NACo Series on County Considerations for Siting Energy Projects:

Solar Energy

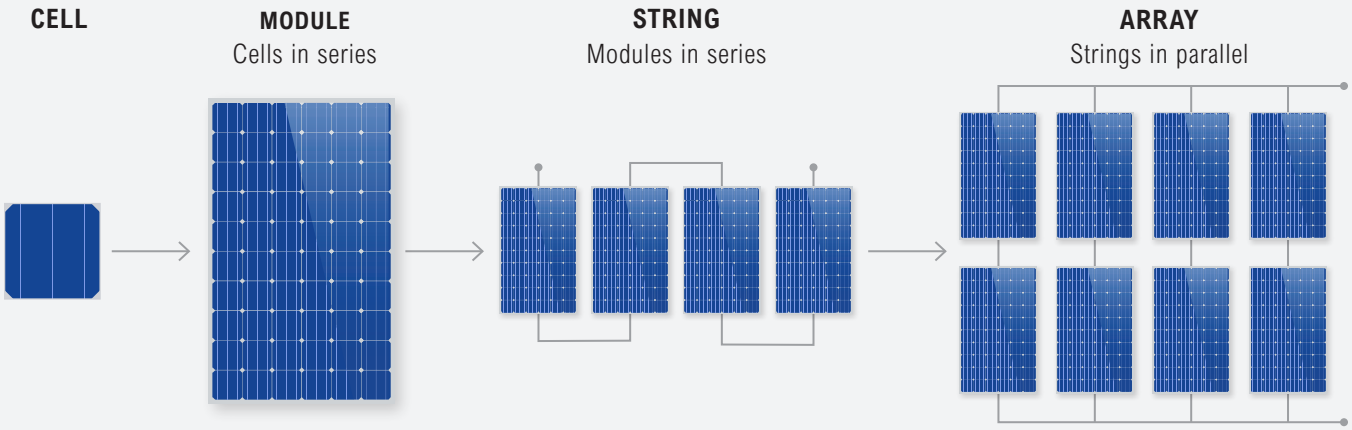
Introduction

Solar energy is a form of renewable energy harnessed directly from the sun. While the quality of the resource varies by location, recent solar technology improvements have made this technology cost competitive in nearly every county nationwide. In the United States, the amount of energy generated annually by this technology has increased ten-fold in the last decade to about 6 percent of all utility scale generation. "Solar power" has been the largest contributor to new generation sources since 2021.[1] For more county insights on energy topics, visit NACo's Energizing Counties Resource Hub.

Solar PV Technology

Solar photovoltaic (PV) cells convert energy in sunlight (photo) directly to electricity (voltaic). **Solar PV cells** are composed of alternating layers of a semiconductor, like silicon, which has unique properties that conduct electricity when exposed to light. These cells can be wired together to form a **solar panel** (or module), which is encased in an aluminum frame with a tempered glass top layer. Multiple solar panels are connected to make *strings* and *strings* connect to form *arrays.* Solar arrays generate DC (direct current) power and are connected to *inverters* that convert it to AC (alternating current) power so it can be transmitted to the electrical grid or used on-site.

Solar Technology Terms



Solar PV System

Solar cells only work during the day and are most efficient when sunlight strikes panels perpendicular to the cells. As such, solar panels are placed in areas with minimal shade and mounted on *racking systems* to ensure they face the sun. In the northern hemisphere, south-facing systems receive maximum exposure. Roof-mounted systems and fixed ground-mounted systems are installed with an advantageous tilt angle and have minimal foundation requirements. Solar panels mounted on a *tracking system* can rotate to follow the sun; while this improves energy generation by 25 to 40 percent, installation tends to be more expensive and requires more complex foundation systems.

Solar Project Types

Solar PV can be scaled from a couple of cells (e.g., landscaping lights) to acres of panels for utility scale projects.

	RESIDENTIAL	COMMERCIAL/ INDUSTRIAL	COMMUNITY	UTILITY
ELECTRIC GRID CONNECTION	Customer side of meter	Customer side of meter	Sub-transmission level	Transmission level
COMMON SIZE	< 25 kW	25 kW - 1 MW	< 10 MW (50 acres)	> 10 MW (50 acres)
MARKET VALUE	Savings on customer energy bill by offsetting purchase from utility	Savings on customer energy bill by offsetting purchase from utility	Energy sales to subscribers or a cooperative under a published rate	Energy sales via a power purchase agreement
OWNERSHIP	Homeowner	Business, farmer/rancher, municipality	Utility, independent power producing company, customer group	Utility or independent power producing company
PLACEMENT	Usually roof	Ground or roof	Ground	Ground

Residential and **commercial or industrial** scale projects that are designed to meet on-site energy needs are connected to the grid through a ***net meter*** that records energy flow both to and from the grid. Any surplus energy is exported to the grid and pulled back as credits when there is a deficit, like at night. These systems, installed behind the customer side of the meter, are called ***behind-the-meter*** projects.

Community scale projects usually interconnect at distribution voltage levels below the transmission station level, and the energy is shared among community members within the same utility service network.

Utility scale projects can be sited far from where the energy is ultimately connected, so they are usually connected to the grid by high voltage transmission lines. These projects are not designed to serve on-site loads but are vital to the overall energy supply and grid stability. Since they are connected to the grid on the utility side of the meter, they are called ***front-of-the-meter*** projects, and energy is purchased by utilities and large consumers.

Authority

Utility scale projects that interconnect at transmission voltages fall under the purview of the Federal Energy Regulatory Commission (FERC) and independent system operators (ISOs). Interconnections to the distribution system are handled by the electric services provider and regulated by the state and/or Public Utilities Commission (PUC). Interconnection queues maintained by these agencies can provide insights for solar project potential in a region.

Siting Solar Projects

Utility scale solar developers prospect for project locations across the country and select sites to maximize project returns. These developers consider factors that include:

Land – Utility scale solar projects typically require around five acres for 1 MW when accessory structures are included, so a 100 MW solar project would require up to 500 acres of land. Developers prioritize clear flat land with few landowners, in proximity to existing electric grid infrastructure. They typically prefer existing zoning ordinances but will pursue conditional use permits if necessary.

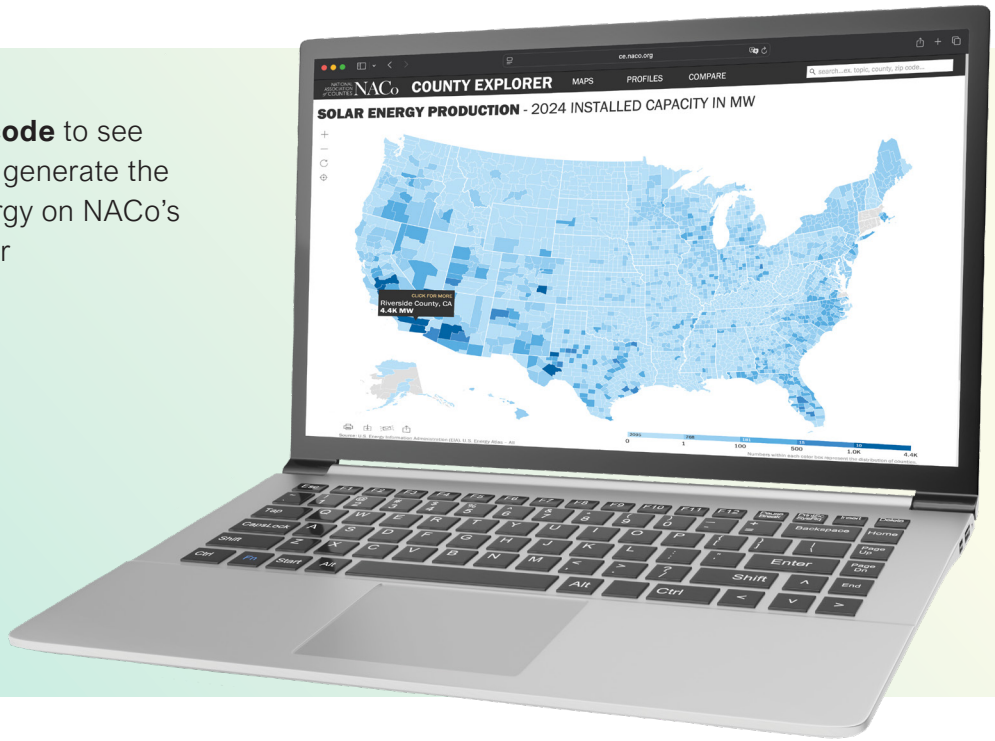
Interconnection – Utility scale projects are typically connected to the transmission grid system and thus require the construction of a project substation. This type of interconnection requires studies and applications that can take several years to process. Utility providers are beginning to prioritize projects that include on-site battery storage.

Incentives – Developers target local, state or federal incentives and tax credits to meet investment hurdles.

Community acceptance – Developers often seek to site projects in jurisdictions where residents are accepting of solar development on private or public land and may engage residents without input from local leaders. County leaders, elected to speak and act on behalf of their constituents, are well-suited to coordinate outreach and facilitate the discussion needed to assess and potentially foster community acceptance.

As these factors can influence developers' desire to site in one location over another, counties may wish to assess each of them independently to make siting more attractive to developers. However, the current nationwide surge in energy demand may make even non-ideal land, interconnection and incentive structures economically viable to developers, opening up more opportunities for counties that may have discounted their resources.

Scan the QR code to see which counties generate the most solar energy on NACo's County Explorer



County Considerations for Siting Solar Projects

Like any major infrastructure project, large solar projects create a variety of positive and negative impacts on surrounding communities. A comprehensive ordinance can ensure project benefits are shared equitably and negative impacts are minimized. This task can be challenging for counties without zoning authority, but county leaders can still promote a healthy relationship between the developer and residents through active collaboration with state and federal regulators. Key issues for county officials in collaborating with developers and drafting solar development ordinances include:

Economic Impact – Behind-the-meter projects benefit local consumers by helping to control their energy costs. For front-of-the-meter projects, landowners receive land lease payments (which are often higher than farming revenues in rural areas) and project owners receive payments for energy sold and potential tax credits. Large scale solar projects provide an income source for counties through negotiated host community agreements or payments in lieu of taxes. County leadership can support residents by ensuring the appropriate benefit-sharing mechanisms are chosen.

Land Use – Ground-mounted solar projects alter land use. While they can revitalize unused sites such as brownfields, large scale solar projects may encroach on productive farmland if not sited appropriately. This conflict can be mitigated by the emerging practice of *agrivoltaics*, which co-locates farming (grazing and crop cultivation) and solar, introducing new and innovative agricultural opportunities to the community.

Scan the QR code to learn more about agrivoltaics from American Clean Power

An Example of Agrivoltaics

Visual Impact – Built less than one-story tall, solar projects are not visible over long distances. But, large scale projects can visually impact neighboring property owners. County leaders can address concerns by promoting public input, identifying optimal development zones and by requiring visual barriers to minimize the impact.

Workforce Development – In the short term, on-site construction labor provides opportunities for local tradespeople. While many jobs are created during the construction of the project, contractors often bring experienced laborers in from outside the community. County leaders can create employment opportunities for residents by requiring local labor engagement. Local trade schools and community colleges can develop energy-based curricula to meet demand for longer-term employment.

End of Project Life – Solar power projects are designed to operate for at least 20 years or more with potential multi-year extensions. Requiring a decommissioning bond or other financial instrument is built into the project budget can ensure the land is returned to its original condition at the end of the project.

Safety – Solar PV systems combine advanced structural and electrical engineering principles with detailed design requirements covered by the International Building Code and National Electric Code respectively, which are updated on a three-year cycle.[2] The authority having jurisdiction is responsible for maintaining current code versions to address safety concerns as solar technology evolves.

Public Perspective – Active community engagement with accurate information can help address misinformation and ensure equitable community growth.

Local Infrastructure – Solar power project components do not typically need unique transportation accommodations. Still, county leaders can require a detailed transportation study to minimize impacts on the community during the construction phase and negotiate with project developers to ensure that any necessary road upgrades or repairs are made by the developer.

Wildlife Impact – Solar power projects can affect the local ecosystem both during and after construction. In addition to compliance with federal environmental regulations, coordination with local and state environmental conservation programs is essential to address impacts to native species and develop appropriate mitigation measures.

Workers Installing Solar Panels

Frequently Asked Questions About Solar PV

How long do solar panels last, and can they be recycled after use?

Solar panel power output degrades at a fraction of a percent annually and maintains more than 85 percent of its original generation capacity after 25 years of operation. Most materials in a solar panel including silicon, aluminum, silver and glass can be recycled.

Is it safe to install solar panels on landfills?

Capped landfills are usually closed off to further development due to the potentially hazardous material under them, but fixed, ground-mounted solar PV projects are increasingly popular on such lands as they can be installed with minimal or no penetration of the cap.

Where is community solar allowed?

As of 2025, at least one community solar project exists in 44 states and localities, including the District of Columbia. Of those, 24 have passed "enabling legislation" that encourages or mandates community solar in their jurisdictions.[3]

What are solar thermal systems and solar concentrators?

Solar thermal systems direct solar energy to heat fluids that can be used to heat homes or businesses. Solar concentrators are mirrors that focus sunlight onto a fluid-filled receiver and that fluid can spin a turbine to make electricity. Solar concentration technology is no longer used widely in the United States.

What is "floatovoltaics?"

Floating solar or floating photovoltaics, sometimes called floatovoltaics, are solar panels mounted on floating structures like plastic buoys. They are placed on a body of water and transmit energy to shore via cables; they can be towed to shore for service and maintenance.

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For official NACo positions, please refer to the American County Platform

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[1] U.S. Energy Information Administration. Electricity data browser - Net generation for all sectors. Accessed October 22, 2024. https://www.eia.gov/electricity/.

[2] 2024 International Building Code, Chapter 31 Special Construction. https://codes.iccsafe.org/content/IBC2024V1.0/chapter-31-special-construction#IBC2024V1.0_Ch31_Sec3111; National Electrical Code Solar Provisions. https://codes.iccsafe.org/content/ISEP2021P1/national-electrical-code-nec-solar-provisions#ISEP2021P1_NEC.

[3] U.S. Department of Energy. Community Solar Basics. Accessed October 22, 2024. https://www.energy.gov/eere/solar/community-solar-basics.

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