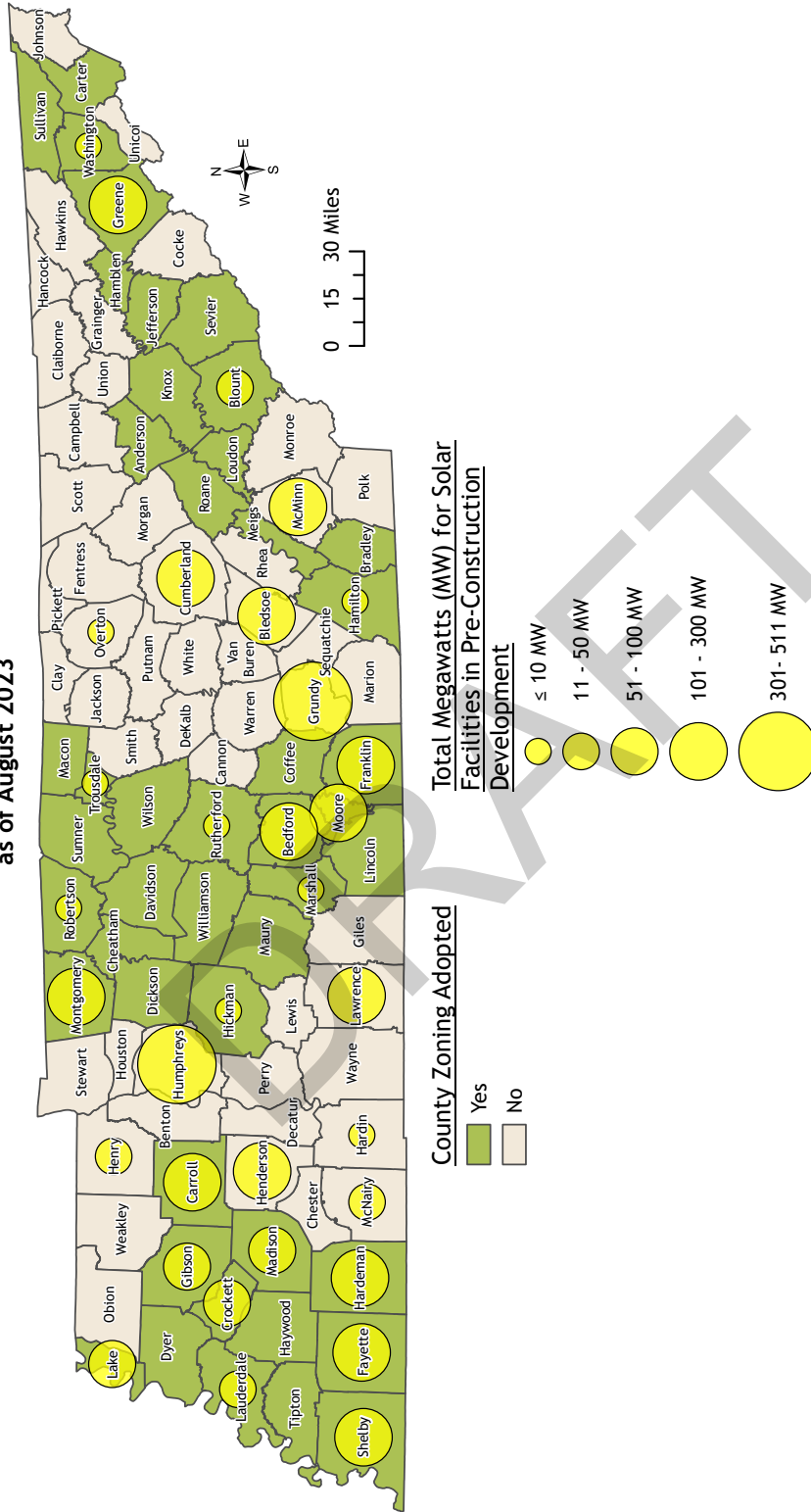
- 22 Music City Community Solar
- 23 Bell Buckle Vanderbilt I
- 24 Elora Solar Energy Center
- 25 Chattanooga Metropolitan Airport Solar
- 26 Volkswagen Chattanooga Solar Farm
- 27 Oak and Greenwood Helioscope
- 28 Appalachian Community Solar
- 29 Greenville I
- 30 Greenville II
- 31 Washington 1 - Martin Solar Farm
- 32 Jonesborough - Telford Solar Farm

**Solar Facilities in Construction**

- 1 Millington II
- 2 Canadaville
- 3 Yum Yum Solar Energy Center
- 4 Brownsville
- 5 Clarksville
- 6 Clarksville II
- 7 Marion and Marion II
- 8 Sequachee Valley EC II
- 9 White Pine - Clearloop
- 10 BrightRidge Solar Learning Lab

Source: TACIR staff map created from BrightRidge 2023; DeLong et al. 2023; Flessner 2017; Hexagon Energy 2019; Origis Energy "TN Solar 1 - Skyhawk Solar"; Silicon Ranch "Projects"; Skehan 2020; US Energy Information Administration 2023; Vanderbilt University 2023; and emails received from Madison Haynes, co-chair, State and Local Policy Committee, Tennessee Solar Energy Industries Association, August 1, 2023; and Stuart Pickrell, senior consultant, Business Development & Renewables, Commercial Energy Solutions, Tennessee Valley Authority, July 31, 2023.

**Map 3. Total Megawatts (MW) by County for Utility-Scale Solar Facilities in Pre-Construction Development and Counties that have Adopted Zoning in Tennessee as of August 2023**



Source: DeLong et al. 2023; and emails received from Madison Haynes, co-chair, State and Local Policy Committee, Tennessee Solar Energy Industries Association, August 1, 2023; and Stuart Pickrell, senior consultant, Business Development & Renewables, Commercial Energy Solutions, Tennessee Valley Authority, July 31, 2023.

At least 11 local governments in Tennessee that have adopted zoning regulations include standards for utility-scale solar development.

Zoning gives communities a mechanism to control how and where different types of development can occur by allowing local governments to set standards including, but not limited to, the use, location, size, and height of buildings and structures; amount of open space; and the percentage of a lot that can be occupied.<sup>88</sup> Local governments can use zoning authority to set standards for utility-scale solar development, and at least nine counties—Bedford, Fayette, Franklin, Greene, Hardeman, Haywood, Jefferson, Sullivan, and Washington—and one city—Brownsville—in Tennessee already do (see appendix D). Additionally, Shelby County and the City of Memphis have created a unified development code that includes solar regulations, and several local governments are considering regulations for solar development. Several representatives of these communities say zoning, including for solar, helps to develop land in a way that allows businesses to operate and grow while using the land for its best use.<sup>89</sup> Some common elements regulated by local governments that have adopted solar zoning ordinances include required setbacks, perimeter buffers, and fencing.<sup>90</sup> For example, a minimum setback of 50 feet from the property line or a public road and a buffer and fence at least six feet high are common.

Zoning can also be used to encourage certain types of development in specific areas. Bedford County uses its zoning authority to encourage solar in parts of the community determined to be preferable for solar.<sup>91</sup> Because of concerns about protecting scenic views and the best use of land, the county considered aesthetics, excessive slope, and areas where infrastructure investments had already been made for other uses, for example where sewer or water lines have been installed for future development in industrial-zoned areas.<sup>92</sup> Based on these criteria, the county established a “renewable energy development zone” that is intended to encourage developers to locate solar facilities only in specific areas of the county by streamlining the approval process and not requiring rezoning for projects inside the zone.<sup>93</sup> Instead of rezoning, projects are approved as a “conditional use”—as long as they meet all the standards, they are approved in the renewable energy zone. Outside that zone, the rezoning process is required, and the standards are stricter, such as larger setbacks and allowing less land to be covered with infrastructure. Rezoning requests are also subject to

<sup>88</sup> Tennessee Code Annotated, Sections 13-7-101 and 13-7-201; Skehan 2020; and email received from Kristy Godsey Brown, manager of legal services, University of Tennessee County Technical Assistance Service, May 10, 2023.

<sup>89</sup> Interviews with Roger Woolsey, county attorney, and Amy Tweed, county planner, Greene County, January 23, 2023; Chris White, director, Office of Planning & Zoning, Bedford County, January 4, 2023, and Michael Banks, former county attorney, Haywood County, January 17, 2023.

<sup>90</sup> TACIR staff review of ordinances.

<sup>91</sup> Interview with Chris White, director, Office of Planning & Zoning, Bedford County, January 4, 2023.

<sup>92</sup> If a local government has invested heavily in infrastructure in an area, then solar wouldn't be the best form of development because it wouldn't make use of the assets that the government (and its citizens) invested in.

<sup>93</sup> Interview with Chris White, director, Office of Planning & Zoning, Bedford County, January 4, 2023, and emails received November 29, 2022, and May 30, 2023.



being denied.<sup>94</sup> Bedford County’s planner said the approach is effective because it helps the county control where solar development occurs while still supporting development in the county.<sup>95</sup> See table 3 for a comparison of the standards for the two zones and appendix D for a copy of Bedford County’s resolution.

**Table 3. Bedford County Solar Zoning Regulations**

	Inside Renewable Energy Overlay Zone	Outside Renewable Energy Overlay Zone
Area Characteristics	usually less than 6% slope; areas not identified by the planning department as being in high growth areas or areas where significant public infrastructure investments have been made or planned	determined to be less desirable for solar development
Approval Process	allowed as a conditional use with approval as a special exception in an agricultural zone by the Board of Zoning Appeals; no re-zoning required	parcel must be re-zoned to Renewable Energy Development District and go through approval process with the Board of Zoning Appeals
Minimum Setbacks	Front - 75 feet Side - 75 feet Rear - 75 feet	Front - 400 feet Side - 375 feet Rear - 390 feet
Maximum Height	35 feet	35 feet
Maximum Lot Coverage	95%	66%

Source: Bedford County 2023; and email received from Chris White, director, Office of Planning & Zoning, Bedford County, June 1, 2023.

Some local government representatives agree that model ordinances and examples of existing ordinances from other local governments and states would help them make decisions regarding the development of large-scale solar facilities based on the needs, issues, and resources in their jurisdiction.<sup>96</sup> A model ordinance that includes the basic standards for utility-scale solar development is available to Tennessee local governments—it was created by the University of Tennessee Municipal Technical Advisory Service (MTAS) and County Technical Assistance

Tennessee has a model ordinance to help local governments make decisions regarding the development of large-scale solar facilities based on the needs, issues, and resources in their jurisdiction.

<sup>94</sup> Tennessee Code Annotated, Section 13-7-105.

<sup>95</sup> Email received from Chris White, director, Office of Planning & Zoning, Bedford County, May 30, 2023.

<sup>96</sup> Interviews with Roger Woolsey, county attorney, Amy Tweed, county planner, and Chuck Jeffers, county property assessor, Greene County, January 23, 2023; Michael Banks, former county attorney, Haywood County, January 17, 2023; and Ambre Torbett, director of planning & community development, Planning & Codes Department, Sullivan County, January 12, 2023.

Agrivoltaics is a tool to preserve farmland that involves grazing animals or growing crops between or under solar panels.

Service (CTAS) in coordination with the Tennessee Chapter of the Solar Energy Industries Association (TenneSEIA). See appendix C for a copy of the model ordinance. Model ordinances and templates provide a starting point that covers the basic standards that local governments can modify to align with their communities' values, interests, and priorities and often make specific suggestions—for example, fencing is suggested to be at least six feet high, setbacks ranging from at least 15 to 50 feet from property lines, and landscaping buffers using trees or other vegetation.<sup>97</sup> Appendix I provides examples of model ordinances from other states in addition to resources to help local governments develop their ordinances for utility-scale solar.

### *Agrivoltaics*

One strategy to preserve farmland is the development of utility-scale solar facilities without taking the underlying farmland out of production. Often referred to as agrivoltaics or dual-use solar, this approach involves grazing animals or growing crops between or under the panels and can involve raising panels higher off the ground—examples of animals and crops include sheep and shade-tolerant plants such as tomatoes or blueberries.<sup>98</sup> The American Farmland Trust says that “agrivoltaics is the practice of installing solar panels on farmland so primary agricultural activities are maintained throughout the life of the project” (see figure 5 and appendix J for information about American Farmland Trust’s utility-scale solar efforts).<sup>99</sup> Agrivoltaics is sometimes done in other states, and in Tennessee, there are currently nine agrivoltaics projects on approximately 1,900 acres of land.<sup>100</sup>

Some states have adopted incentives for agrivoltaics. In Massachusetts, “dual-use systems qualifying as Agricultural Solar Tariff Generation Units receive an additional \$0.06 per kWh [kilowatt-hour]” to the amount they receive for selling electricity.<sup>101</sup> New Jersey’s program is still in the early stages of development, with the state government planning to release details of a pilot program in the summer of 2023.<sup>102</sup> Michigan allows farmers to retain the Michigan equivalent of greenbelt status for property taxation for solar development leases if pollinator species are planted underneath and between solar panels.<sup>103</sup>

<sup>97</sup> TACIR staff review of model ordinances.

<sup>98</sup> Hanley 2022; Macknick et al. 2022; and the University of Maine “Cooperative Extension: Maine Wild Blueberries.”

<sup>99</sup> American Farmland Trust “Smart Solar<sup>SM</sup> on Farmland and Ranchland: Strengthening Farm Viability and Soil Health While Growing Renewable Energy.” See also Hunter et al. 2022.

<sup>100</sup> Macknick et al. 2022; National Renewable Energy Laboratory “Agrivoltaics Map”; Solar Energy Technologies Office 2023; and TACIR staff estimate of 10 acres per MW, which is typically the high end of the range for acres needed.

<sup>101</sup> University of Massachusetts Amherst 2022.

<sup>102</sup> Weaver 2023.

<sup>103</sup> Michigan Department of Agriculture and Rural Development 2022; and Michigan Farm Bureau 2019.

### Figure 5. American Farmland Trust Smart Solar<sup>SM</sup> on Farmland and Ranchland

Smart Solar projects meet three main goals: they accelerate renewable energy development, strengthen farm viability, and safeguard land for farming and ranching. American Farmland Trust developed the following Smart Solar Principles to guide policymakers, developers, and decision-makers:

1. Prioritize solar siting on the built environment and land not well-suited for farming. Concentrate solar development on rooftops, irrigation ditches, brownfields, and marginal lands.
2. Safeguard the ability for land to be used for agriculture. Policies and practices should protect soil health and productivity, especially during construction and decommissioning.
3. Grow agrivoltaics for agricultural production and solar energy. Agrivoltaic projects allow for farming underneath and/or between rows of solar panels throughout the life of the project.
4. Promote equity and farm viability. Require inclusive stakeholder engagement, including farmers and underserved communities, to ensure widespread benefits from solar energy development.

Smart Solar means directing solar development to where it has the least negative impact on land well-suited for farming while protecting soil health, maintaining opportunities for farming, and ensuring equitable community benefits. Smart Solar elevates agricultural considerations and aims to accelerate renewable energy development by calming community fears over solar project impacts.

Source: American Farmland Trust “Smart Solar<sup>SM</sup> on Farmland and Ranchland: Strengthening Farm Viability and Soil Health While Growing Renewable Energy.”

### Land Trusts

Placing land in a trust in which one specifies limits on how that land can be used in the future—even after it is sold—is a way to preserve and protect it from any type of development. Land trusts are entities, usually a governmental body or a nonprofit organization, that work to protect land from any type of development. Most often, they use a tool called a conservation easement, which is a voluntary legal agreement between the landowner and the trust that allows the landowner to continue to use the land while permanently limiting how the land can be used, developed, or subdivided, no matter who owns it in the future.<sup>104</sup>

There are several existing options to help landowners establish land trusts in Tennessee. The Land Trust for Tennessee is a private nonprofit organization that works with landowners to protect their land in Tennessee. The Land Trust ensures the easement—which is recorded with

<sup>104</sup> Tennessee Code Annotated, Section 66-9-301 et seq.; and Tennessee Department of Agriculture “Land Protection Options.”

Placing land in a trust in which one specifies limits on how that land can be used in the future—even after it is sold—is another way to preserve and protect it from any type of development.

Redeveloping brownfields with solar facilities can help protect farmland and undeveloped land from development.

the register of deeds in the county where the property is located—is upheld in perpetuity.<sup>105</sup> Another resource is the state’s Heritage Conservation Trust Fund, which was established in 2005 to permanently conserve land for promoting tourism and outdoor recreation, conserving natural and cultural resources, and preserving “working landscapes.”<sup>106</sup> Tennessee has appropriated \$30 million for fiscal year 2023-24 “to revitalize the Heritage Conservation Trust to support public-private partnerships through a matching grant program,”<sup>107</sup> and money from the fund could be used to protect land from any type of development, including solar development. Since 1999, the Land Trust for Tennessee has protected over 135,000 acres in 70 counties, and between 2006 and 2016, the Heritage Conservation Trust protected almost 40,000 acres.<sup>108</sup>

### *Brownfield Redevelopment*

Governments can encourage the redevelopment of brownfields over the development of farmland and undeveloped land. Brownfields are land that is abandoned or underutilized because of the presence or potential presence of a hazardous substance, pollutant, or contaminant from a former property use.<sup>109</sup> Brownfields can be a good option for solar development—for example, in 2022, the TVA board approved a pilot project to develop a solar facility on a coal ash brownfield in Kentucky.<sup>110</sup> There is also an example of a brownfield in Tennessee being developed for solar. In 2019, Hexagon Energy completed the Somerville Solar facility built on closed sections of the Fayette County, Tennessee, landfill.<sup>111</sup>

Tennessee recently funded a program to help local governments redevelop brownfields. The General Assembly passed Public Chapter 86, Acts of 2023, authorizing the Tennessee Department of Environment and Conservation (TDEC) to create a new resource—the Brownfield Redevelopment Area Fund. According to TDEC Division of Remediation staff, the intent of the program is to provide funding to local governments to encourage the identification, investigation, and remediation of potential brownfield sites to redevelop them for a beneficial use, including for solar facilities.<sup>112</sup> Division of Remediation staff say solar facilities could likely be more cost-effective compared to redevelopment for commercial and residential uses

<sup>105</sup> Tennessee Code Annotated, Section 66-9-303; and Land Trust for Tennessee “Protect Your Land.”

<sup>106</sup> Tennessee Code Annotated, Section 11-7-101 et seq.

<sup>107</sup> Public Chapter 418, Acts of 2023; and Tennessee Office of the Governor 2023.

<sup>108</sup> Land Trust for Tennessee “Our Impact”; and Tennessee Department of Environment and Conservation 2016.

<sup>109</sup> US Environmental Protection Agency 2023g.

<sup>110</sup> Fischer 2022; and Flessner 2022b.

<sup>111</sup> Hexagon Energy 2019.

<sup>112</sup> Interview with Steve Sanders, director, and Justin Meredith, environmental fellow, Division of Remediation, Tennessee Department of Environment and Conservation, March 8, 2023.

because they usually require less remediation.<sup>113</sup> The new program will rely on local government participation, and Division of Remediation staff acknowledge the need to publicize it in collaboration with other agencies, such as the Tennessee Department of Economic and Community Development, MTAS, and CTAS.

### **Tennessee’s solar facility decommissioning law was passed to address concerns about protecting landowners that are specific to solar development.**

Unlike for most other types of development, the likelihood exists that land can be returned to agricultural production or other prior uses after a solar facility reaches the end of its useful life. According to TenneSEIA, solar companies have extensive insurance coverage as required by their lenders and lease agreements, and therefore landowners would not be responsible for damage to the facility caused by a natural disaster or some other event.<sup>114</sup> But stakeholders have expressed concern that landowners could be responsible if something goes wrong with the solar facility on their land or the company that owns the facility goes bankrupt, doesn’t clean up damage, or doesn’t restore the site when the facility is no longer operating.

To further help ensure that landowners are protected, the General Assembly passed a solar power facility decommissioning law—Public Chapter 866, Acts of 2022 (appendix E)—which sets end-of-life requirements for solar facilities of at least 10 MW<sup>115</sup> on leased land. For facilities subject to the decommissioning law’s requirements, solar developers must remove components and restore the land to as close to the condition it was in before construction as reasonably as possible.<sup>116</sup> Electrical and communication lines buried more than three feet can remain. Tennessee also sets requirements for other types of energy-related facilities, including oil and gas wells, wind facilities, and coal mines, to decommission, reclaim, or restore the sites when they are no longer in operation.<sup>117</sup>

Under the decommissioning law, the solar developer lessee must provide a decommissioning plan to the landowner lessor that explains in detail how

Tennessee’s solar facility decommissioning law was passed in 2022 to help ensure that land can be returned to agricultural production or other prior uses after a solar facility reaches the end of its useful life.

<sup>113</sup> Interview with Steve Sanders, director, and Justin Meredith, environmental fellow, Division of Remediation, Tennessee Department of Environment and Conservation, March 8, 2023; and email received from Justin Meredith, June 13, 2023.

<sup>114</sup> Interview with Gil Hough, executive director, and Chris Bowles, attorney, TenneSEIA, August 29, 2023; and email received from Gil Hough, executive director, TenneSEIA, April 5, 2023.

<sup>115</sup> Tennessee’s law specifies that MW are alternating current (ac), which is commonly used for the operating capacity or nameplate capacity of solar facilities. National Renewable Energy Laboratory 2013; and Marcy 2018.

<sup>116</sup> Tennessee Code Annotated, Section 66-9-207.

<sup>117</sup> Rules of the Tennessee Department of Environment and Conservation, Chapters 400.42, 400.44, and 400.52; and Tennessee Code Annotated, Sections 59-8-106, 59-8-109, and 65-17-101 et seq.

For solar facilities subject to the decommissioning law's requirements, solar developers must remove components and restore the land to as close to the condition it was in before construction as reasonably as possible, and they must also provide financial assurance to the landowner.

the company will meet the requirements in the law.<sup>118</sup> If the landowner and company are affiliated—for example if the company purchases the land and becomes the landowner—the requirements of the law can be waived. Agreements for facilities that are smaller than 10 MW are not prohibited from having a decommissioning plan, though they are not required to have them under the law. Local governments cannot impose requirements that are more stringent than or in addition to those in state law.

The solar developer must also provide financial assurance—a legal guarantee—to the landowner unless the facility is smaller than 10 MW. Financial assurance is proof that business owners have sufficient funds to pay for clean-up, damage, and often long-term maintenance, remediation, and monitoring of closed facilities. In Tennessee, it is required for businesses that operate solid and hazardous waste storage facilities, oil and gas wells, and processors of radioactive materials.<sup>119</sup> The solar decommissioning law requires that financial assurance must cover the decommissioning cost of a solar facility, which is defined as “the estimated cost of performing the removal and restoration obligations . . . less the estimated salvage value of the components of the solar power facility as of the date of removal.”<sup>120</sup> Several acceptable forms of financial assurance are allowed, including a surety bond, collateral bond, irrevocable letter of credit, parent guaranty, cash, cashier's check, certificate of deposit, bank joint custody receipt, an approved negotiated instrument not described in the law, or a combination of the forms of security described in the law. Unless the landowner opts to accept the financial assurance on the 15<sup>th</sup> anniversary of the facility's operation start date, as allowed by law, specified amounts of financial assurance must be provided at certain times:

- (A) No less than five percent (5%) of the decommissioning cost on the date the solar power facility commences commercial operation
- (B) No less than fifty percent (50%) of the decommissioning cost on the tenth anniversary of the date the solar power facility commences commercial operation
- (C) No less than the decommissioning cost on the fifteenth anniversary of the date the solar power facility commences commercial operation

The legal definition of decommissioning cost accounts for the salvage value of equipment and materials, and it is possible, and even likely, that the salvage value will exceed the cost to decommission the site, including removal and disposal of materials and restoration of the site. Therefore,

<sup>118</sup> The law defines a solar power facility agreement as “a lease or easement agreement for real property between a grantee and a landowner for the construction, installation, and operation of all or a part of a solar power facility on such real property that generates electricity primarily for use and consumption off the premises.”

<sup>119</sup> Tennessee Department of Environment and Conservation “Financial Assurance Division.”

<sup>120</sup> Tennessee Code Annotated, Section 66-9-207.

the amount of financial assurance required under the law could be negligible or zero. In this case, if the solar company didn't fulfill its legal obligation to decommission the site and restore the land, the landowner would have to rely on selling the salvaged equipment to recoup the cost of decommissioning the facility on their own. Appendix K provides an example of a decommissioning plan and cost estimate for a 75 MW facility at the end of 40 years of operation.<sup>121</sup> In this example, the estimated decommissioning cost is \$3.1 million, while the total salvage value is estimated at \$5.7 million, a difference of \$2.6 million. Under Tennessee's law, because the salvage value exceeds the cost, financial assurance would not be required in this example.

Because the law went into effect on June 1, 2022, and no facilities subject to it have yet been decommissioned, the Commission could not evaluate its effectiveness at protecting landowners. Data on decommissioning from other states are limited as well. According to the US Energy Information Administration, data collected through 2022 show 14 solar sites in five states have been retired, and most of these were one MW or less.<sup>122</sup> Whether or how these facilities were decommissioned is unclear.

Currently, the federal Bureau of Land Management and 23 states, including Tennessee, have solar facility decommissioning laws (see map 4).<sup>123</sup> As of May 2023, three states—Arizona, New York, and Pennsylvania—have legislation pending that would enact solar equipment decommissioning-specific policies.<sup>124</sup> Other states' laws share similarities with Tennessee's law, such as requiring a decommissioning plan and usually proof of financial assurance prior to construction and a minimum MW capacity, although MW thresholds vary. Figure 6 shows MW thresholds in other states. But unlike Tennessee's law, eleven states<sup>125</sup> require greater specificity in how the decommissioning cost is calculated,<sup>126</sup> and all but Tennessee and Texas enforce their laws through state or local government regulatory authority (or both).<sup>127</sup> In Tennessee and Texas, disputes between landowners and solar companies regarding the decommissioning laws are resolved in the courts through civil actions. See table 4 for a summary of decommissioning plan and financial assurance requirements in other states and appendix L for more detail. See appendix M for the national Solar Energy Industry Association's (SEIA) model decommissioning legislation.

The federal Bureau of Land Management and 23 states, including Tennessee, have solar facility decommissioning laws, which have similarities and differences.

<sup>121</sup> Email received from a stakeholder who would like to maintain the company's privacy, August 8, 2023.

<sup>122</sup> US Energy Information Administration 2023.

<sup>123</sup> TACIR staff review of other states' statutes; and Curtis et al. 2021.

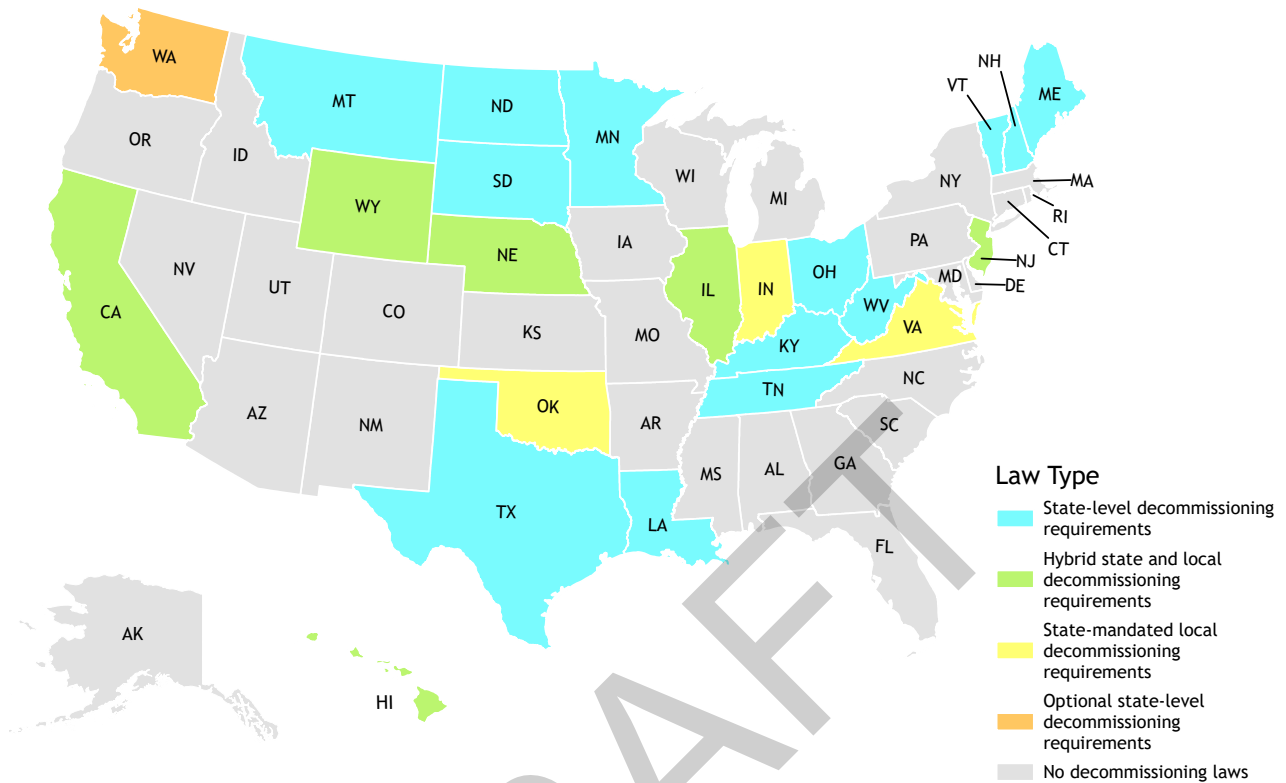
<sup>124</sup> Arizona (H.B. 2618); New York (S.B. 1793); and Pennsylvania (S.B. 211).

<sup>125</sup> California, Illinois, Indiana, Kentucky, Louisiana, Montana, Ohio, Texas, Vermont, Virginia, and West Virginia.

<sup>126</sup> They have step-by-step calculation requirements.

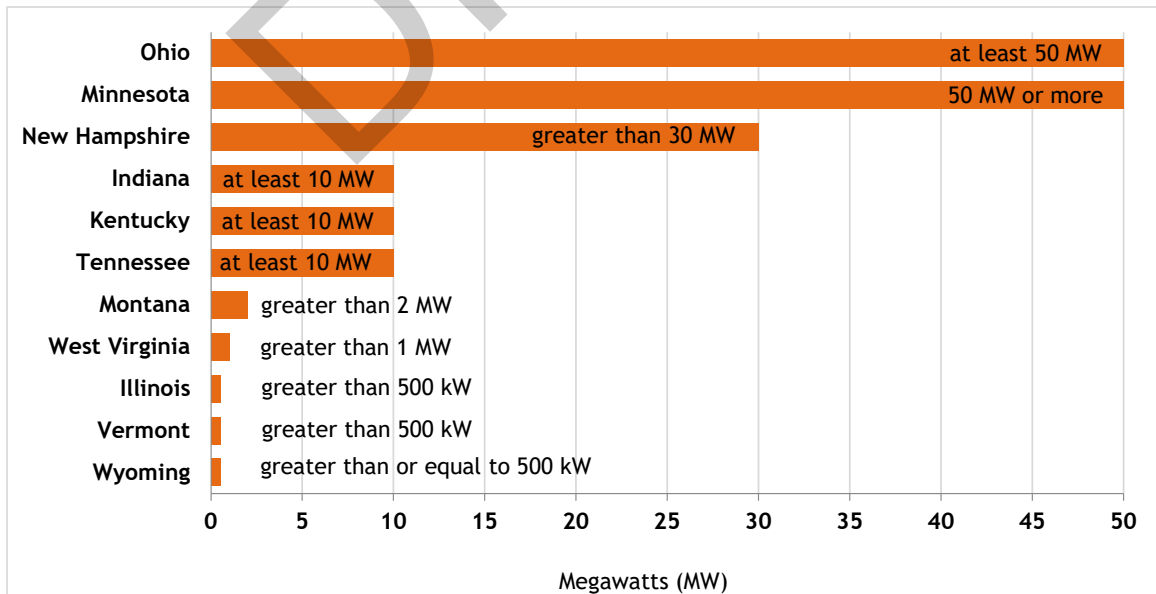
<sup>127</sup> Washington has an optional statewide solar decommissioning program that allows solar project owners to comply with a state certification process in lieu of obtaining local city and county government approvals.

**Map 4. States with Solar Decommissioning Laws**



Source: TACIR staff review of other states' statutes; and Curtis et al. 2021b. Tennessee and Texas state laws require a decommissioning plan and financial assurance but do not provide for state or local government oversight.

**Figure 6. Megawatt (MW) Thresholds for Solar Facility Decommissioning Requirements**



Note: 500 kW = 0.5 MW

Source: TACIR staff review of other states' statutes.



**Table 4. Summary of Decommissioning and Financial Assurance Laws**

State	Decommissioning Plan Required by State Law	Financial Assurance Required by State Law	Specify How Decommissioning Cost is Calculated	Level of Government that Provides Oversight
California	Yes	Yes	Yes	Hybrid state and local
Hawaii	No	Yes	No	Hybrid state and local
Illinois	Yes	Yes	Yes	Hybrid state and local
Indiana	Yes	Yes	Yes	Local
Kentucky	Yes	Yes	Yes	Hybrid state and local
Louisiana	Yes	Yes	Yes	State
Maine	Yes	Yes	No	State
Minnesota	Yes	Yes	No	State
Montana	Yes	Yes	Yes	State
Nebraska*	No	No	No	Hybrid state and local
New Hampshire	Yes	Yes	No	State
New Jersey	Yes	No	No	Hybrid state and local
North Dakota	Yes	Yes	No	State
Ohio	Yes	Yes	Yes	State
Oklahoma*	No	No	No	Local
South Dakota	Yes	Optional	No	State
Tennessee	Yes	Yes	No	None
Texas	Yes	Yes	Yes	None
Vermont	Yes	Yes	Yes	State
Virginia	Yes	Yes	Yes	Local
Washington	Optional	Yes	No	Optional state
West Virginia	Yes	Yes	Yes	State
Wyoming	Yes	No	No	Hybrid state and local

\*Nebraska and Oklahoma do have state-level solar decommissioning laws in place. However, they do not set any requirements for decommissioning plans or financial assurance. Instead, the statutes delegate the authority to the local governments, which may prescribe decommissioning plans and financial assurance requirements. However, R.R.S. Neb. § 70-1014.02(2)(b) says “if the local jurisdiction has not enacted decommissioning requirements, then the Nebraska Power Review Board may bring an action in the name of the State of Nebraska for failure to comply with decommissioning.”

Source: TACIR staff review of other states' statutes; and Curtis et al. 2021b.

Among the 23 states with decommissioning laws, 19 have laws that require solar project owners to submit a decommissioning plan. Fifteen states require financial assurance be provided to a state agency or a local government.<sup>128</sup> New Jersey and Wyoming require a decommissioning plan but not proof of financial assurance. Hawaii does not require a decommissioning plan but does require proof of financial assurance. A decommissioning plan is optional in Washington, and financial assurance is optional in South Dakota. Nebraska and Oklahoma do not have specific statewide decommissioning plan requirements, but instead require compliance with local government rules and regulations. Tennessee and Texas are the only states that require a decommissioning plan and financial

<sup>128</sup> California, Hawaii, Illinois, Indiana, Kentucky, Louisiana, Maine, Minnesota, Montana, New Hampshire, North Dakota, Ohio, Vermont, Virginia, and West Virginia.

Consumers who contract with a company to install solar panels on their residence are protected by Tennessee’s consumer protection laws—the Consumer Protection Act and Home Solicitations Sales Act.

assurance be submitted only to the landowner. Five states<sup>129</sup> require solar facility owners to provide periodic updates to decommissioning plans, cost estimates, or financial assurance instruments after project construction or operation.

### ***There are specific concerns about fraud and consumer protection for residential solar installations.***

Stakeholders generally agree that most of the fraud committed in the solar industry is happening in the residential solar market, not in the utility-scale market. The Tennessee Office of the Attorney General and Reporter’s Division of Consumer Affairs—the state agency that receives complaints from consumers about businesses—received complaints associated with nine residential solar companies between 2020 and 2023.<sup>130</sup> Of the 498 total complaints received, 477 were directed at two companies. Residential solar installations by these two companies were often more expensive than other companies—sometimes approaching \$100,000<sup>131</sup>—and sometimes included long-term interest payments to a finance company.<sup>132</sup> For some homeowners, adding a non-functioning solar system led to a decreased home value.<sup>133</sup> According to *Forbes*, the average cost of residential solar panels in Tennessee is \$10,293, and the national average is \$16,000.<sup>134</sup>

There are protections in state law for those who purchase residential solar systems. Consumers who contract with a company to install a solar system on their residence are protected by Tennessee’s consumer protection laws—the Consumer Protection Act<sup>135</sup> and Home Solicitations Sales Act.<sup>136</sup> The maximum civil fine for violations of the Tennessee Consumer Protection Act is \$1,000, which is on the low end of civil fine maximums compared to other states.<sup>137</sup> A review of other states’ laws finds their maximum penalties generally range from \$1,000 to \$50,000 per violation.<sup>138</sup>

<sup>129</sup> Louisiana, Montana, North Dakota, Ohio, and Vermont.

<sup>130</sup> TACIR staff analysis of data received in an email from Claire Marsalis, director, Division of Consumer Affairs, Office of the Tennessee Attorney General, April 6, 2022.

<sup>131</sup> *Ibid.*

<sup>132</sup> Interview with Kelley Groover, senior assistant attorney general, Sam Keen, assistant attorney general, Alicia Daniels-Hill, assistant attorney general, and Claire Marsalis, director, Division of Consumer Affairs, Office of the Tennessee Attorney General, February 24, 2023.

<sup>133</sup> Tennessee Attorney General and Reporter 2022; Tennessee Attorney General and Reporter 2023; and Commonwealth of Kentucky Office of the Attorney General 2022.

<sup>134</sup> Brill and Oglethorpe 2023; and interview with Kelley Groover, senior assistant attorney general, Sam Keen, assistant attorney general, Alicia Daniels-Hill, assistant attorney general, and Claire Marsalis, director, Division of Consumer Affairs, Office of the Tennessee Attorney General, February 24, 2023.

<sup>135</sup> Tennessee Code Annotated, Section 47-18-101 et seq.

<sup>136</sup> Tennessee Code Annotated, Section 47-18-701 et seq. The Home Solicitations Sales Act provides certain cancellation rights when sales occur in a person’s home, from the back of a truck, or anywhere but the seller’s established place of business.

<sup>137</sup> National Consumer Law Center 2018.

<sup>138</sup> *Ibid.*

Agencies are already working to help consumers avoid fraud—Tennessee Valley Authority (TVA), local power companies (LPC), and the TDEC Office of Energy Programs each have information for homeowners on their websites about residential solar installation.<sup>139</sup> Other states are also educating homeowners about protecting themselves—for example, the California Public Utilities Commission hosts a website providing consumer protection information and resources, Georgia’s Attorney General’s Consumer Protection Division maintains a website with guidance, and North Carolina developed a consumer guide to solar electricity.<sup>140</sup> Some stakeholders in Tennessee have also expressed concerns about safety related to residential solar installations, which are briefly discussed in figure 7.

### Figure 7. Residential Solar Safety Issues

Representatives of the Tennessee State Fire Marshal’s Office and the Board for Licensing Contractors agree that solar installations are unique and complex and that there are some safety issues specific to installing solar on residences. Staff from the State Fire Marshal’s Office report many instances of improper residential solar installation, including systems not properly grounded, the connection to the grid not wired correctly, structural damage to homes, non-functioning panels, and not leaving the required space around panels for firefighters to safely access the roof in case of an emergency. When a residential solar system feeds power to the grid, poor installation can expose local power company line workers to hazardous electrical currents. The National Electric Code requires “qualified personnel” to install solar systems, although this term is loosely defined, and the state has implemented this by requiring solar systems to be installed by a licensed electrician.

Source: Interview with Michael Morelli, executive director, Board of Licensing Contractors, Tennessee Department of Commerce and Insurance, February 14, 2023, and email received March 23, 2023.

### ***The Tennessee Valley Authority, local power companies, and the state are encouraging and supporting solar development in Tennessee, and financial incentives are available.***

The TVA is the utility that produces most of Tennessee’s electricity and serves local power companies (LPC) in Tennessee. It sells power wholesale to the LPCs, and LPCs sell it retail to their customers, the consumers. Although solar power is a relatively small part of TVA’s energy generation mix, TVA and the local power companies it serves have programs to support solar development, and the Tennessee Department of Economic

<sup>139</sup> Tennessee Valley Authority “Green Connect”; Middle Tennessee Electric “Renewables”; and Tennessee Department of Environment and Conservation “Energy Resources.”

<sup>140</sup> California Public Utilities Commission “California Solar Consumer Protection Guide Overview & FAQ”; Georgia Attorney General’s Consumer Protection Division “Solar Power for Your Home”; and North Carolina Sustainable Energy Association 2019.

Although TVA has phased out its residential solar incentive programs, it currently has a few programs to encourage solar development.

and Community Development and TVA agree that solar is an important part of economic development in the state.<sup>141</sup> Further, federal, state, and private financial incentives assist and encourage both utility-scale and residential solar development. Appendix N is a summary of available incentives as of August 2023. Because of the federal Inflation Reduction Act (IRA), passed in 2022, TVA, LPCs, and government agencies are now eligible for tax credits directly. Prior to the passage of the IRA, government entities like TVA only received value from the credits through agreements with private entities because government agencies don't have tax liability on which to use the credits. Government entities can now receive direct payments.<sup>142</sup>

### **TVA has programs for both utility-scale and residential solar.**

TVA is taking several approaches to add 10,000 MW of solar capacity in its service territory by 2035—a “more than a 15-fold increase from today’s operating solar.”<sup>143</sup> In July 2022, the agency announced a request for proposals for 5,000 MW of carbon-free energy that must be operational before 2029, and in May 2023, it said it would begin awarding contracts to 40 solar facilities for a total of approximately 6,000 MW.<sup>144</sup> These facilities could be operational by 2032. TVA’s programs have changed over time, but to meet its goals, its current solar programs for commercial, industrial, and residential customers include Dispersed Power Production, Green Invest, Green Switch, and Green Connect. Although the Inflation Reduction Act includes new and enhanced incentives for residential solar, TVA has phased out its residential solar incentive programs.<sup>145</sup> The current options it offers are described and compared in its “Valley Renewable Energy Solutions Guide” to help businesses determine which program makes sense for them and their customers.<sup>146</sup> The programs include

- Dispersed Power Production - allows residential and commercial renewable electricity-generating facilities up to 80 MW to sell all or excess generation to TVA at TVA’s monthly avoided cost;
- Green Invest - TVA competitively procures “new-to-the-world” commercial renewables within TVA territory to match customers’ renewable energy or carbon-neutral goals;

<sup>141</sup> Interviews with Chassen Haynes, senior director of business development, Tennessee Department of Economic and Community Development, January 24, 2023; and Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022.

<sup>142</sup> US Department of the Treasury 2022; and US Department of the Treasury “Fact Sheet: Treasury, IRS Open Public Comment on Implementing the Inflation Reduction Act’s Clean Energy Tax Incentives.”

<sup>143</sup> Tennessee Valley Authority 2021; and Tennessee Valley Authority 2022.

<sup>144</sup> Flessner 2023a; Flessner 2023b; and Pare 2022.

<sup>145</sup> US Department of the Treasury “Fact Sheet: Treasury, IRS Open Public Comment on Implementing the Inflation Reduction Act’s Clean Energy Tax Incentives”; and Tennessee Advisory Commission on Intergovernmental Relations 2023.

<sup>146</sup> Tennessee Valley Authority “Valley Renewable Energy Solutions Guide”; and Tennessee Valley Authority “Renewable Highlights Fiscal Year 2022.”

- Green Switch - allows residential and commercial customers to purchase \$2 blocks of 200 kWh of solar power;
- Green Connect - “helps residential customers who are ready to commit to a solar generation system (with or without battery storage) connect with quality installers. Customers have access to objective information and a network of quality installers, as well as receive installation verifications to ensure their systems are installed to TVA Green Connect standards;”<sup>147</sup> and
- Virtual Solar Education - A website with information to educate the public about solar energy and assist homeowners who are interested in residential solar.<sup>148</sup>

In addition to these programs that encourage businesses and consumers, in 2020, TVA implemented a power supply flexibility option to encourage LPCs to develop more utility-scale solar generation and supplement TVA’s renewable energy generation.<sup>149</sup> The option allows LPCs that have signed long-term agreements—20 years—with TVA to produce or purchase 5% of their power from entities within the LPC’s service territory other than TVA.<sup>150</sup> Previously, they weren’t allowed to do this, and all non-TVA-owned power had to be sold to TVA (then sold back to LPCs, then sold to customers).<sup>151</sup> As of November 2022, 80 LPCs have signed on to the flexibility agreement.<sup>152</sup> BrightRidge—formerly Johnson City Power Board—is one example of an LPC moving forward with solar and taking advantage of TVA’s 5% option. The LPC, which serves customers in the northeastern part of the state, partnered with TVA and solar developer Silicon Ranch to develop two facilities in Washington County totaling 14 MW and broke ground on a smaller one that will offset electricity use at its administration building and serve as a demonstration project and educational resource.<sup>153</sup>

In 2022, TVA expanded the authorization in the flexibility agreements by allowing LPCs to generate or purchase the allowed 5% of power from outside their service territories or partner with other LPCs. This helps LPCs with limited access to land, especially in urban and metropolitan areas. For

TVA implemented a power supply flexibility option in 2020, which is helping local power companies develop more utility-scale solar generation and supplement TVA’s renewable energy generation.

<sup>147</sup> Tennessee Valley Authority “Green Connect.”

<sup>148</sup> Tennessee Valley Authority “TVA’s Virtual Solar Education Area.”

<sup>149</sup> Flessner 2022a; and Tennessee Valley Authority 2020.

<sup>150</sup> Tennessee Valley Authority 2020.

<sup>151</sup> Interview with David Callis, executive vice president and general manager, and Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, September 9, 2022.

<sup>152</sup> Tennessee Advisory Commission on Intergovernmental Relations 2023.

<sup>153</sup> BrightRidge 2023; BrightRidge “BrightRidge’s Commitment to Clean Energy”; and interview with Jeff Dykes, chief executive officer, BrightRidge, June 2, 2023.

Local power companies in Tennessee are making efforts to encourage and expand solar power options for their customers.

example, Nashville Electric Service (NES) is looking at opportunities for utility-scale solar outside Davidson County through TVA’s 5% option.<sup>154</sup>

### **Local power companies are expanding solar options for their customers.**

Although LPCs in Tennessee mostly distribute power that TVA produces, some are making efforts to encourage and expand solar power and are at different stages of adjusting to the solar energy transition. For example, some LPCs are working with solar developers on smaller projects of one to two MW—including community solar projects. Knoxville Utility Board (KUB) has a 20% renewable goal because their customers want more renewables, and KUB staff say TVA’s flexibility option is helping them reach their goal.<sup>155</sup> KUB also contracted with TVA to purchase solar-generated electricity from West Tennessee to reach its goal and has not contracted directly with any solar developers.

Middle Tennessee Electric (MTE) is another example of an LPC that has developed several programs to assist its customers and encourage solar. Because some of their customers asked for solar, they have tried to provide services for them without burdening the customers that didn’t request it.<sup>156</sup> To offer solar to their customers that are unable to do solar on their own but want access to it, they built a one MW cooperative community solar project that allows MTE to take advantage of economies of scale while providing an opportunity for people to participate in solar if they so choose. Another program, Green Switch 100, is a modified version of TVA’s Green Switch—rather than buying blocks of green power, people can match 100% of their electricity consumption with solar generation by paying an extra one penny per kilowatt-hour. This provides an option for people who want to be 100% solar but can’t do it on their own. MTE’s ProSolar program provides free consultation to share information about solar installations with its commercial and residential members and help them set realistic expectations.<sup>157</sup>

### **The state also has programs supporting solar development.**

TDEC’s Office of Energy Programs (OEP) is responsible for promoting “efficient, effective use of energy to enhance the environmental and

<sup>154</sup> Tennessee Advisory Commission on Intergovernmental Relations 2023; and interview with Kendra Abkowitz, chief sustainability & resilience officer, Office of Mayor John Cooper, and Laurel Creech, assistant director, General Services Division of Sustainability, Metropolitan Government of Nashville & Davidson County, February 14, 2023.

<sup>155</sup> Interview with Mike Bolin, vice president of utility advancement, and Chastity Hobby, environmental programs lead, Knoxville Utility Board, September 14, 2022; and Tennessee Valley Authority “Case Study: Knoxville Utilities Board Leads Southeast in Renewable Energy Investment through Green Invest Program.”

<sup>156</sup> Interview with Brad Gibson, chief operating officer, and Tim Suddoth, distributed energy resources coordinator, Middle Tennessee Electric, April 12, 2023.

<sup>157</sup> Middle Tennessee Electric “Renewables.”

economic health of the state.”<sup>158</sup> This is accomplished by providing education, outreach, technical assistance, and funding opportunities for energy-related topics, such as energy efficiency, energy management, and renewable energy. OEP staff respond to inquiries about solar energy, provide people with information about TVA programs and financial incentives, and refer people to the appropriate resources or agencies.<sup>159</sup> They maintain a website with information about renewable energy with links to resources, programs, and organizations.<sup>160</sup> OEP staff say it would be beneficial to have a state website that serves as a one-stop shop to assist local governments, landowners, developers, and homeowners in Tennessee with solar, and they are open to working with MTAS, CTAS, the Tennessee Chapter of the American Planning Association, and other agencies to expand, update, and maintain OEP’s existing website.<sup>161</sup>

To encourage the use of solar energy, TDEC’s Office of Sustainable Practices administers the Certified Green Energy Production Facilities program, which provides an incentive for solar and other clean energy technologies, including geothermal, hydrogen, and wind sources.<sup>162</sup> Facilities that produce or store electricity using clean energy technology can apply to receive certification as a Certified Green Energy Production Facility. These facilities could be eligible for sales and use tax incentives, either through a refund, credit, or tax exemption on purchases of machinery and equipment used to produce or store electricity. Additionally, these facilities could be exempt from the tangible personal property portion of the franchise tax but not from the net worth portion.<sup>163</sup> Between May 2011, when the program was implemented, and July 2023, the Office of Sustainable Practices approved a total of 1,219 facilities.<sup>164</sup> In 2022, the General Assembly passed Public Chapter 1139, which allows projects that produce energy used either on- or off-site to participate in the program,

TDEC’s Office of Energy Programs maintains a website with information about renewable energy and links to resources, programs, and organizations.

<sup>158</sup> Tennessee Department of Environment and Conservation 2023e.

<sup>159</sup> Interview with Molly Cripps, director, Ben Bolton, senior energy programs administrator, and Taylor Tavormina, executive administrative assistant, Office of Energy Programs, Tennessee Department of Environment and Conservation, December 19, 2022.

<sup>160</sup> Tennessee Department of Environment and Conservation “Energy Resources.”

<sup>161</sup> Interview with Molly Cripps, director, Ben Bolton, senior energy programs administrator, Taylor Tavormina, executive administrative assistant, and Blair Beatty, director of legislative affairs, Office of Energy Programs, Tennessee Department of Environment and Conservation, April 24, 2023.

<sup>162</sup> Tennessee Department of Environment and Conservation 2023a.

<sup>163</sup> Tennessee Code Annotated, Sections 67-4-2004, 67-4-2108, and 67-6-346; Tennessee Department of Revenue 2023; and email received from Matt Taylor, deputy director, Office of Sustainable Practices, Tennessee Department of Environment and Conservation, August 9, 2023.

<sup>164</sup> Email received from Heather Weldon, executive administrative assistant, Office of Sustainable Practices, Tennessee Department of Environment and Conservation, August 28, 2023. For fiscal years 2009-10 through 2021-22, the program cost, including the sales tax revenue that would have been generated if the exemption didn’t exist, was estimated at \$100,000 per year, and for fiscal year 2022-23, the cost is estimated at \$136,400. Email received from Colleen Swinney, manager, Taxpayer Services Division, Tennessee Department of Revenue, August 28, 2023.

According to researchers from the University of Tennessee's Institute of Agriculture, "there are best practices, but what works varies by location."

Issues with the siting, design, and permitting process can be identified more quickly if developers work directly with state environmental agencies, such as TDEC, early in the planning process.

essentially including small and residential projects in the program.<sup>165</sup> The law also added energy storage projects as eligible to participate.

***Other states, agencies, and organizations provide many examples of best practices for both utility-scale and residential solar.***

Solar development is not new, and across the country, universities, federal and state agencies, and nonprofit organizations have created resources and guides with best practices to assist state and local governments, landowners, developers, and homeowners. Some of these are included in appendix I, and a few of the best practices are summarized in table 1 (reposted). While these ideas are considered best practices<sup>166</sup> because they are compiled from multiple sources, and there is agreement that they are helpful and beneficial, as researchers from the University of Tennessee's Institute of Agriculture acknowledged, "there are best practices, but what works varies by location."<sup>167</sup> There is general agreement that gathering information, including best practices, regulations, and laws, in a central, accessible website for all stakeholders in a state is helpful.

When developers work directly with state environmental agencies, it can help with the siting, design, and permitting process.<sup>168</sup> Issues with construction permitting, for instance, can be identified more quickly if TDEC is involved early in the planning process. While permitting solar development is no different from permitting other types of development in Tennessee, other states such as Kentucky, North Carolina, and Virginia have developed environmental guidelines specifically for utility-scale solar development.<sup>169</sup> Environmental offices in some other states recommend panel height, buffers, and fencing to both solar developers and landowners.

Some states and agencies have created toolkits to assist and guide local governments with planning and zoning for solar development. Georgia, Kentucky, New York, and North Carolina have created resource toolkits that provide information for local governments, landowners,

<sup>165</sup> Interview with Matt Taylor, deputy director, Office of Sustainable Practices, Tennessee Department of Environment and Conservation, January 31, 2023.

<sup>166</sup> The *Merriam-Webster Dictionary* defines best practice as "a procedure that has been shown by research and experience to produce optimal results and that is established or proposed as a standard suitable for widespread adoption."

<sup>167</sup> Interview with Forbes Walker, professor and environmental soil specialist, UT Extension, and Christopher Clark, head, Karen Lewis DeLong, associate professor, and David Hughes, professor, Department of Agricultural & Resource Economics, University of Tennessee Institute of Agriculture, February 16, 2023.

<sup>168</sup> Interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023.

<sup>169</sup> Kentucky Energy and Environment Cabinet "Kentucky Solar Toolkit"; North Carolina Department of Environmental Quality 2018; and Virginia Department of Wildlife Resources 2022.



developers, and homeowners.<sup>170</sup> Toolkits generally provide information on permitting, development timelines, stormwater management, and brownfield and greenfield development, among other topics. The US Department of Energy, Farm Energy Initiative, National Association of State Energy Officials, SolSmart, and other agencies and organizations have also developed guidelines and considerations for decision-making and effective solar development.<sup>171</sup>

Along with state and local governments, best practices exist for solar developers. The International Finance Corporation published a resource document with best practices for developers along with environmental and social guidelines,<sup>172</sup> and SEIA created a solar business code with guidelines for its members to “promote transparency, good faith, and understanding in the US solar energy industry.”<sup>173</sup> Stakeholders say a relationship and engagement with the community are important for building trust and minimizing fraud, and they further build trust when they notify the local planning department about their project and communicate about potential concerns and permitting requirements.<sup>174</sup> Understanding building and environmental permits and licensing requirements ahead of selecting and designing the site and an awareness of how jurisdictions regulate development can save time and money both for solar developers and the community. Communicating with the Tennessee Office of State Assessed Properties about changes to land use, from agriculture to utility for example, is important so that both developers and landowners understand the property tax implications associated with a change in land use designation.<sup>175</sup>

Power purchase agreements and lease agreements are key components of solar development. SEIA created guides to understanding both types of agreements that include resources to help with both utility-scale and residential solar.<sup>176</sup> To standardize solar transactions and protect consumers, the National Renewable Energy Laboratory created model contracts for solar development, which SEIA has endorsed and modified for solar developers as well as landowners and consumers.

Stakeholders say communication and engagement with the community and local planning department are important for building trust and minimizing fraud.

Power purchase agreements and solar lease agreements are complicated, and consulting with an attorney when beginning to consider a solar agreement is one of the most important actions a landowner can take.

<sup>170</sup> EPICenter at Georgia Tech “Georgia’s Model Solar Ordinance”; Kentucky Energy and Environment Cabinet “Kentucky Solar Toolkit”; New York State Energy Research and Development Authority 2022; and Lovelady 2014.

<sup>171</sup> Fekete et al. 2023; SolSmart 2022; and Ross et al. 2023.

<sup>172</sup> Lumby et al. 2015.

<sup>173</sup> Solar Energy Industries Association 2015.

<sup>174</sup> Interview with Erin Curran, analyst, government affairs, and Laurel Downen, lead developer, Southeast Region, Invenergy, August 12, 2022.

<sup>175</sup> Interviews with Jason Stewart, senior specialist, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, November 4, 2022; and Greg Moody, director, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, February 28, 2023.

<sup>176</sup> Solar Energy Industries Association “Finance & Tax”; Solar Energy Industries Association “Land Use & Solar Development”; Solar Energy Industries Association “Model Leases and PPAs”; and Solar Energy Industries Association 2016.

Homeowners considering residential solar can take steps to protect themselves, such as contacting their local power company to evaluate whether solar panels would be cost-effective for them and verifying the legitimacy and quality of various solar companies.

A couple of practices are particularly helpful for landowners to protect themselves. Consulting with an attorney—if possible, one with expertise in solar facility leases—when beginning to consider a solar agreement is one of the most important actions a landowner can take.<sup>177</sup> For example, the North Carolina Extension office published a list of considerations for landowners contemplating solar options that an attorney could help navigate. Considerations include determining whether there is a clear title; evaluating any limitations from easements, conservation programs, farm tenants, and lessors; obtaining zoning and special use permits; and resolving property tax issues. In addition, if possible, talking to neighbors and other landowners interested in leasing their land for solar before entering into an agreement and being familiar with general lease and purchase amounts can help landowners make educated decisions.<sup>178</sup>

Similar to landowners, homeowners considering residential solar can take steps to protect themselves. For instance, first contacting their local power company helps homeowners evaluate their energy consumption and whether solar panels would be cost-effective for them.<sup>179</sup> Additionally, as with any home improvement project, it is good practice to talk with several companies and verify their legitimacy and quality. TenneSEIA maintains a code of conduct and ethical standards for its members that is a resource for finding companies for both residential and utility-scale solar in Tennessee, and consumers could also hire solar installers with certifications such as those offered by the North American Board of Certified Energy Practitioners.<sup>180</sup> TVA provides assistance through its Green Connect program, and the TDEC Office of Energy Programs assists homeowners, answers questions, and provides guidance on available incentives.<sup>181</sup>

<sup>177</sup> Branan 2022; and Hannum et al. 2022.

<sup>178</sup> Hannum et al. 2022.

<sup>179</sup> Interview with Brian Solsbee, executive director, Jeremy Elrod, director of government relations, and Savannah Gilman, government relations assistant, Tennessee Municipal Electric Power Association, August 30, 2022.

<sup>180</sup> Solar Energy Industries Association 2015; and interview with Michael Morelli, executive director, Board of Licensing Contractors, Tennessee Department of Commerce and Insurance, February 14, 2023.

<sup>181</sup> Interview with Molly Cripps, director, Ben Bolton, senior energy programs administrator, and Taylor Tavormina, executive administrative assistant, Office of Energy Programs, Tennessee Department of Environment and Conservation, December 19, 2022.

Table 1 (reposted). Examples of Best Practices for Utility-Scale and Residential Solar Development

Entity	Best Practices	Resource Examples	Sources
		<b>Utility-Scale Solar</b>	
<b>State Government</b>	Implement solar decommissioning law	Solar Energy Industries Association (SEIA) "Model Solar Energy Facility Decommissioning Legislation" (see appendix M)	Curtis et al. 2021b
	Develop model ordinances to guide local governments	Georgia Model Solar Ordinance (see appendix I)	Gomez and Morley 2022
	Educate about common issues with regulations for permitting solar development	North Carolina Department of Environmental Quality "Stormwater Design Manual"	Virginia Department of Wildlife Resources 2022; and interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023
	Create a resource document or webpage for solar development in the state, including but not limited to applicable environmental permits and zoning guidelines	Kentucky Solar Toolkit	Kentucky Energy and Environment Cabinet "Kentucky Solar Toolkit"; and Fekete et al. 2023
	Incentivize the use of disturbed or degraded lands with little vegetation or poor soil quality, such as brownfields and former mining sites	The Nature Conservancy "Power of Place National: Executive Summary"	Email received from Lindsay Hanna, director of government relations & climate policy, Tennessee Chapter, The Nature Conservancy, July 18, 2023
<b>Local Governments</b>	Use authority to adopt zoning	Tennessee Model Solar Zoning Ordinance (see appendix C)	Coffey 2019; Skehan 2020; and Tennessee Code Annotated, Sections 13-7-101 and 13-7-201
	Establish solar zoning ordinances with guidelines for permitting, siting, setbacks, panel height, buffering, and decommissioning plans	Haywood County Zoning Resolution (see appendix D)	Gomez and Morley 2022
	Identify and redevelop brownfields, parking lots, and non-prime farmland with solar	US Environmental Protection Agency (EPA) and National Renewable Energy Laboratory (NREL) "Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills"	Tennessee Code Annotated, Section 68-212-220; Tennessee Department of Environment and Conservation "Brownfield Voluntary Cleanup Oversight and Assistance Program"; and US Environmental Protection Agency 2023m

Entity	Best Practices	Resource Examples	Sources
<p><b>Developers</b></p>	<p>Use established templates and guidelines for power purchase agreements and solar leases</p>	<p>US EPA "Understanding Third-Party Ownership Financing Structures for Renewable Energy"</p>	<p>US Environmental Protection Agency 2023i; Solar Energy Industries Association "Model Leases and PPAs"; and Solar Energy Industries Association 2016</p>
	<p>Thoroughly evaluate site selection, facility design, and permit and licensing requirements</p>	<p>US EPA "On-Site Project Development Process"</p>	<p>Doyle et al. 2015</p>
	<p>Communicate and coordinate early in the planning and design process with community stakeholders such as state environmental offices, like Tennessee Department of Environment and Conservation (TDEC), and local governments</p>	<p>TDEC Division of Water Resources</p>	<p>Lumby et al. 2015; University of Massachusetts Clean Energy Extension 2022; and interview with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023</p>
	<p>Seek to avoid effects on wildlife and habitat by consulting with the Tennessee Wildlife Resources Agency (TWRA) to identify sensitive habitats and species of Greatest Conservation Need</p>	<p>TWRA "Tennessee State Wildlife Action Plan"</p>	<p>Email received from Lindsay Hanna, director of government relations &amp; climate policy, Tennessee Chapter, The Nature Conservancy, July 18, 2023</p>
	<p>Use land for solar and agriculture or pollinator habitats (dual use, agrivoltaics, or agrisolar)</p>	<p>NREL "Agrivoltaics Primer"</p>	<p>Macknick et al. 2022; The Nature Conservancy 2023; and University of Maine "Cooperative Extension: Maine Wild Blueberries"</p>
	<p>Allow for wildlife connectivity with wildlife-friendly fencing methods and retain or plant vegetation or trees in buffers for streams, wetlands, and perimeters</p>	<p>The Nature Conservancy "Power of Place National: Executive Summary"</p>	<p>Kalies 2023</p>
<p>Follow ethical guidelines</p>	<p>SEIA "Solar Business Code"</p>	<p>TenneSEIA "Code of Ethics"</p>	

Entity	Best Practices	Resource Examples	Sources
Landowners	Consult with an attorney, if possible, one with expertise in solar facility leases	National Agricultural Law Center "Understanding Solar Energy Agreements"	Branan 2022; and Hannum et al. 2022
	Understand the long-term implications of leasing or selling land	Cornell College of Agriculture and Life Sciences "Considerations when Leasing Agricultural Lands to Solar Developers"	American Farmland Trust "Smart Solar <sup>SM</sup> on Farmland and Ranchland: Strengthening Farm Viability and Soil Health While Growing Renewable Energy"; and US Environmental Protection Agency 2023n
	Understand property tax implications and any rollback taxes associated with changes in property use designation	Tennessee Comptroller of the Treasury "Greenbelt Manual"	Nuckols 2020; and interview with Greg Moody, director, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, February 28, 2023
	Talk with neighbors and other landowners who are considering leasing or who are leasing their land for solar development	American Farmland Trust "Solar Leasing: A Guide for Agricultural Landowners in the Pacific Northwest"	Hannum et al. 2022
	Put land in a conservation easement or trust to preserve it	Tennessee Department of Agriculture "Land Protection Options"	Conservation Easement Act of 1981, Tennessee Code Annotated, Section 66-9-303
	Understand the limitations of easements and conservation programs for solar development	WeConservePA "Solar Energy Development and Land Conservation"	Conservation Easement Act of 1981, Tennessee Code Annotated, Section 66-9-303; Tennessee Department of Agriculture "Land Protection Options"; and Land Trust for Tennessee "Protect Your Land"

Entity	Best Practices	Resource Examples	Sources
State Government	Create a resource webpage with information for consumers	Residential Solar Georgia "Solar Power for Your Home"	Interview with David Callis, executive vice president and general manager, and Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, September 9, 2022
Homeowners	Speak with local electric company regarding cost-effectiveness and return on investment	Middle Tennessee Electric "ProSolar"	Interview with Brian Solsbee, executive director, Jeremy Elrod, director of government relations, and Savannah Gilman, government relations assistant, Tennessee Municipal Electric Power Association, August 30, 2022
	Evaluate residential solar companies for legitimacy and cost	TVA "Green Connect"	Interstate Renewable Energy Council (IREC) 2016
	Call the TDEC Office of Energy programs to answer questions regarding residential solar development and any active incentive programs	TDEC "Office of Energy Programs"	Interview with Molly Cripps, director, Ben Bolton, senior energy programs administrator, and Taylor Tavormina, executive administrative assistant, Office of Energy Programs, Tennessee Department of Environment and Conservation, December 19, 2022
	Consider using providers certified by the North American Board of Certified Energy Practitioners and companies that are members of TenneSEIA, as they are bound by a code of ethics	TenneSEIA "Membership"	Solar Energy Industries Association 2015; and North American Board of Certified Energy Practitioners "NABCEP Board Certifications"

Note: These examples of best practices are discussed in multiple resources from other states, government agencies, and organizations and TACIR staff interviews with stakeholders.

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## Persons Contacted

Kendra Abkowitz, Chief Sustainability & Resilience  
Officer  
Office of Mayor John Cooper  
Metropolitan Government of Nashville & Davidson  
County

Jeff Aiken, Deputy Commissioner  
Tennessee Department of Agriculture

Craig Almanza, Deputy Director  
Central Office Operations  
Division of Solid Waste Management  
Tennessee Department of Environment and  
Conservation

Rogers Anderson, Mayor  
Williamson County

Melissa Ashburn, Legal Consultant  
University of Tennessee  
Municipal Technical Advisory Service

Larson Baker, Energy Market Analyst  
Redeux Energy

Scott Banbury, Conservation Program Coordinator  
and Lobbyist  
Sierra Club Tennessee Chapter

Michael Banks, Former County Attorney  
Haywood County

Lee Barber, Manager of the Natural Resources Unit  
Division of Water Resources  
Tennessee Department of Environment and  
Conservation

Matt Beasley, Chief Commercial Officer  
Silicon Ranch

Blair Beaty, Director of Legislative Affairs  
Office of Energy Programs  
Tennessee Department of Environment and  
Conservation

Brian Blackmon, Director  
Office of Sustainability  
City of Knoxville

Mike Bolin, Vice President of Utility Advancement  
Knoxville Utility Board

Ben Bolton, Senior Energy Programs Administrator  
Office of Energy Programs  
Tennessee Department of Environment and  
Conservation

Chris Bowles, Partner  
Bradley Arant Boult Cummings LLP  
Board Member, Tennessee Solar Energy Industries  
Association (TenneSEIA)

Roger Bredder, Vice President, Business  
Development, Head of Utility Origination  
First Solar, Inc.

Kevin Brooks, Mayor  
City of Cleveland

David Brookshire, Energy Utility and Policy  
Analyst  
Southern Environmental Law Center

Matt Brown, Vice President, Business Development  
Silicon Ranch

Kristy Godsey Brown, Manager of Legal Services  
University of Tennessee  
County Technical Assistance Service

Trey Bussey, Staff Attorney  
Southern Environmental Law Center

Evelyn Butler, Vice President of Technical Services  
Solar Energy Industries Association

Mike Butler, Chief Executive Officer  
Tennessee Wildlife Federation

Jake Bynum, Mayor  
Weakley County

Karina Bynum, Integrated Water Resources  
Engineer  
Division of Water Resources  
Tennessee Department of Environment and  
Conservation

David Callis, Executive Vice President and General  
Manager  
Tennessee Electric Cooperative Association

Christopher Clark, Head, Department of  
Agricultural & Resource Economics  
University of Tennessee Institute of Agriculture

Calvin Clifton, Business Development Manager  
Mattern & Craig

Scott Coenen, Director of Policy and Market  
Regulation  
Avangrid Renewables

David Connor, Executive Director  
Tennessee County Services Association

Laurel Creech, Assistant Director General Services  
Division of Sustainability  
Metropolitan Government of Nashville & Davidson  
County

Molly Cripps, Director  
Office of Energy Programs  
Tennessee Department of Environment and  
Conservation

Joel Crofton, Electrical Inspector  
Tennessee Department of Commerce & Insurance

Clay Crownover, President/Chief Executive Officer  
Associated Builders and Contractors - Greater  
Tennessee

Erin Curran, Analyst, Government Affairs,  
Southeast Region  
Invenergy

Taylor Curtis, Regulatory-Policy Analyst  
Strategic Energy Analysis Center  
National Renewable Energy Laboratory

Charles Dacus, Farmer and Landowner  
Fayette County

Alicia Daniels-Hill, Assistant Attorney General  
Division of Consumer Affairs  
Office of the Tennessee Attorney General

Karen Lewis DeLong, Associate Professor,  
Department of Agriculture and Resource  
Economics  
University of Tennessee Institute of Agriculture

Doug Demosi, Planning Director  
Planning and Engineering Department  
Rutherford County

Laurel Downen, Lead Developer, SE Region  
Invenergy

Laura Duncan, Sr. Project Manager, Valley  
Pathways Study  
Environment & Energy Policy  
Tennessee Valley Authority

Jeff Dykes, Chief Executive Officer  
BrightRidge

Sam Edwards, Legal Advisor  
American Planning Association Tennessee Chapter  
Consultant  
University of Tennessee  
County Technical Assistance Service

Jeremy Elrod, Director of Government Relations  
Tennessee Municipal Electric Power Association

Jonathan Flemings, Director  
Project Development  
GreenGo Energy Group

Michael Forte, Project Developer  
Cypress Creek Renewables

David Foster, Director of Utilities Division  
Tennessee Public Utility Commission

Aaron Friend, State Soil Scientist - Tennessee  
Natural Resources Conservation Service  
United States Department of Agriculture

Amanda Garcia, Senior Attorney and Director,  
Tennessee Office  
Southern Environmental Law Center

Lindsay Gardner, Associate Director of Policy  
Research/Development and Federal Relations  
Tennessee Wildlife Federation

Brad Gibson, Chief Operating Officer  
Middle Tennessee Electric

Will Giese, Southeast Regional Director  
Solar Energy Industries Association

Savannah Gilman, Government Relations Assistant  
Tennessee Municipal Electric Power Association

Kelly Grams, General Counsel  
Tennessee Public Utility Commission

Joe Griffin, Property Assessment Consultant  
University of Tennessee  
County Technical Assistance Service

April Grippo, Deputy Director  
Division of Water Resources  
Tennessee Department of Environment and  
Conservation

Kelley Groover, Senior Assistant Attorney General  
Division of Consumer Affairs  
Office of the Tennessee Attorney General

Ryan Hall, Director of Land Conservation  
Wolf River Conservancy

Lindsay Hanna, Director of Government Relations  
& Climate Policy  
Tennessee Chapter  
The Nature Conservancy

Chris Hansen, Vice President, Origination and  
Renewables  
Tennessee Valley Authority

Jessica Harmon, President  
American Planning Association Tennessee Chapter  
Assistant City Manager  
City of Kingsport

Laura Leigh Harris, Former Assistant Director  
Public Policy Division  
Tennessee Farm Bureau Federation

Chassen Haynes, Senior Director of Business  
Development  
Tennessee Department of Economic and  
Community Development

Madison Haynes, Associate  
Bradley Arant Boult Cummings LLP  
Co-Chair, State and Local Policy Committee  
Tennessee Solar Energy Industries Association

Garvin Heath, Researcher  
Strategic Energy Analysis Center  
National Renewable Energy Laboratory

Kevin Hensley, Director  
Public Policy Division  
Tennessee Farm Bureau Federation

Daniel Hill, Manager  
PPAs & Structured Origination  
RWE Renewables

Chastity Hobby, Environmental Programs Lead  
Knoxville Utility Board

Grace Holmquist, Research Associate  
Tennessee Wildlife Federation

Gil Hough, Executive Director  
Tennessee Solar Energy Industries Association  
(TenneSEIA)

Mandy Huang, Regulatory Affairs  
Invenergy

Jeff Huffman, County Executive  
Tipton County

Stuart Huffman, Associate General Counsel,  
Regulatory Boards  
Office of Legal Counsel  
Board for Licensing Contractors  
Tennessee Department of Commerce & Insurance

David Hughes, Professor  
Department of Agriculture and Resource  
Economics  
University of Tennessee Institute of Agriculture

Lisa Hughey, Director  
Division of Solid Waste Management  
Tennessee Department of Environment and  
Conservation

Bryan Jacob, Solar Program Director  
Southern Alliance for Clean Energy

Chuck Jeffers, Assessor of Property  
Greene County

Samuel Keen, Assistant Attorney General  
Division of Consumer Affairs  
Office of the Tennessee Attorney General

Amy Kelly, Tennessee Valley Beyond Coal  
Senior Campaign Representative  
Sierra Club

Melisa Kelton, County Government Consultant  
University of Tennessee  
County Technical Assistance Service

Jerry Kettles, Director, Economic Analysis  
Tennessee Public Utility Commission

Matt Kisber, Co-Founder, Chairman of the Board  
Silicon Ranch

Mike Knotts, Vice President of Government Affairs  
Tennessee Electric Cooperative Association

Mike Lawyer, Stormwater Program Supervisor  
North Carolina Department of Environmental  
Quality

Gabe Looney, Property Assessment Consultant  
University of Tennessee  
County Technical Assistance Service

Chris Lunghino, Director of Policy &  
Communications  
Silicon Ranch

Lea Maamari, Research & Marketing Senior  
Associate  
SolUnesco

Claire Marsalis, Director  
Division of Consumer Affairs  
Office of the Tennessee Attorney General

Seth Maughan, Director  
Project Development  
SolUnesco

Liz McLaurin, President & Chief Executive Officer  
The Land Trust for Tennessee

Alex McWard, Policy Associate  
Energy Program  
National Conference of State Legislatures

Justin Meredith, Environmental Fellow  
Division of Remediation  
Tennessee Department of Environment and  
Conservation

Jeff Metzger, Legal Consultant  
University of Tennessee  
County Technical Assistance Service

Greg Moody, Director  
Office of State Assessed Properties  
Tennessee Comptroller of the Treasury

Ann Morbitt, Integrated Water Resources  
Consultant  
Division of Water Resources  
Tennessee Department of Environment and  
Conservation

Michael Morelli, Executive Director  
Board of Licensing Contractors  
Former Director, Electrical, Residential Building,  
Marina Inspections  
Fire Prevention/State Fire Marshal's Office  
Tennessee Department of Commerce and Insurance

Warren Nevad, Municipal Management Consultant  
University of Tennessee  
Municipal Technical Advisory Service

Ed Newton, Resident  
Fayette County

Robert Nicholson, Senior Manager of Sustainability  
Solar Energy Industries Association

George Nolan, Senior Attorney  
Southern Environmental Law Center

Margaret Norris, Executive Director  
University of Tennessee  
Municipal Technical Advisory Service

Stuart Pickrell, Senior Consultant  
Business Development & Renewables  
Commercial Energy Solutions  
Tennessee Valley Authority

Martha Potter, Taxpayer Service Supervisor  
Revenue/Taxpayer Services  
Tennessee Department of Revenue

Kim Raia, Environmental Management Consultant  
University of Tennessee  
County Technical Assistance Service

Aaron Reed, Principal  
Emeren Group

Bob Rial, Mayor  
Dickson County

Nathan Ridley, Attorney, Government Affairs  
Bradley Arant Boult Cummings LLP

Grace Rogers, Chief Executive Officer  
Associated General Contractors of Tennessee

Shawn Rumery, Senior Director of Research  
Solar Energy Industries Association

Mary Samaniego, Planning Director  
City of Tullahoma

Steve Sanders, Director  
Division of Remediation  
Tennessee Department of Environment and  
Conservation

Charles Schneider, Chief Executive Officer  
Home Builders Association of Tennessee

Tim Schwarz, Legislative Affairs  
Tennessee Public Utility Commission

Joe Shirley, Utility Audit Compliance  
Tennessee Public Utility Commission

Thomas Skehan, Regional Planner, Historic  
Preservationist  
Southwest Tennessee Development District

Heather Slayton, Assistant State Forester  
Division of Forestry  
Tennessee Department of Agriculture

Aaron Smith, Associate Professor  
University of Tennessee Institute of Agriculture

Brian Solsbee, Executive Director  
Tennessee Municipal Electric Power Association

Tony Soruco, Director  
Government Affairs & External Relations  
RWE Renewables

Amanda Stallings, Senior Regulatory Manager  
National Grid Renewables

Jason Stewart, Senior Specialist  
Office of State Assessed Properties  
Tennessee Comptroller of the Treasury

Tim Suddoth, Distributed Energy Resources  
Coordinator  
Middle Tennessee Electric

Colleen Swinney, Manager  
Taxpayer Services Division  
Tennessee Department of Revenue

Taylor Tavormina, Executive Administrative  
Assistant  
Office of Energy Programs  
Tennessee Department of Environment and  
Conservation

Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection  
with the Protection of Land and Communities

Matt Taylor, Deputy Director  
Office of Sustainable Practices  
Division of Stakeholder Engagement  
Tennessee Department of Environment and  
Conservation

Ambre Torbett, Director of Planning & Community  
Development, Stormwater Administrator  
Planning & Codes Department  
Sullivan County

Amy Tweed, County Planner  
Greene County

Shelby Vannoy, Assistant Director  
Public Policy Division  
Tennessee Farm Bureau Federation

Zane Vanover, Commissioner  
Sullivan County

Jon Walden, Executive Director  
University of Tennessee  
County Technical Assistance Service

Forbes Walker, Professor and Environmental Soil  
Specialist, Biosystems Eng. & Soil Science  
UT Extension  
University of Tennessee Institute of Agriculture

Kristen Walker, Associate Director of Commodity  
and Industry Relations  
Public Policy Division  
Tennessee Farm Bureau Federation

Michael Wallace, Vice President of Origination  
BrightNight

Page Walley, State Senator  
District 26, Tennessee

Heather Weldon, Executive Administrative  
Assistant  
Office of Sustainable Practices  
Tennessee Department of Environment and  
Conservation

Emma Wellbaum, Associate Attorney  
Southern Environmental Law Center

Chris White, Director  
Office of Planning & Zoning  
Bedford County

Luke Wilkinson, Senior Vice President of Project  
Development  
Silicon Ranch

Joey Wisby, GIS Manager  
The Nature Conservancy

Roger Woolsey, County Attorney  
Greene County

Alex Wyss, Director of Conservation  
Tennessee Chapter  
The Nature Conservancy

Ken Yager, State Senator  
District 12, Tennessee



## Appendix A: Public Chapter 1043, Acts of 2022



### *State of Tennessee*

#### PUBLIC CHAPTER NO. 1043

#### SENATE BILL NO. 2797

By Walley, Lundberg, Bowling, Campbell, Crowe, Niceley, Reeves, Rose

Substituted for: House Bill No. 2761

By Gant, Vital, Reedy, Sherrell, Travis,

AN ACT to amend Tennessee Code Annotated, Title 4, Chapter 5; Title 6; Title 13; Title 65; Title 66; Title 67 and Title 68, relative to solar energy development.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. (a) The Tennessee advisory commission on intergovernmental relations (TACIR) is directed to perform a study of the overall effects of utility-scale solar energy development in this state. The study must include, but not be limited to, examinations of:

(1) Short-term and long-term projections on the amount of acreage needed to accommodate utility-scale solar development;

(2) Hazardous waste as defined in § 68-212-104, that may exist in photovoltaic modules, energy storage system batteries, or other equipment used in utility-scale solar energy development;

(3) Federal regulatory requirements regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development;

(4) Statutory and regulatory requirements in other states regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development;

(5) Financial assurances and responsibilities of owners and operators in the event of natural disasters, pollution from solar energy system failures, decommissioning of a solar energy system, and end-of-life management of photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar development;

(6) Which federal and state regulatory agencies are responsible for certification and oversight to determine the proper installation and operation of utility-scale solar energy systems;

(7) The needed state infrastructure to facilitate the collection, transport, and disposal of utility-scale solar energy systems;

(8) Implications of utility-scale solar energy systems on the local property tax base;

(9) Local zoning and regulatory templates to ensure consistency throughout the state regarding local siting of utility-scale solar energy development;

(10) The importance of private property rights and the ability of a landowner to use or transfer interests in property;

(11) The importance of a variety of energy sources in this state's economic and community development recruiting efforts;

SB 2797

(12) The efforts of the Tennessee valley authority and local power companies to offer utility-scale sustainable power options; and

(13) Required lease terms and conditions to protect future property use and rights of lessors in the event of default or termination of a lease.

(b) The study must also examine, for the purpose of determining any necessary consumer protections, the installation of solar energy generation and storage on the property of residential electric customers.

(c) It is the legislative intent that this study be conducted within TACIR's existing resources.

(d) On or before September 30, 2023, TACIR shall report its findings and recommendations, including any proposed legislation, to members of the energy, agriculture and natural resources committee of the senate and members of the agriculture and natural resources committee of the house of representatives.

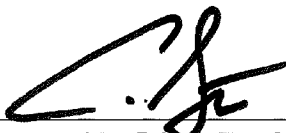
SECTION 2. This act takes effect upon becoming a law, the public welfare requiring it.

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SENATE BILL NO. 2797

PASSED: April 27, 2022

  
RANDY McNALLY  
SPEAKER OF THE SENATE

  
CAMERON SEXTON, SPEAKER  
HOUSE OF REPRESENTATIVES

APPROVED this 11<sup>th</sup> day of May 2022

  
BILL LEE, GOVERNOR

DRAFT

## Appendix B: Responses to the 14 Points that Public Chapter 1043, Acts of 2022, Directed TACIR to Address

### I. **Short-term and long-term projections on the amount of acreage needed to accommodate utility-scale solar development**

- Large, utility-scale ground-mounted solar photovoltaic (PV) systems—the main type in Tennessee—require between 5 and 10 acres per megawatt (MW) of generating capacity, depending on the type of technology.<sup>1</sup>
- The Tennessee Valley Authority (TVA) plans to add 10,000 MW of solar generation by 2035 in its territory—not just in Tennessee—including 5,000 MW of carbon-free energy before 2029.<sup>2</sup>
  - To provide 10,000 MW of solar power, TVA is planning for 10 acres per MW, which would require 100,000 acres of land—0.3% of TVA’s entire service area.<sup>3</sup>
  - TVA does not have an estimate of how many MW of solar generation will be in Tennessee—it depends on developers’ analysis of where to site facilities and the connection to the grid.<sup>4</sup>
  - Even if all of TVA’s solar facilities were in Tennessee, that would be approximately 0.4% of all land and 1% of all farmland in the state.<sup>5</sup>
  - TVA’s 2019 Integrated Resource Plan (IRP) says that compared to other energy resources, solar facilities “have a relatively low level of impact to the land.”<sup>6</sup>
- The effects on land use are not limited to agricultural land.

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<sup>1</sup> Solar Energy Industries Association “Land Use & Solar Development”; Ong et al. 2013; and interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022.

<sup>2</sup> Tennessee Valley Authority 2022.

<sup>3</sup> Interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022.

<sup>4</sup> Email received from Laura Duncan, senior project manager, Valley Pathways Study, Environment & Energy Policy, Tennessee Valley Authority, May 24, 2023.

<sup>5</sup> Based on a total 10,700,000 acres of farm operations in the state and 640 acres per square mile. US Department of Agriculture 2022; and US Census Bureau 2022.

<sup>6</sup> Tennessee Valley Authority 2019.

- Natural communities are also potentially affected by solar development in Tennessee, including forests, wetlands, floodplains, and previously undisturbed lands, as well as landscape-scale concerns from habitat fragmentation.<sup>7</sup>
- Studies quantify the direct effect on biodiversity when large-scale solar developments are placed on undisturbed habitats resulting from grading soil, herbicides, and infrastructure blocking the movement and seasonal migrations of wildlife species.<sup>8</sup>
- In 2023, the University of Tennessee Institute of Agriculture conducted a study focused on how many acres are likely to be used for solar development in Tennessee and found the following:
  - “If by 2035 TVA reached their sustainability goal and added an additional 10 GW of PV generation to the existing 344 MW of PV production in Tennessee, and assuming that TVA placed all PV developments in Tennessee, 57,514 to 103,443 acres of land would be required for utility-scale PV installments (i.e., an amount equivalent to 0.22 to 0.39% of Tennessee land or 0.53 to 0.96% of Tennessee farmland if exclusively placed on farmland).”
  - “However, not all of this additional production would be located in Tennessee, which occupies a little more than half of TVA’s 80,000 square-mile service region.”<sup>9</sup>
- Additional land could be needed for future solar development by local power companies (LPC) or demanded by private companies beyond TVA’s planned 10,000 MW.
- A 2022 North Carolina study found that the state’s more than 7,460 MW of installed solar PV “occupies 0.12% of the total land area of the state and 0.28% of agricultural land.”<sup>10</sup>
- It is possible for land leased for utility-scale solar facilities to be returned to agricultural use when the facility is no longer in use, but there are potential

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<sup>7</sup> Hartmann et al. 2013; and US Department of Energy 2021.

<sup>8</sup> Hamed and Alshare 2022.

<sup>9</sup> DeLong et al. 2023.

<sup>10</sup> Brookshire, Carey, and Parker 2022.

challenges, such as removal of topsoil and soil compaction during construction.<sup>11</sup>

- If enough landowners convert their land to solar, farmers leasing land could have a hard time competing with the price per acre for solar leasing, and local and regional farming economies could be affected.<sup>12</sup>
- Land management practices, such as simultaneous use of farmland for solar power generation and agriculture—sometimes called dual-use or agrivoltaics—are being studied in other states and have the potential to reduce environmental effects and even improve soil over the long term.<sup>13</sup>
- Because landowners can lease their land to solar companies for more than they could to farmers, the additional revenue and resulting financial security could help farmers stay in operation in the long term.<sup>14</sup>
- While it is true that some of Tennessee’s agricultural land has been developed for utility-scale solar and more will be needed—over the most recent 20-year period for which data is available, over a million acres of farmland has shifted to non-agricultural use.<sup>15</sup>

## **2. Hazardous waste, as defined in Tennessee Code Annotated, Section 68-212-104, that may exist in photovoltaic modules, energy storage system batteries, or other equipment used in utility-scale solar energy development**

- Tennessee Code Annotated, Section 68-212-104, defines hazardous waste as “waste, or combination of wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may: (A) Cause, or significantly contribute to an increase in mortality or an increase in serious irreversible illness or incapacitating reversible illness; or (B) Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.”
- The Resource Conservation and Recovery Act (RCRA) of 1976 gives the US Environmental Protection Agency (EPA) authority to regulate the generation,

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<sup>11</sup> Hannum et al. 2022; and Solar Energy Technologies Office “Farmer's Guide to Going Solar.”

<sup>12</sup> Hannum et al. 2022; and Hunter et al. 2022.

<sup>13</sup> National Renewable Energy Laboratory “Agrivoltaics Primer”; Macknick, Beatty, and Hill 2013; and Macknick et al. 2022.

<sup>14</sup> Hannum et al. 2022; and Solar Energy Technologies Office “Farmer's Guide to Going Solar.”

<sup>15</sup> US Department of Agriculture 2017.

transportation, treatment, storage, and disposal of hazardous waste, and the Tennessee Department of Environment and Conservation (TDEC) administers the RCRA in Tennessee.<sup>16</sup>

- According to the US EPA “some solar panels are hazardous waste, and some solar panels are not hazardous waste, depending on the leachability of RCRA toxic materials present in the solar panel. . . . It is the responsibility of the generator of the solar panel waste to determine if solar panels are hazardous by performing the appropriate tests or by using generator knowledge.”<sup>17</sup>
  - “Solid waste, including solar panels, is hazardous waste if it exhibits any of the four characteristics of hazardous waste (toxicity, ignitability, reactivity, corrosivity). The most common reason that solar panels would be determined to be hazardous waste is if they meet the characteristic of toxicity.
  - Heavy metals like lead and cadmium may leach at such concentrations that waste panels would fail the toxicity characteristic leaching procedure (TCLP), a test required under RCRA to determine if materials are hazardous.”<sup>18</sup>
- Materials in solar panels that could potentially be hazardous if they are present in high enough quantities include, but are not limited to, lead, cadmium, arsenic, hexavalent chromium, copper, and selenium.<sup>19</sup>
- “Depending on the local regulations, some components—typically some batteries or power transformers—may be considered hazardous or toxic waste.” But “from a regulatory point of view, PV panel waste still largely falls under the general waste classification,” and it is usually treated as non-hazardous solid waste.<sup>20</sup>
  - The main risk from lithium-ion batteries, which are used for energy storage, is fire risk if they are damaged or crushed.<sup>21</sup>

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<sup>16</sup> US Environmental Protection Agency 2023f; and Tennessee Department of Environment and Conservation “Hazardous Waste Program.”

<sup>17</sup> US Environmental Protection Agency 2022. See also US Environmental Protection Agency 2023a.

<sup>18</sup> US Environmental Protection Agency 2022.

<sup>19</sup> Association of State and Territorial Solid Waste Management Officials 2022.

<sup>20</sup> Curtis et al. 2021a; and Weckend, Wade, and Heath 2016.

<sup>21</sup> US Environmental Protection Agency 2023g.



- The EPA issued a memorandum in 2023 that clarifies “how the hazardous waste regulations for universal waste and recycling apply to lithium-ion batteries.”<sup>22</sup>
- Solar PV modules are designed and tested to endure harsh outdoor conditions for 25 years or more and are unlikely to leach materials, even if they are cracked or broken. A small percentage—an estimated average of 0.04%—breaks each year.<sup>23</sup>
- The TDEC Division of Solid Waste Management (DSWM) regulates the disposal of solid waste, including solar panels that are removed from sites in Tennessee.<sup>24</sup>
- There is competition for lithium-ion batteries—most are going into other industries, such as electric vehicles (EV). Compared to EVs, energy storage system batteries are a small share of the market for lithium-ion batteries.<sup>25</sup>
- Most of the component materials of solar panels can be recycled, although such recycling is a new and evolving industry. The Solar Energy Industry Association (SEIA) has been developing a PV recycling network across the US and has one recycling partner in Middle Tennessee.<sup>26</sup>

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<sup>22</sup> US Environmental Protection Agency 2023b.

<sup>23</sup> Solar Energy Technologies Office “Farmer’s Guide to Going Solar”; Summers and Radde 2003; Sinha et al. 2019; and interview with Craig Almanza, deputy director, and Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, February 6, 2023.

<sup>24</sup> Interview with Craig Almanza, deputy director, and Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, February 6, 2023.

<sup>25</sup> Curtis et al. 2021a.

<sup>26</sup> US Environmental Protection Agency 2023c; and Solar Energy Industries Association 2020.

### **3. Federal regulatory requirements regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development**

- The only federal regulations specific to solar PV decommissioning and end-of-life management are those of the Bureau of Land Management (BLM) for development on its land.<sup>27</sup> BLM doesn't manage land in Tennessee.<sup>28</sup>
- "Decommissioning a PV system typically includes removing the PV array; removing all balance-of-system (BOS) equipment (i.e., other parts of the PV system, excluding modules, which can include wiring, inverters, and the mounting system); and restoring the land or infrastructure (e.g., roofs and irrigation canals) to its original condition or for a new use."<sup>29</sup>
- Solar decommissioning policies in the US vary by federal, state, and local jurisdiction, according to a 2021 policy survey by the National Renewable Energy Laboratory (NREL).<sup>30</sup>
- PV modules, batteries, and other equipment are not uniquely regulated by the US EPA—they are handled like any other waste stream, which depends on the materials and varies by jurisdiction.<sup>31</sup>

### **4. Statutory and regulatory requirements in other states regarding decommissioning and managing end-of-life photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar energy development**

- In addition to Tennessee, 22 states have statewide solar facility decommissioning laws, and several are considering legislation.<sup>32</sup> See table 4 on page 45 of this report for a summary of decommissioning plan and financial assurance requirements in other states and appendix L for more detail.
  - The laws share similarities with Tennessee's law, such as requiring a decommissioning plan and usually proof of financial assurance prior to

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<sup>27</sup> Weckend, Wade, and Heath 2016; and Curtis et al. 2021b.

<sup>28</sup> US Department of the Interior "Jupiter Inlet Lighthouse Outstanding Natural Area."

<sup>29</sup> Curtis et al. 2021b.

<sup>30</sup> Ibid.

<sup>31</sup> Association of State and Territorial Solid Waste Management Officials 2022.

<sup>32</sup> TACIR staff review of other states' statutes.

construction and a minimum MW capacity, although MW thresholds vary. But unlike Tennessee’s law, 11 states<sup>33</sup> specify how the decommissioning cost is calculated, and all but Tennessee and Texas provide state or local government oversight authority (or both),<sup>34</sup> including allowing penalties for noncompliance.

- In Tennessee and Texas, disputes between landowners and solar companies regarding the decommissioning laws are resolved in the courts through civil actions.
- As of May 2023, three states—Arizona, New York, and Pennsylvania—have legislation pending that would enact solar equipment decommissioning-specific policies.<sup>35</sup>
- Tennessee’s solar facility decommissioning law is intended to protect landowners and communities from potential hazards and costs resulting from abandoned solar facilities when land is leased.<sup>36</sup> Silicon Ranch is the only solar energy company doing business in Tennessee that typically purchases land.<sup>37</sup>
- NREL recommends several best practices for managing end-of-life.<sup>38</sup> See appendix I.
- SEIA’s model solar decommissioning legislation is included as appendix M.
- North Carolina completed a decommissioning study in 2021 and a plan with recommendations for financial assurance in 2022.<sup>39</sup>
- At least nine states—Georgia, Iowa, Massachusetts, New York, North Carolina, Oregon, Rhode Island, Texas, and Wisconsin—have model ordinances,

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<sup>33</sup> California, Illinois, Indiana, Kentucky, Louisiana, Montana, Ohio, Texas, Vermont, Virginia, and West Virginia.

<sup>34</sup> Washington has an optional statewide solar decommissioning program that allows solar project owners to comply with a state certification process in lieu of obtaining local city and county government approvals.

<sup>35</sup> Arizona (H.B. 2618); New York (S.B. 1793); and Pennsylvania (S.B. 211).

<sup>36</sup> Tennessee Code Annotated, Section 66-9-207.

<sup>37</sup> Interview with Luke Wilkinson, senior vice president of project development, Matt Beasley, chief commercial officer, and Matt Kisber, co-founder, chairman of the board, Silicon Ranch, August 3, 2022.

<sup>38</sup> Curtis et al. 2021c.

<sup>39</sup> North Carolina Department of Environmental Quality and Environmental Management Commission 2021; and North Carolina Department of Environmental Quality 2022.

templates, or other resources that local governments may—but are not required—to use in developing their local solar decommissioning policies.<sup>40</sup>

- Five states have acted to address PV waste and recycling.<sup>41</sup>
  - New Jersey and North Carolina have created a statewide task force to evaluate disposal issues and available recycling infrastructure and make recommendations to address long-term concerns related to solar waste.
  - California and Hawaii amended waste regulations to include PV modules as one of the waste streams that are subject to increased oversight, including training and requiring facilities to track waste.
  - Washington adopted a statutorily required extended producer responsibility program for PV modules, making the manufacturers of products and materials responsible for the waste.

**5. Financial assurances and responsibilities of owners and operators in the event of natural disasters, pollution from solar energy system failures, decommissioning of a solar energy system, and end-of-life management of photovoltaic modules, energy storage system batteries, and other equipment used in utility-scale solar development**

- Lenders and landlords typically require companies to have insurance that would cover them in the case of natural disasters like tornados, and there is no evidence showing that solar systems cause pollution while in operation or during decommissioning.<sup>42</sup>
- Tennessee’s solar energy facility decommissioning law, Public Chapter 866, Acts of 2022 (appendix E), requires solar power facility agreements to include a decommissioning plan with financial assurance to ensure that the person leasing the land removes components and restores the land to as close to the condition it was in before construction as reasonably possible.<sup>43</sup>
- Financial assurance must cover the decommissioning cost, which is defined as “the estimated cost of performing the removal and restoration obligations set

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<sup>40</sup> Curtis et al. 2021b.

<sup>41</sup> Association of State and Territorial Solid Waste Management Officials 2022.

<sup>42</sup> Summers and Radde 2003; interview with Gil Hough, executive director, TenneSEIA, August 29, 2022, and email received April 5, 2023; and interview with Craig Almanza, deputy director, and Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, February 6, 2023.

<sup>43</sup> Tennessee Code Annotated, Section 66-9-207.

forth in subsection (c), less the estimated salvage value of the components of the solar power facility as of the date of removal.”

- Tennessee’s law specifies a timeline for the provision of financial assurance:
  - (A) No less than five percent (5%) of the decommissioning cost on the date the solar power facility commences commercial operation;
  - (B) No less than fifty percent (50%) of the decommissioning cost on the tenth anniversary of the date the solar power facility commences commercial operation; and
  - (C) No less than the decommissioning cost on the fifteenth anniversary of the date the solar power facility commences commercial operation.
- Acceptable forms of financial assurance include: surety bond, collateral bond, irrevocable letter of credit, parent guaranty, cash, cashier’s check, certificate of deposit, bank joint custody receipt, an approved negotiated instrument not described in the law, or a combination of the forms of security described in the law.
- Appendix L compares Tennessee’s decommissioning law to other states’ laws.

## **6. Which federal and state regulatory agencies are responsible for certification and oversight to determine the proper installation and operation of utility-scale solar energy systems**

- For large-scale projects selling power to TVA—most of the utility-scale facilities in Tennessee—a National Environmental Policy Act (NEPA) review is required, which is a comprehensive process.
  - Under NEPA, all executive federal agencies are required to prepare environmental assessments (EAs) and environmental impact statements (EISs).<sup>44</sup>
  - TVA reviews the businesses’ performance records and examines the projects before they become operational.<sup>45</sup>
  - Projects without TVA agreements—including those developed by local power companies—are not required to conduct a NEPA review but are required to comply with state and local permitting requirements.

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<sup>44</sup> US Environmental Protection Agency 2023e.

<sup>45</sup> Interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022, and email received March 22, 2023.

- TDEC Division of Water Resources (DWR) implements the US EPA Clean Water Act and administers the National Pollutant Discharge Elimination System (NPDES) permit program by enforcing water quality and stormwater regulations and permits. Any planned development project in the state that will disturb at least one acre of soil is required to get an NPDES stormwater construction permit, referred to as the construction general permit (CGP).<sup>46</sup>
  - There is no permit specifically for solar development, but the two permits that would apply are the CGP and the Aquatic Resource Alteration Permit (ARAP) if someone wants to alter a stream, river, lake, or wetland.
  - To obtain a CGP, all project developers are required to submit a site-specific aquatic resource inventory and a stormwater pollution prevention plan saying how they will address water quality on the site.
  - Developers are required to get the permits, not the landowners or TVA.
  - The most common stormwater issues during construction—erosion and sediment runoff—occur across industries.
  - DWR staff do not perceive increased water quality or quantity issues resulting from large-scale solar facilities. They say solar projects generally minimize disturbance and environmental impact and have a better environmental outcome compared to other types of projects with heavy construction.
- TDEC Division of Solid Waste Management (DSWM) would investigate if someone filed a complaint about leakage or burning materials on the site.<sup>47</sup>
- The state fire marshal’s office—part of the Tennessee Department of Commerce and Insurance—issues electrical permits. There isn’t a specific solar PV electrical permit, but residential and large-scale solar systems both require “qualified personnel” to install.<sup>48</sup>

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<sup>46</sup> US Environmental Protection Agency 2023d; and interviews with April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023; and Ann Morbitt, integrated water resources consultant, and Karina Bynum, integrated water resources engineer, Division of Water Resources, Tennessee Department of Environment and Conservation, March 10, 2023.

<sup>47</sup> Interview with Craig Almanza, deputy director, and Lisa Hughey, director, Central Office Operations, Division of Solid Waste Management, Tennessee Department of Environment and Conservation, February 6, 2023.

<sup>48</sup> Interview with Michael Morelli, executive director, Board of Licensing Contractors, Tennessee Department of Commerce and Insurance, February 14, 2023.

- Solar installations can't operate until they pass the electrical inspection by the fire marshal's office.<sup>49</sup>
- Counties and municipalities can also have their own regulations that they enforce.<sup>50</sup>
- The Tennessee Wildlife Resources Agency does not play a role in certification or oversight of solar developments.<sup>51</sup>
- There are recommended best practices based on research for stormwater management at large-scale solar facilities.<sup>52</sup>

## **7. The needed state infrastructure to facilitate the collection, transport, and disposal of utility-scale solar energy systems**

- The primary infrastructure need for utility-scale solar facilities is access to the electric grid, specifically high transmission lines, which are expensive and difficult to construct because they often require the use of eminent domain.<sup>53</sup>
  - Large-scale solar facilities typically don't need additional infrastructure such as water, sewer, or new roads.
  - Based on interviews with stakeholders, the collection and transportation of solar panels—whether at the beginning or end-of-life—is relatively easily done with existing roads and large trucks.

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<sup>49</sup> Ibid.

<sup>50</sup> Interviews with Michael Morelli, executive director, Board of Licensing Contractors, Tennessee Department of Commerce and Insurance, February 14, 2023; April Grippo, deputy director, Ann Morbitt, integrated water resources consultant, and Lee Barber, natural resources unit manager, Division of Water Resources, Tennessee Department of Environment and Conservation, February 13, 2023; and Ann Morbitt, integrated water resources consultant, and Karina Bynum, integrated water resources engineer, Division of Water Resources, Tennessee Department of Environment and Conservation, March 10, 2023.

<sup>51</sup> Email received from Lindsay Hanna, director of government relations & climate policy, Tennessee Chapter, The Nature Conservancy, July 18, 2023.

<sup>52</sup> Hanson et al. 2021.

<sup>53</sup> Interviews with Gil Hough, executive director, TenneSEIA, August 29, 2022; Mike Bolin, vice president of utility advancement, and Chastity Hobby, environmental programs lead, Knoxville Utility Board, September 14, 2022; David Callis, executive vice President and general manager, and Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, September 9, 2022; and Jeremy Elrod, director of government relations, Brian Solsbee, executive director, and Savannah Gilman, government relations assistant, Tennessee Municipal Electric Power Association, August 30, 2022.

- The additional infrastructure is largely landfill space and recycling networks. Researchers are working to identify the most economical method of recovering materials from end-of-life solar panels.<sup>54</sup>

## **8. Implications of utility-scale solar energy systems on the local property tax base**

- Solar facility properties are appraised and assessed differently from other types of properties. Figure 3 on page 21 of this report shows the steps in the appraisal and assessment process, and appendix F shows hypothetical assessments and the estimated taxes.
- Tennessee Code Annotated, Section 67-5-601, directs that “the sound, intrinsic and immediate value of solar source property should not initially exceed twelve and one-half percent (12.5%) of total installed costs,” meaning that only 12.5% of installed costs of equipment (personal property) are taxed. The statute requires the property owner to provide either a TDEC Green Energy Production Facility Certification or a public utility filing to the Comptroller.
- Solar facility properties (real property) are assessed as a public utility at 55% if the power is sold and 40% if the power is used on-site. Agriculture and residential real properties are assessed at 25% and commercial and industrial real properties at 40%. As a result, solar facility properties could generate more tax revenue for local governments based on real property alone.<sup>55</sup>
- A few studies have found that large solar facilities can have a small effect—on average—on the value of neighboring properties, but how much depends on various factors, especially distance from the facility.<sup>56</sup>

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<sup>54</sup> Solar Energy Technologies Office “Solar Manufacturing Map”; Weckend, Wade, and Heath 2016; and National Renewable Energy Laboratory 2021.

<sup>55</sup> Tennessee Constitution, Article II, Section 28; and interviews with Greg Moody, director, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, February 28, 2023; and Roger Woolsey, county attorney, Amy Tweed, county planner, and Chuck Jeffers, county property assessor, Greene County, January 23, 2023.

<sup>56</sup> Vasundhara and Lang 2020; Dröes and Koster 2021; and Elmallah et al. 2023.



## **9. Local zoning and regulatory templates to ensure consistency throughout the state regarding local siting of utility-scale solar energy development.**

- Cities and counties have the authority to implement local zoning in Tennessee.<sup>57</sup>
- Statewide consistency is not likely, given that, as of 2020, of all 95 counties, 40 counties have adopted county zoning, 70 have subdivision zoning, and 74 have active planning commissions; out of a total of 345 cities, 271 have municipal zoning and 267 have subdivision zoning.<sup>58</sup>
- Like other types of development, both large-scale and residential solar installations are subject to local zoning requirements and restrictions except on utility-owned land.<sup>59</sup>
- Some Tennessee counties have resolutions to regulate solar development within their jurisdictions, including Bedford, Fayette, Franklin, Greene, Hardeman, Haywood, Jefferson, Sullivan, and Washington Counties. The City of Brownsville has a solar ordinance, and the city of Memphis and Shelby County have a unified code that includes a solar ordinance. See appendix D.
- Other states have model solar zoning ordinances, including Georgia, Kentucky, Illinois, Indiana, Iowa, Minnesota, North Carolina, and Wisconsin, and Tennessee also has a model ordinance. See appendices C and I.
- There are also best practices and several guides for local governments. See appendix I.
- To balance solar expansion with farmland preservation, states with high levels of solar generation have implemented solar siting policies, including: tax incentives and penalties to encourage farmland preservation, zoning, and permitting, and programs for development on brownfields or marginal land.<sup>60</sup>
- In Tennessee, programs to incentivize land preservation include conservation easements and land trusts, the Greenbelt program, the Heritage Conservation

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<sup>57</sup> Tennessee Code Annotated, Sections 13-7-101 et seq. and 13-7-201 et seq.

<sup>58</sup> Skehan 2020.

<sup>59</sup> Tennessee Code Annotated, Sections 13-7-101 et seq. and 13-7-201 et seq.; and email received from Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 28, 2022.

<sup>60</sup> Grout and Ifft 2018.

Fund, and the new Brownfield Redevelopment Area Fund directed by Public Chapter 86, Acts of 2023.<sup>61</sup>

**10. The importance of private property rights and the ability of a landowner to use or transfer interests in property.**

- Zoning attempts to balance private property rights with communities' interests through regulations for land use.<sup>62</sup>
- Stakeholders agree that private property rights are important and mostly agree that reasonable limits are good. For example, the Tennessee Farm Bureau believes in property rights and the free market but is also concerned about losing farmland to solar development.<sup>63</sup>
- Solar power facility agreements are structured in such a way that the landowner can sell their property even with the solar facility already in operation, and the agreement rights would transfer to the new landowner.<sup>64</sup>
- Moratoriums on zoning and development are legal if they have a limited timeframe and address a public interest without creating an unreasonable burden, but generally are not viewed favorably because they limit private property rights.<sup>65</sup>

**11. The importance of a variety of energy sources in this state's economic and community development recruiting efforts**

- TVA's asset mix balances four characteristics—affordability, reliability, sustainability, and resiliency—and adds resources while keeping these in balance.<sup>66</sup>

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<sup>61</sup> Tennessee Department of Agriculture "Land Protection Options"; Tennessee Comptroller of the Treasury 2022; and Tennessee Code Annotated, Sections 11-7-101 et seq. and 68-212-220.

<sup>62</sup> Local Planning Assistance Office 2004; and Tennessee Advisory Commission on Intergovernmental Relations 2013.

<sup>63</sup> Tennessee Farm Bureau Federation "About Tennessee Farm Bureau"; and interviews with Kevin Hensley, director of public policy, Laura Leigh-Harris, former assistant director, and Shelby Vannoy, assistant director, Public Policy Division, Tennessee Farm Bureau Federation, July 25, 2022; and Charles Dacus, farmer and landowner in Fayette County, January 11, 2023.

<sup>64</sup> Email received from Gil Hough, executive director, TenneSEIA, April 5, 2023.

<sup>65</sup> Ashburn 2002; and email received from Melisa Kelton, county government consultant, University of Tennessee County Technical Assistance Service, February 3, 2023.

<sup>66</sup> Tennessee Valley Authority 2019; Tennessee Valley Authority 2022; and interview with Chris Hansen, vice president, Origination and Renewables, Tennessee Valley Authority, November 14, 2022.

- TVA considers solar to be closely tied to economic development. It is market driven—large companies often require 100% renewable energy sources to meet their carbon-free or carbon-neutral goals.<sup>67</sup>
- Tennessee Department of Economic and Community Development (ECD) staff agree that a diverse energy portfolio is important for economic and community development.<sup>68</sup>
  - ECD staff said that solar and renewable energy is at the forefront of conversations with companies and that TVA is at every initial meeting they have with large companies.
  - ECD doesn't take a position on solar development but is concerned about land use, especially using industrial-zoned land for solar.
- A 2014 report by the Baker Center for Public Policy to the General Assembly on the energy sector in Tennessee said, "The state's efforts to promote economic development must be balanced against the need for environmental stewardship to protect and improve public health and preserve the state's natural assets, which are all required for a prosperous Tennessee."<sup>69</sup>
- Appendix N describes federal and state tax incentives available for both utility-scale and residential solar development.

## **12. The efforts of the Tennessee Valley Authority and local power companies to offer utility-scale sustainable power options**

### **Tennessee Valley Authority (TVA)**

- TVA's Renewable Energy Solutions Guide compares TVA's offerings for renewables to help companies figure out which program makes sense for them and their customers.<sup>70</sup> The programs include
  - Dispersed Power Production - allows residential and commercial renewable electricity-generating facilities up to 80 MW to sell all or excess generation to TVA at TVA's monthly avoided cost;

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<sup>67</sup> Ibid.

<sup>68</sup> Interview with Chassen Haynes, senior director of business development, Tennessee Department of Economic and Community Development, January 24, 2023.

<sup>69</sup> Murray et al. 2014.

<sup>70</sup> Tennessee Valley Authority "Valley Renewable Energy Solutions Guide."

- Green Invest - TVA competitively procures “new-to-the-world” commercial renewables within TVA territory to match customers’ renewable energy or carbon-neutral goals; and
- Green Switch - allows residential and commercial customers to purchase \$2 blocks of 200 kWh of solar power.
- In 2020, TVA also implemented the Power Supply Flexibility option.<sup>71</sup>
  - This option allows LPCs with long-term agreements (typically 20 years) with TVA to produce or purchase 5% of their power—including renewable power—from entities other than TVA.
  - In August 2022, the TVA board voted to modify the option by allowing LPCs to build solar facilities outside their territory and partner with other LPCs to generate up to 5%.<sup>72</sup>
  - As of November 14, 2022, 80 distributors had signed flexibility agreements as part of their long-term partnership contracts with TVA, allowing them to obtain power from other sources.<sup>73</sup>
- In 2022, the TVA board approved a pilot project to develop a utility-scale solar facility on one of its coal ash landfills at the Shawnee Fossil Plant in Kentucky.<sup>74</sup>

### **Local Power Companies (LPC)**

- LPCs understand that solar energy growth is happening and are at different stages of adjusting to the transition. Land access and grid connection are the biggest challenges.<sup>75</sup>
- According to one LPC representative, the best way for LPCs to develop solar is to coordinate with their big customers.<sup>76</sup>

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<sup>71</sup> Tennessee Valley Authority 2020; and Flessner 2022.

<sup>72</sup> Flessner 2022.

<sup>73</sup> Tennessee Advisory Commission on Intergovernmental Relations 2023.

<sup>74</sup> Keefe 2022.

<sup>75</sup> Interviews with David Callis, executive vice president and general manager, and Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, September 9, 2022; and Brian Solsbee, executive director, Jeremy Elrod, director of government relations, and Savannah Gilman, government relations assistant, Tennessee Municipal Electric Power Association, August 30, 2022.

<sup>76</sup> Interview with Mike Bolin, vice president of utility advancement, and Chastity Hobby, environmental programs lead, Knoxville Utility Board, September 14, 2022.

- Most LPCs in Tennessee have signed TVA’s power supply flexibility option.<sup>77</sup>
- Some LPCs are developing smaller projects—one to two MW—like community solar projects on marginal lands or brownfield sites.<sup>78</sup>
- Examples of LPC efforts include
  - BrightRidge—formerly Johnson City Power Board—is taking advantage of TVA’s 5% flexibility option by developing two facilities in Washington County totaling 14 MW. It also broke ground on a smaller one that will offset electricity use at its administration building and serve as a demonstration project and educational resource;<sup>79</sup>
  - Knoxville Utility Board (KUB) has a 20% renewable goal because their customers want more renewable power and has contracted with TVA to purchase solar megawatts from west Tennessee to reach its goal. KUB staff say TVA’s flexibility option helps;<sup>80</sup>
  - Middle Tennessee Electric (MTE) offers its Green Switch 100, Cooperative Solar, and ProSolar programs and works with TVA through its Green Invest and Green Flex programs. MTE’s goal is to maximize TVA’s flexibility option using solar;<sup>81</sup>
  - Nashville Electric Service (NES) is developing a utility-scale solar project outside its service territory through TVA’s flexibility option;<sup>82</sup> and
  - Paris Board of Public Utilities (BPU) partnered with Silicon Ranch to use TVA’s flexibility option for the Paris Solar Farm–Puryear.<sup>83</sup>

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<sup>77</sup> Interview with David Callis, executive vice president and general manager, and Mike Knotts, vice president of government affairs, Tennessee Electric Cooperative Association, September 9, 2022.

<sup>78</sup> Interviews with Mike Bolin, vice president of utility advancement, and Chastity Hobby, environmental programs lead, Knoxville Utility Board, September 14, 2022; Kendra Abkowitz, chief sustainability and resilience officer, Office of Mayor John Cooper, and Laurel Creech, former assistant director, General Services Division of Sustainability, Metropolitan Government of Nashville & Davidson County, February 14, 2023; and Jeff Dykes, chief executive officer, BrightRidge, June 2, 2023.

<sup>79</sup> BrightRidge 2023; BrightRidge “BrightRidge’s Commitment to Clean Energy”; and interview with Jeff Dykes, chief executive officer, BrightRidge, June 2, 2023.

<sup>80</sup> Eggers 2022; and interview with Mike Bolin, vice president of utility advancement, and Chastity Hobby, environmental programs lead, Knoxville Utility Board, September 14, 2022.

<sup>81</sup> Middle Tennessee Electric “Renewables”; and interview with Brad Gibson, chief operating officer, and Tim Suddoth, distributed energy resources coordinator, Middle Tennessee Electric, April 12, 2023.

<sup>82</sup> Eggers 2022; and Eggers 2023.

<sup>83</sup> Silicon Ranch 2022.

### **13. Required lease terms and conditions to protect future property use and rights of lessors in the event of default or termination of a lease**

- Financial assurance required by Tennessee’s decommissioning law protects landowners in the event of a developer defaulting.<sup>84</sup>
- Contracting and financing are critical—stakeholders recommend that landowners consult with legal counsel with expertise in utility-scale solar leases.<sup>85</sup>
- If the lease contract is specific about the duration of the lease, the landowner and the company would be legally bound to honor that duration.<sup>86</sup>
- There are resources available to help with leases and conditions to protect property and the parties involved. See appendix I.

### **14. For the purpose of determining any necessary consumer protections, the installation of solar energy generation and storage on the property of residential electric customers**

- Consumers who contract with a company to install a solar system on their residence are protected by Tennessee’s consumer protection laws: the Consumer Protection Act and Home Solicitations Sales Act.<sup>87</sup>
- SEIA has a business code for solar companies “to promote transparency, good faith, and understanding in the U.S. solar energy industry.”<sup>88</sup>
- Stakeholders generally agree that fraud mostly happens in the residential solar market, not the utility-scale market.<sup>89</sup>
- While most companies are acting in good faith, the Tennessee Attorney General’s Office has received complaints about a few and has taken legal action

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<sup>84</sup> Tennessee Code Annotated, Section 66-9-207.

<sup>85</sup> Breger 2022; Hannum et al. 2021; Nuckols 2020; Solar Energy Industries Association 2016; and interview with Will Giese, southeast regional director, Solar Energy Industries Association, December 7, 2022.

<sup>86</sup> University of Tennessee Extension “Termination and Renewal of Agricultural Leases in Tennessee”; and email received from Gil Hough, executive director, TenneSEIA, April 5, 2023.

<sup>87</sup> Tennessee Code Annotated, Sections 47-18-101 et seq. and 47-18-701 et seq.

<sup>88</sup> Solar Energy Industries Association 2015.

<sup>89</sup> Interview with Sam Keen, assistant attorney general, Kelley Groover, senior assistant attorney general, Alicia Daniels-Hill, assistant attorney general, and Claire Marsalis, director, Division of Consumer Affairs, Office of the Tennessee Attorney General, February 24, 2023.

against the two residential solar companies that were doing business in Tennessee with the most consumer complaints.<sup>90</sup>

- The civil fine for violation of the Tennessee Consumer Protection Act is “up to \$1,000,” which is on the low end of civil fines in the 50 states.<sup>91</sup>
- A review of other states’ laws finds their maximum penalties generally range from \$1,000 to \$50,000 per violation.<sup>92</sup>
- There are many resources available for homeowners who are considering installing solar on their property. Some other states have created resources for their residents. See appendix I.

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<sup>90</sup> Flessner 2023; Tennessee Attorney General and Reporter 2022; and interview with Sam Keen, assistant attorney general, Kelley Groover, senior assistant attorney general, Alicia Daniels-Hill, assistant attorney general, and Claire Marsalis, director, Division of Consumer Affairs, Office of the Tennessee Attorney General, February 24, 2023.

<sup>91</sup> Tennessee Code Annotated, Section 47-18-108(b)(3); and TACIR staff review of other states’ fines.

<sup>92</sup> TACIR staff review of other states’ statutes.

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## Appendix C: Tennessee Model Solar Zoning Ordinance

### RESOLUTION NO. [\_\_\_\_\_]

#### A RESOLUTION TO AMEND THE TEXT OF THE [\_\_\_\_\_] ZONING ORDINANCE ESTABLISHING REGULATIONS FOR SOLAR ENERGY SYSTEMS AS A PERMITTED USE IN THE [\_\_\_\_\_] DISTRICT AND ESTABLISHING REGULATIONS GOVERNING THE DEVELOPMENT OF SOLAR ENERGY SYSTEMS

WHEREAS, pursuant to Tennessee Code Annotated § 13-7-101 and § 13-7-102, a zoning ordinance and map have been adopted by [\_\_\_\_\_]; and

WHEREAS, the Planning Commission of the [\_\_\_\_\_] has recommended that the following described amendments be made in the text of the adopted zoning ordinance; and

WHEREAS, pursuant to Tennessee Code Annotated § 13-3-403(c), a public notice was published at least fifteen (15) days prior to the meeting.

NOW, THEREFORE, BE IT RESOLVED by the [\_\_\_\_\_] of the [\_\_\_\_\_] as follows:

1. **Definitions.** [\_\_\_\_\_] shall be amended to include the following definitions.

Solar Energy System (“SES”) means a device or structural design feature that provides for the collection of solar energy for electricity generation, consumption, or transmission or for thermal, residential, or utility scale application. For purposes of this section, SES refers only to (1) photovoltaic SESs that convert solar energy directly into electricity through a semiconductor device, or (2) solar thermal systems that use collectors to convert the sun’s rays into useful forms of energy for water heating, space heating, or space cooling. SES includes all components of the electricity generating facility (inverters, transformers, switchgear, substations, communications infrastructure, and other ancillary or related equipment), but does not include transmission lines or generation tie lines connecting the SES to a utility-owned substation.

Integrated Solar Energy System (“ISES”) means an SES where solar materials are incorporated into building materials, such that the two are reasonably indistinguishable, or where solar materials are used in place of traditional building components, such that the SES is structurally an integral part of a house, building, or other structure. An ISES may be incorporated into, among other things, a building façade, skylight, shingles, canopy, groundmount system, light, or parking meter.

Accessory Solar Energy System (“ASES”) means an SES that is (i) structurally mounted to the roof of a house, building or other structure, (ii) located on property for which the primary use is not related to the production of energy, or (iii) located on the same property as the house, building or other structure in which the energy from the SES is consumed or on property adjacent thereto.

Ground Mounted Solar Energy System (“GSES”) means an SES that is structurally mounted to the ground and is larger than twenty (20) acres within the fenced area required by [\_\_\_\_\_] of this ordinance. If an SES qualifies as either an ISES or an ASES, it shall not be considered a GSES.

2. **SES Standards.** The following shall be inserted as [\_\_\_\_\_]:

[\_\_\_\_\_]. Development Standards for Ground Mounted Solar Energy Systems (“GSES”)

A GSES must conform to the following development standards:

- A. Fence. A GSES shall be enclosed by perimeter fencing of at least six (6) feet in height sufficient to prevent unauthorized access.
- B. Setbacks. A GSES shall be subject only to the following setbacks: (a) solar panel structures shall be set back at least fifty (50) feet from all property lines unless a lesser setback is approved by the Board of Zoning Appeals, and (b) solar panel structures shall be set back at least one hundred (100) feet from all residential dwelling units occupied at the time of site plan review. The setback requirements of this section do not apply to internal parcels within the same GSES.
- C. Landscape Buffering. A GSES shall have, to the extent reasonably practicable, a visual buffer of natural vegetation, fencing, and/or plantings, that upon maturation, would provide a visual screen to reduce the view of the GSES from residential dwelling units on adjacent lots that are occupied at the time of site plan review. Notwithstanding anything to the contrary this section, existing natural tree growth and natural landforms along the perimeter of a GSES that create a reasonably sufficient visual buffer shall satisfy the requirements of this section.
- D. Signage. A GSES shall have signs (a) stating the risks that may result from contact with a GSES, (b) identifying the owner or operator of the GSES, and (c) providing a 24-hour emergency contact phone number. All signs displayed with respect to a GSES shall comply with the requirements of the applicable zoning district for displaying advertisements.
- E. Decommissioning. Unless otherwise approved by the Board of Zoning Appeals, decommissioning of a GSES shall begin no later than twelve (12) months after a GSES has permanently ceased to generate electricity, at which time the owner or operator of the GSES shall restore and reclaim the site within twenty-four (24) months after a GSES has permanently ceased to generate electricity. Notwithstanding anything to the contrary, a GSES will not be considered to have permanently ceased to generate electricity unless it has failed to diligently pursue the production of, or restoration of the GSES’s ability to produce, electricity for at least twelve (12) consecutive months. The owner or operator of the GSES shall provide the Planning Commission with a copy of its decommissioning plan and evidence of its decommissioning security to the extent required pursuant to 2022 Tenn. Pub. Acts 866. No decommissioning security shall be required other than that provided for pursuant to 2022 Tenn. Pub. Acts 866.

- F. FAA. A GSES shall conform with any applicable Federal Aviation Administration requirements and, if required, secure any necessary approvals prior to commencement of construction of the GSES.
- G. Non-GSES Development. Notwithstanding anything provided herein, an ISES and ASES shall be permitted as of right so long as the primary use is permitted as of right in the applicable zoning district. Any other SES that does not qualify as a GSES will be permitted as of right in the [\_\_\_\_\_] zoning district(s), provided that the SES otherwise complies with the general standards for other permitted uses the applicable district.

3. [\_\_\_\_\_] **District**. “Solar energy systems” shall be inserted as Section [\_\_\_\_\_].

BE IT FURTHER RESOLVED that this Resolution shall become effective immediately upon adoption, the public health, safety and welfare requiring it.

Approved and adopted by the [\_\_\_\_\_] of the [\_\_\_\_\_] on

\_\_\_\_\_

\_\_\_\_\_, County/City Mayor

Attest:

\_\_\_\_\_, County/City Clerk

DRAFT

## Appendix D: Tennessee Local Government Solar Zoning Resolutions

### Bedford County Zoning Resolution

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#### 4.066. RENEWABLE ENERGY DEVELOPMENT DISTRICT (REDD)

The purpose of the Renewable Energy Development District is to allow Bedford County government to establish special land use regulations related to the development of solar and other various renewable energy power generating technologies which generally consume enormous quantities of available lands and present a visual impact which industrializes the natural viewshed to near or adjoining parcels. Of special concern are areas of Bedford County considered to be predominantly rural and agricultural in nature.

Additionally, various other areas of Bedford County are considered unique in that a major investment in public infrastructure has taken place or have been planned using large sums of public funds. The protection of these public investments and assets on behalf of the taxpayer where government has made investments of public funds for future jobs growth and industry diversity for the citizens of Bedford County are paramount. Such areas may have been pre-planned by local government to eventually develop in a way, either civic, residential, commercial, or industrial, that will create housing, sustainable incomes, and job opportunities for its citizens. Planning for industry requires the necessary public infrastructure needed to encourage or incubate these types of developments.

Lastly, Bedford County boasts an undulating topography which lends itself to important cultural panoramic viewsheds intended to be protected as cultural assets. It is the intent of this section to provide suitable land resources for the development of renewable energy projects without any significant adverse economic or cultural impacts to these important investments and assets.

Any parcel lying outside of the **Bedford County Renewable Energy Overlay Zone (REZ)** intended for use as an NPU must first be re-zoned to the **Renewable Energy Development District (REDD)** zone classification. Parcels zoned A-1 which lie inside the adopted boundaries of the REZ, intended for use as an NPU shall qualify as a conditional use in the A-1 zone, needing only approval as a special exception from the **Board of Zoning Appeals (BZA)**.

g. Commercial, Non-Public Utility Power Generating Facility (NPU).

### Bedford County Tennessee Zoning Resolution

## 1. Commercial Solar Energy Development

### g. Use and Structure Provisions

#### 1) Uses Permitted

Solar NPU's (*see* Article II, Section 2.141) lying inside the boundaries of the **Bedford County Renewable Energy Zone** as defined by the Bedford County Renewable Energy Overlay Zone Map (*see Appendix C.*).

#### 2) Uses Permitted as Accessory Uses

- a) The construction of accessory structures used specifically for the operational or office/business needs of an NPU.
- b) The construction of electrical sub-stations and their physical connectivity to a public or private electrical grid.

#### 3) Prohibited Uses

Any use or structure not specifically permitted by right or special exception as presented in the Land Use Activity Table in *Appendix D* is prohibited. The use of a mobile home or similar structure as an office, storage space, retail space, or in any other manner is expressly prohibited.

#### 4) Development Standards:

*See* Article II, Section 2.141 (*see also, Appendix C. and Appendix D.*)

### h. Bulk, Yard, Density, and Intensity Regulations

The regulations appearing below in *Appendix C.* shall apply to both A-1 and *REDD* zone lots.

**Appendix C. Renewable Energy Development District – Bulk Regulations**

Zoning District		Minimum Lot Area	Minimum Lot Width	Minimum Building Setback	Maximum Height	Maximum Lot Coverage
<b>A-1 (Conditional Use Only)</b>	NPU Inside the Bedford County Renewable Energy Overlay Zone	NONE	NONE	Front – 75 feet Side – 75 feet Rear – 75 feet	35 ft.	95%
<b>REDD</b>	NPU Outside the Bedford County Renewable Energy Overlay Zone	NONE	NONE	Front – 400 feet Side - 375 feet Rear - 390 feet	35 ft.	66%

i. Special Allowances, Variances and Prohibitions

The regulations appearing below in *Appendix D.* apply to *REDD* zone lots and buildings or other structures located on any *REDD* zone lot or portion of a *REDD* zone lot including all new developments, enlargements, extensions, or conversions. Existing buildings, structures or use activities that do not comply with one or more of the applicable bulk regulations are classified as nonconforming and are subject to the provisions of **Article VI, Section 6.020.**

**Appendix D. Uses: REDD Permitted, Special Exceptions, Exemptions and Non-Permitted.**

Zoning Overlay District	Permitted Uses	Special Exceptions	Zoning Exemptions	Prohibited Uses
<b>REDD</b>	NPU Equipment, fixtures, and structures associated with the collection, storage, and transmission of solar energy intended to produce an electrical product for sale and delivery to a public or private electrical grid.	NONE	NONE	Residential dwellings, Commercial Operations other than NPU, Industrial, mobile home, RV's, or other similar structures for any purpose.

#### 4.066.0 **BEDFORD COUNTY RENEWABLE ENERGY OVERLAY ZONE (REZ)**

The **Bedford County Renewable Energy Overlay Zone** was established with the intent of creating large, designated areas of Bedford County which are deemed to be most appropriate areas for the development of large renewable energy projects such as commercial solar energy farms – NPU's. NPU's can be multi-hundred-acre sites which generally contain 10,000 to 25,000 or more solar panels and can, by themselves, have a considerable transformative effect on our rural village character and the agricultural landscapes and viewsheds important to the cultural fabric and history of Bedford County.

In addition, Bedford County has made significant investments of public funds toward the identification and planning of its high-growth areas deemed suitable for residential, commercial, and industrial development. These investments having been made in order to cultivate and attract business and industry for the creation and sustainability of stable employment opportunities, services, retail and adequate quality of life for its citizens and, in-kind, an educated workforce for attracting and maintaining existing industry. In those expenditures and efforts, it has invested large sums of its public funds for the improvement of the public infrastructure (water, sewer, gas, electric) required for those instant and long-term needs.

As renewable energy development projects such as the identified NPU do not require nor use the same public infrastructure (high-capacity water, sewer, or natural gas), it is critical that those public fund investments and the rare multi-hundred-acre improved lands, be properly planned and utilized in such a way as for local government to not be wasteful of public monies and of our most valuable resources.

The undulating and high-rolling natural topographies of Bedford County is also deemed inappropriate for these types of developments. Bedford County enjoys a mix of both flat and hill lands. The **Bedford County Renewable Energy Overlay Zone** is a boundary of lands identified to have a

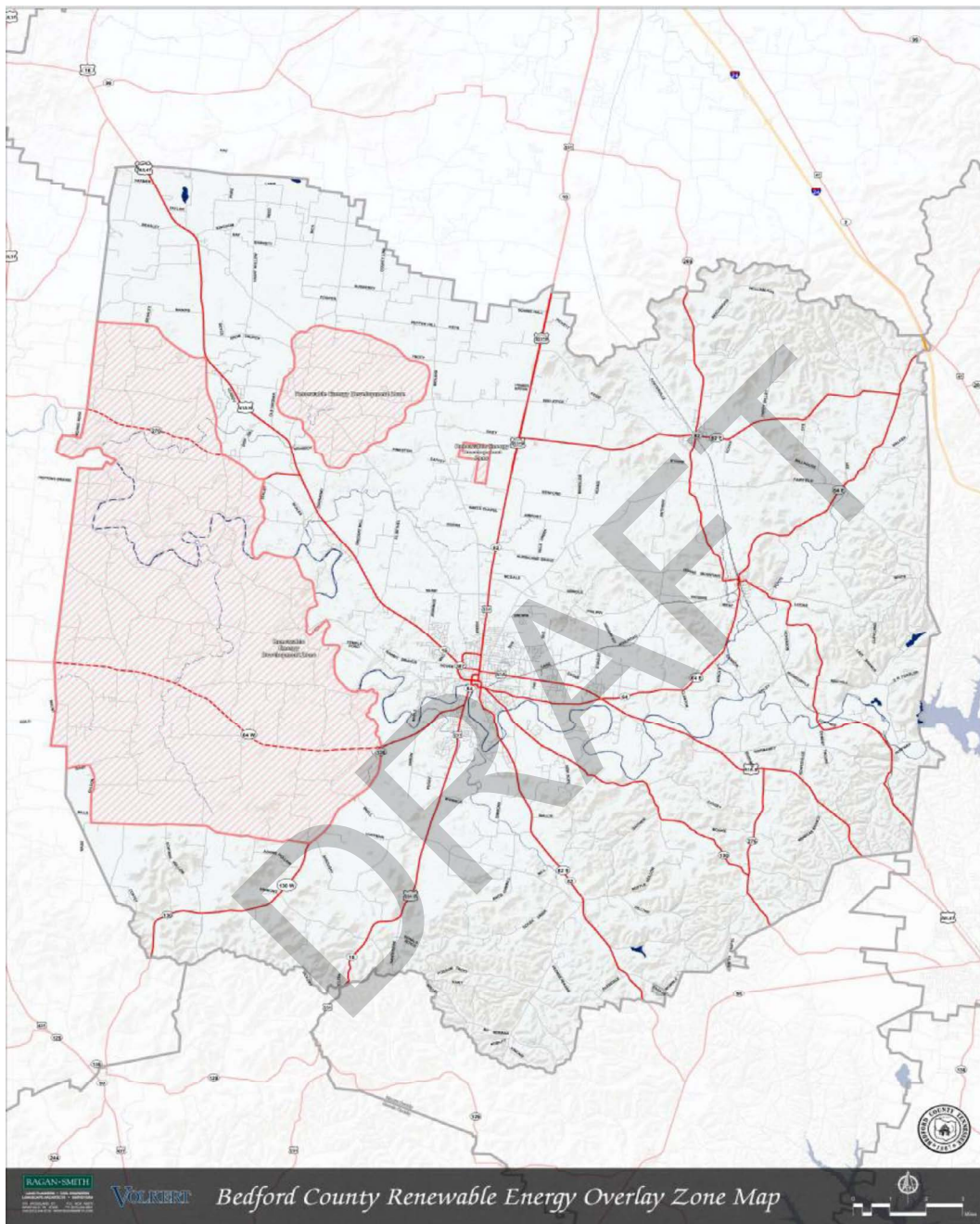


typical topography of less than 6% slopes and areas not identified by the Planning Department as being in high growth areas or areas where significant public infrastructure investments have been made or planned.

Applicants wanting to rezone lands for use as an NPU are eligible to apply for the **Renewable Energy Development District (REDD)** zoning classification in areas outside of the mapped **Bedford County Renewable Energy Overlay Zone**. However, any NPU approved for a zone lot outside of the designated **Bedford County Renewable Energy Overlay Zone** shall be subject to increased standards (i.e., Bulk, Density, Setbacks) as referenced in *Appendix C*, in order to mitigate adverse cultural viewsheds, protect agricultural areas from taking on an industrial appearance, and to protect area property values. NPU's desiring to locate inside the boundaries of the Bedford County Renewable Energy Overlay Zone shall qualify as a conditional use in the A-1 zone without the need to rezone the lot to **REDD** and are eligible for setback and bulk relief as referenced in *Appendix C*. due to its impact being deemed less adverse to nearby property.

#### **4.066.1 BEDFORD COUNTY RENEWABLE ENERGY ZONE MAP**

The Bedford County Renewable Energy Overlay Zone Map (*see* map below) has identified areas of Bedford County deemed most suitable for NPU development. Applicants desiring to develop NPU's in Bedford County are encouraged to find suitable lands in the designated (red shaded) areas defined on the said MAP (*see* Article IV, Section 4.066 (A)(1)(b.) appendix C. and Section 4.066 (A)(1)(c.) appendix D.). NPU developments inside the boundaries of this zone shall qualify as a conditional use under the A-1 zone.



- Areas shaded in red with diagonal lines are deemed appropriate areas for Renewable Energy Developments and NPU's and qualify as conditional uses under the A-1 Zone.
- Areas not shaded in red with diagonal lines shall be subject to more intensive setback regulations (see Appendix C) and must rezoned to **Renewable Energy Development District (REDD)**.

### Bedford County Tennessee Zoning Resolution

**BROWNSVILLE TN ZONING ORDINANCE – ALLOWED BY RIGHT IN GI (GENERAL INDUSTRIAL) AND RI (RESTRICTED INDUSTRIAL) ZONES ONLY**

SOLAR FARMS, subject to site plan review by the Board of Zoning Appeals and the following conditions:

- i. Solar farms shall be enclosed by perimeter fencing to restrict unauthorized access at a height of eight (8) feet.
- ii. Adequate screening shall be provided. This can be achieved by either the required perimeter fencing being constructed as a board-to-board privacy fence or by vegetative screening being placed beyond the perimeter fence to a density and height that adequately buffers the solar farm from any nearby uses.
- iii. Solar farms shall adhere to the setback, height, and coverage requirements of the district.
- iv. Solar farm structures must be setback a minimum of 500 feet from residential structures.
- iv. Solar farms must be located on lots of no less than 50 acres in size.
- v. Solar farms must not create increased noise levels that are discernible to nearby residential uses.
- vi. Solar farms must not produce glare that would constitute a nuisance to occupants of neighboring properties or persons traveling neighboring roads.
- vii. All electrical interconnection and distribution lines within the project boundary shall be underground.
- ix. Solar farms which become inactive for a period exceeding one (1) year shall be removed at the owners or operators expense and the site shall be returned to its natural state. This includes the obligation to dismantle and remove from the site all electrical generating equipment, cables, panels, foundations, buildings and ancillary equipment. To the extent possible, the operator shall restore and reclaim the site to its pre-project topography and topsoil quality. Any agreement between the operator and landowner for removal to a lesser extent than set forth in this paragraph shall be required prior approval by the board. The restoration activities must be complete within 18 months from the date the solar farm becomes inactive.
- x. The applicant shall submit to the board a decommissioning plan describing the manner in which the applicant anticipates decommissioning the project. The plan shall include a description of the manner in which the applicant will ensure that it has the financial capability to carry out the restoration requirements. The board may from time to time request the operator to submit a report describing how it is fulfilling this obligation. The board shall decide if it is prudent to include provisions that ensure financial resources will be available for decommissioning. This may include bonding or other methods of guaranteeing performance, such as establishing an escrow account into which the developer / operator will deposit funds on a regular basis over the life of the project which would allow the City of Brownsville to have access to the escrow account for the explicit purpose of decommissioning in the event of default. Financial provisions shall not be so difficult as to make the solar farm unfeasible.

## Fayette County Zoning Resolution

tower's surface.

- "Guy Wire Supported Tower" is a tower requiring guy wires and/or ground anchors to support it.
- "Lattice Tower" is a self-supporting tower constructed of a lattice of structural members not connected to guy wires and ground anchors.
- "Monopole Tower" is a self-supporting tower consisting of a single pole not connected to guy wires and ground anchors.
- "Stealth Flagpole Tower" is a monopole tower with the proportions of a flagpole and an antenna array(s) hidden inside the tower.
- "Stealth Tree Tower" is a monopole tower with the appearance of a large tree and antenna array(s) hidden by the artificial tree limbs.

### Section 13 Solar Photovoltaic Facilities.

- 13.1 Procedure: A Solar Photovoltaic Facility shall be a use permitted as a special exception as provided hereinbelow. To assure the fullest possible possession of all facts relevant to the location and design of a prospective solar photovoltaic facility, as well as to prevent a premature or even needless expenditure of public resources, a five-step sequential procedure including two (2) System Impact Studies shall govern review and construction of any solar photovoltaic facility of more than fifty (50) kilowatts, as follows:
- 13.1.1 Distributor Study. The applicant at his expense shall obtain a first System Impact Study from the local electric distributor whose system the proposed solar photovoltaic facility will access, elaborating the distributor's requirements for the electrical power generated by the facility to be conveyed into its electrical grid and concluding that the facility will not impose new costs on the distributor's current customers. The Board of Appeals may require documentation that issues surfaced in the local electric distributor's System Impact Study have been resolved as part of the board's Location Review specified in Section 13.1.2.
- 13.1.2 Facility Location Review. The proposed site as delineated with reasonable precision shall undergo evaluation of its location by the Board of Appeals to determine whether the "Facility Location Standards" of Sections 13.2 and 13.4 will be satisfied. This review shall be a public hearing and shall incorporate the same hearing procedures as govern other special exception applications before the board. Should the Board of Appeals determine the location criteria are not satisfied it shall disapprove the proposed location. Should the Board of Appeals determine the location criteria are satisfied it shall approve the proposed location pending design approval and indicate any special provisions it requires be incorporated into the site design or concerns the design must address, provided such specification at that time shall not bar the Board of Appeals from later specifying additional design requirements or operational stipulations that were reasonably unforeseen as needed on initial review of the facility. Once location approval is obtained from the Board of Appeals all future evaluation by the Board of Appeals shall be limited to how the facility will be designed and not whether it may occur, provided that following location approval there is no alteration of topography or removal of land cover at the site. Location approval shall lapse after a period of five (5) years unless the Board of Appeals shall vote to extend it, with the duration of the extension to be as specified in the adopted motion, and should the Board of Appeals not vote to extend location approval the site may be resubmitted for Location Review after a lapse of one (1) year under the same procedures as governed the original application. For the duration there remains in effect location approval for a solar photovoltaic facility, the building commissioner shall notify any person applying for a building permit to erect or place a dwelling within five hundred (500) feet of the site that the facility is pending. Notwithstanding any policy of the Board of Appeals, once location approval is granted no reconsideration of such approval may occur except on the building commissioner's written recommendation citing just cause, or because there has occurred alteration of topography or removal of land cover at the site.
- 13.1.3 TVA Study. The Applicant at his expense shall obtain a second System Impact Study from

the Tennessee Valley Authority (TVA), elaborating TVA's requirements for the electrical power generated by the facility to be conveyed into its electrical grid. The Board of Appeals may require documentation that issues surfaced in the TVA System Impact Study have been resolved as part of its Design Review.

- 13.1.4 Facility Design Review. The proposed facility shall undergo evaluation of its design by the Board of Appeals both to determine whether the "Facility Design Standards" of Section 13.3 and 13.4 will be satisfied and whether the site as designed will be adequately buffered from view by current or reasonably foreseeable neighboring homesteads. This evaluation will be a public hearing and shall incorporate the same hearing procedures as govern other special exception applications before the board, except the public comment and discussion may address only matters of design. The Board of Appeals may revise and supplement design requirements at any time prior to final design approval. Site design approval shall lapse after a period of three (3) years unless the Board of Appeals shall vote to extend it, which duration of extension shall be as specified in the adopted motion. Should the Board of Appeals not vote to extend design approval the site may be resubmitted for Design Review after a lapse of one (1) year under the same procedures as governed the original application. For the duration there remains in effect design approval for a solar photovoltaic facility, the Building commissioner shall notify any person applying for a building permit to erect or place a dwelling within five hundred (500) feet of the site that the facility is pending. Notwithstanding any policy of the Board of Appeals, once design approval is granted no reconsideration of such approval may occur except on the building commissioner's written recommendation citing just cause, or because there has occurred alteration of topography or removal of land cover at the site.
- 13.1.5 Construction. No building permit at the site for any component of the solar photovoltaic facility shall issue prior to final design approval, and neither shall any certificate of occupancy be issued nor any generation of electricity commence until all specifications of the site plan have been satisfied and any required financial assurances have been submitted in the form and manner specified by the building commissioner.
- 13.2 Facility Location Standards. The following criteria shall be applicable at the stage of Location Review:
- 13.2.1 The facility shall be located only within an area designated Rural by the Fayette County Growth Plan, provided this provision may be waived within a city's Urban Growth Boundary by the consent of the relevant city as expressed by a Resolution of its legislative body adopted after a public hearing advertised in a newspaper of local circulation at least fifteen (15) day prior to the hearing.
- 13.2.2 The facility shall not be located in trespass of any utility easements whether as to infrastructure existing or prospective, mains or service lines.
- 13.2.3 No part of any site proposed for a solar photovoltaic facility may be further than one-and-a-half (1.50) miles from the centerline of an operational Tennessee Valley Authority right-of-way designed to convey at least 161,000 volts of electricity, unless the site is adjacent to a solar photovoltaic facility already in operation or under construction.
- 13.3 Facility Design Standards. The following criteria shall be applicable at the stage of Design Review:
- 13.3.1 The facility shall not install or cause the installation of any fill material in a floodplain.
- 13.3.2 All electrical interconnection and distribution lines within the facility shall be underground.
- 13.3.3 No structural component of the facility shall be more than 25 feet above natural grade.

- 13.3.4 Except in exceptional circumstance related to a physical feature of the approved solar site, no setback shall be required from a common lot line between two or more lots where such common lot line is entirely within the approved exterior boundary of the site, provided that all above-ground structural components of the facility shall maintain a minimum setback of thirty (30) feet from the approved exterior boundary of the site, which minimum the board of appeals may extend where warranted by conditions of drainage or visibility, especially in proximity to a public right-of-way.
- 13.3.5 Not less than twenty (20) percent and not more than forty (40) percent of the approved site location shall be designated for open space by the board of appeals, which open space shall not be occupied by any above-ground facility, and no minimum building setback specified in Article VII for the district in which the facility is located shall be considered a part of this open space.
- 13.3.6 The Board of Appeals may specify areas of topography or land cover that the facility must preserve.
- 13.3.7 A facility operations and management plan shall be part of the site plan – including, but not limited to, provisions for fencing, lighting, grass-cutting, preservation of landscape screening, drainage, and access, along with such design data as the Board of Appeals may require – along with a statement satisfactory to the county attorney and executed by a duly empowered company officer acknowledging the company's agreement that any continuing or repeated failure to fully comply with the approved operations and maintenance arrangements will be sufficient legal grounds for Fayette County to compel complete cessation and removal of the use.
- 13.3.8 Geometric and contextual data for the site design shall include state plane coordinates and otherwise shall be as specified by the building commissioner, with the Board of Appeals having prerogative to add but not subtract from the building commissioner's specifications.
- 13.3.9 No design of the facility or its site shall be approved by the Board of Appeals without a written declaration from both the local electric distributor whose system the proposed solar photovoltaic facility will access and the Tennessee Valley Authority that the proposed design does not incorporate any unsatisfactory element, provided that non-response by either authority beyond sixty (60) days after documented receipt of the design from the building commissioner shall constitute satisfaction of this requirement.
- 13.3.10 If the facility has been approved for location within an Urban Growth Boundary, the building commissioner shall afford the city's Board of Mayor and Alderman an opportunity of not less than thirty (30) days duration to review and comment on the design.
- 13.3.11 Once approved, the site plan, including all documents as well as diagrams, shall be recorded in the Office of the Fayette County Register at the expense of the party seeking the special exception.
- 13.4 The following criteria shall be applicable at the stages of both Facility Location Review and Facility Design Review:
  - 13.4.1 The facility shall be located on a lot or contiguous leased site at least 150 acres in size and shall have not less than two (2) means of assured ingress/egress at least 200 feet apart at all points, which shall be constructed or improved as specified by the Board of Appeals.
  - 13.4.2 Topography and land cover shall lend itself to concealment of the facility, and no alteration or removal of such elements shall occur without approval of the Board of Appeals.
  - 13.4.3 No solar panels shall be installed within five hundred (500) feet of any existing livable dwelling

unit, whether or not occupied, not owned by the owner of the lot on which the facility is located, provided this shall not govern in any way the location of a dwelling unit.

- 13.4.4 No solar panels shall be located within five hundred (500) feet of the centerline of any State Road or Major County Road so designated by the map recorded at Plat Book 8, Page 46, in the Office of the Fayette County Register, provided the Board of Appeals may reduce this requirement to not less than one hundred (100) feet if natural or constructed topography and/or existing land cover will be adequate to fully screen the panels to the extent of five hundred (500) feet from centerline of the subject road.
- 13.5 The Board of Appeals shall require the approved facility design to include a written statement duly executed by the empowered party(s), running with the land, reciting the language of Sections 13.3.1, 13.3.2, 13.3.3, 13.3.4, and 13.4.2 and acknowledging that these provisions are continuing obligations governing the facility and that nonconformity with any of them shall be grounds for the Board of Appeals to revoke the special exception following documentation of the nonconformity at a public hearing and order complete cessation of the use and removal of the facility.
- 13.6 The Board of Appeals shall obtain satisfactory financial assurance that the facility will be fully disassembled and removed from the site within one (1) year after cessation of its function to generate electricity, which assurance may include a lien on the property.
- 13.7 In the course of facility location review and/or facility design review the Board of Appeals may impose such additional conditions and/or restrictions upon a proposed solar photovoltaic facility as it may deem necessary in furtherance of the intents and purposes of this Resolution, which conditions and/or restrictions shall be continuing obligations enforceable by revocation of the special exception and resort to such financial provisions as may have been required to the purpose of facility removal.
- 13.8 Because of the extensive time required to evaluate a proposed solar photovoltaic facility, particularly a large one, with its consequent potential to delay the projects of others, the process of facility location review and facility design review shall not be bound to a codified deadline but rather shall each be as specified in writing by the building commissioner within thirty (30) days after an application is submitted with full payment of the applicable fees along with a written request for such specification, and if the applicant is dissatisfied with the building commissioner's specification he may request the Board of Appeals to direct a faster review, which request shall be in writing and placed on the agenda of the Board of Appeals at its first regular meeting scheduled for two (2) weeks or more after the applicant makes the request. In its review the Board of Appeals may consider any element it deems relevant and may modify the building commissioner's specification as it believes proper, and to that end shall have the powers of the building commissioner.

**Section 14** Flag Lots Of Record. No permissible building area of a flag lot of record created after April 24, 2007, shall be located behind the rear lot of record line of another flag lot of record having frontage on the same road, provided further that a flag lot of record created after August 25, 2015, shall have no permissible building area behind any rear lot of record line of another flag lot of record having frontage on the same road.

**Section 15** Location of Buildings. No building location shall be established on any lot served or to be served by an individual sewage disposal system except in conformity with the requirements of the Tennessee Department of Environment and Conservation Division of Groundwater Protection or this Resolution, whichever is more restrictive.

**Section 16** Provisions Governing On-Site Subsurface Sewage Disposal Systems.

- 16.1 Wherever there is not public sanitary sewer, a dwelling shall have on the same lot on which it

## Franklin County Solar Farm Resolution

RESOLUTION NO: \_\_\_\_\_

### A RESOLUTION REGARDING COMMERCIAL RENEWABLE ENERGY PRODUCTION FACILITIES

**WHEREAS** the County Commissioners of Franklin County are concerned about the ramifications of commercial renewable energy production facilities attempting to locate in Franklin County; and,

**WHEREAS** commercial renewable energy facilities such as, but not limited to, solar farms, wind farms, etc. consume large amounts of arable or potentially industrial or residential land; and,

**WHEREAS** the long-term environmental effects of such facilities are still undetermined; and,

**WHEREAS** the employment and economic benefits of such facilities are negligible; and,

**WHEREAS** Franklin County zoning currently allows for renewable energy facilities only when they are wholly owned and operated by utility companies; and,

**WHEREAS** Franklin County zoning currently allows for renewable energy production for private use on private land; and,

**WHEREAS** Franklin County is already home to a power production facility in the form of Tims Ford hydroelectric dam; and,

**WHEREAS** the Board of County Commissioners of Franklin County is of the opinion that commercial renewable energy facilities would not benefit the citizens of Franklin County; and,

**NOW, THEREFOR, BE IT RESOLVED**, by the Board of County Commissioners of Franklin County, Tennessee expresses to the Board of Planning and Zoning that such changes would not be welcomed; and,

**BE IT FURTHER RESOLVED** that this Resolution establishes an indefinite moratorium which shall prohibit the review, approval or creation of any renewable energy production facilities not currently allowed by Franklin County zoning; and,

**BE IT FURTHER RESOLVED** that this Resolution shall take effect upon adoption, the general welfare requiring it.

ADOPTED this \_\_\_\_\_ day of \_\_\_\_\_, 2022.

APPROVED:

ATTEST:

\_\_\_\_\_  
David Alexander, Mayor and Chair

\_\_\_\_\_  
Phillip Custer, County Clerk

REESOLUTION SPONSORED BY: King & Earle



## Greene County Solar Ordinance

2. The owner/operator shall reside on premise.
  3. The center is licensed by the State of Tennessee.
  4. The center is located on an arterial or collector road as shown on the Greene County Zoning Map.
  5. The center is located on a lot of one acre or more.
  6. Signage, fencing, and buffering requirements shall be determined by the Greene County Regional Planning Commission as part of the site plan review.
- R. Small Woodworking Shops, provided:
1. One principal structure used for manufacturing not to exceed 1,600-sq. ft. in size.
  2. Accessory structures shall be permitted provided they are not used for manufacturing.
  3. Parking shall be gravel.
  4. Hours of operation shall be daylight hours.
  5. Design shall meet or exceed the minimum State requirements.
  6. Maximum number of employees shall not exceed three (3).
- S. Solar panel farms, provided:
1. Buffer Zones shall be:
    - (a) A minimum of fifty feet in width as measured from the exterior of the fence surrounding a solar farm;
    - (b) Maintained as green space for the entire width of the buffer zone, except for necessary intrusions for vehicular or power access, fencing, or drainage structures required elsewhere in these regulations;
    - (c) Used to preserve, where possible and practical, existing trees located in the buffer zone, provided that doing so will not block reasonable access for the solar farm.

2. Solar Farm Buffer Strips. Solar farm buffer strips shall:
  - (a) Be located outside required fencing.
  - (b) Be planted with evergreen shrubs and/or trees that are at a minimum of six feet in height at the time of planting and are staggered ten (10) feet on center.
  - (c) The applicant may request credit or a waiver of buffer planting requirements if existing vegetation exists that meets the buffer planting standard.
  - (d) Be maintained even if the solar farm is no longer operational and/or falls into disuse, unless and until the solar farm is dismantled and removed from the parcel(s) upon which it was constructed.
  - (e) Required where the solar farm fencing would be visible off-site.
  - (f) Be required where lease lines overlay exterior property lines, provided that separate tax parcels under the same ownership are considered one property for the purposes of this sub section.
  - (g) Not be required within the interior of a solar farm development where areas leased from different property owners abut one another.
  - (h) Be shown on plans submitted to and approved by the Enforcing Officer, who shall approve the design, width, height, opacity, growing period to maturity, time schedule for installation, and responsibility for perpetual maintenance.
3. Setbacks. Setback requirements to the lease/property line for any building or solar array shall be a minimum of fifty feet, except that the setback from any Residential Dwelling existing at the time of approval of the solar panel farm shall be three hundred (300) feet from the corner of the residential dwelling to the closest solar array. Residential Dwelling shall mean a permanent, not temporary, improvement used for residential purposes.
4. Fencing. All solar farms shall be enclosed with a fence measuring a minimum of six (6) feet in height that is topped with at

least three strands of barbed wire that shall be maintained in good condition to the satisfaction of the Enforcing Officer.

5. Land Development. Unless a variance is granted by the board of zoning appeals, the following requirements must be met.

(a) Pre-development drainage patterns shall be maintained so that post development surface water run-off does not exceed pre-development surface water run-off for a 25 year storm event.

(b) Soil shall be retained on-site through the appropriate use of silt fencing, straw bales, or other effective manner.

(c) The area of the solar farm located to the interior of the buffer zone shall be maintained in a grassed condition, with the exception of access driveways, building pads, utility facilities and necessary equipment supports.

(d) Grassed areas within the solar array shall be maintained in accordance with established and recommended procedures for maintaining hay crop and pasture weed management as recommended by the University of Tennessee Extension Service.

6. Glare. Glare studies shall be as required by state and/or federal regulations.

7. Additional Requirements. The following information shall be submitted to the Enforcing Officer prior to construction of the site. Proof that:

(a) The project has been approved by the utility, all applicable interconnection procedures necessary to deliver electricity to the local utility have been completed, as well as an executed interconnection agreement.

(b) The lease for the project contains wording to the effect that, at the end of the lease period or if the solar farm is no longer operational for a period of twelve consecutive months and the lessee or the landowner does not, within such twelve month period commence a good faith effort to make such solar farm operational, the solar farm shall be deconstructed within twelve months thereafter, and the land returned to the owner in substantially the same condition as prior to development.

(c) The property owner is ultimately responsible for the removal of the solar farm array. (Entirety of Section 601.1S added 7/20/15).

- T. Tiny homes, as defined in 256 B, provided:
1. Units must meet the minimum size requirements of the International Building Code that is in place at the time of construction.
  2. Those units built on-site must meet the International Building Code in effect at the time of construction.
  3. Out-of-county on frame tiny homes must be inspected by a Tennessee state licensed structural engineer throughout the building process. The engineer must provide all inspection reports to the Greene County Building Commissioner. A full set of plans must accompany each home. Plans must be stamped by a Tennessee state licensed structural engineer. Plans must also show all anchoring information.
  4. Site built homes, or manufactured tiny homes which have their wheels removed, must be situated on a permanent foundation with permanent connections to water, sewer/septic, and electric utilities.
  5. Homes constructed in a manufacturing facility that retain their wheels shall provide underpinning, foundations and tie-downs per structural engineers requirements. (Added 7/17/17).
- U. Campgrounds, provided:
1. They are five (5) acres or larger in size.
  2. Site plans are submitted and approved by the Greene County Regional Planning Commission.
  3. Buffers are provided as follows:
    - (a) A buffer area of at least fifty (50) feet in width shall be provided around the periphery of the campground.
    - (b) The outer twenty-five (25) of buffer area shall contain a landscape strip planted with evergreen trees, measuring a minimum of six (6) feet in height at the time of

## Hardeman County Solar Ordinance

RESOLUTION # \_\_\_\_\_  
(Alternative / Option- 2)

A RESOLUTION TO AMEND CHAPTERS 2, "DEFINITIONS", 5, "PROVISIONS GOVERNING FAR (FORESTRY, AGRICULTURE, RESIDENTIAL) DISTRICTS, 12, "PROVISIONS GOVERNING I-1 (LIGHT INDUSTRIAL) DISTRICTS, 13, "PROVISIONS GOVERNING I-2 (RESTRICTED INDUSTRIAL), AND 14, "PROVISIONS GOVERNING I-3 (RURAL INDUSTRIAL) DISTRICTS, OF THE TEXT OF THE HARDEMAN COUNTY ZONING RESOLUTION TO INCLUDE DEFINITION FOR SOLAR FARMS AND TO ALLOW FOR SUCH AS USES PERMITTED ON APPEAL IN FAR DISTRICTS AND USES PERMITTED IN I-1 (LIGHT INDUSTRIAL), I-2 (RESTRICTED INDUSTRIAL), AND I-3 (RURAL INDUSTRIAL

WHEREAS, pursuant to TENNESSEE CODE ANNOTATED, Sections 13-7-101 and 13-7-102, a Zoning Resolution and Map have been adopted by the Hardeman County Commission; and,

WHEREAS, the Hardeman County Commission deems it necessary, for the purpose of promoting the health, safety, prosperity, morals and general welfare of the County to amend said Resolution; and,

WHEREAS, in accordance with Tennessee Code Annotated, Section 13-7-105, the Hardeman County Planning Commission has reviewed and recommended that the following described amendments be made in the text of the adopted Zoning Resolution; and,

WHEREAS, in accordance with Tennessee Code Annotated, Section 13-7-105, the Bolivar Municipal-Regional Planning Commission has reviewed and recommended the following described amendments to be made in the text of the adopted Zoning Resolution; and,

WHEREAS, pursuant to TENNESSEE CODE ANNOTATED, Section 13-7-104, the Hardeman County Commission has given due public notice of a hearing on said amendments and has held a public hearing;

NOW, THEREFORE, BE IT RESOLVED by the Hardeman County Commission:

Section 1. That Chapter 2, DEFINITIONS, be amended by adding the following term:

"Solar Farm" – includes a use of land where a series of one or more solar collectors are placed in an area on a parcel of land for the purpose of generating photovoltaic power and said series of one or more solar collectors placed in an area on a parcel of land collectively has a nameplate generation capacity of at least 15 kilowatts (kw) direct current (DC) or more when operating at maximum efficiency. Solar Farm is also referred to as solar power plant or solar photovoltaic farm. "Solar collector" means a device, structure or a part of a device or structure for which the primary purpose is to transform solar radiant energy into thermal, mechanical, chemical, or electric energy. However, notwithstanding anything to the contrary contained herein, the term "Solar Farm" shall not be construed to include, so as to prohibit, or have the effect of prohibiting, the installation of a solar collector that gather solar radiation as a substitute for traditional energy for water heating, active space heating and cooling, passive heating, or generating electricity for a residential property.

Further, notwithstanding anything to the contrary contained herein, the term "Solar Farm" shall not be construed in such a way as to prohibit the installation or mounting of a series of one or more solar collectors upon roofs of residential and/ or commercial structures regardless of whether the said series of one or more solar collectors collectively has a total nameplate generation of at least 15 kilowatts (kw) and direct current (DC) or more when operation at maximum efficiency.

Section 2. That Chapter 5, Provisions Governing (FAR) Forestry-Agriculture-Residential Districts, be amended by amending Section 5.02, Uses Permitted on Appeal, to include the following:

- K. Solar Farms – provided the following standards are met and presented on a site plan approved by the Planning Commission:
- 1) Safety fencing. All Solar Farms shall be fenced around the exterior of the Solar Farm with an opaque or semi opaque fence of earth tone colors which shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run above such six feet. All fencing shall be constructed so as to substantially lessen the likelihood of entry into a Solar Farm by unauthorized individuals.
  - 2) Gates and Locks. All gates to the fences of all Solar Farms shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run above such six feet. All gates to the fences of all Solar Farms shall remain locked at all times except for those times when the owner and / or operator, or their respective agents is / are using the gate for ingress and / or egress or is / are otherwise present and monitoring the Solar Farm(s).
  - 3) Setbacks. Every Solar Farm shall be setback at least **50 feet** from all property lines of the parcel upon which the Solar Farm is located or to be located. Every Solar Farm shall be **50 feet** from the margin of any public road. Solar Farms shall be at least 100 feet from the stream banks of any navigable stream. All setbacks set forth herein shall be measured from the exterior of the fencing and gates which are required around the perimeter of all Solar Farms.
  - 4) Evergreen Vegetative Buffer. A continuous evergreen vegetative buffer shall be present and maintained at all times around the perimeter of the exterior of the fencing and gates which are required around the perimeter of all Solar Farms. Nothing contained herein shall be construed so as to require such continuous evergreen vegetative buffer to block reasonable access to a Solar Farm. The evergreen vegetative buffer shall be composed of evergreen trees or shrubs of a type which at planting shall be a minimum of four (4) feet in height and which shall be maintained at maturity at a height of not less than six (6) feet in height. The evergreen trees or shrubs shall be spaced no more than ten (10) feet apart (from the base of tree or shrub to the base of tree or shrub). The evergreen vegetative buffer shall be carefully planted and shall be maintained in good condition. Failure to maintain the evergreen vegetative buffer shall constitute a violation of this resolution.

Section 3. That Chapter 12, Provisions Governing (I-1) Light Industrial Districts, be amended by amending Section 12.01, Uses Permitted, to include the following:

- R. Solar Farms – provided the following standards are met and presented on a site plan approved by the Planning Commission:
- 1) Safety fencing. All Solar Farms shall be fenced around the exterior of the Solar Farm with an opaque or semi opaque fence of earth tone colors which shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run above such six feet. All fencing shall be constructed so as to substantially lessen the likelihood of entry into a Solar Farm by unauthorized individuals.
  - 2) Gates and Locks. All gates to the fences of all Solar Farms shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run

above such six feet. All gates to the fences of all Solar Farms shall remain locked at all times except for those times when the owner and / or operator, or their respective agents is/are using the gate for ingress and / or egress or is / are otherwise present and monitoring the Solar Farm(s).

- 3) Setbacks. Every Solar Farm shall be setback at least **50 feet** from all property lines of the parcel upon which the Solar Farm is located or to be located. Every Solar Farm shall be **50 feet** from the margin of any public road. Solar Farms shall be at least **50 feet** from the stream banks of any navigable stream. All setbacks set forth herein shall be measured from the exterior of the fencing and gates which are required around the perimeter of all Solar Farms.
- 4) Evergreen Vegetative Buffer. A continuous evergreen vegetative buffer shall be present and maintained at all times around the perimeter of the exterior of the fencing and gates which are required around the perimeter of all Solar Farms. Nothing contained herein shall be construed so as to require such continuous evergreen vegetative buffer to block reasonable access to a Solar Farm. The evergreen vegetative buffer shall be composed of evergreen trees or shrubs of a type which at planting shall be a minimum of four (4) feet in height and which shall be maintained at maturity at a height of not less than six (6) feet in height. The evergreen trees or shrubs shall be spaced no more than ten (10) feet apart (from the base of tree or shrub to the base of tree or shrub). The evergreen vegetative buffer shall be carefully planted and shall be maintained in good condition. Failure to maintain the evergreen vegetative buffer shall constitute a violation of this resolution.

Section 4. That Chapter 13, Provisions Governing (I-2) Restricted Industrial Districts, be amended by amending Section 13.01, Uses Permitted, to include the following:

- N. Solar Farms – provided the following standards are met and presented on a site plan approved by the Planning Commission:
  - 1) Safety fencing. All Solar Farms shall be fenced around the exterior of the Solar Farm with an opaque or semi opaque fence of earth tone colors which shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run above such six feet. All fencing shall be constructed so as to substantially lessen the likelihood of entry into a Solar Farm by unauthorized individuals.
  - 2) Gates and Locks. All gates to the fences of all Solar Farms shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run above such six feet. All gates to the fences of all Solar Farms shall remain locked at all times except for those times when the owner and / or operator, or their respective agents is/are using the gate for ingress and / or egress or is / are otherwise present and monitoring the Solar Farm(s).
  - 3) Setbacks. Every Solar Farm shall be setback at least **50 feet** from all property lines of the parcel upon which the Solar Farm is located or to be located. Every Solar Farm shall be **50 feet** from the margin of any public road. Solar Farms shall be at least **50 feet** from the stream banks of any navigable stream. All setbacks set forth herein shall be measured from the exterior of the fencing and gates which are required around the perimeter of all Solar Farms.
  - 4) Evergreen Vegetative Buffer. A continuous evergreen vegetative buffer shall be present and maintained at all times around the perimeter of the exterior of the fencing and gates which are required around the perimeter of all Solar Farms. Nothing contained herein shall be construed so as to require such continuous evergreen

vegetative buffer to block reasonable access to a Solar Farm. The evergreen vegetative buffer shall be composed of evergreen trees or shrubs of a type which at planting shall be a minimum of four (4) feet in height and which shall be maintained at maturity at a height of not less than six (6) feet in height. The evergreen trees or shrubs shall be spaced no more than ten (10) feet apart (from the base of tree or shrub to the base of tree or shrub). The evergreen vegetative buffer shall be carefully planted and shall be maintained in good condition. Failure to maintain the evergreen vegetative buffer shall constitute a violation of this resolution.

Section 5. That Chapter 14, Provisions Governing (1-3) Rural Industrial Districts, be amended by amending Section 14.01, Uses Permitted, to include the following:

- F. Solar Farms – provided the following standards are met and presented on a site plan approved by the Planning Commission:
- 1) Safety fencing. All Solar Farms shall be fenced around the exterior of the Solar Farm with an opaque or semi opaque fence of earth tone colors which shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run above such six feet. All fencing shall be constructed so as to substantially lessen the likelihood of entry into a Solar Farm by unauthorized individuals.
  - 2) Gates and Locks. All gates to the fences of all Solar Farms shall be at least six (6) feet in height and which shall additionally have at least three strands of barbed wire run above such six feet. All gates to the fences of all Solar Farms shall remain locked at all times except for those times when the owner and / or operator, or their respective agents is/are using the gate for ingress and / or egress or is / are otherwise present and monitoring the Solar Farm(s).
  - 3) Setbacks. Every Solar Farm shall be setback at least **50 feet** from all property lines of the parcel upon which the Solar Farm is located or to be located. Every Solar Farm shall be **50 feet** from the margin of any public road. Solar Farms shall be at least **50 feet** from the stream banks of any navigable stream. All setbacks set forth herein shall be measured from the exterior of the fencing and gates which are required around the perimeter of all Solar Farms.
  - 4) Evergreen Vegetative Buffer. A continuous evergreen vegetative buffer shall be present and maintained at all times around the perimeter of the exterior of the fencing and gates which are required around the perimeter of all Solar Farms. Nothing contained herein shall be construed so as to require such continuous evergreen vegetative buffer to block reasonable access to a Solar Farm. The evergreen vegetative buffer shall be composed of evergreen trees or shrubs of a type which at planting shall be a minimum of four (4) feet in height and which shall be maintained at maturity at a height of not less than six (6) feet in height. The evergreen trees or shrubs shall be spaced no more than ten (10) feet apart (from the base of tree or shrub to the base of tree or shrub). The evergreen vegetative buffer shall be carefully planted and shall be maintained in good condition. Failure to maintain the evergreen vegetative buffer shall constitute a violation of this resolution.

Section 6. BE IT FURTHER RESOLVED that this Resolution shall become effective immediately upon adoption, THE PUBLIC WELFARE REQUIRING IT.



Approved and adopted by the County Commission of Hardeman County, Tennessee.

\_\_\_\_\_  
Date

\_\_\_\_\_  
County Mayor

Attest:

\_\_\_\_\_  
County Clerk

DRAFT

## Haywood County Zoning Resolution

### Definitions:

Accessory Solar Collection System: – An accessory use, consisting of a panel(s), or other solar energy device(s), that collects, inverts, stores, and distributes solar energy for the purpose of electricity generation that solely serves the principal use of the property.

Solar Farm: - A utility-scale energy generation facility, principally used to convert solar energy to electricity, for the primary purpose of wholesale or retail sales of said electricity.

## CHAPTER V - PROVISIONS GOVERNING FORESTRY, AGRICULTURE, RESIDENTIAL (FAR) DISTRICTS

### 5.02 Uses Permitted on Appeal - Following public notice and hearing and subject to appropriate conditions and safeguards, the Board of Zoning Appeals may permit:

...

- I. Solar Farms, subject to site plan review by the Board of Zoning Appeals (BZA) and the following conditions:
  - i. As to protect the agricultural heritage and agricultural economy of Haywood County, the total acreage of all solar farms in FAR, I-1 districts and I-2 districts not exceed three (3) percent (10,252.8 acres) in Haywood County.
  - ii. Solar farm operations equipment enclosed by perimeter fencing to restrict unauthorized access.
  - iii. Adequate screening for solar farm operations that will be located on arterial status roads deemed a scenic highway by the State of Tennessee. This can be achieved by vegetative screening being placed beyond the perimeter fence to a density and height that adequately buffers the solar farm from any nearby uses. Screening along the side and rear of solar farm operations located on all other roads. This may be achieved by vegetative screening being placed beyond the perimeter fence to a density and height that adequately buffers the solar farm from any nearby uses. However, this requirement may be waived at the discretion of the Board of Zoning Appeals when the proposed solar farm operation is in an area in which the surrounding properties are primarily vacant.
  - iv. Solar farm operations shall have a front-yard setback requirement of 100 feet on Arterial Status Roads. Solar farm operations shall have a front yard setback of requirement of 60 feet on all other roads.
  - v. Solar farm operations shall adhere to the side and rear setback, height, and coverage requirements of the district.
  - vi. Solar farm operation structures must be setback a minimum of 500 feet from residential structures.
  - vii. Solar farm operations must be located on a site not less than 150 acres.
  - viii. Solar farm operations must not produce glare that would constitute a nuisance to occupants of neighboring properties or persons traveling neighboring roads.
  - ix. All solar facilities must meet or exceed the standards and regulations of the Federal Aviation Administration (FAA), and any other agency of the local, state, or federal government with the authority to regulate such facilities that are in force at the time of the application.
  - x. To ensure the structural integrity of the solar facility, the owner shall ensure that it is designed and maintained in compliance with standards contained in all

applicable local, state, and federal building codes and regulations that were in force at the time of the permit approval.

- xi. Lighting shall use fixtures to minimize off-site glare and shall be the minimum necessary for safety and security purposes.
- xii. Solar farms that become inactive for a period exceeding one (1) year shall be removed at the owners or operators' expense and the site shall be returned to its natural state. This includes the obligation to dismantle and remove from the site all electrical generating equipment, cables, panels, foundations, buildings, and ancillary equipment. To the extent possible, the operator shall restore and reclaim the site to its pre-project topography and topsoil quality. Any agreement between the operator and landowner for removal to a lesser extent than set forth in this paragraph shall be required prior approval by the board. The restoration activities must be complete within 18 months from the date the Building Official declares in writing to the solar farm operator the solar farm inactive.
- xiii. The applicant shall submit to the board a decommissioning plan describing the way the applicant anticipates decommissioning the project. The plan shall include a description of the way the applicant will ensure that it has the financial capability to carry out the restoration requirements.

The BZA may from time to time request the operator to submit a report describing how it is fulfilling this obligation. The BZA shall decide if it is prudent to include provisions that ensure financial resources will be available for decommissioning. This may include bonding or other methods of guaranteeing performance, such as establishing an escrow account into which the developer / operator will deposit funds on a regular basis over the life of the project that would allow Haywood County to have access to the escrow account for the explicit purpose of decommissioning in the event of default.

If the Solar Farm operation involves more than one property owner, a surety is required for each landowner. Financial provisions shall not be so difficult as to make the solar farm unfeasible.

#### **CHAPTER IX - PROVISIONS GOVERNING LIGHT INDUSTRIAL (I-1) DISTRICTS**

9.02 Uses Permitted on Appeal - The following uses and their accessory uses may be permitted on appeal if, in the opinion of the Board of Zoning Appeals, such use will not be detrimental to the district in which it is located, and subject to such conditions and safeguards as may be required by the Board of Zoning Appeals:

...

D. Solar Farms, subject to site plan review by the Board of Zoning Appeals and the following conditions:

1. Solar farms shall be enclosed by perimeter fencing to restrict unauthorized access at a height of eight (8) feet.
2. Adequate screening shall be provided. This can be achieved either by the required perimeter fencing being constructed as a board-to-board privacy fence or by vegetative screening being placed beyond the perimeter fence to a density and height that adequately buffers the solar farm from any nearby uses.
3. Solar farms shall adhere to the setback, height, and coverage requirements of the district.

4. Solar farm structures must be setback a minimum of 500 feet from residential structures.
5. Solar farms must be located on lots of no less than 100 acres in size.
6. Solar farms must not create increased noise levels that are discernible to nearby residential uses.
7. Solar farms must not produce glare that would constitute a nuisance to occupants of neighboring properties or persons traveling neighboring roads.
8. All electrical interconnection and distribution lines within the project boundary shall be underground.
9. Solar farms that become inactive for a period exceeding one (1) year shall be removed at the owners or operators expense and the site shall be returned to its natural state. This includes the obligation to dismantle and remove from the site all electrical generating equipment, cables, panels, foundations, buildings and ancillary equipment. To the extent possible, the operator shall restore and reclaim the site to its pre-project topography and topsoil quality. Any agreement between the operator and landowner for removal to a lesser extent than set forth in this paragraph shall be required prior approval by the board. The restoration activities must be complete within 18 months from the date the solar farm becomes inactive.
10. The applicant shall submit to the board a decommissioning plan describing the manner in which the applicant anticipates decommissioning the project. The plan shall include a description of the manner in which the applicant will ensure that it has the financial capability to carry out the restoration requirements. The board may from time to time request the operator to submit a report describing how it is fulfilling this obligation. The board shall decide if it is prudent to include provisions that ensure financial resources will be available for decommissioning. This may include bonding or other methods of guaranteeing performance, such as establishing an escrow account into which the developer / operator will deposit funds on a regular basis over the life of the project that would allow Haywood County to have access to the escrow account for the explicit purpose of decommissioning in the event of default. Financial provisions shall not be so difficult as to make the solar farm unfeasible.

## CHAPTER X PROVISIONS GOVERNING RESTRICTED INDUSTRIAL (I-2) DISTRICTS

### 10.01 Uses Permitted

...

- K. Utilities limited to:
  1. Electric utilities including but not limited to solar farms, subject to site plan review by the Planning Commission and the following standards for said solar farms:
    - a. Solar farms shall be enclosed by perimeter fencing to restrict unauthorized access at a height of eight (8) feet.

- b. Adequate screening shall be provided. This can be achieved either by the required perimeter fencing being constructed as a board-to-board privacy fence or by vegetative screening being placed beyond the perimeter fence to a density and height that adequately buffers the solar farm from any nearby uses.
- c. Solar farms shall adhere to the setback, height, and coverage requirements of the district.
- d. Solar farm structures must be setback a minimum of 500 feet from residential structures.
- e. Solar farms must be located on lots of no less than 100 acres in size.
- f. Solar farms must not create increased noise levels that are discernible to nearby residential uses.
- g. Solar farms must not produce glare that would constitute a nuisance to occupants of neighboring properties or persons traveling neighboring roads.
- h. All electrical interconnection and distribution lines within the project boundary shall be underground.
- i. Solar farms that become inactive for a period exceeding one (1) year shall be removed at the owners or operators expense and the site shall be returned to its natural state. This includes the obligation to dismantle and remove from the site all electrical generating equipment, cables, panels, foundations, buildings and ancillary equipment. To the extent possible, the operator shall restore and reclaim the site to its pre-project topography and topsoil quality. Any agreement between the operator and landowner for removal to a lesser extent than set forth in this paragraph shall be required prior approval by the board. The restoration activities must be complete within 18 months from the date the solar farm becomes inactive.
- j. The applicant shall submit to the board a decommissioning plan describing the manner in which the applicant anticipates decommissioning the project. The plan shall include a description of the manner in which the applicant will ensure that it has the financial capability to carry out the restoration requirements. The board may from time to time request the operator to submit a report describing how it is fulfilling this obligation. The board shall decide if it is prudent to include provisions that ensure financial resources will be available for decommissioning. This may include bonding or other methods of guaranteeing performance, such as establishing an escrow account into which the developer / operator will deposit funds on a regular basis over the life of the project that would allow Haywood County to have access to the escrow account for the explicit purpose of decommissioning in the event of default. Financial provisions shall not be so difficult as to make the solar farm unfeasible.

## Jefferson County Zoning Resolution

3. Have a maximum of 30.0 percent slope.
  4. Be at least 300 feet up gradient or 150 down gradient from any well.
  5. Be at least 150 feet from any creek, stream, and the 1002 contour line for Douglas Lake or other water body.
  6. Be at least 165 feet from any property line.
- I. Driveway/Parking. The inner area shall be accessed by a gravel driveway at least eight (8) feet wide and have at least two (2) gravel parking spaces.
- J. Monitoring. Owners or operators of any cadaver research center shall conduct quarterly studies of water quality down gradient at the edge of the property and prepare appropriate reports of its findings. Upon completion, monitoring reports shall be provided to the Jefferson County Environmental Department.

**7.9. Development Standards for Solar Energy Systems.** (Resolution 2015-34, 1-22-2016) Solar energy systems are considered a principal use of land if electricity generated is primarily sold or used off site. Conversely, solar energy systems which produce electricity solely for on-site use are considered accessory to the principal use of the property.

The following requirements apply to solar energy systems as a principal use.

- A. A detailed site plan showing the locations of buildings, driveways, fencing, solar panels, and other facilities drawn at a scale of no less than 1" = 50' shall be provided to the planning commission.
- B. The planning commission shall be provided with documentation showing that site and construction plans have been approved and that all federal and state requirements will be met.
- C. Solar panels shall be set back from front property lines a minimum of thirty (30) feet and twenty-five (25) feet from side and rear property lines.
- D. Associated buildings and appurtenances shall meet the minimum setback requirements for the district in which they are located.
- E. All on-site power lines and interconnections between producer and a utility shall be underground.

The following requirements apply to solar energy systems as an accessory use.

- A. Solar energy systems as accessory uses are allowed for all uses.
- B. Solar panels shall meet the setback requirements for the district in which they are located.

## Memphis/Shelby County Unified Development Code

2.6 Use Standards

Article 2 Districts and Uses

2.6.2 Civic Use Standards

2. Noise emanating from the operation of a building mounted wind energy system(s) shall not exceed, at any time, the lowest ambient noise level that is present between the hours of 9:00 p.m. and 9:00 a.m. at any property line of a residential use parcel or from the property line of parks, schools, hospitals or churches. Noise emanating from the operation of a building mounted wind energy system shall not exceed, at any time, 5 dB over the lowest ambient noise level that is present between the hours of 9:00 p.m. and 9:00 a.m. at any property line of a non-residential use parcel.
3. Guy-wires shall not be permitted.
4. Building mounted wind energy systems shall not exceed 15 feet in height as measured from the highest point of the roof of the building excluding chimneys, antennae, and similar appurtenances.

### c. Wind Farms

1. Large wind energy systems are permitted as principal uses by right in the IH districts and by special use approval and only in CA and EMP districts.
2. Large wind energy systems must be of monopole design, without guy wires.
3. Total height of each individual unit shall not exceed 500 feet.
4. Towers shall be set back a minimum of 110% the tower height from a participating property line. Towers shall be set back a minimum of 1000 feet from non-participating property lines. Towers shall be setback 150% the tower height or 500 feet, whichever is greater, from any public right of way or overhead utility line.
5. A wind tower shall be separated from every other wind tower by a sufficient distance so as to not interfere with the other wind tower, particularly in the event of a tower or portion thereof falling. There is no limit to the number of individual units that may be situated in a large scale wind farm so long as all setback requirements and other stated limitations are adhered to.
6. The vertical distance from ground level to the tip of a wind turbine blade when the blade is at its lowest point shall be at least 75 feet.
7. The noise generated by the operation of a large wind energy system shall not exceed 55 dB as measured at any point on non-participating property adjacent to the parcel on which the large wind energy system is located.
8. Large wind systems shall be subject to any additional standards as set by MLGW for interconnection purposes.

## 2. Solar Energy Systems

### a. General Provisions

1. Solar energy systems are permitted as an accessory use in all zoning districts, except for solar farms which are permitted as principal uses according to Chapter 2.5, Use Table.
2. Panels 4 square feet or less are exempt from these regulations.
3. All ground mounted electrical or control equipment shall be secured to prevent unauthorized access.
4. Equipment that is not functional or has not been used for a period of one (1) year must be removed.
5. Trees in the right-of-way may not be removed or damaged for increased access to sun.
6. Power grid interconnection shall be in accordance with MLGW standards and regulations.

### b. Freestanding Solar Energy Systems

1. Free standing arrays are permitted in rear and side yards only.
2. Panel arrays must be setback either the minimum district setback or 110% the height of the panel array, whichever is greater, as measured from grade to highest point on the array.
3. Arrays may not exceed the height of the principal structure or 35 feet, whichever is less.
4. Electrical lines from the panel array must be in conduit and placed below ground.
5. Panels must be appropriately screened from neighboring properties and public rights-of-ways.

### c. Building Mounted Solar Energy Systems

1. On single-family residential structures, panel arrays shall not extend more than 12 inches above the peak of any roof that is viewed from the street nor shall they extend more than 12 inches beyond any edge of the roof.

2. Where the panels are placed atop a flat roof they shall not extend more than five feet above the roof and shall be appropriately screened from the public right of way via the building's façade or similar mechanism.
3. Where panels are incorporated into or attached to the walls of a building they shall be appropriately glazed so as to prevent glare.

**d. Solar Farms**

1. Panel arrays shall meet all setback requirements of the respective district in which they are located. In no instance shall an array be setback less than 110% of the height of the array.
2. Solar farms shall adhere to interconnection standards established by MLGW.

**K. Blood Plasma Donation Center**

Blood plasma donation centers established before November 28, 2017, in the CMU-2 and CMU-3 districts may be modified, expanded or rebuilt on the same site without the issuance of a Conditional Use Permit.

**2.6.3 Commercial Use Standards**

**A. Adult-Oriented Establishment**

The governing bodies find that adult oriented establishments have a negative secondary effect on both the commercial and residential properties, resulting in blight and the downgrading of property values, increased criminal activity, and an adverse health impact. The following standards shall apply to all adult oriented establishments.

1. It shall be a violation of this development code for a person, corporation, or other legal entity to operate or cause to be operated any adult oriented establishment within one thousand five hundred (1,500) feet of:
  - a. A duly organized and recognized place of worship;
  - b. A public or private elementary, middle, junior high or high school;
  - c. A public or private day care facility or kindergarten;
  - d. A boundary of a residential zoning district, open zoning district or historic overlay district;
  - e. Any residential use;
  - f. A family recreation center;
  - g. A day care center;
  - h. A park; or
  - i. Any other adult oriented establishment.
2. For the purpose of this section, measurement shall be made in a straight line, without regard to intervening structures or objects, from the nearest property line of the premise where the adult oriented establishment is located, to the nearest property line of the premises of a place of worship, public or private elementary, middle, junior high or high school, public or private day care facility or kindergarten, residential use, family recreation center, day care center, park and any other adult oriented establishment, or to the nearest boundary of a residential zoning district or historic overlay district.
3. Adult-oriented establishments shall not be permitted on any site with a designated frontage. See Section 3.10.3.

**B. Bar, Tavern, Cocktail Lounge, Nightclub**

1. If located within the city limits of the City of Memphis then any bar, tavern, cocktail lounge or nightclub shall meet all requirements of Title 7, Alcoholic Beverages, of the City of Memphis Code of Ordinances.
2. If located within unincorporated Shelby County then any bar, tavern, cocktail lounge or nightclub shall be regulated in accordance with the requirements of Title 57 of the Tennessee Code Annotated. The use shall be located at least 500 feet from any single family residential district as measured from property line of the bar, tavern, cocktail lounge, or nightclub to the nearest boundary line of the single family residential district.

**C. Radio, TV, or Recording Studio**

Radio and television transmission towers subject to the following additional standards:

1. Radio and television towers shall not be located in the approach or landing zones of an airport or heliport.
2. The application for a special use permit shall be accompanied by the written recommendations of appropriate state and federal agencies.



## Sullivan County Zoning Regulations

- a. No such activity shall be permitted on a lot, unless it contains twice the lot area requirements of the district; however, campgrounds, shall require a minimum of three (3) acres.
  - b. The use shall comply with all of the district bulk regulations, applicable off-street parking requirements and landscaping and buffering standards.
  - c. Buffering standards as defined in the definitions shall be required alongside and rear lot lines and a thirty-foot (30) building setback shall be required on all property lines. The Planning Commission may require additional plantings and/or screening for buffering purposes.
  - d. All campgrounds shall be subject to the minimum applicable standards as also required for temporary commercial campgrounds (See Appendix B-106).
5. Educational Facilities - All uses classified in the educational facilities activity type shall be subject to the following supplementary regulations.
- a. The Board of Zoning Appeals may grant a variance from minimum yard requirements whenever an existing structure is proposed for conversion to a community education facility.
  - b. Any school in existence upon adoption of this resolution shall not be subject to the land area requirements of this section but shall be subject to all other code requirements including fire, electrical, plumbing and building codes if applicable.
6. Extensive Impact Facilities - In all districts where authorized as special exception (BZA) uses, Planning Commission approval (PC) required or uses permitted with supplemental provisions (SUP), the following supplementary regulations shall apply to uses classified in the extensive impact activity type.
- a. The location, size, and design of such facilities shall be such that the proposed development shall be compatible with the development within the surrounding area, thus reducing the impact upon the surrounding area.
  - b. The traffic generated by such facility shall be safely accommodated along arterial and collector streets without traversing local minor streets.
  - c. The proposed facility shall provide a basic community function or essential service necessary for a convenient and functional living environment in order to be located on the proposed site.
  - d. The off-street parking requirements shall be determined by the Planning Commission.
  - e. Renewable Energy for Utility-Scale/Commercial Production and/or Resale shall be permitted only in Planned Manufacturing Districts (PMD-1 and PMD-2). The following Supplemental Regulations Shall apply to all Renewable Energy Facilities (Solar and Wind/Turbine Facilities):
    - i. When such renewable energy structures and facilities are considered as the primary use of the property, the panels and equipment shall meet the primary/principal structure building setbacks of the district;
    - ii. Such land use shall require a comprehensive development plan for review by the Sullivan County Regional Planning Commission for approval per 5-104 Regulations and Procedures;
    - iii. Such commercial renewable energy (solar or wind/turbine) facilities shall not be located within one-mile of a designated historic overlay district or national register of historic properties or district. *(amended 01/20,2022)*
7. Health Care Facilities - In all districts where authorized as a use permitted with supplemental provisions (SUP), Planning Commission approval (PC) required or a special exception (BZA) use, the following supplementary regulations shall apply to uses classified in the health care activity type as indicated.
- a. Minimum Lot Area
    - i. No health clinic shall be permitted on a zone lot, unless it contains a minimum of ten thousand (10,000) square feet, or twice the lot area requirements of the district, whichever is greater.
    - ii. No hospital or center for observation or rehabilitation shall be permitted on a zone lot, unless it contains a minimum of five (5) acres.
  - b. Hospital, Centers for Observation or Rehabilitation - The minimum side and rear yards for hospitals and centers for observation or rehabilitation shall be fifty (50) feet for one (1) or two (2) story building.
  - c. All other regulations of the zone district shall apply.
  - d. There shall be provided along the entire site boundaries fencing, screening, and landscaping as appropriate to protect any surrounding residential area.

## Washington County Zoning Resolution

516. Renewable Energy- The intent of this section is to promote alternative renewable energy sources while maintaining the aesthetics and safety of the community in which they are proposed.

516.1 Solar Energy- Solar Panels and related equipment shall be permitted in all zones and in accordance with the following:

516.1.1 All panels and equipment shall be co-located on the primary dwelling or accessory structure if the property is zoned A-1, A-2, R-1, R-1A, R-1B, R-2, R-2A, R-3, R-3A, B-1, Planned Residential, Planned Residential Business.

516.1.1.1 Freestanding solar panels and associated equipment may be allowed on lots at least three (3) acres in size in the A-1 and A-2 zoning districts provided that no panel or equipment be located closer than 50' from any property line. No freestanding solar panel or associated equipment in the A-1 and A-2 district shall exceed 1,500 square feet of surface area or a maximum height of 20'

516.1.2 Solar Panels and equipment may co-located or be freestanding individual structures in the following zones: A-3, B-3, B-4, MS, M-1, M-2, and Planned Manufacturing districts. In the event the solar panels are the primary use of the property, the panels and equipment shall meet the primary building setbacks of the district, otherwise it may be treated as an accessory structure. A site plan is required if the panels and equipment are not co-located on a structure.

516.2 Wind Energy – Any single or combination of Wind Turbines greater than 10kW shall submit a site plan for approval by the Washington County Regional Planning Commission to ensure the conformity with the community. Wind Turbines and related equipment are permitted in all zones in accordance with the following:

516.2.1 The Turbine and equipment shall be located as on the same property as the primary use of property and the setback shall be at least the same distance as the height of the turbine from the ground if the property is zoned A-1, A-2, R-1, R-1A, R-1B, R-2, R-2A, R-3, R-3A, B-1, Planned Residential, Planned Residential Business.

516.2.2 The Turbine and equipment may be the primary or secondary use in the following zones: A-3, B-3, B-4, MS, M-1, M-2, and Planned Manufacturing districts.

## Appendix E: Public Chapter 866, Acts of 2022



### *State of Tennessee*

#### PUBLIC CHAPTER NO. 866

#### SENATE BILL NO. 1925

By Walley, Bowling, Reeves, Rose, Stevens

Substituted for: House Bill No. 2056

By Hurt, Faison, Sherrell, Shaw, Ragan, Grills, Lamberth, Moon

AN ACT to amend Tennessee Code Annotated, Title 5; Title 6; Title 7; Title 65; Title 66, Chapter 9, Part 2 and Title 68, relative to solar energy.

WHEREAS, it is the intent of the General Assembly to establish reasonable and uniform requirements to protect landowners and communities from the potential hazards and costs associated with abandoned energy-generating facilities while also protecting property rights and the positive business environment in the State of Tennessee, the reliability of the electrical grid, and the ability of the State of Tennessee to encourage economic development, quality jobs, and business investments that require low-cost electricity from new renewable energy sources; now, therefore,

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE:

SECTION 1. Tennessee Code Annotated, Title 66, Chapter 9, Part 2, is amended by adding the following language as a new section:

#### **66-9-207. Solar power facility agreements.**

(a) As used in this section, unless the context otherwise requires:

(1) "Decommissioning cost" means the estimated cost of performing the removal and restoration obligations set forth in subsection (c), less the estimated salvage value of the components of the solar power facility as of the date of removal;

(2) "Grantee" means a person, other than a public utility, as defined by § 65-4-101, who leases property from a landowner or holds an easement interest pursuant to a solar power facility agreement;

(3) "Landowner" means the owner or owners of a fee simple interest in land;

(4) "Premises" means the real property leased or granted by a landowner to a grantee pursuant to a solar power facility agreement;

(5)(A) "Solar power facility" means, collectively, a device or structure, or series thereof, that provides for the collection of solar energy for electricity generation, together with all facilities and equipment, other than any facility or equipment owned by a public utility, as defined by § 65-4-101, located proximate to and in support of the operation of such electricity generation device or structure, including, without limitation, all underground and aboveground electrical collection, distribution, and transmission lines; inverters; transformers; substations; energy storage facilities; telecommunications equipment and communication lines; meteorological towers; maintenance yards; switchgear; fences; and foundations supporting other components of the solar power facility; and

(B) "Solar power facility" does not include a solar-generating device or structure that is less than ten megawatts (10 MW) in size, measured in alternating current at the point of interconnection to the electrical grid, unless the application of this part is expressly provided for in the solar power facility agreement; and

Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection  
with the Protection of Land and Communities

SB 1925

(6) "Solar power facility agreement" means a lease or easement agreement for real property between a grantee and a landowner for the construction, installation and operation of all or a part of a solar power facility on such real property that generates electricity primarily for use and consumption off the premises.

(b) All solar power facility agreements:

(1) Must provide, at a minimum, that the grantee shall, upon or prior to the expiration or termination of the solar power facility agreement, safely remove or cause the removal of all components of the solar power facility located on the premises, except for any electrical or communications lines buried more than three feet (3') below the surface grade of the land, and restore the land comprising the premises to, as near as reasonably possible, its condition as of the date of the commencement of construction of the solar power facility; and

(2) Must either contain or provide that the grantee shall deliver to the landowner a decommissioning plan detailing the grantee's plan for performing or causing the performance of the obligations in subdivision (b)(1).

(c)(1) A solar power facility agreement must require the grantee to obtain and deliver to the landowner financial assurance in the following amounts to secure the performance of the grantee's removal and restoration obligations in subsection (b):

(A) No less than five percent (5%) of the decommissioning cost on the date the solar power facility commences commercial operation;

(B) No less than fifty percent (50%) of the decommissioning cost on the tenth anniversary of the date the solar power facility commences commercial operation; and

(C) No less than the decommissioning cost on the fifteenth anniversary of the date the solar power facility commences commercial operation.

(2) Acceptable forms of financial assurance must be set forth in the solar power facility agreement and must include one (1) or more of the following in the amount required by subdivision (c)(1):

(A) A surety bond;

(B) A collateral bond;

(C) An irrevocable letter of credit;

(D) A parent guaranty;

(E) Cash;

(F) A cashier's check;

(G) A certificate of deposit;

(H) A bank joint custody receipt;

(I) An approved negotiated instrument not described in subdivisions (c)(2)(A)-(H); or

(J) A combination of the forms of security described in subdivisions (c)(2)(A)-(I).

(3) A landowner has the right to expressly extend the date the financial assurance required by this subsection (c) is first delivered to the landowner to no later than the fifteenth anniversary of the date the solar power facility commences commercial operation.

(d) This section does not prohibit a local government from regulating solar power facilities pursuant to its zoning authority granted in title 13, except that a local government shall not impose removal or restoration obligations or require financial assurance securing such obligations that are more stringent than or additional to those provided for in this section.

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(e) Except as provided in subdivision (c)(3), a provision of a solar power facility agreement that purports to waive a right or exempt a grantee from a liability or duty established by this section is void unless the landowner and the grantee are affiliated entities.

(f) A person who is harmed by a violation of this section is entitled to relief provided under title 29, chapter 14.

(g) The requirements of this section only apply to solar power facility agreements initially entered into on or after the effective date of this act. If a grantee and landowner agree to amend a solar power facility agreement initially entered into before the effective date of this act, the parties may include the rights and obligations established by this section, and this section must govern such amended agreements.

SECTION 2. The heading to a section in this act is for reference purposes only and does not constitute a part of the law enacted by this act. However, the Tennessee Code Commission is requested to include the heading in any compilation or publication containing this act.

SECTION 3. This act takes effect on June 1, 2022, the public welfare requiring it.

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SENATE BILL NO. 1925

PASSED: March 28, 2022

  
\_\_\_\_\_  
RANDY McNALLY  
SPEAKER OF THE SENATE

  
\_\_\_\_\_  
CAMERON SEXTON, SPEAKER  
HOUSE OF REPRESENTATIVES

APPROVED this 14<sup>th</sup> day of April 2022

  
\_\_\_\_\_  
BILL LEE, GOVERNOR

## Appendix F: Hypothetical Property Assessments and Tax Revenue Estimates for Utility-Scale Solar Facilities Compared to Farmland

Property Assessment	Farmland (10 acres)		Solar Facility (1 MW/ 10 acres)		Farmland (100 acres)		Solar Facility (10 MW/ 100 acres)		Farmland (500 acres)		Solar Facility (50 MW/ 500 acres)		Farmland (1,000 acres)		Solar Facility (100 MW/ 1,000 acres)	
	Assessment	Value	Assessment	Value	Assessment	Value	Assessment	Value	Assessment	Value	Assessment	Value	Assessment	Value	Assessment	Value
Initial Cost*		\$830,000		\$8,300,000		\$83,000,000		\$830,000		\$8,300,000		\$83,000,000		\$830,000		\$8,300,000
Valuation Percentage		12.5%		12.50%		12.50%		12.50%		12.5%		12.5%		12.5%		12.5%
Value		\$103,750		\$1,037,500		\$10,375,000		\$103,750		\$1,037,500		\$10,375,000		\$103,750		\$1,037,500
Level of Assessment		not assessed		55%		55%		55%		not assessed		55%		not assessed		55%
Assessed Value		\$57,063		\$570,625		\$5,706,250		\$57,063		\$570,625		\$5,706,250		\$57,063		\$570,625
Personal Property Reduction <sup>#</sup>		85%		85%		85%		85%		85%		85%		85%		85%
Reduced Assessment		\$48,503		\$485,031		\$4,850,313		\$48,503		\$485,031		\$4,850,313		\$48,503		\$485,031
<b>Real Property</b>																
Real Property (Land/Building) Appraisal <sup>^</sup>		\$51,000		\$510,000		\$5,100,000		\$51,000		\$510,000		\$5,100,000		\$51,000		\$510,000
Level of Assessment		25%		25%		25%		25%		25%		25%		25%		25%
Real Property Assessed Value		\$12,750		\$127,500		\$1,275,000		\$12,750		\$127,500		\$1,275,000		\$12,750		\$127,500
<b>Personal and Real Property Combined</b>																
Personal Property Reduced Assessment - Solar Facility		na		\$48,503		na		\$485,031		na		\$4,850,313		na		\$4,850,313
Real Property (Land/Building) Assessed Value		\$12,750		\$127,500		\$1,275,000		\$127,500		\$637,500		\$1,402,500		\$1,275,000		\$2,805,000
Total Reduced Assessment		\$12,750		\$76,553		\$127,500		\$765,531		\$637,500		\$3,827,656		\$1,275,000		\$7,655,313
Equalization Ratio in Anderson County (2022) <sup>§</sup>		0.7295		0.7295		0.7295		0.7295		0.7295		0.7295		0.7295		0.7295
Total Equalized Assessment		\$9,301		\$55,846		\$93,011		\$558,455		\$465,056		\$2,792,275		\$930,113		\$5,584,550
<b>Taxes</b>																
Anderson County Tax Rate per \$100 of Assessment (2022)		0.026289		0.026289		0.026289		0.026289		0.026289		0.026289		0.026289		0.026289
County Taxes		\$245		\$1,468		\$2,445		\$14,681		\$12,226		\$73,406		\$24,452		\$146,812

\*Initial cost estimated to be approximately \$830,000 per megawatt and 10 acres per megawatt. Hyder 2022.

<sup>#</sup>The 15% reduction is based on *Northwest Airlines v. Tennessee State Board of Equalization*.

<sup>^</sup>Cost of farmland estimated at \$5,100 per acre. US Department of Agriculture 2022b.

<sup>§</sup>Anderson County was chosen randomly.

Source: Emails received from Jason Stewart, senior specialist, Office of State Assessed Properties, Tennessee Comptroller of the Treasury, November 4, 2022, and June 9, 2023.

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## Appendix G: Complaints Received by TDEC Division of Water Resources between January 2009 and June 2023

Concern Category	Total Number of Complaints Received	Number of Complaints Reported about a Solar Site	Number of Solar Sites	Year and Status of Complaints about Solar Sites
Ag/ Animal Waste	658	0	0	na
Bypassing Subsurface Sewage Disposal System (SSDS)	171	0	0	na
Dam	62	0	0	na
Dead Animals/Garbage in Creek	252	0	0	na
Discoloration/Appearance/ Particulates	132	0	0	na
Drainage	1,165	0	0	na
Erosion/Sediment	3,755	1	1	2017 - issue resolved
Failing SSDS	392	0	0	na
Fish Kill	236	0	0	na
Illegal Dumping	1	0	0	na
Installing SSDS without Installers Permit	3	0	0	na
Junkyards	114	0	0	na
Leaks	26	0	0	na
Logging	643	0	0	na
Low Pressure/No Water	19	0	0	na
Mining	378	0	0	na
No SSDS	106	0	0	na
Other	1,865	2	2	2011 - closed 2018 - no jurisdiction
Pollution/Spills/Illicit Discharge	3,381	0	0	na
Pumper Illegally Disposing Septage	23	0	0	na
Pumper without Permit	2	0	0	na
SSDS Construction without Permit	29	0	0	na
Sewage Bypass/Overflow	2,244	0	0	na
Sinkholes	25	0	0	na
Sludge/Bio-solids	65	0	0	na
Source Water/Wellhead Protection	6	0	0	na

Concern Category	Total Number of Complaints Received	Number of Complaints Reported about a Solar Site	Number of Solar Sites	Year and Status of Complaints about Solar Sites
Stormwater - Construction	1,780	2	2	2011 - closed 2023 - completed
Stormwater - Industrial	200	0	0	na
Stormwater - Post-Construction	176	0	0	na
Stream Alteration	2,573	0	0	na
Stream Debris	395	1	1	2011 - resolved
Taste and Odor	12	0	0	na
Water Quality/Health Effects	102	0	0	na
Wells	9	0	0	na
Wetlands	431	1	1	2023 - no problem found
<b>Total</b>	<b>21,431</b>	<b>7</b>	<b>4*</b>	

\*A total of seven complaints were received about four solar sites. One solar site received four complaints.

Note: These complaints were received by the water pollution control program area as of June 14, 2023. A total of 7,913 complaints were also received by the water supply and groundwater protection program areas, but none of these were reported about solar sites. TDEC’s dataviewer shows data from as early as 2009.

Source: Tennessee Department of Environment and Conservation “DataViewer - Division of Water Resources (DWR)”<sup>1</sup>; and interview with Ann Morbitt, integrated water resources consultant, Division of Water Resources, Tennessee Department of Environment and Conservation, June 5, 2023.

## Appendix H: The Nature Conservancy Principles for Utility-Scale Solar Energy Development in Tennessee



2 Maryland Farms, Suite 150  
Brentwood, TN 37027

Tel (615) 383-9909

[nature.org/tennessee](https://nature.org/tennessee)

### The Nature Conservancy Principles for Utility-Scale Solar Energy Development in Tennessee

The Nature Conservancy (TNC) is a global conservation organization dedicated to conserving the lands and waters on which all life depends. Guided by science, TNC creates innovative, on-the-ground solutions to our world's toughest challenges so that nature and people can thrive together. TNC aims to achieve carbon reduction goals by 2030, conserve lands, oceans, and freshwater to support biodiversity, and deploy nature-based solutions to support communities at the front lines of climate-related emergencies. TNC supports the rapid expansion of renewable energy and solar development when responsibly sited in areas of low environmental impact.

In addition to agricultural land, natural communities may potentially be impacted by solar development in Tennessee, including forests, wetlands, grasslands, previously undisturbed lands, as well as landscape-scale concerns from habitat fragmentation.<sup>1 2</sup> When large-scale solar developments are placed on undisturbed habitats, many studies quantify the direct impact on biodiversity from grading soil, herbicides, and infrastructure blocking the movement and seasonal migrations of wildlife species. Current regulatory processes provide protections under the National Environmental Protection Act (NEPA) and Endangered Species Act for 108 Threatened and Endangered species.<sup>3</sup> The Tennessee Wildlife Resources Agency's 2015 State Wildlife Action Plan identified 1,499 aquatic, subterranean, terrestrial, and plant species to be of Greatest Conservation Need (GCN), including those 108 listed as Threatened and Endangered. Existing regulatory processes do not provide protections for all of these GCN species. Additionally, rare and intact lands provide significant benefits regardless of whether they are occupied by listed or GCN species. One example of a GCN species on the decline is the Northern Bobwhite Quail, which occupies open-space grasslands that are already on the decline from habitat loss.<sup>4 5</sup> Proactively avoiding Bobwhite Quail and other GCN important habitats can help avoid future listings of declining species as habitat loss is the most common cause of species decline. Solar development siting decisions should reflect consideration of species and habitats that are at-risk and ecologically rare or intact habitat that provides significant benefits, in addition to habitat for regulated species.

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<sup>1</sup> Solar Impacts on Wildlife and Ecosystems. Request for Information Response Summary. U.S. Department of Energy. November 2021. <https://www.energy.gov/eere/solar/summary-solar-impacts-wildlife-and-ecosystems-request-information>.

<sup>2</sup> Hartmann, Heidi & Patton, Terri & Almer, L. & Smith, K.P. 2013. An Overview of Potential Environmental, Cultural, and Socioeconomic Impacts and Mitigation Measures for Utility-Scale Solar Energy Development. 10.13140/RG.2.2.12780.87689. [https://www.researchgate.net/publication/320944992\\_An\\_Overview\\_of\\_Potential\\_Environmental\\_Cultural\\_and\\_Socioeconomic\\_Impacts\\_and\\_Mitigation\\_Measures\\_for\\_Utility-Scale\\_Solar\\_Energy\\_Development?channel=doi&linkId=5a03e81da6fdcc1c2f5917ab&showFulltext=true](https://www.researchgate.net/publication/320944992_An_Overview_of_Potential_Environmental_Cultural_and_Socioeconomic_Impacts_and_Mitigation_Measures_for_Utility-Scale_Solar_Energy_Development?channel=doi&linkId=5a03e81da6fdcc1c2f5917ab&showFulltext=true).

<sup>3</sup> Tennessee State Wildlife Action Plan. 2015. Page 30. [https://www.tn.gov/content/dam/tn/twra/documents/swap/tn\\_swap\\_chapter\\_3.pdf](https://www.tn.gov/content/dam/tn/twra/documents/swap/tn_swap_chapter_3.pdf).

<sup>4</sup> Tennessee Farm Bureau. Northern Bobwhite Quail. <https://tnfarmbureau.org/wp-content/uploads/2022/08/Northern-Bobwhite-Quail.pdf>.

<sup>5</sup> Tennessee Wildlife Resources Agency. Northern Bobwhite Management in Tennessee. [https://www.tn.gov/content/dam/tn/twra/documents/birds/northern\\_bobwhite\\_plan.pdf](https://www.tn.gov/content/dam/tn/twra/documents/birds/northern_bobwhite_plan.pdf).



2 Maryland Farms, Suite 150  
Brentwood, TN 37027

Tel (615) 383-9909

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Solar siting decision-makers can consider various approaches to avoid, minimize, and mitigate unavoidable residual impacts to species of concern and their habitats. TNC in Georgia developed a publicly available [Solar Siting Tool](#) that could be replicated in Tennessee for identifying areas for low-impact solar development.<sup>6</sup> Currently, there are mapping resources available through the Tennessee Wildlife Resources Agency’s (TWRA) State Wildlife Action Plan (SWAP), for which TNC in Tennessee assisted in completing the 2005 and 2015 mapping of biodiversity priorities. Natural resource managers and solar developers can use SWAP mapping data to identify Tennessee’s plant and animal species of GCN and their habitats and seek to avoid developing in these areas. The SWAP will be updated in 2024, and 2015 mapping tools are currently available at [Tennessee State Wildlife Action Plan](#).

Stakeholders in Tennessee could also work together to develop best management practices for site selection, design, and operation. TNC in North Carolina did a similar initiative to create shared principles to inform and potentially guide solar developers and operators to minimize impacts to natural ecosystems and biodiversity. Additionally, TNC in North Carolina is working with solar developers to continue monitoring and researching effective conservation practices at their facilities.<sup>7</sup> These principles could serve as a starting point for stakeholders to develop Tennessee-specific principles and best practices:

**Table: Principles for Minimizing Solar Impacts to Natural Ecosystems and Biodiversity<sup>8</sup>**

PRINCIPLE	SITING	DESIGN
1. Avoid areas of high native biodiversity and high quality natural communities	Avoid siting in resilient areas	
2. Allow for wildlife connectivity, now and in the face of climate change	Avoid siting in and fragmenting climate corridors	Where appropriate, use wildlife-friendly fencing or unfenced wildlife passageways
3. Preferentially use disturbed or degraded lands	Preferentially site on degraded lands with little vegetation and/or poor soil quality	Retain or plant vegetation/trees in buffers or outside of perimeter fence
4. Protect water quality and avoid erosion	Do not site in floodplains	Buffer streams and wetlands
5. Restore native vegetation and grasslands		Integrate the planting of native and/or pollinator vegetation where appropriate
6. Provide wildlife habitat		Protect and restore on-site wildlife habitat features (e.g., wetlands, vegetated buffers); provide supplemental habitat as appropriate

<sup>6</sup> The Nature Conservancy uses the Blueprint to help inform low impact solar siting in Georgia. 2022. <https://secassoutheast.org/2022/09/14/TNC-uses-the-Blueprint-to-help-inform-low-impact-solar-siting-in-GA.html>.

<sup>7</sup> Impacts of conservation practices at solar facilities: vegetation, pollinator, and wildlife monitoring (2018-2021). The Nature Conservancy, NC Wildlife Resources Commission, US Fish and Wildlife Service. <https://ncpollinatoralliance.org/wp-content/uploads/2022/06/Solar-farm-monitoring-report-FINAL-May-2022.pdf>.

<sup>8</sup> Principles of Low Impact Solar Siting and Design. The Nature Conservancy in North Carolina. 2019. [https://www.nature.org/content/dam/tnc/nature/en/documents/ED\\_TNCNCPrinciplesofSolarSitingandDesignJan2019.pdf](https://www.nature.org/content/dam/tnc/nature/en/documents/ED_TNCNCPrinciplesofSolarSitingandDesignJan2019.pdf).

## Appendix I: Solar Development Resources for State and Local Governments, Developers, Landowners, and Homeowners

*This is not intended to be a comprehensive list.*

### State Governments

#### Model Ordinances

States have developed model solar ordinances, which provide a foundation for structured and consistent guidelines for jurisdictions.

- **Georgia (2018)**  
<https://epicenter.energy.gatech.edu/georgias-model-solar-ordinance/#:~:text=The%20Georgia%20Institute%20of%20Technology%2C%20Emory%20University%2C%20and,and%20a%20common%20baseline%20from%20which%20to%20work>
- **Illinois (2020)**  
<https://epicenter.energy.gatech.edu/georgias-model-solar-ordinance/#:~:text=The%20Georgia%20Institute%20of%20Technology%2C%20Emory%20University%2C%20and,and%20a%20common%20baseline%20from%20which%20to%20work>
- **Indiana (2020)**  
<https://eri.iu.edu/documents/in-solar-ordinance-2020-december.pdf>
- **Iowa (2020)**  
<https://www.growsolar.org/wp-content/uploads/2020/09/IA-Solar-Ordinance-2020.pdf>
- **Kentucky (2020)**  
[https://www.kyrc.org/assets/files/news\\_images/20-02A\\_KentuckyModelSolarZoningOrdinance.pdf#:~:text=KENTUCKY%20MODEL%20SOLAR%20ZONING%20ORDINANCE%202.2%20SEPTEMBER%2020201,the%20framework%20of%20local%20planning%20and%20zoning%20ordinances](https://www.kyrc.org/assets/files/news_images/20-02A_KentuckyModelSolarZoningOrdinance.pdf#:~:text=KENTUCKY%20MODEL%20SOLAR%20ZONING%20ORDINANCE%202.2%20SEPTEMBER%2020201,the%20framework%20of%20local%20planning%20and%20zoning%20ordinances)
- **Minnesota (2020)**  
<https://www.growsolar.org/wp-content/uploads/2020/08/MN-Solar-Ordinance-2020.pdf>
- **North Carolina (2014)**  
[https://nccleantech.ncsu.edu/wp-content/uploads/2018/05/NC-Template-Solar-Ordinance\\_2016.pdf](https://nccleantech.ncsu.edu/wp-content/uploads/2018/05/NC-Template-Solar-Ordinance_2016.pdf)
- **Tennessee (2022)**  
<https://tennesseiasolar.com/wp-content/uploads/2022/11/Model-Tennessee-Solar-Zoning-Ordinance-Final-4833-3498-8020-9.pdf>
- **Wisconsin (2020)**  
<https://www.growsolar.org/wp-content/uploads/2020/09/WI-Solar-Ordinance-2020.pdf>

## State Environmental Offices Permitting Guidelines

State environmental offices have developed guidelines for solar development that outline the permitting process as well as potential areas of concern, such as stormwater runoff.

- **Kentucky (2022) – Energy and Environment Cabinet “Compliance Assistance”**  
<https://eec.ky.gov/Environmental-Protection/Compliance-Assistance/Pages/default.aspx>
- **North Carolina (2018) – Department of Environmental Quality “Stormwater Design Manual: E.6 Solar Farms”**  
<https://www.deq.nc.gov/energy-mineral-and-land-resources/stormwater/bmp-manual/2018-e-6-solar-farm-manual/download>
- **Virginia (2022) – Department of Wildlife Resources “Solar Energy Facility Guidance”**  
<https://dwr.virginia.gov/wp-content/uploads/media/Solar-Energy-Facility-Guidance.pdf>

## Local Governments

### Tennessee Local Government Ordinances

Counties and cities in Tennessee have developed ordinances for solar development in their jurisdictions.

- **Bedford County**  
<https://cms5.revize.com/revize/bedfordtn/Document%20Center/Department/Planning%20and%20Zoning/Bedford%20Co%20Zoning%20Res%20vers%2011.31.pdf>
- **Fayette County**  
<https://fayettetn.us/wp-content/uploads/2022/03/Zoning-Resolution.pdf>
- **Greene County**  
<https://www.greencountytn.gov/wp-content/uploads/2017/09/Greene%20County,%20TN.Zoning%20Res.Dec%202015.pdf#:~:text=A%20resolution%20establishing%20zone%20districts%20within%20the%20unincorporated,enforcement%20and%20penalties%20for%20violation%20of%20this%20resolution>
- **Hardeman County (“Zoning Compliance”)**  
<https://hardemancounty.org/departments/zoning-compliance>
- **Haywood County**  
<https://haywoodtn.gov/wp-content/uploads/2022/12/Haywood-County-Zoning-Resolution-October-2020-8-2.pdf>
- **Jefferson County**  
[https://jeffersoncountyttn.gov/wp-content/uploads/2021/07/Revised-Zoning-Resolution\\_April-2021.pdf](https://jeffersoncountyttn.gov/wp-content/uploads/2021/07/Revised-Zoning-Resolution_April-2021.pdf)
- **Sullivan County (“Planning and Codes”)**  
[https://sullivancountyttn.gov/?page\\_id=211](https://sullivancountyttn.gov/?page_id=211)
- **Washington County**  
<https://www.washingtoncountyttn.org/DocumentCenter/View/1710/Washington-County-Zoning-Resolution-11-28-22-PDF>
- **City of Memphis and Unincorporated Shelby County**  
<https://shelbycountyttn.gov/DocumentCenter/View/32499/ZTA-18-001-AS-APPROVED-FINAL>

- **City of Tullahoma (proposed)**  
<https://www.mtas.tennessee.edu/knowledgebase/solar-ordinance>

## Planning Guides and Tools

Other states, government agencies, and organizations have developed tools for local governments to plan for solar development.

- **American Planning Association (2019) – “Planning for Utility-Scale Solar Energy Facilities”**  
<https://www.planning.org/publications/document/9184153/>
- **Great Plains Institute (2023) – “Best Practices: Photovoltaic Stormwater Management Research and Testing (PV-SMaRT)”**  
<https://betterenergy.org/wp-content/uploads/2023/01/PV-SMaRT-Best-Practice.pdf>
- **Iowa (2020) – “Iowa Solar Siting Resource Guide: A Roadmap for Counties”**  
<https://www.cfra.org/sites/default/files/publications/iowa-solar-siting-resource-guide.pdf>
- **Kentucky (2020) – “Kentucky Solar Toolkit”**  
<https://kentucky-solar-toolkit-kygis.hub.arcgis.com/>
- **Kleinman Center for Energy Policy – “Regulating Utility-Scale Solar Projects on Agricultural Land”**  
<https://kleinmanenergy.upenn.edu/wp-content/uploads/2022/08/KCEP-Regulating-Utility-Scale-Solar-Projects.pdf>
- **Massachusetts (2022) – “Community Planning for Solar Toolkit”**  
<https://ag.umass.edu/clean-energy/research-new-initiatives/solarplanning>
- **National Renewable Energy Laboratory – “Photovoltaic Stormwater Management Research and Testing”**  
<https://www.nrel.gov/solar/market-research-analysis/pv-smart.html>
- **National Renewable Energy Laboratory – “Solar Siting and Integration”**  
<https://www.nrel.gov/solar/market-research-analysis/solar-siting-integration.html>
- **National Renewable Energy Laboratory – “SLOPE: State and Local Planning for Energy”**  
<https://maps.nrel.gov/slope/>
- **Office of Energy Efficiency & Renewable Energy – “Siting of Large-Scale Renewable Energy Projects”**  
<https://www.energy.gov/eere/siting-large-scale-renewable-energy-projects>
- **New York (2022) – “Solar Guidebook for Local Governments”**  
<https://www.nyserda.ny.gov/All-Programs/NY-Sun/Communities-and-Local-Governments/Solar-Guidebook-for-Local-Governments>
- **SolSmart (2022) – “Best Practice Guidance for Solar and Zoning – Accessory Use”**  
<https://solsmart.org/wp-content/uploads/imported-files/Best-Practices-Guidance-for-Solar-and-Zoning.v1.pdf>
- **Tennessee Department of Environment and Conservation (2018) – “Tennessee Brownfields Redevelopment Toolbox”**  
[https://www.tn.gov/content/dam/tn/environment/remediation/documents/brownfieldsvoap/rem\\_Tennessee-Brownfields-Redevelopment-Toolbox.pdf](https://www.tn.gov/content/dam/tn/environment/remediation/documents/brownfieldsvoap/rem_Tennessee-Brownfields-Redevelopment-Toolbox.pdf)

- **US Department of Energy (2022) – “Solar@Scale: A Local Government Guidebook for Improving Large-Scale Solar Development Outcomes”**  
[https://planning-org-uploaded-media.s3.amazonaws.com/publication/download\\_pdf/Solar-at-Scale-Guidebook-V2.pdf](https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Solar-at-Scale-Guidebook-V2.pdf)
- **US Department of Energy (2023) – “Local Government Guide for Solar Deployment”**  
<https://www.energy.gov/eere/solar/local-government-guide-solar-deployment>
- **US Environmental Protection Agency (2023) – “Brownfields Technical Assistance and Research”**  
<https://www.epa.gov/brownfields/brownfields-technical-assistance-and-research>
- **US Environmental Protection Agency (2023) – “RE-Powering America’s Land”**  
<https://www.epa.gov/re-powering>
- **US Environmental Protection Agency and National Renewable Energy Laboratory (2022) – “Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills”**  
[https://www.epa.gov/system/files/documents/2022-05/best-practices-siting-solar-photovoltaics-municipal-solid-waste-landfills\\_051722-pub.pdf](https://www.epa.gov/system/files/documents/2022-05/best-practices-siting-solar-photovoltaics-municipal-solid-waste-landfills_051722-pub.pdf)

## Developers

Other states, government agencies, and organizations have developed guides for solar developers. Landowners could also benefit from these resources.

- **City of Raleigh, North Carolina (2023) – “Failing an Inspection: Solar Photovoltaic (PV) Systems”**  
<https://raleighnc.gov/permits/services/residential-solar-photovoltaic-pv-system/failing-inspection-solar-photovoltaic-pv>
- **Kentucky (2018) – “Consumer Energy Management and Access Guide”**  
<https://eec.ky.gov/Energy/Documents/Consumer%20Energy%20Management%20and%20Access%20Guide.pdf>
- **International Finance Corporation (2015) – “Utility-Scale Solar Photovoltaic Power Plants: A Project Developer’s Guide”**  
[https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-03/IFC\\_Solar\\_Report\\_Web\\_\\_08\\_05.pdf](https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/2022-03/IFC_Solar_Report_Web__08_05.pdf)
- **National Renewable Energy Laboratory (2015) – “Best Practices in Commercial and Industrial (C&I) Solar Photovoltaic System Installation”**  
<https://www.nrel.gov/docs/fy16osti/65286.pdf>
- **National Renewable Energy Laboratory (2015) – “Solar Access to Public Capital (SAPC) Working Group Best Practices in PV System Installation”**  
<https://www.nrel.gov/docs/fy15osti/63234.pdf>
- **National Renewable Energy Laboratory (2021) – “Best Practices at the End of the Photovoltaic System Performance Period”**  
<https://www.nrel.gov/docs/fy21osti/78678.pdf>
- **North Carolina Pollinator Conservation Alliance (2022) – “North Carolina Technical Guidance for Native Plantings on Solar Sites”**  
<https://ncpollinatoralliance.org/wp-content/uploads/2022/06/NC-Solar-Technical-Guidance-FINAL-May-2022.pdf>



- **Solar Energy Industries Association (SEIA) – “Model Leases and PPAs”**  
<https://www.seia.org/research-resources/model-leases-and-ppas>
- **The Nature Conservancy in North Carolina (2019) – “Principles of Low Impact Solar Siting and Design”**  
[https://www.nature.org/content/dam/tnc/nature/en/documents/ED\\_TNCNCPrinciplesofSolarSitingandDesignJan2019.pdf](https://www.nature.org/content/dam/tnc/nature/en/documents/ED_TNCNCPrinciplesofSolarSitingandDesignJan2019.pdf)
- **US Department of Energy – “Community Solar Basics”**  
<https://www.energy.gov/eere/solar/community-solar-basics>

## **Landowners**

Government agencies, universities, and other organizations have developed guides and considerations for landowners interested in leasing land for solar companies.

- **American Farmland Trust (2021) – “Solar Leasing: A Guide for Agricultural Landowners in the Pacific Northwest”**  
<https://farmlandinfo.org/wp-content/uploads/sites/2/2022/11/AFT-PNW-solar-leasing-guide.pdf>
- **Cornell University (2020) – “Considerations when Leasing Agricultural Lands to Solar Developers”**  
<https://smallfarms.cornell.edu/2020/04/considerations-when-leasing-agricultural-lands-to-solar-developers/>
- **Farmers’ Legal Action Group, Inc. (2019) – “Farmers’ Guide to Solar and Wind Energy in Minnesota”**  
<http://www.flaginc.org/wp-content/uploads/2019/04/Farmers%E2%80%99-Guide-to-Solar-and-Wind-Energy-in-Minnesota-April-2019.pdf>
- **The National Agricultural Law Center – “Understanding Solar Energy Agreements”**  
<https://nationalaglawcenter.org/wp-content/uploads/assets/articles/ferrell-solar.pdf>
- **National Renewable Energy Laboratory (2015) – “Standard Contracts and Securitization Resources”**  
<https://www.nrel.gov/analysis/standard-contracts.html>
- **North Carolina Cooperative Extension (2021) – “Considerations for Transferring Agricultural Land to Solar Panel Energy Production”**  
<https://craven.ces.ncsu.edu/considerations-for-transferring-agricultural-land-to-solar-panel-energy-production/>
- **North Carolina State Extension (2021) – “Solar Leases: Clearing Matters of Title During Solar Developer Due Diligence”**  
<https://farmlaw.ces.ncsu.edu/solar-leases-clearing-matters-of-title-during-solar-developer-due-diligence/>
- **North Carolina State Extension (2022) – “Legal Issues Surrounding Due Diligence for Solar Development”**  
<https://content.ces.ncsu.edu/legal-issues-surrounding-due-diligence-for-solar-development>
- **NYSERDA – “Fact Sheet: Landowner Considerations for Solar Land Leases”**  
[https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/17044/Solar\\_Lease\\_Landowner\\_Considerations\\_May2016.pdf?1470164409](https://s3.amazonaws.com/assets.cce.cornell.edu/attachments/17044/Solar_Lease_Landowner_Considerations_May2016.pdf?1470164409)

- **US Department of Energy (2022) – “Farmer’s Guide to Going Solar”**  
<https://www.energy.gov/eere/solar/farmers-guide-going-solar>
- **US Department of Energy OpenEI (2022) – “Agrivoltaics Primer”**  
<https://openei.org/wiki/InSPIRE/Primer>

## Homeowners

State and federal agencies and other organizations have developed guides and resources for residential solar development.

## Tennessee

- **Tennessee Valley Authority – “Learn About Renewable Energy Options”**  
<http://www.tvagreenconnect.com/>
- **Tennessee Valley Authority – “Tennessee Valley Solar Calculator”**  
<https://edt.tva.gov/>
- **Tennessee Valley Authority – “Virtual Solar Education”**  
<https://tvavirtual.com/solar/tvasolar/SitePages/Engage/Engage-OpenHouse.aspx>
- **Middle Tennessee Electric (2022) – “Common Solar Installation Problems”**  
<https://mte.com/SolarInstallationProblems>
- **National Renewable Energy Laboratory (2020) – “Solar Consumer Protection”**  
<https://www.nrel.gov/state-local-tribal/solar-consumer-protection.html>
- **Solar Energy Industries Association (2015) – “Consumer Protection”**  
<https://www.seia.org/initiatives/consumer-protection>
- **Solar Energy Industries Association (2022) – “Residential Consumer Guide to Solar Energy”**  
<https://www.seia.org/sites/default/files/2023-05/Resi%20Guide%20to%20Solar%20Power%20June%202023.pdf>
- **Tennessee Department of Environment and Conservation (2023) – “Office of Energy Programs”**  
<https://www.tn.gov/environment/program-areas/energy.html>
- **Interstate Renewable Energy Council (2023) – “A Checklist for Residential Consumers Considering Solar Energy”**  
<https://www.irecusa.org/programs/consumer-protection/checklist/>
- **Consumer Reports (2023) – “How the Solar Tax Credit Works”**  
<https://www.consumerreports.org/home-garden/alternative-energy/how-the-residential-clean-energy-solar-tax-credit-works-a1771685058/>
- **US Department of Energy – “Using Electricity at Home: Energy Saver”**  
<https://www.energy.gov/energysaver/using-solar-electricity-home>

## Other States

- **California – “California Solar Consumer Protection Guide Overview & FAQ”**  
<https://www.cpuc.ca.gov/solarguide/>

- **Idaho (2022) – “Attorney General Issues Tips for Homeowners on Solar Installations”**  
<https://www.ag.idaho.gov/newsroom/attorney-general-issues-tips-for-homeowners-on-solar-installations/>
- **Georgia – “Solar Power for Your Home”**  
<https://consumer.georgia.gov/solar-power-your-home>
- **North Carolina (2019) – “Consumer Guide to Solar Electricity for the North Carolina Homeowner”**  
[https://energync.org/wp-content/uploads/2019/08/NC\\_Solar\\_Consumer\\_GuidevWeb2.pdf](https://energync.org/wp-content/uploads/2019/08/NC_Solar_Consumer_GuidevWeb2.pdf)
- **South Carolina – “A Consumer Guide to Solar for the South Carolina Homeowner”**  
<https://www.energy.sc.gov/files/view/SolarGuideHomeowners.pdf>
- **Massachusetts (2022) – “An Overview of the New Massachusetts Solar Consumer Protection Best Practices Guide”**  
<https://www.masscec.com/event/overview-new-massachusetts-solar-consumer-protection-best-practices-guide>
- **Ohio – “Interested in Solar? Ask Now–Avoid Surprises Later!”**  
<https://ohiosolar101.com/tec/>

## General Information

- **American Farmland Trust and Smart Solar – “Smart Solar”**  
<https://farmlandinfo.org/solar-siting/>
- **Clean Energy State Alliance – “Resource Library”**  
<https://www.cesa.org/resource-library/>
- **Inside of Knoxville (2022) – “Solar Power: Where Does Tennessee (and Knoxville) Stand and Where Is It Going?”**  
[https://insideofknoxville.com/2022/11/solar-power-where-does-tennessee-and-knoxville-stand-and-where-is-it-going/?utm\\_medium=email](https://insideofknoxville.com/2022/11/solar-power-where-does-tennessee-and-knoxville-stand-and-where-is-it-going/?utm_medium=email)
- **Tennessee Valley Authority – “Valley Renewable Energy Solutions Guide”**  
[https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/energy/valley-renewable-energy/tva-green-solutions-guide5494ec07-9495-42a5-a137-104cdc45adfa.pdf?sfvrsn=e12c7d62\\_3](https://tva-azr-eastus-cdn-ep-tvawcm-prd.azureedge.net/cdn-tvawcma/docs/default-source/energy/valley-renewable-energy/tva-green-solutions-guide5494ec07-9495-42a5-a137-104cdc45adfa.pdf?sfvrsn=e12c7d62_3)
- **Tennessee Wildlife Resources Agency and The Nature Conservancy (2015) – “Tennessee State Wildlife Action Plan”**  
<https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/tn/swa/Pages/default.aspx>
- **US Department of Transportation Federal Highway Administration (2019) – “Renewable Energy in Highway Right-of-Way”**  
[https://www.fhwa.dot.gov/real\\_estate/right-of-way/corridor\\_management/alternative\\_uses.cfm?\\_gl=1\\*1hrx3e2\\*\\_ga\\*MTY20DExNDA2OS4xNjkyODA2ODU1\\*\\_ga\\_VW1SFWJKBB\\*MTY5MjgwNjg1NC4xLjEuMTY5MjgwNzIxOS4wLjAuMA](https://www.fhwa.dot.gov/real_estate/right-of-way/corridor_management/alternative_uses.cfm?_gl=1*1hrx3e2*_ga*MTY20DExNDA2OS4xNjkyODA2ODU1*_ga_VW1SFWJKBB*MTY5MjgwNjg1NC4xLjEuMTY5MjgwNzIxOS4wLjAuMA)
- **The Nature Conservancy (2023) – “Power of Place: National Executive Summary”**  
[https://www.nature.org/content/dam/tnc/nature/en/documents/FINAL\\_TNC\\_Power\\_of\\_Place\\_National\\_Executive\\_Summary\\_5\\_2\\_2023.pdf](https://www.nature.org/content/dam/tnc/nature/en/documents/FINAL_TNC_Power_of_Place_National_Executive_Summary_5_2_2023.pdf)

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## Appendix J: American Farmland Trust “Smart Solar<sup>SM</sup> on Farmland and Ranchland”



### Smart Solar<sup>SM</sup> on Farmland and Ranchland Strengthening Farm Viability and Soil Health While Growing Renewable Energy

Over the next three decades, our nation’s electric power sector will transition from a fossil-fuel dependent system to a more distributed and decarbonized energy network. Driving this change are markets, where solar and other forms of renewable energy are now cost-competitive, as well as ambitious local, state, and federal policy goals to address climate change by dramatically reducing greenhouse gas emissions. Achieving these essential goals will require substantial increases in renewable energy and primarily solar, which, according to a 2020 U.S. Department of Energy study, may rise from 4% of our nation’s total energy production today to 45% by 2050. With dramatically increased funding for solar in the recently enacted Inflation Reduction Act, this pace should accelerate quickly.



American Farmland Trust’s new report found that **83%** of new solar could be sited on farmland.

projects that **83% of new solar built by 2040 could be sited on agricultural lands, with almost half located on our most productive land for producing food and crops.** This is corroborated by a 2021 Cornell University study by Katkar et

According to the same DOE study, increasing solar generation to 45% could require nearly 7.4 million acres of land by 2040 and 10.4 million acres by 2050, with approximately 90% expected to occur in rural communities.

Further studies reveal that most solar development will take place on farmland. Modeling done by American Farmland Trust (AFT), through the *Farms Under Threat: 2040* analysis,

#### DOE Solar Futures Decarb+E Scenario

Land area of utility-scale solar photovoltaics (projection in 2040)

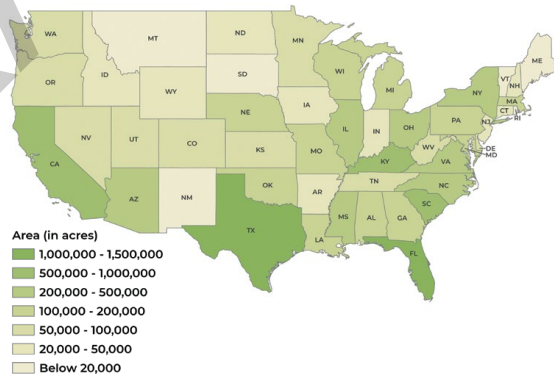


Figure 1. Projected acres of utility-scale solar photovoltaics energy generation facilities by state in 2040.

al. that found 82 to 85% of land suitable for solar to meet New York’s ambitious climate goals is farmland. Displacing farming from productive land could put more marginal farmland in production, leading to decreased productivity, farm viability, and food security, as well as increased environmental impact.

Solar developers often select high-quality farmland, since it is more likely to be flat, dry, clear, and close to existing infrastructure. And, according to research AFT conducted in 2021, developers are often willing to pay over 10 times the amount that landowners can make renting the land to farmers, with many offering the security of long-term leases lasting on

average 25–40 years. **The growth of solar development will reshape many rural landscapes and farm economies. It also has the potential to generate public backlash and permitting moratoria that could slow the achievement of decarbonization goals.**

Scientists agree that society needs to drastically reduce emissions to slow climate change and minimize future impacts from droughts, floods, and extreme heat—including on farmers and ranchers. In addition, solar energy leases can generate new streams of income for farmland owners, helping to keep the farm viable. But solar can displace farmer-renters, and large-scale solar may threaten the future viability of local economies dependent on agricultural production.

AFT’s modeling reveals that, although solar development will be widely distributed across the country, projects will be concentrated in communities with favorable siting and transmission opportunities. For example, by 2040 Texas could have over 1 million acres of solar, and many Northeastern states could have solar on as much as 6% of their undeveloped land. In addition, large-scale solar projects could take hundreds or thousands of acres of a community’s farmland out of production at once. This concentrated conversion will strain the viability of the farms that remain by decreasing land availability, increasing land prices, and reducing the viability of farm support services.

**But America needs both—renewable energy and productive, resilient farms and ranches. Smart Solar can be the solution.** In 2018 AFT began its efforts to help communities accelerate solar development in ways that strengthen farm viability.

### Smart Solar Principles

Smart Solar projects meet three main goals: they accelerate renewable energy development, strengthen farm viability, and safeguard land for farming and ranching. AFT developed the following Smart Solar Principles to guide policymakers, developers, and decisionmakers:

1. Prioritize solar siting on the built environment and land not well suited for farming. Concentrate solar development on rooftops, irrigation ditches, brownfields, and marginal lands.
2. Safeguard the ability for land to be used for agriculture. Policies and practices should protect soil health and productivity, especially during construction and decommissioning.
3. Grow agrivoltaics for agricultural production and solar energy. Agrivoltaic projects allow for farming underneath

and/or between rows of solar panels throughout the life of the project.

4. Promote equity and farm viability. Require inclusive stakeholder engagement, including farmers and underserved communities, to ensure widespread benefits from solar energy development.

Smart Solar means directing solar development to where it has the least negative impact on land well-suited for farming while protecting soil health, maintaining opportunities for farming, and ensuring equitable community benefits. Smart Solar elevates agricultural considerations and aims to accelerate renewable energy development by calming community fears over solar project impacts.

### Recommendations

Many stakeholders—from landowners to solar companies to government officials—have important roles to play to achieve a Smart Solar buildout. Legislative bodies can ensure laws and regulations reflect Smart Solar principles. Solar companies can adopt the principles into their operations. State and federal governments can provide guidance, resources, and incentives. Actions various stakeholders can take:

- Incorporate **Smart Solar Principles** into land-use plans, permitting processes, and policies to guide approval of specific projects.
- Fund and participate in local/regional planning and community engagement with broad stakeholder involvement including farmers, developers, transmission groups, tribes, and environmental justice stakeholders.
- Define community preferred sites (e.g., the built environment, contaminated lands, land not well-suited to farming) and priority protection areas; prioritize siting

on preferred sites with financial incentives and permit fast-tracking and disincentivize siting on protection areas with mitigation fees.

- Develop and require minimum standards to protect soil health and productivity based on the **USDA NRCS soil health principles** during construction, operation, and decommissioning.
- Fund research and create pilot programs to advance agrivoltaic projects and help determine which production systems should qualify for future agrivoltaic incentives.
- Invest in research to assess socioeconomic effects of solar on farm viability, land access, equity, and energy prices.



### RESOURCES

## Appendix K: Decommissioning Plan and Cost Estimate Example

### ABC Solar, LLC Decommissioning Plan

Prepared and Submitted by **ABC Solar, LLC**

Decommissioning will occur as a result of any of the following conditions:

1. The land lease expires or is terminated; or
2. The solar energy system the (“SES”) does not produce power for a period of 12 consecutive months

**ABC Solar, LLC** (the “Operator”) of the SES will do the following as a minimum to decommission the SES:

1. Remove all components of the solar power facility located on the premises, except for any electrical or communications lines buried more than three (3’) below the surface grade of the land; and
2. Restore the land comprising the premises to, as near as reasonably possible, its condition as of the date of the commencement of construction of the solar power facility

All such removal and decommissioning shall occur within 18 months of any aforementioned decommissioning condition.

The Operator is responsible for decommissioning the SES.

The Operator will provide the landowner with an updated signed decommissioning plan within 30 days if the operator of the SES changes.

Any updates to this plan will be submitted to the landowner by the party responsible for decommissioning the SES.

Operator: ABC Solar, LLC

Signature: \_\_\_\_\_ Date: \_\_\_\_\_



<i>Project:</i>	████████ Solar, LLC	<i>Engineer:</i>	████████
<i>Client:</i>	████████	<i>Issue Date:</i>	████████
<i>Location:</i>	████████	<i>Revision:</i>	0

OPINION OF PROBABLE COST - PV PLANT DECOMMISSIONING - SAT - 74.97 Mwac

This opinion of probable costs is based on the engineer's experience in the design and construction of energy facilities and are subject to final engineering. This opinion is also based on our experience supervising the construction of PV plants and supervising the demolition of other non-PV facilities. The engineer accepts no liability for errors, omissions, or the accuracy and adequacy of this opinion. It is a violation of state law for any person, unless they are acting under direction of a licensed professional engineer to alter this document in any way. The engineer is unaware of a significant body of decommissioning PV plants with which to benchmark its opinion of cost. With the exception of the PV modules and inter-module wiring, none of the activities undertaken to disassemble a PV plant are unique to PV plants. Disassembly costs can be estimated similar to other types of facilities. While 3rd party software such as RS Means do contain data on PV plant disassembly, we have found that the data is not applicable to large ground-mounted systems.

This opinion assumes a third-party contractor, experienced in the construction and decommissioning of PV facilities will lead the effort. The reported costs include labor, materials, taxes, insurance, transport costs, equipment rental, contractor's overhead, and contractor's profit. Labor costs have been estimated using regional labor rates and labor efficiencies from the Bureau of Labor Statistics. This opinion assumes open-shop labor rates.

This opinion of cost has been split between plant disassembly, site restoration, and salvage which reflects the overall decommissioning process. The PV plant will first be disassembled, with all above and below grade components removed to a depth of 3 feet. This includes all buried cables, conduits, and foundations. Costs for disassembly are overall less than those for original assembly of the facility. While PV modules will need to be removed by hand to retain their salvage value, the racks, buried cables, and concrete can be removed by machine to increase efficiency. It is assumed that concrete, gravel, and fiber optic cable do not have salvage value and will be disposed off site. Other materials are assumed to have salvage value and can be sold at market prices.

It is expected that the entire site will be re-seeded with native grasses and vegetation. Planting of trees, shrubs, and other woody vegetation (re-forestation) or other beautification is not included in the costs. It is assumed that mulching and stabilization of seeded areas will only be required where gravel roads or concrete foundations were removed. As all cables will be direct buried, excavation to remove the cables will not be required, and the disturbance to those areas will be minimal. The remainder of site will already be vegetated and disassembly activities will not significantly disturb the vegetation. Seeding in those areas is included as a precautionary measure.

It is assumed that re-grading of the site to remove diversion dikes and retention ponds is not required. The earth-moving required to remove these features would likely trigger a NPDES (or state/local equivalent) permit, which would in turn require those same features to be installed to control stormwater on the site. In addition, it is assumed no new erosion and sediment control measure will be required for disassembly. These would have been put in place during the original construction, and would be required to remain in place and properly maintained for the project life.

Salvage values, if included, have been estimated using publicly available data from <http://www.scrapmonster.com>. Inverters were priced at the rate for Complete Computers, which is lower than what could be attained if they were disassembled on site. Transformers were priced at 80% of the market rate for Sealed Unit Transformers. PV modules may have residual value as functioning units, but were instead assumed to be priced a Low Grade Boards.

Inflation, if included in this estimate has been projected based on the Producer Price Indices for Final Demand Construction. PPI is a more appropriate measure than CPI as it is targeted to the specific commodity. Detailed assumptions and the total opinion of cost for decommissioning is provided on the next sheets. Inflation has not been assumed for salvage values.





Project: █████ Solar, LLC                      Engineer: █████  
 Client: █████                                      Issue Date: █████  
 Location: █████                                    Revision: 0

PV PLANT ANTICIPATED DISASSEMBLY METHODS	
ITEM	DISASSEMBLY METHOD
PV Modules	Hand Removal. Place modules face down on pallets, tape wire ends, tied down and transport via skid-steer to staging location. Assumed 5% breakage, salvage value for crystalline, no salvage for thin-film. 1200 modules/day. 6-person crews
Inverters	Removal by crane and transport via flat-bed to staging location. Assume no disassembly. Assumed salvage value.
Transformers	Removal by crane and transport via flat-bed to staging location. Assume no disassembly. Oil removal performed by scrap facility. Assumed salvage value.
Racking Frame	Stabilize w/ machine. Cut legs and lower to ground level. Cut cross beams to appropriate size and transport via dump truck to staging location. Assumed salvage value.
Racking Posts	Remove via post-puller and transport via dump truck to staging location. Assumed salvage value.
Racking Wiring	Disconnect PV connectors, cut cable ties, and remove wires from cable tray. Transport via dump truck to staging area. Assumed salvage value.
Underground Cable	Excavate to cable depth at one end of trench. Use tractor or backhoe pull out all cables in common trench. Cables are direct buried so complete excavation of trenches is not required. Transport via dump truck to staging area. Assumed salvage value.
Fence	Machine roll fence fabric. Remove posts via post-puller and transport via dump truck to staging location. Assumed salvage value.
Concrete	Remove with excavator and jack hammer. Backfill and compact as needed. Transport via dump truck to staging area. Assumed offsite disposal.
Gravel	Remove with skid steer with sweeper. Transport via dump truck to staging area. Assumed offsite disposal.
Offsite Disposal	Assumed disposal at \$95/ton or \$45/CY including tipping fee.
Re-Seeding	Re-seed using an ATV-pulled drill seeder, at 5lbs bulk seed per acre of native grasses. Stabilize and mulch on areas where concrete or gravel was removed only.
Re-Grading	No bulk re-grading is included as this would alter site hydrology.
Erosion & Sediment Control	Install silt fence around project perimeter. Install tracking control at site entrance and replace once during disassembly. Remove at end of disassembly. We anticipate net soil disturbance is < 1 acre.
Energy Storage System	Assumes a containerized solution w/ up to 5MWh per container. Container has assumed salvage value. Batteries and racks have offsite disposal. Other components addressed as above.



Project: [Redacted] Solar, LLC      Engineer: [Redacted]  
 Client: [Redacted]      Issue Date: [Redacted]  
 Location: [Redacted]      Revision: 0

GENERATION SUBSTATION ANTICIPATED DISASSEMBLY METHODS	
ITEM	DISASSEMBLY METHOD
Steel Structures	Disassembled, lowered by crane, and transported via flat-bed to staging location. Assumed salvage value.
Circuit Breakers	Removed from pads and transported via flat-bed to staging location. Assumed no salvage value, and no difference in recycling vs. disposal cost.
Power & Instrument Transformers	Removal by crane and transport via flat-bed to staging location. Assume no disassembly or oil removal of small units, oil drained from main power transformer prior to transport. Assumed salvage value.
Disconnect Switches	Removal by crane, disassemble, and transport via flat-bed to staging location. Assumed salvage value for metal components. Insulators assumed no value.
Insulators and Arresters	Removal from supports. Assumed no salvage value.
Primary Conductor	Cut cable and bus pipe at ends and transport to staging location. Assumed salvage value.
Underground Cable	Excavate to cable depth at one end of trench. Use tractor or backhoe remove all cables and conduits in common trench. Transport via dump truck to staging area. Assumed salvage value.
Pre-Fab Steel Buildings	Rough disassembly on site. Assumed salvage value.
Control Panels	Removal of electronic components. Rough disassembly. Assumed salvage value for electronic and metal components.
Fence	Machine roll fence fabric. Remove posts via post-puller and transport via dump truck to staging location. Assumed salvage value.
Concrete	Remove with excavator and jack hammer. Transport via dump truck to staging area. Assumed offsite disposal.
Gravel	Remove with skid steer with sweeper. Transport via dump truck to staging area. Assumed offsite disposal.
Offsite Disposal	Assumed disposal at \$95/ton or \$45/CY including tipping fee.
Re-Seeding & Re-Grading	Re-seed using an ATV-pulled drill seeder, at 3.2lbs per acre of native grasses. Use rough grading machine to lower substation pad to native elevation.



Project: [Redacted] Solar, LLC      Engineer: [Redacted]  
 Client: [Redacted]      Issue Date: [Redacted]  
 Location: [Redacted]      Revision: 0

OPINION OF PROBABLE COST - PV PLANT DECOMMISSIONING - 74.97 MW - ANNUAL INFLATION=1.3% - END OF LIFE: YEAR 40				
DISASSEMBLY & DISPOSAL				
ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL
1.0	PV Modules (440 W)	221,508	\$ 1.68	\$ 372,133.44
2.0	PV Inverter(s) (2.5 MVA)	34	\$ 996	\$ 33,864.00
3.0	PV Transformer(s) (2.5 MVA)	34	\$ 498	\$ 16,932.00
4.0	ESS Inverter(s) (2MVA)	0	-	-
5.0	ESS Container(s)	0	-	-
6.0	ESS Transformer(s) (2MVA)	0	-	-
7.0	Racking Frame (Single Axis)	2,880	\$ 136	\$ 391,680.00
8.0	Racking Posts	37,440	\$ 15	\$ 561,600.00
9.0	Tracker Motors	2,880	\$ 18	\$ 51,840.00
10.0	Racking Wiring	2,593,689 LF	\$ 0.07	\$ 181,558.23
11.0	Underground Cable (LV, MV, Comm)	299,674 LF	\$ 0.53	\$ 158,827.22
12.0	PV Plant Fence	38,161 LF	\$ 2.29	\$ 87,388.69
13.0	Interconnection Facilities	1 LS	\$ 135,224.06	\$ 135,224.06
14.0	Concrete	104 CY	\$ 68	\$ 7,072.00
15.0	Gravel	8,220 CY	\$ 26	\$ 213,720.00
16.0	Offsite Disposal by Volume	8,325 CY	\$ 45	\$ 374,625.00
17.0	Offsite Disposal by Weight	0.00 TON	\$ 95	\$ -
18.0	General Conditions	75 MW	\$ 3,604	\$ 270,191.88
SUBTOTAL				\$ 2,856,656.52
SITE RESTORATION				
ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL
19.0	Re-Seeding	888 ACRES	\$ 127	\$ 112,776.00
20.0	Re-Grading	0 CY	\$ 17	\$ -
21.0	Erosion and Sediment Control	1 LS	\$ 105,571	\$ 105,571.00
SUBTOTAL				\$ 218,347.00
SALVAGE				
ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL
22.0	PV Modules (440 W)	210,433	\$ 14	\$ 2,946,062.00
23.0	PV Inverter(s) (2.5 MVA)	34	\$ 2,998	\$ 101,932.00
24.0	PV Transformer(s) (2.5 MVA)	34	\$ 2,576	\$ 87,584.00
25.0	ESS Inverter(s) (2MVA)	0	\$ 2,998	\$ -
26.0	ESS Container(s)	0 LBS	\$ 0.12	\$ -
27.0	ESS Transformer(s) (2MVA)	0	\$ 2,576	\$ -
28.0	Racking Frame (Single Axis)	8,659,728 LBS	\$ 0.12	\$ 1,039,167.36
29.0	Racking Posts	6,177,600 LBS	\$ 0.12	\$ 741,312.00
30.0	Tracker Motors	155,520 LBS	\$ 0.26	\$ 40,435.20
31.0	Interconnection Steel Structures	39,200 LBS	\$ 0.12	\$ 4,704.00
32.0	Interconnection Power & Instrument Transformers	144,141 LBS	\$ 0.12	\$ 17,296.92
33.0	Interconnection Disconnect Switches (1 & 3-Phase)	7,091 LBS	\$ 0.40	\$ 2,836.40
34.0	Interconnection Primary Conductor	8,050 LBS	\$ 0.40	\$ 3,220.00
35.0	Interconnection Pre-Fab Steel Buildings	34,500 LBS	\$ 0.12	\$ 4,140.00
36.0	Control Panels	1,200 LBS	\$ 0.12	\$ 144.00
37.0	Electronic Controls	357 LBS	\$ 0.25	\$ 89.25
38.0	LV Wiring (PV Plant & Interconnection)	206,870 LBS	\$ 1.61	\$ 333,060.70
39.0	MV Wiring	288,180 LBS	\$ 1.03	\$ 296,825.40
40.0	Chain Link Fence (PV Plant & Interconnection)	582,960 LBS	\$ 0.12	\$ 69,955.20
SUBTOTAL				\$ 5,688,764.43

TOTAL DISASSEMBLY, DISPOSAL, & SITE RESTORATION COST \$ 3,075,003.52  
 TOTAL SALVAGE VALUE \$ 5,688,764.43  
 NET DECOMMISSIONING COST \$ (2,613,760.91)

[Redacted]  
 [Redacted]  
 [Redacted] PE  
 Principal Project Manager  
 [Redacted]

[Redacted]  
 Date

DRAFT

## Appendix L: Summary of Decommissioning Laws

State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Tennessee	<p>Solar Power Facility Agreement</p> <p>Exemption allowed only if the landowner and the grantee are affiliated entities</p> <p>Exemption for electrical or communications lines buried more than three feet below the surface grade</p> <p>(Tennessee Code Annotated, Section 66-9-207)</p>	Landowner	Landowner	Solar Power Facility Agreement	<p>(A) No less than five percent (5%) of the decommissioning cost on the date the solar power facility commences commercial operation;</p> <p>(B) No less than fifty percent (50%) of the decommissioning cost on the tenth anniversary of the date the solar power facility commences commercial operation; and</p> <p>(C) No less than the decommissioning cost on the fifteenth anniversary of the date the solar power facility commences commercial operation</p> <p>(Tennessee Code Annotated, Section 66-9-207)</p>	<p>(A) A surety bond; (B) A collateral bond; (C) An irrevocable letter of credit; (D) A parent guaranty; (E) Cash; (F) A cashier's check; (G) A certificate of deposit; (H) A bank joint custody receipt; (I) A bank joint custody receipt; (J) An approved negotiated instrument not described in subdivisions (C)(2)(A)-(H); or (J) A combination of the forms of security described in subdivisions (C)(2)(A)-(I)</p> <p>Landowner can waive until 15 year mark. (Tennessee Code Annotated, Section 66-9-207)</p>	<p>Declaratory Judgments</p> <p>"A person who is harmed by a violation of this section is entitled to relief provided under title 29, chapter 14,"</p> <p>(Tennessee Code Annotated, Section 66-9-207(f))</p>
California	<p>The Soil Management and Site Restoration Plan</p> <p>(Cal. Code Regs. tit. 14, § 3108)</p>	Local city or county government; then local city or county government submits the solar use easement application, the soil management and site restoration plan, and financial assurance documents to the California Department of Conservation for final review and approval <p>(Cal. Code Regs. tit. 14 § 3101)</p>	City or county in which the project is located	Not specified: "It shall be the sole responsibility of the solar use easement landowner to provide the city or county with sufficient information to demonstrate that the amount of restoration security is adequate to restore the solar-use easement lands in accordance with the approved management plan and the requirements of Government Code section 51191.3(C)."	<p>Amount is based on the costs of site restoration and reclamation, cost of equipment, transportation, and labor necessary for infrastructure removal, liability insurance, contingency amount not to exceed 10% of the costs of site restoration; must be reviewed and resubmitted to the local government for approval every 5 years</p> <p>(Cal. Code Regs. Tit. 14, § 3111)</p>	<p>Performance bond</p>	<p>California Department of Conservation and local city or county government; Forfeiture of financial assurance</p> <p>(Cal. Code Regs. tit. 14 § 3111, 3115)</p>

Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection with the Protection of Land and Communities

State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Hawaii	Owners of solar energy facilities must comply with state decommissioning requirements, but no plan is required. (Haw. Rev. Stat. § 205-4.5)	State law does not require submittal of a decommissioning plan; local regulations may apply.	Local county planning commission; then local county planning commission must submit all special use permit application documents, including financial assurance documents, to the Hawaii Land Use Commission (Haw. Rev. Stat. § 205-4.5)	Special Use Permit Application (Haw. Rev. Stat. §§ 205-4.5, 205-6)	Requires financial assurance prior to operation (Haw. Rev. Stat. § 205-4.5)	Instrument type is not prescribed by state statute or regulation; local regulations may specify.	Local Planning Commission or the Department of Natural Resources; fine of up to \$5,000 (Haw. Rev. Stat. §§ 205-12, 205-13)
Illinois	Agricultural Impact Mitigation Agreement (conveys the decommissioning standards); Deconstruction Plan (505 Ill. Comp. Stat. 147/15)	Agricultural Impact Mitigation Agreement to the Department of Agriculture and the landowner; County government (505 Ill. Comp. Stat. 147/15)	County government	Agricultural Impact Mitigation Agreement	The facility owner must submit 10% before the end of the first year of operation, 50% before the end of the sixth year of operation, and 100% before the eleventh year of operation. The financial assurance must be based on the cost estimate as set forth within the decommissioning plan and includes cost estimate, which includes: number of solar panels, racking, and related facilities, original construction costs, size and capacity of the facility, and salvage value of the facility. (Illinois Department of Agriculture 2019; and "Standard Agricultural Mitigation Agreement Form")	Reclamation bond, surety bond, or another financial instrument acceptable to the county with jurisdiction (Illinois Department of Agriculture 2019; and "Standard Agricultural Mitigation Agreement Form")	Local jurisdiction; determined by the jurisdiction/variable (505 Ill. Comp. Stat. 147/15)

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State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Indiana	Decommissioning and Site Restoration Plan (Ind. Code § 8-1-42-18)  Project assets may remain in place after decommissioning is complete if: (1) the location and condition of the assets conform with local regulations at the time of decommissioning; and (2) the written consent of the landowner is obtained.	the Permit Authority	the Permit Authority	Not specified	The facility owner must submit 25% of the decommissioning cost not later than the start of the commercial solar energy (CSE) system operation, 50% of the decommissioning costs not later than the 5th anniversary of the start of the CSE operation, and 100% of the decommissioning costs not later than the 10th anniversary of the start of the CSE operation. The financial assurance must be based on the cost estimate set in the decommissioning plan and calculated by a third party licensed or registered engineer or by another person with suitable experience in decommissioning of CSE systems, as agreed upon by the owner and the permit authority. (Ind. Code § 8-1-42-18)	Surety bond, parent company guarantee, or an irrevocable letter of credit (Ind. Code § 8-1-42-18)	The Permit Authority; if site is not decommissioned within one year of proposed date, permit authority may engage contractors to enter site, remove and sell all commercial solar energy (CSE) system assets, and remediate the site; permit authority may also initiate proceedings to recover costs incurred (Ind. Code § 8-1-42-18)
Kentucky	Application to obtain a construction certificate from the Kentucky State Board on Electric Generation and Transmission Siting (Ky. Rev. Stat. § 278.706)	Public Service Commission (Ky. Rev. Stat. § 278.706)	Public Service Commission (Ky. Rev. Stat. § 278.706)	Application to obtain a construction certificate (Ky. Rev. Stat. § 278.706)	The amount of the financial assurance shall be determined by an independent, licensed engineer who is experienced in the decommissioning of solar electric generating facilities and has no financial interest in either the merchant electric generating facility or any parcel of land upon which the merchant electric generating facility is located. (Ky. Rev. Stat. § 278.706)	Bond or other similar security (Ky. Rev. Stat. § 278.706)	Energy and Environment Cabinet; subject to civil penalties not to exceed \$2,500 per day; the secretary of the Cabinet can draw upon the decommissioning bond and implement the decommissioning plan if the facility fails to complete the plan within 18 months of the facility ceasing to produce electricity (Ky. Rev. Stat. §§ 224.10-100(30), -285, 224.99-010)

Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection with the Protection of Land and Communities

State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Louisiana	Alternative Energy Source Lease: Decommissioning Application  If any archaeological resource is discovered while conducting decommissioning activities, bottom-disturbing activities within 1,000 feet of the discovery shall immediately cease. (La. Admin. Code tit. 43 § V.962)	Louisiana Department of Natural Resources (La. Admin. Code tit.43 § V.901)	Louisiana Department of Natural Resources	Alternative Energy Source Lease: Decommissioning Application	The Louisiana Department of Natural Resources determines the amount, which can be no less than \$500,000, and it may base the amount on the estimated costs of decommissioning, past due rent and payments incurred by the owner, any other monetary obligations, including insurance that the owner is required to maintain for the duration of the Alternative Energy Source Lease. (La. Admin. Code tit. 43: V, §§ 953, 955)	Bond (La. Admin. Code tit. 43 § V.953)	Louisiana Department of Natural Resources; forfeiture of financial assurance; owner liability for facility removal and costs; civil penalty up to \$300/day (La. Admin. Code tit. 43:V, § 969)
Maine	Not specified	Department of Environmental Protection or Maine Land Use Planning Commission (Me. Rev. Stat. tit. 35-A, §§ 3491, 3495)	Department of Environmental Protection or Maine Land Use Planning Commission	Decommissioning Plan (Me. Rev. Stat. tit. 35-A, § 3495)	Maine requires financial assurance prior to approval of the decommissioning plan. Financial assurance is required to be updated 15 years after approval of the plan and no less frequently than every 5 years thereafter. (Me. Rev. Stat. tit. 35-A, § 3495)	Performance bond, surety bond, irrevocable letter of credit, or other form of financial assurance acceptable to the Department of Environmental Protection or Maine Land Use Planning Commission, for the total cost of decommissioning (Me. Rev. Stat. tit. 35-A, § 3495)	Department of Environmental Protection or Maine Land Use Planning Commission (Me. Rev. Stat. tit. 35-A, § 3496); penalties vary on which authority issues the permit
Minnesota	Site Permit Application (Minn. R. 7854.0500)	Minnesota Public Utilities Commission (Minn. Stat. Ann. § 216E.03)	Minnesota Public Utilities Commission	Site Permit Application (Minn. R. 7854.0500)	Requires financial assurance prior to issuance of the site license (Minn. R. 7854.0500)	Not specified	Minnesota Public Utilities Commission; civil action to compel performance; civil penalty of up to \$10,000/day (Minn. Stat. § 216E.17)



Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection  
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State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Montana	Not specified  Decommissioning activities must commence within 90 days after abandonment, unless the owner receives department approval of an alternative written plan for decommissioning. (Mont. Admin. R. 17.86.102)	Montana Department of Environmental Quality (Mont. Admin. R. 17.86.102)	Montana Department of Environmental Quality (Mont. Admin. R. 17.86.115)	The Decommissioning Plan (Mont. Admin. R. 17.86.105)	Any time prior to the 15th year of operation; the Montana Department of Environmental Quality (DEQ) determines the amount, and may base the amount on the cost estimate submitted by the owner, the character and nature of the site, costs of managing, maintaining, and/or decommissioning the facility in the event of owner abandonment, and the current salvage value of the facility infrastructure. It is reviewed by the DEQ every 5 years. (Mont. Admin. R. 17.86.102, 106, 115)	Surety bond or collateral bond (Mont. Admin. R. 17.86.115)	Montana Department of Environmental Quality; civil penalty of up to \$1,500/day (Mont. Admin. R. 17.86.110; 75-26-304)
Nebraska	The state does not set any requirements for decommissioning plans. Instead, the statutes delegate the authority to the local governments, which may prescribe decommissioning plans. (Neb. Rev. Stat. Ann § 66-911.01)	Local jurisdictions (Office of the Register of Deeds) (Neb. Rev. Stat. Ann § 66-911.01)	Local jurisdictions (Office of the Register of Deeds) (Neb. Rev. Stat. Ann § 66-911.01)	The state does not set any requirements for financial assurance. Instead, the statutes delegate the authority to the local governments, which may prescribe financial assurance requirements. (Neb. Rev. Stat. Ann § 66-911.01)	State law mandates compliance with local financial assurance requirements. The solar facility owner must describe any financial assurance instrument required by the local government where the facility is located as a condition of a solar agreement. (Neb. Rev. Stat. § 66.911-01)	Not specified	Local jurisdiction; determined by the jurisdiction/variable (Neb. Rev. Stat. § 66.911-01)
New Hampshire	Certificate for an Energy Facility Application (N.H. Rev. Stat. Ann. § 162-H:7)	New Hampshire Site Evaluation Committee (N.H. Rev. Stat. Ann. § 162-H:7)	New Hampshire Site Evaluation Committee (N.H. Rev. Stat. Ann. § 162-H:7)	Certificate for an Energy Facility Application (N.H. Rev. Stat. Ann. § 162-H:7)	Requires financial assurance prior to issuance of the site license and project construction. (N.H. Admin. R. Site 301.08(d)(2))	Letter of credit, performance bond, surety bond, or guarantee (N.H. Admin. R. Site 301.08(d)(2))	New Hampshire Site Evaluation Committee; revocation or suspension of Certificate of Site and Facility Application; civil penalty of up to \$10,000/day or criminal charges (N.H. Rev. Stat. Ann. § 162-H:12, -19)

Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection  
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State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
New Jersey	Conservation Site Plan and/or Landscaping or Revegetation Plan (N.J. Admin. Code § 2:76-2A.12)	New Jersey State Agriculture Development Committee or New Jersey Pinelands Commission (N.J. Admin. Code § 2:76-2A.12)	New Jersey does not require proof of financial assurance at a state level for solar facility decommissioning but localities may impose financial assurance requirements. (N.J. Admin. Code §§ 2:76-2A.12, 7:50-5.36)	Not specified	na	na	State Agriculture Development Committee or Pinelands Commission; civil action (N.J. Admin Code §§ 2:76-2A.12, 7:50-8.1)
North Dakota	Not specified  The commission may waive a decommissioning requirement upon receipt of a request signed by the applicable landowner and finding good cause that the requirement be waived. (N.D. Admin. Code § 69-09-10-05)	North Dakota Public Service Commission (N.D. Admin. Code § 69-09-10-06)	North Dakota Public Service Commission (N.D. Admin. Code §§ 69-09-10-01, -06)	Decommissioning Plan (N.D. Admin. Code 69-09-10-01)	The facility owner must issue the first installment prior to construction. The owner must also issue the second installment after construction is complete but prior to facility operation. When the second installment is received, the first installment is returned. The first installment must be in an amount equal to 5% of the estimated costs of construction. The second installment must be enough to cover the costs of decommissioning. (N.D. Admin. Code § 69-09-10-08)	Letter of credit, performance bond, surety bond, guarantee, cash escrow, or incremental bond schedule (N.D. Admin. Code 69-09-10-08)	North Dakota Public Service Commission; forfeiture of financial assurance (N.D. Admin. Code § 69-09-10-09)
Ohio	Not specified	Ohio Power Siting Board (Ohio Rev. Code Ann. § 4906.21)	Ohio Power Siting Board (Ohio Rev. Code Ann. § 4906.22)	Not specified	Requires financial assurance prior to beginning construction. The performance bond shall be equal to the estimate of the costs of decommissioning included in the decommissioning plan and shall be updated every five years. (Ohio Rev. Code § 4906.221, 222)	Performance bond (Ohio Rev. Code Ann. § 4906.22)	Ohio Public Utilities Commission; fine of not less than \$1,000 nor more than \$10,000 for each day of violation, or imprisoned for not more than one year, or both (Ohio Rev. Code Ann. § 4906.99)

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State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Oklahoma	Solar Energy Agreement (Okla. Stat. tit. 60, § 820.1)	Local jurisdiction (Okla. Stat. tit. 60, § 820.1)	Local jurisdiction (Okla. Stat. tit. 60, § 820.1)	Solar Energy Agreement (Okla. Stat. tit. 60, § 820.1)	State law mandates compliance with local financial assurance requirements. The solar facility owner must describe any financial assurance instrument required by the local government where the facility is located as a condition of a solar agreement. (Okla. Stat. tit. 60, § 820.1)	Not specified	Local jurisdiction; determined by the jurisdiction/variable (Okla. Stat. tit. 60, § 820.1)
South Dakota	Not specified (S.D. Admin. R. 20:10:22:33.01)  The commission may waive compliance with and provisions of this chapter if the utility or applicant demonstrates that an immediate, urgent need for a facility exists, and that the utility or applicant did not know that a need for the facility existed sufficiently in advance to fully comply with the provisions of this chapter. The commission may also waive compliance with any provisions of this chapter upon notice that a facility has been damaged or destroyed as a result of a natural disaster, or as a civil disorder, and there exists a need for construction of a new facility, or the relation of a previously existing facility or associated facility, in order to promote the public health, safety or welfare. (S.D. Codified Laws § 49-41B-23)	S.D. Public Utilities Commission (S.D. Admin. R. 20:10:22:04)	S.D. Public Utilities Commission (S.D. Codified Laws § 49-41B-39)	Financial Security Agreement (S.D. Codified Laws § 49-41B-39)	The commission may require a bond, guarantee, insurance, or other requirement to provide funding for the decommissioning and removal of a solar energy facility. The commission shall consider the size of the facility, the location of the facility, and the financial condition of the applicant when determining whether to require some type of funding. (S.D. Admin. R. 20:10:22:33.01)	Bond, guarantee, insurance, or other requirement to provide funding for the decommissioning and removal of a solar energy facility; the commission may not require any financial security from an owner of solar energy facilities who is also a public utility (S.D. Admin. R. 20:10:22:33.01; S.D. Codified Laws § 49-41B-39)	Public Utilities Commission; Class 1 misdemeanor and subject to civil penalty of \$10,000 (S.D. Codified Laws § 49-41B-34)

Managing Solar Energy Development to Balance Private Property Rights and Consumer Protection with the Protection of Land and Communities

State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Texas	Solar Power Facility Agreement (Tex. Util. Code § 302.0004)	Landowner (Tex. Util. Code § 302.0004)	Landowner (Tex. Util. Code § 302.0005)	Solar Power Facility Agreement (Tex. Util. Code § 302.0005)	Grantee must deliver to the landowner an updated estimate, prepared by an independent, third-party professional engineer licensed in the state, of the cost of removal and the salvage value on or before the 10th anniversary of the commercial operations date of the solar power facilities and at least once every five years after the commercial operations date of the solar power facilities for the remainder of the term of the agreement and ensuring that the amount of the financial assurance remains sufficient to cover the amount required. (Tex. Util. Code § 302.0005)	Parent company guaranty with a minimum investment grade credit rating for the parent company issued by a major domestic credit rating agency, a letter of credit, a bond, or another form of financial assurance reasonably acceptable to the landowner (Tex. Util. Code § 302.0005)	Decommissioning oversight authority not specified  Injunctive relief to prevent further violations (Tex. Util. Code § 302.0003)
Vermont	Certificate of Public Good (Vt. PUC Rule 5.906)	Vermont Public Utility Commission (Vt. PUC Rule 5.906)	Vermont Public Utility Commission (Vt. PUC Rule 5.906)	Certificate of Public Good (Vt. PUC Rule 5.906)	Requires financial assurance prior to issuance of the Certificate for Public Good and project construction. Must cover the costs of decommissioning and site restoration as set forth in the cost estimate submitted by the owner. Must be adjusted every 3 years to account for inflation. (Vt. PUC Rule 5.904)	Letter of credit (Vt. PUC Rule 5.906)	Vermont Public Utility Commission; civil penalty of up to \$100; imprisonment up to 60 days (30 V.S.A. § 247)
Virginia	Site Plan and Written Agreement (Va. Code Ann. § 15.2-2241.2)	Local jurisdiction (Va. Code Ann. § 15.2-2241.2)	Local jurisdiction (Va. Code Ann. § 15.2-2241.2)	Site Plan and Written Agreement (Va. Code Ann. § 15.2-2241.2)	Requires financial assurance prior to construction. The financial assurance must be based on the cost estimate as set forth within the decommissioning plan. (Va. Code Ann. § 15.2-2241.2)	Bond, letter of credit, guarantee, certified fund, or cash escrow (Va. Code Ann. § 15.2-2241.2)	Local jurisdiction; local jurisdictional entity may enter property without consent and begin decommissioning (Va. Code Ann. § 15.2-2241.2)

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State	What Document Conveys the Decommissioning Plan, if Any? (and notes about state)	Who Does the State Require the Decommissioning Plan be Provided to?	Who Does the State Require Financial Assurance be Provided to?	What Document Conveys the Financial Assurance?	Description of Financial Assurances	Types of Assurances Allowed	Decommissioning Oversight Authority and Penalties for Noncompliance
Washington	Site Restoration Plan (Wash. Admin. Code § 463-72-040)	Energy Facility Site Evaluation Council (Wash. Admin. Code § 463-72-030)	Energy Facility Site Evaluation Council (Wash. Admin. Code § 463-72-030)	Site Restoration Plan (Wash. Admin. Code § 463-72-020)	Proof of financial security that is sufficient to manage the restoration of the site and that includes evidence of pollution liability insurance coverage and provides justifications for the amounts of the financial securities as proof that they will be sufficient to fund decommissioning and site restoration (Wash. Admin. Code § 463-72-040)	Site closure bond, sinking fund, or other financial instrument or security (Wash. Admin. Code § 463-72-040)	State of Washington Energy Facility Site Evaluation Council; penalties of \$1,000-\$25,000 per day (Wash. Rev. Code § 80.50.150)
West Virginia	Not specified (W. Va. Code § 22-32-4)	Department of Environmental Protection (DEP) (W. Va. Code § 22-32-4)	Department of Environmental Protection (DEP) (W. Va. Code § 22-32-4)	Decommissioning Agreement (W. Va. Code § 22-32-8)	To determine the bond amount, the DEP shall take into account the report submitted with an application and assess a bond value based upon the total disturbed acreage of land upon which the wind generation or solar generation facility is operated, less salvage value; provided, that the amount of the bond required shall not exceed the total projected future cost of decommissioning, less salvage value. (W. Va. Code § 22-32-4)	A surety bond or any other arrangement, including, but not limited to, letters of credit and escrow accounts payable to the State of West Virginia in a form acceptable by the DEP (W. Va. Code §§ 22-32-3, -4)	Department of Environmental Protection; DEP may take any necessary actions to decommission the facility; DEP may file suit to enforce the permit conditions, plans, and agreements to recoup the cost of decommissioning and reclamation in the circuit court of the county in which the facility is located (W. Va. Code § 22-32-6)
Wyoming	Waste Management Plan of the Permit Application (Wyo. Stat. §§ 18-5-502, -503)	County Board of Commissioners (Wyo. Stat. Ann. § 18-5-503)	Wyoming does not require proof of financial assurance for energy facility decommissioning; local regulations may apply.	Not specified	na	na	County board of commissioners; fine of up to \$10,000/day (Wyo. Stat. Ann. § 18-5-512)

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## Appendix M: Solar Energy Industries Association Model Solar Energy Facility Decommissioning Legislation

### DECOMMISSIONING OF SOLAR ENERGY FACILITIES

Sec.

1. DEFINITIONS.
2. REQUIRED AGREEMENT PROVISIONS ON FACILITY REMOVAL.
3. REQUIRED AGREEMENT PROVISIONS ON FINANCIAL ASSURANCE.
4. REQUIRED DECOMMISSIONING PLAN PROVISIONS.
5. SEPARATE FINANCIAL ASSURANCE NOT REQUIRED.
6. APPLICABILITY.
7. EFFECTIVE DATE.

§ 1. DEFINITIONS.

THE FOLLOWING WORDS AND PHRASES WHEN USED IN THIS CHAPTER SHALL HAVE THE MEANINGS GIVEN TO THEM IN THIS SECTION UNLESS OTHERWISE SPECIFIED:

(a) "SOLAR ENERGY FACILITY AGREEMENT." A LEASE AGREEMENT BETWEEN A GRANTEE AND A SURFACE PROPERTY OWNER THAT AUTHORIZES THE GRANTEE TO OPERATE A SOLAR ENERGY FACILITY ON LEASED PROPERTY.

(b) "SOLAR ENERGY FACILITY." A FACILITY THAT GENERATES OR STORES SOLAR ENERGY, AS DEFINED IN [relevant state law].

(c) "BUSINESS." A CORPORATION, PARTNERSHIP, SOLE PROPRIETORSHIP, LIMITED LIABILITY COMPANY, BUSINESS TRUST OR OTHER COMMERCIAL ENTITY. THE TERM INCLUDES NOT-FOR-PROFIT ORGANIZATIONS.

(d) "COMMENCEMENT OF CONSTRUCTION." THE TIME AT WHICH A GRANTEE, GRANTEE'S AGENT, OR STATE OR LOCAL PERMITTING AUTHORITY ISSUES FINAL AUTHORIZATION TO PROCEED WITH CONSTRUCTION OF A SOLAR ENERGY FACILITY.

(e) "COMMERCIAL IN-SERVICE DATE." THE DATE ON WHICH A SOLAR ENERGY FACILITY BEGINS PRODUCING ELECTRICITY FOR SALE ON A RETAIL OR WHOLESALE BASIS.

(f) "DECOMMISSIONING PLAN." A DOCUMENT ON FILE WITH THE COUNTY RECORDER OF THE COUNTY IN WHICH THE SOLAR ENERGY FACILITY IS SITED DESCRIBING THE PROCESS TO PERMANENTLY REMOVE A SOLAR ENERGY FACILITY FROM SERVICE, AND THE AMOUNT, FORM, AND TIMING OF FINANCIAL ASSURANCE THAT IS TO BE PROVIDED. THE FILING OF A DECOMMISSIONING PLAN DOES NOT OTHERWISE ENCUMBER OR RUN WITH THE SURFACE OWNER'S REAL PROPERTY.

(g) "DEPARTMENT." THE DEPARTMENT OF ENVIRONMENTAL PROTECTION [or like agency] OF THE STATE.

(h) "GRANTEE." THE OWNER OF A SOLAR ENERGY FACILITY ON LEASED PROPERTY.

(i) "PROFESSIONAL ENGINEER." HAS THE MEANING AS DEFINED IN [relevant state law].

## § 2. REQUIRED AGREEMENT PROVISIONS ON FACILITY REMOVAL.

A SOLAR ENERGY FACILITY AGREEMENT EXECUTED AFTER THE EFFECTIVE DATE OF THIS ACT MUST PROVIDE THAT THE GRANTEE IS RESPONSIBLE FOR DECOMMISSIONING THE GRANTEE'S SOLAR ENERGY FACILITY ON THE SURFACE PROPERTY OWNER'S PROPERTY IN ACCORDANCE WITH THIS CHAPTER NO LATER THAN 18 MONTHS AFTER THE FACILITY HAS CEASED PRODUCING ELECTRICITY, EXCEPT FOR INSTANCES WHERE THE GRANTEE IS ACTIVELY WORKING TO RECOMMENCE PRODUCTION OF ELECTRICITY, INCLUDING INSTANCES FOLLOWING THE OCCURRENCE OF A FORCE MAJEURE OR SIMILAR EVENT.



§ 3. REQUIRED AGREEMENT PROVISIONS ON FINANCIAL ASSURANCE.

(a) REQUIREMENT OF FINANCIAL ASSURANCE. THE OWNER OF A SOLAR ENERGY FACILITY WITH A SOLAR ENERGY FACILITY AGREEMENT EXECUTED 12 MONTHS AFTER THE EFFECTIVE DATE OF THIS SECTION, UNLESS BOUND TO A DECOMMISSIONING AGREEMENT WITH FINANCIAL ASSURANCE EXECUTED BEFORE THE EFFECTIVE DATE OF THIS SECTION, MUST PROVIDE A DECOMMISSIONING PLAN AND SUBMIT FINANCIAL ASSURANCE TO THE COUNTY RECORDER OF THE COUNTY IN WHICH THE SOLAR ENERGY FACILITY IS SITED. THE FINANCIAL ASSURANCE MUST CONFORM TO THE REQUIREMENTS OF THIS CHAPTER TO SECURE THE PERFORMANCE OF THE GRANTEE'S OBLIGATION TO DECOMMISSION THE GRANTEE'S SOLAR ENERGY FACILITY.

(b) AMOUNT OF FINANCIAL ASSURANCE. THE AMOUNT OF FINANCIAL ASSURANCE SHALL BE EQUAL TO THE COST OF DECOMMISSIONING THE SOLAR ENERGY FACILITY, LESS THE FACILITY'S SALVAGE VALUE.

(1) DECOMMISSIONING AND SALVAGE VALUE COSTS SHALL BE CALCULATED BY AN INDEPENDENT PROFESSIONAL ENGINEER AT THE EXPENSE OF THE GRANTEE.

(2) THE CALCULATION IN SUBSECTION (b) (1) SHALL BE UPDATED PERIODICALLY, BUT NOT LESS THAN EVERY 10 YEARS. WITHIN SIX MONTHS OF ANY SUCH UPDATE, THE GRANTEE SHALL SUBMIT NEW FINANCIAL ASSURANCE UNDER SECTION 4(d) IF THE CALCULATION DIFFERS FROM THE EXISTING FINANCIAL ASSURANCE AMOUNT. [1]

(c) FORMS OF FINANCIAL ASSURANCE. FINANCIAL ASSURANCE

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<sup>1</sup> Section 3(b) may also include the following optional subsection: "THE COST OF DECOMMISSIONING CALCULATED IN SUBSECTION (b) (1) SHALL BE INCREASED BY 10% TO ENSURE ADEQUATE FINANCIAL ASSURANCE IS PROVIDED OVER THE LIFE OF THE PROJECT, AND WHICH INCREASE SHALL BE REFLECTED IN THE GRANTEE'S FINANCIAL ASSURANCE FILING UNDER SECTION 4(d)."

SHALL BE PROVIDED BY A BOND, A PARENT COMPANY GUARANTY WITH A MINIMUM INVESTMENT GRADE CREDIT RATING FOR THE PARENT COMPANY ISSUED BY A MAJOR DOMESTIC CREDIT RATING AGENCY, OR A LETTER OF CREDIT.

§ 4. REQUIRED DECOMMISSIONING PLAN PROVISIONS.

(a) DEVELOPMENT OF FORM. THE DEPARTMENT SHALL DEVELOP WITHIN 180 DAYS, SUBJECT TO PUBLIC NOTICE AND COMMENT, A TEMPORARY STANDARD FORM FOR THE DECOMMISSIONING PLAN AND FINANCIAL ASSURANCE TO BE FILED WITH THE COUNTY RECORDER OF THE COUNTY IN WHICH THE SOLAR ENERGY FACILITY IS SITED IN ACCORDANCE WITH THIS CHAPTER.

(b) EXPIRATION. THE TEMPORARY STANDARD FORM DEVELOPED UNDER SUBSECTION (a) SHALL EXPIRE UPON THE PROMULGATION OF FINAL STANDARD FORM OR TWO YEARS FOLLOWING THE EFFECTIVE DATE OF THIS SECTION, WHICHEVER IS EARLIER.

(c) CONTENT. THE TEMPORARY AND FINAL STANDARD FORM FOR THE DECOMMISSIONING PLAN AND FINANCIAL ASSURANCE SHALL INCLUDE THE FOLLOWING PROVISIONS:

(1) UNLESS THE SURFACE PROPERTY OWNER AND GRANTEE MUTUALLY AGREE IN WRITING ON AN ALTERNATIVE CONDITION FOR RESTORING THE PROPERTY, THE GRANTEE'S DECOMMISSIONING PLAN SHALL:

(i) REMOVE ALL NON-UTILITY OWNED EQUIPMENT, CONDUITS, STRUCTURES, FENCING, AND FOUNDATIONS TO A DEPTH OF AT LEAST THREE FEET BELOW GRADE. THE GRANTEE SHALL NOT HAVE TO REMOVE EQUIPMENT AND MATERIALS THAT THE PUBLIC UTILITY REQUIRES TO REMAIN ON SITE.

(ii) REMOVE ALL GRAVELED AREAS AND ACCESS ROADS UNLESS THE SURFACE PROPERTY OWNER AGREES OTHERWISE IN WRITING.

(iii) RESTORE THE PROPERTY TO A CONDITION REASONABLY SIMILAR TO ITS CONDITION BEFORE THE COMMENCEMENT OF CONSTRUCTION.

(iv) RE-SEED ANY CLEARED AREAS, UNLESS AGREED IN WRITING BY THE SURFACE PROPERTY OWNER TO NOT RE-SEED.

(2) THE REQUIRED FINANCIAL ASSURANCE AS PROVIDED FOR UNDER SECTION 3.

(d) TIMING. THE GRANTEE SHALL FILE THE DECOMMISSIONING PLAN AND FINANCIAL ASSURANCE IN CONFORMANCE WITH SECTION 3 TO THE COUNTY RECORDER OF THE COUNTY IN WHICH THE SOLAR ENERGY FACILITY IS SITED PRIOR TO THE FIFTEENTH ANNIVERSARY OF THE COMMERCIAL IN-SERVICE DATE OF THE SOLAR ENERGY FACILITY.

§ 5. APPLICABILITY.

THE REQUIREMENTS UNDER THIS CHAPTER SHALL NOT APPLY TO:

(a) A SOLAR ENERGY FACILITY WITH A NAMEPLATE CAPACITY OF 3 MEGAWATTS AC OR LESS.

(b) A NET-METERED SOLAR ENERGY FACILITY.

(c) THE OWNER OR OPERATOR OF A FARM WHO OWNS AND OPERATES A SOLAR ENERGY GENERATION FACILITY ON THE FARM PREMISES, REGARDLESS OF THE LOCATION OF CONSUMPTION OF THE ENERGY GENERATED THEREFROM.

§ 6. PREEMPTION.

THE REGULATION OF SOLAR ENERGY FACILITY DECOMMISSIONING IS

A MATTER OF GENERAL STATEWIDE INTEREST THAT REQUIRES UNIFORM STATEWIDE REGULATION, AND THIS CHAPTER AND RULES ADOPTED UNDER IT CONSTITUTE A COMPREHENSIVE PLAN WITH RESPECT TO ALL ASPECTS OF SOLAR ENERGY FACILITY AGREEMENTS, FINANCIAL ASSURANCE, AND DECOMMISSIONING PLANS ASSOCIATED WITH SOLAR ENERGY FACILITIES WITHIN THIS STATE. ANY COUNTY, MUNICIPAL, OR OTHER LOCAL GOVERNMENTAL REGULATION OF MATTERS REGULATED BY THIS CHAPTER, OR THAT MATERIALLY IMPEDE OR FRUSTRATE THE PURPOSE OF THIS CHAPTER, SHALL BE PREEMPTED AND WITHOUT FORCE AND EFFECT.

§ 7. THIS ACT SHALL TAKE EFFECT AS FOLLOWS:

- (a) SECTION 4 SHALL TAKE EFFECT IMMEDIATELY.
- (b) THE REMAINDER OF THE ACT SHALL TAKE EFFECT IN 180 DAYS.

## Appendix N: Financial Incentives for Solar Development as of August 2023

Program	Federal/ State/ Private	Agency/ Entity	Utility Scale or Small Scale	Incentive	Eligible Entities	Source
Green Energy Property Tax Assessment	State	Tennessee Comptroller of the Treasury and Tennessee Department of Environment and Conservation	Both	<ul style="list-style-type: none"> <li>- Property tax reduction</li> <li>- Solar facilities certified as green energy production facilities by Tennessee Department of Environment and Conservation are assessed at 12.5% of their installed costs</li> </ul>	Individuals, for-profit businesses, and nonprofits	Tennessee Code Annotated, Section 67-5-601 <a href="https://programs.dsireusa.org/system/progrm/detail/5216/green-energy-property-tax-assessment">https://programs.dsireusa.org/system/progrm/detail/5216/green-energy-property-tax-assessment</a>
Greenhouse Gas Reduction Fund Section 134(a)(1) - Zero-Emissions Technologies Grant Program (Solar for All)	Federal	US Environmental Protection Agency	Both	<ul style="list-style-type: none"> <li>- Grants</li> <li>- Funding for deployment of residential and community solar facilities and energy storage in low-income and disadvantaged communities</li> <li>- \$7 billion available for up to 60 grants</li> </ul>	States, tribal governments, municipalities, and nonprofits	<a href="https://sam.gov/fal/cffd228dd8a34254b68d497672a5235e/view">https://sam.gov/fal/cffd228dd8a34254b68d497672a5235e/view</a> <a href="https://www.epa.gov/greenhouse-gas-reduction-fund/about-greenhouse-gas-reduction-fund">https://www.epa.gov/greenhouse-gas-reduction-fund/about-greenhouse-gas-reduction-fund</a>
High Energy Cost Grant Program*  *Not currently accepting new applicants	Federal	US Department of Agriculture Rural Development Rural Utilities Service	Both	<ul style="list-style-type: none"> <li>- Grants</li> <li>- For projects that acquire, construct, extend, repair, upgrade, or otherwise improve facilities serving communities in which the average home energy costs exceed 275% of the national average under one or more high energy cost benchmarks published in grant announcement</li> <li>- Application window currently closed</li> </ul>	Individuals, for-profit businesses, federally-recognized tribes and tribal entities, nonprofits, and governments	<a href="https://www.rd.usda.gov/programs-services/electric-programs/high-energy-cost-grants">https://www.rd.usda.gov/programs-services/electric-programs/high-energy-cost-grants</a> <a href="https://programs.dsireusa.org/system/progrm/detail/4359/usda-high-energy-cost-grant-program">https://programs.dsireusa.org/system/progrm/detail/4359/usda-high-energy-cost-grant-program</a> <a href="https://www.ecfr.gov/current/title-7/subtitle-B/chapter-XVII/part-1709?toc=1">https://www.ecfr.gov/current/title-7/subtitle-B/chapter-XVII/part-1709?toc=1</a>

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Program	Federal/ State/ Private	Agency/ Entity	Utility Scale or Small Scale	Incentive	Eligible Entities	Source
Powering Affordable Clean Energy (PACE) Program	Federal	US Department of Agriculture	Both	<ul style="list-style-type: none"> <li>- Loans and loan forgiveness</li> <li>- Loans can be used for solar, as well as wind, hydro, geothermal, biomass, or other renewables</li> <li>- Loan forgiveness ranges from 20% to 60% of loan depending on the characteristics of community served</li> <li>- Maximum loan \$100 million</li> <li>- Minimum loan \$1 million</li> <li>- Application window closes September 29, 2023</li> </ul>	For-profit businesses, nonprofits, and governments	<p><a href="https://www.rd.usda.gov/programs-services/electric-programs/powering-affordable-clean-energy-pace-program">https://www.rd.usda.gov/programs-services/electric-programs/powering-affordable-clean-energy-pace-program</a></p> <p><a href="https://www.usda.gov/media/press-releases/2023/05/16/biden-harris-administration-makes-historic-11-billion-investment">https://www.usda.gov/media/press-releases/2023/05/16/biden-harris-administration-makes-historic-11-billion-investment</a></p>
Renewable Energy Production Tax Credit (PTC)	Federal	US Internal Revenue Service and US Department of Energy	Both	<ul style="list-style-type: none"> <li>- Tax credit against federal income taxes*</li> <li>- Small credits—cents per kilowatt-hour produced during first 10 years facility in operation based on worker wages, use of US-made inputs (e.g. steel), size of facility, and location (e.g. low-income community, brownfield, or former coal mine)</li> <li>- Facility also eligible for accelerated depreciation</li> </ul> <p>*Tax-exempt entities—including electric cooperatives, other nonprofits, governments, and TVA—eligible to receive direct payments equal to the amount of credit otherwise available to for-profit entities</p>	For-profit businesses, nonprofits, and governments	<p><a href="https://www.energy.gov/eere/solar/federal-solar-tax-credits-businesses">https://www.energy.gov/eere/solar/federal-solar-tax-credits-businesses</a></p>

Program	Federal/ State/ Private	Agency/ Entity	Utility Scale or Small Scale	Incentive	Eligible Entities	Source
Rural Energy for America Program: Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants	Federal	US Department of Agriculture Rural Development	Both	<ul style="list-style-type: none"> <li>- Grants and loan guarantees</li> <li>- Grants for up to 50% of eligible project costs, \$1,500 minimum and \$1 million maximum</li> <li>- Loan guarantees for up to 75% of eligible project costs</li> <li>- Combined grant and loan guarantee funding up to 75% of total eligible project costs</li> </ul>	<p>Agricultural operations with at least 50% of gross income coming from agricultural operations and small businesses in rural areas</p>	<p><a href="https://www.rd.usda.gov/programs-services/energy-programs/rural-energy-america-program-renewable-energy-systems-energy-efficiency-improvement-guaranteed-loans#overview">https://www.rd.usda.gov/programs-services/energy-programs/rural-energy-america-program-renewable-energy-systems-energy-efficiency-improvement-guaranteed-loans#overview</a></p> <p><a href="https://programs.dsireusa.org/system/progam/detail/917/usda-rural-energy-for-america-program-reap-grants">https://programs.dsireusa.org/system/progam/detail/917/usda-rural-energy-for-america-program-reap-grants</a></p> <p><a href="https://programs.dsireusa.org/system/progam/detail/2511/usda-rural-energy-for-america-program-reap-loan-guarantees">https://programs.dsireusa.org/system/progam/detail/2511/usda-rural-energy-for-america-program-reap-loan-guarantees</a></p>
Sales Tax Credit for Clean Energy Technology	State	Tennessee Department of Revenue and Tennessee Department of Environment and Conservation	Both	<ul style="list-style-type: none"> <li>- Tax credit, refund, or exemption</li> <li>- Credit, refund, or exemption equal to 100% of the sales and use tax owed for purchases of machinery and equipment for facilities certified as green energy production facilities by Tennessee Department of Environment and Conservation</li> <li>- Whether to apply for credit, refund, or authority to make tax exempt purchases is at purchaser's discretion</li> </ul>	<p>Individuals, for-profit businesses, nonprofits, and governments</p>	<p>Tennessee Code Annotated, Section 67-6-346</p> <p><a href="https://programs.dsireusa.org/system/progam/detail/4919/sales-tax-credit-for-clean-energy-technology">https://programs.dsireusa.org/system/progam/detail/4919/sales-tax-credit-for-clean-energy-technology</a></p> <p><a href="https://www.tn.gov/environment/program-areas/ops-policy-and-sustainable-practices/certifications/ops-certified-green-energy-production-facilities.html">https://www.tn.gov/environment/program-areas/ops-policy-and-sustainable-practices/certifications/ops-certified-green-energy-production-facilities.html</a></p> <p><a href="https://www.tn.gov/content/dam/tn/revenue/documents/tax_manuals/march-2023/Sales-Use-Tax.pdf">https://www.tn.gov/content/dam/tn/revenue/documents/tax_manuals/march-2023/Sales-Use-Tax.pdf</a></p>
Tennessee Solar Access Law of 1979	State	Tennessee State Government	Both	<ul style="list-style-type: none"> <li>- Easement—a nonpossessory right to use and/or enter onto the real property of another without possessing it</li> <li>- Authorizes property owners to negotiate and establish easements with neighboring property owners to ensure access to sunlight for solar facilities</li> </ul>	<p>Individuals, for-profit businesses, nonprofits, and governments</p>	<p>Tennessee Code Annotated, Section 66-9-201 et seq.</p> <p><a href="https://programs.dsireusa.org/system/progam/detail/18/tennessee-solar-easement-and-access-laws">https://programs.dsireusa.org/system/progam/detail/18/tennessee-solar-easement-and-access-laws</a></p>

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Program	Federal/ State/ Private	Agency/ Entity	Utility Scale or Small Scale	Incentive	Eligible Entities	Source
US Department of Energy Loan Guarantee	Federal	US Internal Revenue Service and US Department of Energy	Both	<ul style="list-style-type: none"> <li>- Loans and loan guarantees for deploying innovative clean energy technologies at commercial scale (Innovative Energy)</li> </ul>	For-profit businesses, nonprofits, and governments	<p><a href="https://www.energy.gov/lpo/innovative-clean-energy-loan-guarantees">https://www.energy.gov/lpo/innovative-clean-energy-loan-guarantees</a></p> <p><a href="https://www.energy.gov/lpo/articles/innovative-clean-energy-loan-guarantee-solicitation-current">https://www.energy.gov/lpo/articles/innovative-clean-energy-loan-guarantee-solicitation-current</a></p> <p><a href="https://www.energy.gov/lpo/articles/title-17-lending-reference-guide">https://www.energy.gov/lpo/articles/title-17-lending-reference-guide</a></p>
Energy Efficiency Loans	Private	Pathway Lending	Small Scale	<ul style="list-style-type: none"> <li>- Loans for the implementation of renewable energy projects</li> <li>- For businesses (for-profit and nonprofit): 4% interest rate for 5 years, 6% rate for 10 years</li> <li>- For governments: 4% interest rate for 6 years</li> </ul>	For-profit businesses, nonprofits, and governments	<a href="https://www.pathwaylending.org/energy-efficiency-loans/">https://www.pathwaylending.org/energy-efficiency-loans/</a>
Energy Efficient Mortgages	Federal	Federal Housing Authority	Small Scale	<ul style="list-style-type: none"> <li>- Financing</li> <li>- Loans insured by the Federal Housing Authority (FHA)</li> <li>- Loan amounts added to regular FHA mortgage</li> <li>- Maximum loan the lesser of (1) the cost of facility or (2) the lesser of 5% of (a) the home's adjusted value, (b) 115% of median single-family home price for area, or (c) 150% of national conforming mortgage limit</li> </ul>	Homeowners and homebuyers	<p><a href="https://www.energystar.gov/newhomes/mortgage_lending_programs/energy_efficient_mortgages">https://www.energystar.gov/newhomes/mortgage_lending_programs/energy_efficient_mortgages</a></p> <p><a href="https://programs.dsireusa.org/system/program/detail/742/energy-efficient-mortgages">https://programs.dsireusa.org/system/program/detail/742/energy-efficient-mortgages</a></p>



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Program	Federal/ State/ Private	Agency/ Entity	Utility Scale or Small Scale	Incentive	Eligible Entities	Source
Energy Efficient Mortgages	Federal	US Department of Veterans Affairs	Small Scale	<ul style="list-style-type: none"> <li>- Financing</li> <li>- Loans insured by Veterans Affairs (VA)</li> <li>- Maximum loan varies: (1) max is \$3,000 if request based solely on documented costs; (2) max is \$6,000 if projected energy savings exceed increase in mortgage payments; (3) VA at its discretion may increase these amounts</li> </ul>	Qualified military personnel, reservists, and veterans	<p><a href="https://programs.dsireusa.org/system/progrm/detail/742/energy-efficient-mortgages">https://programs.dsireusa.org/system/progrm/detail/742/energy-efficient-mortgages</a></p> <p><a href="https://www.energystar.gov/sites/default/files/asset/document/VA_Pamphlet_26-7Revised.pdf">https://www.energystar.gov/sites/default/files/asset/document/VA_Pamphlet_26-7Revised.pdf</a></p>
Federal Investment Tax Credit for Residential Solar Photovoltaics (PV)	Federal	US Internal Revenue Service	Small Scale	<ul style="list-style-type: none"> <li>- Tax credit against federal income taxes; project needs to be created in tax year to be eligible for credit for that year</li> <li>- Credit ranges from 22% to 30% of investment based on what year solar facility was put in service</li> <li>- Program set to expire in 2035</li> </ul>	Individuals	<a href="https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics">https://www.energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics</a>
Green Rewards	Federal	Fannie Mae	Small Scale	<ul style="list-style-type: none"> <li>- Financing</li> <li>- According to DSIRE "provides preferential pricing and up to an additional 5% of loan proceeds by including up to 75% of projected owner energy and water savings and 25% of projected tenant savings in the loan underwriting"</li> </ul>	Multifamily properties	<a href="https://multifamily.fanniemae.com/financing-options/specialty-financing/green-rewards">https://multifamily.fanniemae.com/financing-options/specialty-financing/green-rewards</a>

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HomeStyle Energy Mortgage	Federal	Fannie Mae	Small Scale	<ul style="list-style-type: none"> <li>- Financing</li> <li>- Can borrow up to 15% of home's appraised value</li> <li>- Appraised value is based on future value once project completed</li> </ul>	Homebuyers	<p><a href="https://www.knowyouroptions.com/buy-overview/affordable-mortgage-options/homestyle-energy-mortgage">https://www.knowyouroptions.com/buy-overview/affordable-mortgage-options/homestyle-energy-mortgage</a></p> <p><a href="https://www.energystar.gov/newhomes/mortgage_lending_programs/energy_efficient_mortgages">https://www.energystar.gov/newhomes/mortgage_lending_programs/energy_efficient_mortgages</a></p> <p><a href="https://programs.dsireusa.org/system/program/detail/742/energy-efficient-mortgages">https://programs.dsireusa.org/system/program/detail/742/energy-efficient-mortgages</a></p>
Residential Energy Conservation Subsidy Exclusion	Federal	US Internal Revenue Service	Small Scale	<ul style="list-style-type: none"> <li>- Income deduction on federal income taxes</li> <li>- Subsidies provided directly or indirectly by utilities for purchase and installation of solar facility for a house, apartment, condominium, mobile home, boat, or similar property can be excluded from gross income</li> </ul>	Individuals and corporations	<p><a href="https://www.irs.gov/publications/p525#en_US_2022_publication1000229515">https://www.irs.gov/publications/p525#en_US_2022_publication1000229515</a></p> <p><a href="https://programs.dsireusa.org/system/program/detail/666/residential-energy-conservation-subsidy-exclusion-personal">https://programs.dsireusa.org/system/program/detail/666/residential-energy-conservation-subsidy-exclusion-personal</a></p>
Business Energy Investment Tax Credit (ITC)	Federal	US Internal Revenue Service	Utility Scale	<ul style="list-style-type: none"> <li>- Tax credit against federal income taxes*</li> <li>- Credit ranges from 6% to 80% of investment based on worker wages, use of US-made inputs (e.g. steel), size of facility, and location (e.g. low-income community, brownfield, or former coal mine)</li> <li>- Facility also eligible for accelerated depreciation</li> </ul> <p>*Tax-exempt entities—including electric cooperatives, other nonprofits, governments, and TVA—eligible to receive direct payments equal to the amount of credit otherwise available to for-profit entities</p>	For-profit businesses, nonprofits, and governments	<p><a href="https://www.energy.gov/eere/solar/federal-solar-tax-credits-businesses">https://www.energy.gov/eere/solar/federal-solar-tax-credits-businesses</a></p>

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Program	Federal/ State/ Private	Agency/ Entity	Utility Scale or Small Scale	Incentive	Eligible Entities	Source
Empowering Rural America (New ERA) Program	Federal	US Department of Agriculture	Utility Scale	<ul style="list-style-type: none"> <li>- Grants and loans</li> <li>- Funding can be used to purchase, build, or deploy renewable energy, as well as several other uses, including efficiency improvements, zero-emission systems, and carbon capture systems</li> <li>- Grant awarded for no more than 25% of project costs</li> <li>- Loan rates set either at US Treasury rate or as low as 2%</li> <li>- Can refinance existing loans of stranded assets if savings are used to finance eligible projects</li> <li>- Grant and loan combinations are acceptable</li> <li>- No single awardee may receive more than \$970 million</li> </ul>	Electric cooperatives (including their subsidiaries) that serve predominantly rural areas, existing or former USDA Rural Utilities Service borrowers, and former Rural Electrification Administration borrowers	<p><a href="https://www.rd.usda.gov/programs-services/electric-programs/empowering-rural-america-new-era-program">https://www.rd.usda.gov/programs-services/electric-programs/empowering-rural-america-new-era-program</a></p> <p><a href="https://www.usda.gov/media/press-releases/2023/05/16/biden-harris-administration-makes-historic-11-billion-investment">https://www.usda.gov/media/press-releases/2023/05/16/biden-harris-administration-makes-historic-11-billion-investment</a></p>
Modified Accelerated Cost Recovery System	Federal	US Internal Revenue Service	Utility Scale	<ul style="list-style-type: none"> <li>- Income deduction on federal income taxes</li> <li>- Allows businesses to recover investments through depreciation deductions on federal income taxes</li> <li>- Solar facilities depreciated on five-year schedule</li> </ul>	For-profit businesses	<p><a href="https://www.irs.gov/pub/irs-pdf/p946.pdf">https://www.irs.gov/pub/irs-pdf/p946.pdf</a></p> <p><a href="https://programs.dsireusa.org/system/progrm/detail/676/modified-accelerated-cost-recovery-system-macrs">https://programs.dsireusa.org/system/progrm/detail/676/modified-accelerated-cost-recovery-system-macrs</a></p>