Difference between solar battery and ac unit

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With utility rates soaring and net metering policies eroding, home battery storage systems have become essential for homeowners to control their essential electricity costs. But picking a solar battery isn’t as easy as picking a AAA to power your TV remote.

The main difference between AC- and DC-coupled batteries is the type of electrical current that flows into the battery. All solar batteries store DC electricity, but AC-coupled batteries are designed to receive alternating current (AC) while DC-coupled batteries are designed to receive direct current (DC).

On a practical level, DC-coupled batteries are more efficient because they can receive the DC electricity produced by solar panels. On the flip side, AC-coupled battery systems are less efficient because the direct current from the solar panels must be inverted twice — from DC to AC, then back to DC — before actually going into the battery for storage, and a little bit of energy is lost each time the current is inverted.

As mentioned above, there are two types of electrical currents — AC and DC — that are used in different ways. AC is better suited for transporting electricity over distances and is therefore used by the electrical grid, the wiring inside your home, and certain household appliances like toasters, garage door motors, and washing machines. DC is better suited for energy storage and powering certain household devices like laptops, TVs, and microwaves.

Many modern solar-only systems have microinverters attached to each solar panel, so the first inversion takes place before the electricity ever leaves the solar panel. In order to add batteries to these systems, the battery needs to be able to receive AC electricity and invert it back into storable DC electricity — hence AC-coupled batteries.

AC-coupled solar batteries seamlessly integrate with existing solar inverters, making them a popular choice for retrofitting solar systems. This compatibility with the grid and solar inverters simplifies installation and reduces initial costs.

On the flip side, these systems suffer from double conversion losses -- once when DC from solar panels is converted to AC for home use, and again when storing excess AC as DC in the batteries. Due to energy losses during these inversions, the maximum round-trip efficiency for today’s AC-coupled batteries is 90%. So, if your solar system sends 10 kWh of electricity to your battery during the day, you’ll only draw 9 kWh from your battery at night.

With fewer components, DC-coupled batteries can be easier and less expensive to configure into new solar

systems. However, their integration can be complex in existing solar setups, potentially limiting their appeal to new installations or homeowners willing to overhaul their current system.

As a rule of thumb, AC-coupled batteries are better suited for adding into existing solar systems while DC-coupled are better suited for installing at the same time as the solar panels. However, with enough time, money, and installation expertise, it is possible to configure a DC-coupled battery into an existing solar system.

As we covered above, many modern solar systems have microinverters attached to each panel that flip the current from DC to AC before it even leaves the panel. In order to configure a DC-coupled battery into such a system, you’d need to remove the microinverters from each panel — which requires additional labor and essentially wastes the microinverters.

The process can be a bit simpler in systems with a single “string inverter” that inverts electricity for all the panels. However, there is still a significant amount of labor and waste in such a re-configuration.

Efficiency becomes an even greater factor if you plan on powering large loads like air conditioning and home EV charging. If you have a three-battery system with 40 kWh of usable capacity, then a 90% efficient system would allow you to access 36 kWh while a 97.5% efficient system would give you access to 39 kWh.

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