

# Solar Connection

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## at the Brown County STEM Innovation Center



## How the STEM Innovation Center Solar Energy System Works

With 276 solar panels installed on the roof of the STEM Innovation Center, you may wonder how this system works. There are three major stages to producing solar energy: absorption, conversion, and production. In absorption, the solar panels take in sunlight with photovoltaic cells. This comes in the form of direct current (DC) energy. In conversion, the DC energy is sent to the inverter and converted into alternating current (AC) energy. Lastly in production, the energy is pushed to your home's electrical panel and distributed accordingly. Any excess power produced will be sent to the electrical grid.

The scientific core of solar energy is the photovoltaic effect. The effect is the characteristic of certain materials that allows them to generate an electric current when exposed to sunlight. In a solar panel, the solar cells first absorb solar radiation. The electrons in that cell then begin to move, which generates an electrical current. Finally, the wiring in the cell captures the current and combines the current from other solar cells. This is the energy that is sent to the inverter.



As stated earlier, any excess power will be sent to the electrical grid. This is done with a utility meter. Your energy provider will use it to measure and supply power to your home. The majority of households and commercial buildings also have access to net metering throughout the country. Net metering allows people who generate their own electricity from solar power to sell any electricity they aren't using back to the grid. Net metering essentially sends your solar energy to the grid when your system is over-producing for the building. The system takes the difference of how much you sent to the grid and how much you used and the customers are billed for their "net" energy use. Most of the states in the U.S. have passed net metering laws, while others use regulatory decisions to offer net metering programs. How solar customers get compensated differs across these different mechanisms.

Thankfully, Wisconsin is one of many states to offer net metering. Wisconsin offers net metering to customers of Investor-owned utilities (IOUs) and municipal utilities for systems under or equal to 20 kW. Utilities are also not able to charge customers fees in addition to minimum monthly charges that apply to other customers. A 20 kW system is big enough for most residential buildings, but Wisconsin does also allow net metering for systems larger than 20 kW. Utilities that offer this include Xcel Energy, We Energies, and Madison Gas and Electric. However, utilities are able to charge higher application fees for the bigger the system.

<https://news.energysage.com/solar-panels-work/>

<https://www.seia.org/initiatives/net-metering>

<https://www.nrel.gov/solar/rps/wi.html>

### Total Energy Produced by the STEM Solar Panels from November 2019 to January 2020: 9,000 kWh

This is the equivalent of:

**Gallons of gas saved**

716 gallons



**Pounds of coal avoided**

7,012 pounds



**Propane cylinders used for home barbecues**

260 cylinders



**Number of smartphones charged**

811,533 smartphones



## Home Solar Panel Installation

Solar is becoming a much more common sustainable energy solution as technology advances. Over one million homes have gone solar in the U.S. and equipment is becoming more available to numerous households. From the day you sign your solar contract with your installer, it will usually take between one to three months before your solar panels are connected to the grid and producing energy for your home. To help those interested in solar power, [Energy Sage](#) has detailed five main steps for a typical solar installation process:

- 1. Engineering Site Visit:** An engineer will come to your property and evaluate the electrical status of your home. This is to ensure that everything is compatible with your new energy system including your roof and the electrical panel.
- 2. Incentives and Permits:** Your installer will work with you to apply for state and federal incentives as well as completing other docs such as building permits.
- 3. Ordering Equipment:** The installer will recommend various brands for solar panels and inverters as well as other needed equipment. The primary factors for this equipment are durability, efficiency, and aesthetics.
- 4. Solar Panel Installation:** The installation time will range from one to three days depending on how big the system is. What the installer will do during installation:
  - a. Prep the roof to ensure tiles/shingles are attached properly
  - b. Install electrical wiring that connects to your electrical panel
  - c. Attach racking to support your panels
  - d. Place panels on racking
  - e. Inverter(s) are connected to the panels to convert direct current (DC) from solar energy to alternating current (AC) to be used in the home
- 5. Approval and Interconnection:** A municipal and an electric company representative will come to your house to inspect and ensure that the system was properly installed. Expect to wait from two weeks to a month for both representatives to confirm their inspections. Once this is done, your system will be connected to the grid and producing solar energy.

<https://news.energysage.com/solar-panel-installation-guide-what-should-you-expect/>

## Solar Energy in Wisconsin

### Utility Providers



**Net Metering:** Available for systems  $\leq$  20 kW

**Tax Exemptions:** No added tax for equipment or added value to property

**Reimbursements:** Focus on Energy offers incentives equal to 12% of the installed costs of a system that doesn't exceed \$2,000

State-Wide Benefits	
Types	Available in WI?
Net Metering	Yes
Tax Exemptions	Yes
Reimbursements	Yes

## Solar Panel Brands

The biggest considerations to take into account when looking at different solar energy brands is efficiency, price, and warranty. For example, SunPower, LG, and Panasonic are widely considered the top solar panel companies. This is because of their high efficiencies, competitive pricing, and 25-year warranty. Other companies that are consistently associated with the best products on the market are Silfab, Hanwha Q CELLS, Canadian Solar, JinkoSolar, and Trina Solar. Another detail to watch for is the type of the solar panel. Most of the best solar panels are made with premium monocrystalline solar cells. These cells are made with a single crystal of silicon instead of many silicon fragments that are melted together, which is the case with polycrystalline cells. Here are the best solar panel companies ranked by efficiency:

1. SunPower – 22.8%
2. LG – 21.7%
3. REC Group – 21.7%
4. Panasonic – 20.3%
5. Solartech Universal – 19.9%

<https://news.energysage.com/best-solar-panels-complete-ranking/>



## Ideas or Questions about Solar Energy?

Have an idea about renewable energy on campus, want to know more about solar energy, or have other questions? Contact Ethan at [ahneea05@uwgb.edu](mailto:ahneea05@uwgb.edu) or stop by the EMBI office in Environmental Sciences 105 on weekdays.

Organized by the Environmental Management and Business Institute at the University of Wisconsin – Green Bay