

WOLFWORKS GUIDE TO SOLAR ENERGY AND STORAGE

Wolfworks mission includes equipping homes to rely on renewably generated electric energy for all occupant uses, including transportation (EV's), and integrating that system with a backup strategy that relies on battery storage. This system includes a bidirectional interconnection with Eversource in which you both use and produce electricity. This is an overview of that systems working parts.

BUILDING LOADS

To design this integrated system, you begin by taking an inventory of the amount of electricity your home will need to power the systems that provide comfort, health, and practical functions:

- Heating and Cooling
- Hot Water
- Ventilation
- Pumps (if there is a well or sewage ejector)
- Cooking
- Cleaning (Dishwasher & Laundry)
- Refrigeration
- Lighting
- Media
- Plug Loads (everything you use that needs an outlet)
- Electric Vehicle(s)

These are the home's energy loads. To eliminate dependence on fossil fuels, you want each to be powered electrically. Some use small amounts intermittently, while others require more energy more frequently. At different times of day and levels of occupancy the cumulative load may be small or large (almost everything "on"). Your homes circuit panel and its size manage and serves each of these needs.

REDUCE THEN PRODUCE

Your first question is: Are you meeting each of these needs with the most efficient equipment available? If you can, you want to lighten your load with these systems and equipment:

- Minisplit Heat Pump heating and cooling
- Heat Pump Water Heater
- Balanced Heat Recovery Ventilation
- Properly sized efficient fans (if you need them)
- Induction Cooktops
- Energy Star Appliances and Equipment
- LED Lighting

In addition, you have the opportunity to construct the building in a way that minimizes the amount of energy the home will require to maintain comfort: bake those features in (they are much harder, if not impossible, to add later). By reducing that load the home can rely on much smaller heating and cooling systems that use far less energy.

You then match the size of the solar photovoltaic (PV) system to the amount of electricity the home will require. Smaller loads mean a smaller, less expensive system requiring fewer panels and less roof area.

SOLAR ENERGY

Solar energy is harvested from the sun and converted to usable electric current with an array of photovoltaic (PV) panels. The current is directed according to the overall system components (batteries or not). A stand-alone system has a grid interconnect. The energy your home actually uses continues to come from Eversource, so if there is a power interruption you will not be able to use the energy you are producing.

While your system should optimally be placed on a south facing roof at a 35 degree incline, the efficiency and relative cost of today's panels allow placement on roof areas with differing slopes and orientations between east and west.



YOUR ENERGY BANKS

During the summer months when the days are long, the sun is high, and you don't require heat (the largest energy load) you will produce more energy than you use. In the winter the opposite is true. The days are short, and the sun is low while it is cold outside and thus, your energy needs are highest. You need more energy than you are producing. On balance, your system should be designed to produce as much energy as you use on an annual basis, thus the term Net Zero Energy.

Whenever you are overproducing Eversource will compensate you under one of two systems: Buy All or Netting. Under the Buy All option you are credited a fixed amount on your utility bill over twenty years (the conditions are onerous, and we do not recommend this option). Under Netting you are credited for any excess you produce at the retail rate you are paying. You are also eligible for a Renewable Energy Credit (REC) for the environmental attributes of the system, currently \$0.0318 per Kilowatt Hour (KwH). Eversource is motivated to support this system to achieve a 100% Zero Carbon Electric Grid by 2040.

SOLAR STORAGE

The prospect of losing power caused by weather events motivates people to install gas powered generators. With a solar power system, you have the option to instead store energy in batteries; eliminating the need for fossil fuel, avoiding the noise of a generator, and reducing the requirements for testing and maintenance.

Like a generator, the size of a battery storage system is determined by the systems you want to power during an outage, as well as how long you would be without power. During a power outage you are living "off grid" with no connection to utility power. All your power is now coming from the sun. This is called "islanding."

You rely on your batteries to "bank" the energy you are producing while the sun shines for use later. Each day without power you are alternately draining and filling your batteries. Your system includes a "smart" energy hub that manages how energy from your solar panels is directed (to serve your home directly or to recharge your batteries). If your system is having trouble meeting all your needs, you can set priorities for essential services.

If you own an electric vehicle (EV) this system integrates with your EV charger and allows you to add that large EV battery as another backup energy banking resource.

DIRECTING ENERGY

Since your heating equipment uses the most energy, you may choose to ration its use. The benefit of a high-performance home with windows tuned to collect solar energy is that every sunny day the home will be directly reheated by the sun. Those windows become part of your heating system and run even if you choose to turn it off for a spell.

Should you experience a sequence of cloudy days limiting energy production, by monitoring your battery level and where energy is being used you control how the system is balanced to assure your essential needs will be met.

You can do the same when reconnected to the grid. Your smart hub can direct solar energy to your home, your battery, your EV, or the grid according to what makes sense at any given moment. This is called "interactive" mode. When both the storage and EV battery are fully charged excess production is directed back to the grid.

SHARING YOUR BATTERY

As renewable resources become an increasing segment of the overall pool of energy being shuffled to where it is needed at any given time by Independent Service Operators (ISO New England in your case), there will be incentives that increase reimbursements during periods of peak demand.

Eversource provides incentives for batteries paired with solar PV systems. You will be eligible for an upfront incentive of around \$200 per kilowatt-hour (kWh) of battery capacity, with a maximum incentive per project of \$7,500. As an example, this would be \$2,700 for a single 13.5 kWh battery unit, or \$5,400 for two. Residential customers enrolled in the program will also receive performance incentive payments every year based on the average power your battery contributes to the grid during critical periods.



Under this agreement you are obligated to maintain the system for ten years and allow the utility to draw power from your battery during their peak load periods. They do have caveats that prioritize your use during blackouts or anticipated weather events.

In return for the upfront incentive, you must allow Eversource to passively dispatch power from your batteries between 3 and 8 p.m. on weekdays in June through August. Additionally, you may choose to allow the utilities to actively dispatch power from your batteries during anticipated peak-demand days in the summer and winter. You will be notified by Eversource the day before such an event and may choose whether to participate. At the end of the year, you will receive compensation based on the average kilowatts used per event.

INCENTIVES AND REBATES

With passage of the Inflation Reduction Act there are several provisions that generously subsidize your solar system as well as the equipment and energy efficient methods used when building for high performance. Some of these programs are labeled by the section of the tax code under which they operate.

The 25D Residential Clean Energy Credit

Solar tax credits will be 30% for solar equipment placed in service any time after January 1, 2022. This includes all equipment, including batteries and controls, as well as installation cost. The credit is claimed on your individual income tax return. You do not need to submit specific documentation with the tax return but should retain documentation as part of your tax records so you can prove you purchased eligible property in the event of an IRS audit.

The 25C Energy Efficient Home Improvement Credit

This is for remodeling projects and will take effect on January 1, 2023. A \$1,200 annual tax credit limit will replace the old \$500 lifetime limit. The tax credit will be equal to 30% of the costs for all eligible home improvements made to your home during each calendar year. It has been expanded to cover things such as biomass stoves and boilers, electric panels, and home energy audits.

Annual limits for particular types of qualifying alterations have improved. For example, it's \$250 for an exterior door, or \$500 for all exterior doors; \$600 for exterior windows and skylights; and \$2,000 for heat pump and heat pump hot water heaters for homeowners who don't qualify for the rebate due to higher household income – see below. (The latter \$2,000 is the exception to the \$1,200 annual limit.)

High-Efficiency Electric Home Rebate Program

The High-Efficiency Electric Home Rebate Act (HEEHRA) provides point-of-sale consumer rebates to enable low- and moderate-income households across America to electrify their homes. HEEHRA is a voluntary program that covers 100 percent of electrification project costs (up to \$14,000) for low-income households and 50 percent of costs (up to \$14,000) for moderate-income households, meaning household income cannot exceed 150% of the area median income as calculated by the Department of Housing and Urban Development to qualify. (Here's an [Area Median Income Lookup Tool](#) from Fannie Mae).

There is an upfront rebate of up to \$8,000 to install heat pumps that can both heat and cool homes. It provides a rebate of up to \$1,750 for heat pump water heaters. There is a rebate of up to \$840 to offset the cost of a [heat-pump clothes dryer](#) or an electric stove, including induction ranges. For insulation and sealing – there's a rebate of up to \$1,600.

Sales and Property Tax Exemption

Solar systems are exempt from Property Tax Appraisals and systems are exempt from the State Sales Tax of 6.35%.

Energize CT Residential New Construction Program

This is not part of the IRA but is something we actively participate in on all our projects. Our projects receive appx. \$9500 in incentives for high performance and being all electric. There is an appx. \$2500 fee for third party verification to qualify for this.

