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Enphase™ IQ Solar Battery Storage

Adding batteries to your solar energy system can increase your savings, improve energy independence, and keep your home powered during outages. This section is your guide to how batteries work, the different types of batteries, and why it's a good idea to add one or more batteries to your solar energy system.

Your solar energy system will be designed to produce enough energy to meet your annual electricity needs. But most likely, you won't need all the energy your system generates, especially during the middle of the day when production is high, but your power consumption is low. So what to do with all that excess energy? It's simple: solar batteries can store the surplus energy and power your home with it once the sun sets, reducing or even eliminating your need for grid power overnight.

When designing your system, your installer can ensure you have enough battery storage capacity—and panels to charge them—to get you through the longest winter nights. When the sun rises, your solar will start to power your home again, and recharge the batteries with any excess production. If your system is tied to the grid (the vast majority are), any extra energy produced after your battery is full can feed back into the utility grid, often earning you bill credits under net energy metering programs. (Depending on your net metering export rates, it might be better to program your battery to export surplus energy to the grid rather than charging your battery, especially during peak hours when you get a higher credit for that energy.)

Many states and utilities also offer incentives to lower the cost of including batteries with your solar energy system. Incentives are often on a per-kWh basis (a set amount of money for each kWh of storage; so, for instance, if you have a 10 kWh battery and the incentive is \$200/kWh, your incentive or rebate would be \$2,000). Some states offer higher rebates for lower-income households to give wider access to money-saving clean energy.

Batteries are eligible for the 30% [federal tax credit](#) in the [Inflation Reduction Act](#), reducing battery costs.

Having solar with batteries can enhance your energy independence, save you even more money, and, if configured for backup, help protect you against outages in your area.

Batteries can be installed outside (Enphase IQ Batteries, for example, are fully weather-resistant), or in a garage or basement. Your solar installer will help determine the best location for your batteries.

Types of batteries

There are several types of batteries that your solar can charge and use for supplemental or backup power.

AC-coupled

AC-coupled batteries like the [Enphase IQ Battery 5P](#) can accept AC current. Working in conjunction with the Enphase IQ8 Microinverters on your solar panels, energy is converted from DC to AC at each panel and then fed to your house to power daily needs and charge the battery.

The IQ Battery 5P has built-in microinverters that convert the AC back to DC for storage since AC can't be stored. When you draw energy from the battery to power your home, the microinverters convert the DC back to AC for your home to use. AC-coupled batteries tend to be easier to install with existing solar systems, as well as new ones.

DC-coupled

DC-coupled batteries like the Tesla Powerwall 3, SolarEdge, and LG Chem work a bit differently.

They're more commonly used with solar systems that employ string inverters. Panels generate DC electricity, some of which is fed into a central string inverter and converted to AC for your home, while some of the DC is fed directly into your battery to store.

When you draw energy out to your home, the DC runs out of the battery through the same string inverter your panels use to convert DC into usable AC electricity. However, as noted earlier, these systems have a single point of failure—if the central inverter goes down, so do the panels and batteries. These batteries can be less expensive, but there's a reliability risk because of this single point of failure.

Batteries help because you can set them up to power your home during peak rate periods—usually late afternoon and through the evening—instead of drawing grid power. This will reduce the overall amount of grid power you use annually and do it during the most expensive times of the day.

In addition, you can program your battery to send power back into the grid when export rates (the rate your utility pays for power sent to the grid from your battery) are higher, so you get a higher credit for that energy. (Also usually during peak rate periods.)

This strategy can help offset energy costs by reducing your dependence on expensive grid power.
Protection from grid outages

Grid outages—whether caused by extreme weather, fire-prevention shutoffs, or system overload remain the prime reason people include batteries configured for backup in their solar energy system.

If the grid goes down during the day, solar will continue to power your home and charge your backup battery until nightfall. Then the battery can power your home until sunrise or the grid comes back online. With a smart Enphase Energy System, even if your battery nears empty overnight, your solar panel will still work when the sun rises again.

Along with powering your home, solar will also start charging your battery when production exceeds the power your home is drawing.

There are two primary chemistries available today:

Lithium nickel manganese cobalt oxide (NMC)

NMC batteries like Tesla's Powerwall 1 and 2 tend to have higher energy density than LFP but also a bit less longevity—1,000 to 2,000 charge/discharge cycles.

Lithium iron phosphate (LFP)

LFP batteries have a longer lifespan—3,000 or more charge/discharge cycles—and are safer because of their more stable battery chemistry.

Enphase IQ Batteries use [LFP chemistry](#) and operate with low-voltage AC power, which avoids the risks associated with high-voltage DC power.

Enphase backs its batteries with a 15-year limited warranty covering up to 6,000 charge/discharge cycles.

IQ Batteries are also the first microinverter-based storage system to meet the UL 9540A safety standard—a test for protection against the spread of runaway fire for indoor battery storage systems.

It means you can safely install them inside, and install more of them in a smaller space, too.

Are batteries right for your home?

There are a few questions you should ask yourself when deciding whether to add batteries to your solar energy system, whether it's an existing system or a new one you're installing.

Will the savings from the battery justify the investment?

There are many factors to consider when calculating potential savings. First, take the upfront cost minus any tax credits and incentives, then calculate how much you'll save by storing excess solar production and using it to power your home after sunset—often the time with the highest per-kWh electricity rate.

Don't worry. An Enphase installer can help calculate this for you.

Do you need backup power? Batteries provide backup during outages, which is particularly valuable if you live in areas prone to severe weather, wildfires, or your utility experiences frequent outages.

Do you have space to install batteries? Batteries like the Enphase IQ Battery 5P are compact and rated for indoor or outdoor use, so you can install them where it works best for you.

Put simply, the combination of savings and peace of mind offers a strong argument for including or adding batteries to just about every system.

Choosing the right battery

If you want battery storage for your solar system, you just need to find the right battery and decide [how much storage you need](#).

Your installer can figure out how much energy you use, what your essential loads are—like lights, refrigerator, and Wi-Fi—and how much energy they use daily to determine storage capacity needs.

They can also recommend the best place to install the batteries and address safety concerns you may have.

This should help you get the right amount of storage and the best type of battery for your home.

Today, most homes and businesses use lithium-ion solar battery technology to store energy safely and efficiently on-site.

Although there are several other types of solar [battery chemistries](#) available today, the best overall storage solution for a home will almost always be a lithium-ion-based system.

	Lead-acid batteries	Lithium-ion batteries	Flow batteries
Technologies	Flooded or sealed; AGM (Absorbed Glass Mat), Gel (Gelled Electrolytes)	Lithium iron phosphate (LFP or LiFePO4), nickel manganese cobalt (NMC), and more	Redox, hybrid, and membraneless; saltwater, iron, and more
About	The oldest and cheapest storage technology, such as batteries in combustion engine vehicles	The most common type of solar batteries in homes, with superior energy density, safety, efficiency, availability, and lifespan	An emerging, eco-friendly technology that stores electricity within a liquid chemical solution
Applications	Small DIY solar installations with a tight budget	Ideal for residential and commercial solar energy storage	Best for large-scale energy installations when available
Safety	Generally safe, but may become hazardous if handled incorrectly	The safest home solar battery technology, with built-in thermal management features	Safe performance with ongoing monitoring, low fire-risk
Maintenance	Often requires regular maintenance and upkeep	Minimal maintenance required outside of routine inspections	May require ongoing maintenance for optimal efficiency
Performance	Moderate efficiencies, slow charging, and low depth of discharge (50% to 80%)	High efficiencies, fast charging, and high depth of discharge (80% to 98%)	High efficiencies, rapid recharging, and up to 100% depth of discharge
Lifespan	Short (3 to 7 years), depending on the technology and upkeep	Medium to long (5 to 20 years), depending on battery chemistry and quality	Long (20 to 30+ years), with few tested examples
Energy density, size, and weight	Low-density, bulky, and heavy	Dense, compact, and relatively lightweight	Low-density, with large tanks required

While lead-acid batteries may be the technology of yesterday and flow batteries could be the future of large-scale electricity storage, lithium-ion batteries are the best choice for homeowners going solar today. Although lithium-ion batteries may cost more than lead-acid alternatives upfront, they are generally better investments with increased efficiency, greater storage capacity, longer lifespans, and the potential to qualify for [solar tax incentives](#) and other clean energy programs.

Factors to consider when choosing a solar battery

Within the realm of lithium-ion solar batteries, there are many different products available currently with various capabilities, price points, and intended uses.

While this article explores permanently installed solar energy storage for homes, lithium-ion solar batteries are also typically used in portable energy systems.

Home solar battery capacity and quantity

A solar battery's capacity determines how much energy can be stored and used in your home or exported to the electricity grid. Although prices naturally rise with increased storage capacity, larger battery systems can also be more valuable in offsetting all or most of your utility electricity expenses.

If sustained [power during local outages](#) is your primary motivation for a solar battery, rather than total energy independence, then you may not necessarily need to install a large backup reserve. Instead, you could opt for a smaller capacity, lower-cost system designed to exclusively run your property's essentials.

Today, most [solar batteries](#) can be "stacked," so that you can find the optimal storage capacity to meet your energy goals and budget.

Just as [solar microinverters](#) make it easy to add solar panels later in the life of your home energy system, it may also be possible to incorporate additional solar batteries after an initial storage installation.

Solar battery size and installation requirements

When choosing your [home solar battery](#), you may find that various products have differing installation guidelines or requirements.

Provided there's enough space on your property, most high-quality lithium-ion solar batteries can be mounted onto the wall indoors or outdoors and typically found in garages, utility rooms, and other non-living spaces.

AC-coupled vs. DC-coupled battery

Lithium-ion solar batteries may be [AC- or DC-coupled](#), depending on the design of your energy system.

While DC-coupled battery systems may be slightly more efficient, neither technology is explicitly better.

In general, AC-coupled batteries are considered easier to install or replace on an existing system and allow you to store electricity from your solar panels or the energy grid.

AC-coupled vs. DC-coupled battery

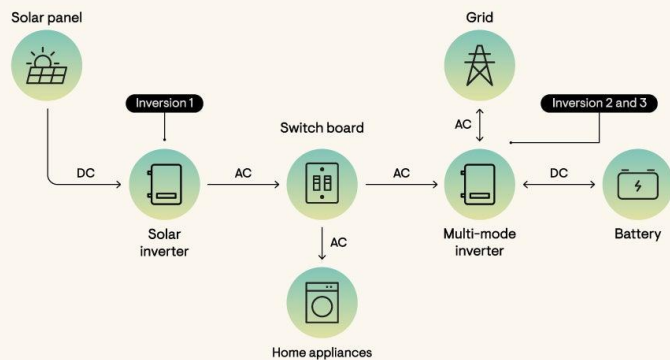


- 3 inversions required to use solar energy in the battery
- Easier to install and configure into existing solar systems
- Stores both solar and grid power as alternating current (AC), which is the type of electricity most home appliances use

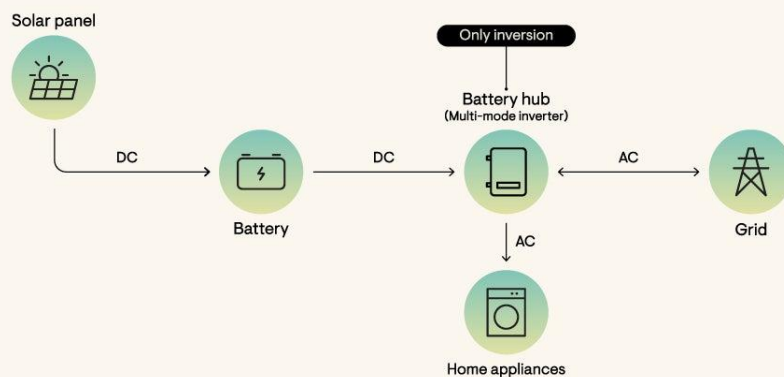


- Only 1 inversion required to use solar energy in the battery
- Difficult to install and configure into existing solar systems
- Stores the direct current (DC) electricity from your solar panels and AC to DC converted from the grid

AC-coupled battery systems



DC-coupled battery systems



When designing your home solar power system, it's important to talk to [your installer](#) about plausible storage options and whether an AC- or DC-coupled solar battery will make more sense for your installation.

Solar battery efficiency and features

While all solar batteries are built to store and discharge renewable energy, a system's "round-trip efficiency" represents how well it can do. Beyond efficiency alone, many of today's top solar batteries also include special operating features to optimize your home's electricity generation and consumption, typically controlled with an app or on the hardware. Advanced solar batteries include several [operating modes](#) to automatically minimize ongoing electricity costs or leave the lowest possible carbon footprint while remaining prepared for local power outages.

Warranty and expected lifespan

Finally, a solar battery's warranty coverage is the best way to guarantee your energy independence and ensure your investment in electricity storage will be worth it.

Along with the included warranty period, a solar battery may be more likely to perform for its expected lifespan when purchased from a reputable brand, rather than a riskier, cheaper alternative.

Key takeaways and designing your solar battery system

In short, there are several different types of solar batteries, but lithium-ion systems are the most common and best overall technology for residential use today.

With a highly efficient and advanced lithium-ion solar battery, you can increase the capabilities of your renewable power system, which, in turn, leads to reductions in home energy bills and your property's carbon footprint.

Built for safety, efficiency, and reliability, [Enphase IQ Batteries](#) can help you reach your energy goals.

Tested to rigorous safety standards above market requirements, Enphase IQ Batteries include an industry-leading 15-year limited warranty and offer full control of your solar power and ongoing electricity expenses with the [Enphase App](#).

SERVICES AND SERVICE ENHANCEMENTS



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Add-on Battery
Service



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