SOLAR IN CT

SOLAR BASICS

How Does Solar Work and How Will It Improve the Grid?

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HOW DOES SOLAR WORK?

The sun is an abundant source of free clean energy. Photovoltaic (PV) systems are capable of converting this energy into electricity.

The solar panels in a PV system consist of solar cells made of a semiconductor material such as silicon. When sunlight strikes the panel, the sun's energy causes electrons inside the solar cells to move. The electrons travel along the wire in the cells creating a direct current often referred to as DC. The electrical current flows to the wires on the solar cells and from there to the system's inverter. The job of the inverter is to convert the DC to an alternating current also called AC. AC is the type of electricity used by most appliances. Alternatively, your system may use microinverters. In this case, the conversion occurs at the panel.

Most solar systems are connected to the larger electrical grid. From the inverter, the electricity is either used or stored on site or sent to the electrical grid. A meter monitors the energy production and sends the information to your electric utility.

HOW MUCH ELECTRICITY CAN A SOLAR ARRAY PRODUCE?

There are many variables that affect the productivity of a solar PV system. The building's geographic location and weather determine the amount of sunlight available but the orientation of the roof is also a key factor. Generally, a south-facing roof with a slope between 15 and 40 degrees is ideal though solar works for many other roof configurations. There are some conditions that preclude the addition of rooftop solar such as a slate roof, a roof that needs replacement, and an overly shaded roof. In these cases, ground-mounted solar or a solar canopy may be possible. The panel composition and how the panels are mounted also impact solar PV potential.

400 Watt Panels Are the Standard

A 400 watt (W) panel has the capacity to produce 400 W of electricity. However, the actual output will vary depending on peak sun hours, or useable sunlight. In Connecticut, we have an average of about 4 peak sun hours per day. Multiplying this times the wattage of the panel, that gives you 1600 Watt-hours per day or 1.6 kWh per day. This is about 48 kWh per month per panel. Knowing your monthly electricity usage, you can estimate how many panels you would need to cover your electrical load.

ARE ALL SOLAR PANELS THE SAME?

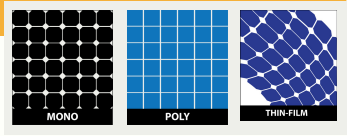
The short answer is "No." Panels have different **efficiency rates** — the amount of available sunlight converted to electricity — typically ranging between 15 to 23%. There is also a loss of efficiency over time called **degradation**. A degradation rate of .25% or less per year is good with performance at 85% of peak after 25 years.

Most solar panels are made from silicon. In the factory, molten silicon is processed into either a single crystal (monocrystalline) or many smaller crystals (polycrystalline).

4 Types of Panel Construction

Monocrystalline - darker in color; more efficient and last longer but cost more and greater waste in production
Polycrystalline - appearance is lighter in color and less uniform; less efficient; less waste in production
Passivated Emitter and Rear Cell (PERC) - A modified mono or poly panel where the cells have an extra layer making them more efficient; more expensive
Thin-film - thin layers of non-crystalline silicon or other minerals combined to create a flexible light weight film; more versatile and can be integrated into buildings; some types have lower efficiencies and shorter lifespans

Panels can also be **bifacial** meaning that both sides of the panel can collect the sun's energy.



WHAT ARE THE METERING AND FINANCE OPTIONS?

METERING

There are two options for Eversource and UI customers when it comes to solar on your property: Buy-All and Netting. In **Buy-All,** the system is not tied to the load of the building and all of the energy produced is exported to the grid. The utility purchases the electricity at the tariff rate set by PURA. The customer in turn buys all of their electricity from the utility. In **Netting**, all power production and consumption are metered together. Energy produced, but not used within the month, is netted and compensated at customer's retail rate. The size of a netted system is limited to the building load.

FINANCING

The most common ways to access solar are:

- **Purchase** - purchasing solar outright costs more upfront but allows you to access federal and state incentives. Low interest loans are available through the CT Green Bank.
- **Lease** - in a lease agreement, you don't own the system but instead pay a fixed monthly fee to use it
- **PPA** - in a purchase power agreement you don't own the system installed on your property, instead you purchase the electricity produced at a fixed rate
- **SCEF** - participants in the Shared Clean Energy Facility program receive a small percentage off their utility bills. This program is provided to a certain number of people with a low income. Others who cannot install solar must apply.

HOW DOES SOLAR SUPPORT THE GRID?

Energy from solar power can support the grid in many ways. Solar power can contribute to strengthening the electrical grid in Connecticut in many ways:

1. **Distributed Generation:** Rooftop solar panels generate electricity close to the point of consumption reducing the strain on the grid infrastructure caused by electricity traveling long distances from centralized power plants. It alleviates congestion and lowers the risk of power outages.
2. **Peak Load Management**: Solar power production often aligns with peak electricity demand, which typically occurs during the daytime when the sun is shining. By generating electricity during these peak periods, solar power can offset the need for fossil fuel peaker plants.
3. **Voltage Support and Grid Stability**: Solar installations can provide voltage support to the grid by injecting power at the distribution level. During periods of high electricity demand, solar generation can help maintain voltage levels, preventing voltage drops and instability. This support enhances the overall stability and reliability of the grid.
4. **Grid Resilience**: PV systems, particularly those equipped with energy storage, can enhance grid resilience during power outages. When the grid experiences disruptions, solar power systems with battery storage can continue to supply electricity to critical loads or even provide power to nearby communities as microgrids. This decentralized energy generation and storage capability can help reduce the impact of outages and speed up the recovery process.
5. **Renewable Energy Integration**: Solar power is a clean and renewable energy source. By integrating solar generation into the grid, Connecticut reduces its reliance on fossil fuels and lower greenhouse gas emissions. The increased use of solar power aligns with the state's clean energy goals .

RESOURCES

- Solar Photovoltaic Cell Basics | Department of Energy
- Homeowner's Guide to Going Solar | Department of Energy
- Resi Guide to Solar Power (seia.org)
- Money Matters: How to Finance Your Rooftop Solar Energy System | Department of Energy
- CT Green Bank

VIDEO

- Energy 101 Video: Solar PV | Department of Energy

For more information, visit PACEcleanenergy.org