

Solar Energy for New Construction

Building Your Solar-Powered Home

Modern technology makes it cost-effective and sensible to build a 100% solar-powered home, with no utility bills and minimal carbon footprint. At ReVision Energy, we've helped thousands of homeowners achieve their dream of living in a solar-powered home through new construction, whether we work directly with the homeowner, or with their builder or architect.

This guide is designed for those in the process of building a new home, though many of the concepts apply to existing homes as well. It will cover:



- 1 THE MANY BENEFITS OF GOING SOLAR IN NEW ENGLAND**
- 2 KEY CONSIDERATIONS TO BUILD YOUR NEW HOME BETTER (IT'S NOT JUST ABOUT THE SOLAR!)**
- 3 HOW SOLAR CAN POWER, HEAT, AND COOL YOUR NEW HOME**

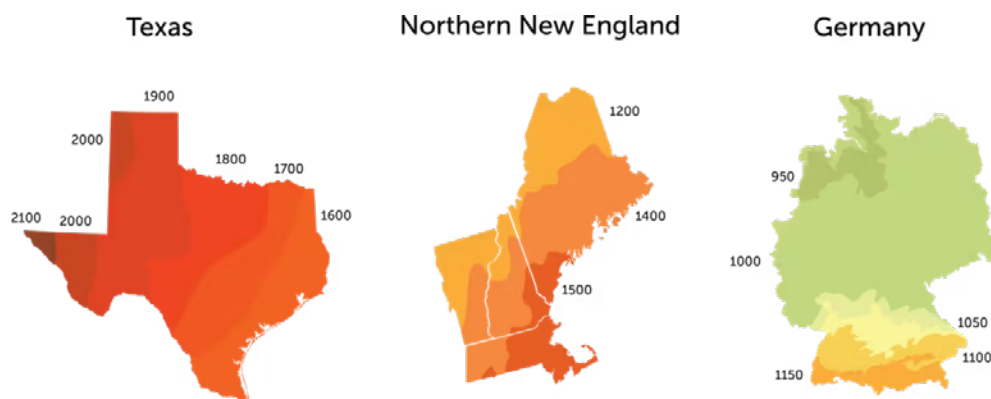
Looking for a new home but not planning to build one? Check out our blog post on [buying a home with solar panels](#) already installed.

Solar Makes Sense in New England

Maine, Massachusetts, and New Hampshire offer key economic and geographic advantages that make solar a viable option for your new construction.

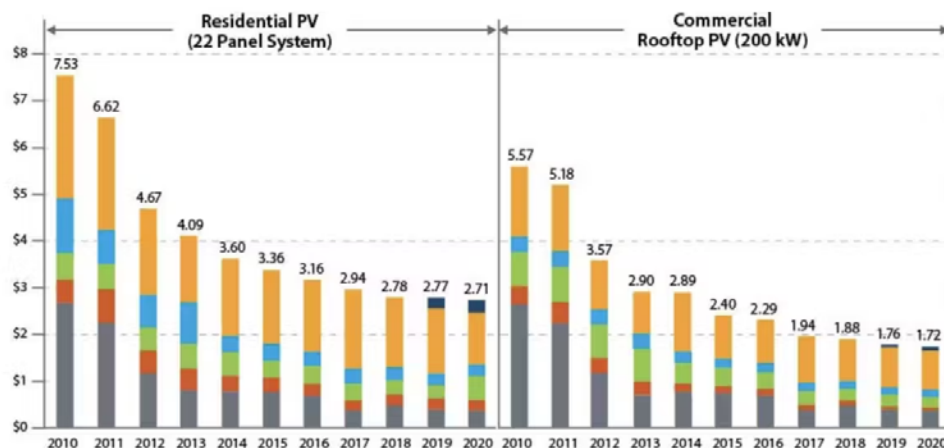
While most people know that powering your home with solar is better for the environment, many don't know that solar is a powerful economic benefit too:

- ✓ **New England's solar resource is abundant.** Each year, we receive the same amount of usable solar energy as Houston, Texas. Our bright, chilly spring and fall and long summers help make up for the dark days of winter.
- ✓ **The cost of solar panels has declined sharply in the last decade.** We've seen a steady decline in costs, driven largely by photovoltaic (PV) module efficiencies (now 19.5%, up from 19.2% in 2019) and hardware and inverter costs. Since 2010, there has been a 64% reduction in the cost of residential PV systems, respectively.



Measured in kWh/kw per year. Data courtesy Solargis.

- ✓ **Solar electricity can be used to heat and cool your home.** While it's great to save money on your electric bill, solar really becomes a valuable investment when used to power heating and cooling equipment, such as modern cold climate heat pumps and heat pump water heaters. By building a tight, well-insulated home, you reduce the need to build an expensive monstrosity of a heating system, freeing up funds to pay for the heat pump and solar combo (more on that shortly).



- ✓ **Solar panels are incredibly reliable.** Solar panels come warrantied for 25 years and are expected to have a service life of 40+ years. With no moving parts, a solar panel system is one of the most reliable, long-lived mechanical systems you can invest in.
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Before Solar, Build it Better

Building a well-insulated and efficiently ventilated house will set you up for greater success when powering your home with solar. The most important advice we have doesn't even pertain to solar...it's about the house itself. Build it better!

While building codes have gotten tougher around energy efficiency, we still think that a code-built home is far below the minimum insulation/air-tightness that any reasonable person would want. It really doesn't cost that much more money to build a tighter, better-insulated home, and the effort to do so will result in huge savings down the road, in terms of energy bills you don't need to pay and carbon pollution you'll keep out of the atmosphere.

There are lots of nuances to this, but we're generally fans of building at least to a "Pretty Good House" standard. Since this term was thought up, there have been numerous resources and guide published about how to build a [Pretty Good House](#). We recommend you check those out!

Pretty Good House Standards:

- Well-insulated (R20+) basement or slab
- R30-40+ wall system, such as 2x6 walls with dense pack cellulose for thermal resistance and 2 inch of rigid foam to eliminate thermal bridging (even better to do a double-stud wall system!)
- R60+ attic insulation
- Better than average air sealing (easier said than done, as many trades on a jobsite need to have air sealing literacy for this to be successful. For example, choices in the framing process matter in terms of air sealing, and electricians/plumbers can screw up a really good air sealing job!)
- High-end double-hung windows, or triple-glazed windows
- Mechanical ventilation (without this it'll be hard to breathe in your tight new house - more on this later!)

For context, a home built to this standard may command a 26% cost premium over a barely-meets-code build home, but will use roughly ½ as much energy. It's worth remembering: A code-built house is literally the worst house you are legally allowed to build in your region... A far cry from the best! (Thanks to [Emily Mottram](#) for this particular line.)

Ventilation is Crucial

New construction requires a mechanical ventilation strategy. The more air-tight and insulated a home is, the less energy needed to heat and cool it. Naturally, such a house will also “breathe” less; to be a healthy environment for people and pets, every house needs to be able to exchange stale air for fresh outdoor air.

Building codes in most states mandate that one third of the stale air inside a home should be replaced with fresh air from the outdoors every hour, also known as the baseline Air Exchange Rate (ACH) of .3 ACH per hour.

Older, draftier homes do this by leaking air from walls, doors, windows, attics, and basements. However, as you might imagine, they lose an awful lot of heat in the process. The solution is to “build tight and ventilate right.” A Balanced Mechanical Ventilation system ensures that the right amount of potentially toxic indoor air is replaced with precisely the same amount of fresh outdoor air each hour. Energy Recovery Ventilation (ERV) and Heat Recovery Ventilation (HRV) systems improve on this concept by extracting heat from the outgoing stale air, keeping it inside the house. Thus, the needed air changes can occur with minimal loss of BTUs!

There are [several configurations and brands of ventilation systems](#), which have varying levels of efficiency. The least efficient will only preserve around 50% of the heat from the exhaust air (and often even less if improperly installed). At ReVision, we only work with the best products in every technology, and exclusively install [Zehnder Energy Recovery Systems](#).



Zehnder, based in Italy, is a leading manufacturer of ventilation equipment in Europe, where standards for energy efficiency have been higher than in the US for some time. The ComfoQ ERVs from Zehnder offer up to 90% efficient heat recovery – significantly more than most domestic ventilation systems.

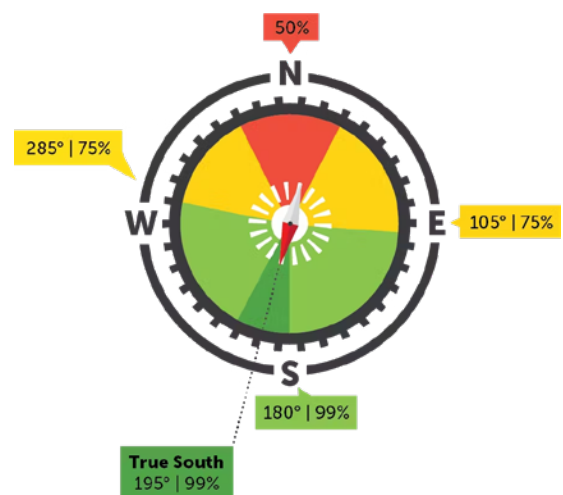
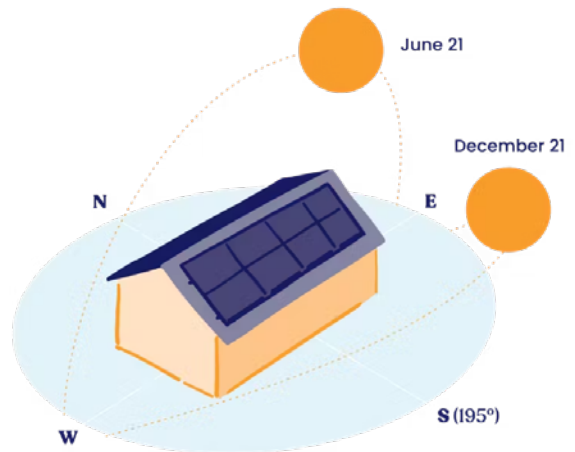
Our team would be happy to guide you as you consider ventilation systems for your new construction.

Build it in the Right Direction

The location, orientation, and design of your roof is a key factor in building your solar powered home – if you're planning on rooftop solar, of course.

The roof matters!! Some decisions around how you design and orient your home can have big impacts on solar. Some key considerations:

- Everyone knows that the sun rises in the east and sets in the west... But did you know it tracks along the southern skyline as it does so? This is why solar panels (in the Northern Hemisphere) get oriented to the south. The sun is relatively higher in the skyline during the summer, and relatively lower in the wintertime, as seen on the right.
- "True" south in New England is 195 degrees on the compass (slightly west of magnetic south). An ideal solar roof will be designed to face this "true" south.
- NO SHADE – Shade trees (or other obstructions) have a serious negative effect on solar production.
- A perfect solar array will be on a pitched roof (6/12 to 12/12) facing +/- 15 degrees of true south. That said, solar panels will produce up to 90% of their rated output even at more east and west orientations, so if your future home's site makes a southerly orientation impossible, it doesn't mean solar won't be a great investment.
- Simple roof layouts (minimum dormers, plumbing vents, chimneys, etc) are much better for solar. Put plumbing vents and chimneys on the north side of the roof, if possible.
- If you absolutely can't design your roof in such a way that it is compatible with solar, you can install solar elsewhere! We have ground-mounted solar options available.



Powering your New Home with Solar

Finally, the good part! There are different ways to go solar (off-grid, grid-tied, etc.) but for this guide, we're going to assume you're going with a grid-tied solar options. Here's why:

- 99% of solar installations in the US are grid-tied, meaning they still have a physical connection to the public utility grid, but can also produce their own solar power.
- Under this arrangement, you treat the utility like a gigantic battery – anytime the sun is out, your home produces and consumes its own solar electricity, but any excess you can send out to the grid. At night or during crummy weather, you use power from the electric grid like normal.
- Utilities are required by law to give you credits for any solar power you send out to the grid, under an arrangement called 'net metering.' In most places, you get a 1:1 credit, or 1 unit of exported solar = 1 unit of utility credit you can use later.
- The best of both worlds, is have a grid-tied solar array (which allows your solar to produce as much power as it possibly can with no limits) with battery backup (so that if the grid goes down you have a source of backup power). ReVision offers [modern battery backup solutions](#).

In a grid-tied solar electric system, with or without battery backup, the goal is generally to achieve net-zero, meaning, at the end of the year your home will have produced as much electricity as it has consumed. This is not always possible (especially if you're heating with solar and also running an electric car) but it's a worthy goal!



“Plug Load” Electricity Estimate

Before we get into heating and cooling, we start with getting an estimate for 'plug loads' – the amount of power you need for your household appliances, electronics, well pump, etc.

This is tricky! No two families are alike, and two families living in the same home can have VERY different electricity bills depending on occupant behavior. Once you start to work with a ReVision Solar Design Specialist, we'll do a more thorough analysis, and ideally get a professional energy designer in the mix to build a more complex model.

Some useful terminology for you to know:

- **Electricity is measured in units called kilowatts (1,000 watts).** This represents instantaneous power – much like miles per hour measure the speed of a vehicle, but not its travel over time.
- **Electricity is billed in units called kilowatt-hours.** This is the amount of total energy as an expression of kilowatts and time. This is like measuring how many miles a car traveled, and averaging the miles-per-hour over that time period.
- **Solar panel arrays are usually sold in kilowatts** (the ‘nameplate’ rating of the panels in full sun) but its far more important to understand how much energy they will produce over time – or their kilowatt-hour (kWh) potential.
- **Each 1kw of solar panels (roughly 3) = 1,200 kWh a year** of solar production on a decent solar site in our region.

Heating & Cooling your Home with Solar

Modern heat pumps are fundamentally more efficient than older technologies like baseboard heating and air conditioning and a great option for new construction.

Do you dread the idea of putting a noisy, fuel-sucking heater or boiler into your new home? Well, good news! Your solar-powered home of the future needs no oil or gas at all. [Modern heat pumps](#), which can be powered by solar, are the best option for you newly constructed homes (old homes too, for that matter).

Cold-climate heat pumps work by using a refrigeration process similar to the way your home’s refrigerator works. Warmth is extracted from the ambient outside air (down to temperatures around -15F) and transferred into your home. Since the heat pump is moving, not creating, heat, it is highly efficient. Powered by solar, a heat pump can heat your home for the equivalent of around \$1/gallon for oil!

Heat pumps also replace the need for air conditioning. In warmer months, heat pumps extract hot air and humidity from your home, for less than what a typical air conditioning unit costs to generate cool air.



While it's possible to keep drafty old homes warm with heat pumps, they are far more effective when used in a tight, well-insulated house, hence our recommendation that you build one. If you build a good quality house, then you can heat primarily with heat pumps, and install a small backup system (say a pellet stove or electric baseboard) to supplement the heat pumps during periods of extreme cold weather.

Since heat pumps are powered by electricity, you can use solar power you bank in the summertime as your fuel source in the winter.

If you're planning on building a new home and want to harness the power of the sun to create an energy efficient, climate friendly household, get in touch with ReVision!



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