

# Residential Lithium-Ion Battery Storage Fire Safety

## FREQUENTLY ASKED QUESTIONS



**Lithium-ion battery installed on the exterior of a home.**

Photo: Dennis Schroeder/NREL

### What is residential battery storage?

A residential battery energy storage system is a rechargeable battery located in a home or apartment building that stores excess energy from other sources, such as rooftop solar panels, to be discharged and used at a later time. These batteries offer a clean, reliable, and automatic backup power option in the event of a grid outage, and they can provide cost savings throughout the year. Battery systems can be charged from the electric grid or by on-site solar panels.

While battery storage systems can be composed of different materials, lithium-ion batteries are the most common. This fact sheet focuses exclusively on safety considerations for residential lithium-ion batteries.

### Are residential battery storage systems safe?

Yes. There have been only 65 injuries reported worldwide between 1995 and 2024 across all battery storage sectors (residential, commercial, and utility scale), with no deaths since 1995. In the US between 2011 and 2024, there were seven reported fires, three explosions, and one

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incident of battery swelling associated with residential battery systems, [according to UL data](#). (This data set is limited by a reliance on public sources, though incident tracking is expected to improve with the recent rollout of the [National Emergency Response Information System \(NERIS\)](#), which aims to enhance data collection.)

Though residential battery storage adoption doubled from 2023 to 2024, emergency incidents are decreasing due to improved technologies, standards, and codes. In comparison, diesel generators (like the ones sold at hardware stores) cause an estimated 100 deaths a year, mostly due to carbon monoxide poisoning from improper use.

### What fire safety risks should I be aware of?

Most residential energy storage systems are composed of lithium-ion batteries, which are the same type of battery found in phones, laptops, electric vehicles, and other everyday items. Lithium-ion batteries can cause fires due to a process called [thermal runaway](#), in which the battery enters an uncontrollable, self-heating state. This can be caused by issues including prolonged exposure to high temperatures, overcharging, an aging battery, system failures, or manufacturer defects. Fires caused by lithium-ion batteries are rare and largely preventable. Thermal runaway can also be triggered by exposure to high heat, such as from an unrelated fire within the home.

### How can I mitigate risk of a battery storage fire in my home?

- Work with a certified and trained electrician to install your battery and provide guidance on safety considerations specific to your location.
- Choose an accessible location for your residential battery, so that first responders will have easy access to the system in the event of an emergency.
- Indoor installations must be well ventilated to dissipate heat and flammable gases. Outdoor installations offer good ventilation but must be protected from the elements.
- If your area is at risk of flooding, you may need to install the battery higher off the ground or in a waterproof enclosure. Floodwater—salt water in particular—can increase fire risk for lithium-ion batteries.
- Place visible warning labels and signage for first responders that identify the battery type and fire suppressant guidelines.
- Inform the fire department that your home has a battery storage system installed, so that they will have this information available in the event of an emergency.
- Maintain updated home fire alarms. When possible, install sprinklers.
- Consider installing a [whole-home surge protector](#) to prevent fire from lightning or power surges.

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### How do I choose a qualified battery storage installer?

It is extremely important to choose a qualified electrician to install your solar and/or battery storage installation.

- Some states, like [New York](#) and [California](#), provide a vetted list of pre-approved solar and battery storage installers. Check with your state's energy agency to learn more.
- Installers should be licensed, experienced, and follow the National Electric Code and local regulations. Installers should utilize components certified by recognized safety standards. Learn more about [NFPA855](#) safety and standards [here](#).
- Work with your installer on an operations and maintenance agreement, in which the installer completes a comprehensive routine inspection of the battery, including a review for corrosion, damage, or leaks. The agreement can include any necessary solar maintenance as well. These inspections typically take place annually.

### What to do in case of a fire

1. **Evacuate the building.** Fires involving lithium-ion batteries can spread quickly and emit toxic fumes.
2. **CALL 911.**
  - Let first responders know that there is a **lithium-ion energy storage battery** in the building, where it is located within the building, and whether it is currently on fire.
  - If you have **solar panels**, let them know about those as well.
3. After the fire has been extinguished, **get a qualified electrician to remove the battery** and any solar panels. The batteries are at risk of re-ignition if not removed.

### What you can expect from first responders

- First responders will use large amounts of water to extinguish the battery storage fire and cool the batteries to a safe temperature.
- Solar panel fires will be extinguished with water, and the panels will then be covered in black plastic so that they do not produce any more energy from sunlight.

### Once the fire has been extinguished, are there any health or environmental concerns I should worry about?

Health and environmental impacts of a battery storage fire vary depending on the severity of the fire as well as suppression methods. A [review of large-scale battery energy storage fires](#) in the US since 2012 found that none resulted in widespread contaminant risks. Battery fires produce a significant amount of smoke during and after a fire, but [studies show](#) that toxic gas emissions mostly stay near the location of the fire and dissipate quickly outdoors. The risk of groundwater contamination is also low. There is no one-size-fits-all approach to remediation

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and environmental concerns. To learn more about potential impacts to your community, reach out to your local public health department.

### Solar Safety Considerations

Solar panels are often installed alongside battery storage systems because storage addresses the main limitation of solar—intermittency. Pairing solar and storage can provide year-round cost savings and continuous backup power during grid outages. Rooftop solar is most common for residential applications, but solar systems can be ground mounted as well.

Solar safety considerations:

- Solar panels should be installed by licensed professionals using certified components.
- Panels should be inspected annually.
- Solar developers should install [arc fault circuit interrupters](#) to detect and stop dangerous arcing faults in the system, which is a leading cause of solar fires.

Additional information about solar fire safety can be found in the U.S. Department of Energy's [Guide to Fire Safety with Solar Systems](#) webpage.

### Learn More

- To learn more about residential battery storage safety, see slides and recordings from Clean Energy Group's [June 2025 webinar](#) with Captain Richard Birt, a solar and battery storage fire safety expert and founder of Solar and Fire Educators (SAFE).
- To learn more about battery energy storage, see Clean Energy Group's report [Understanding Solar+Storage: Answers to Commonly asked Questions About Solar PV and Battery Storage](#)
- Additional fact sheets related to lithium-ion battery storage safety are available on [Clean Energy Group's](#) website.



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#### DISCLAIMER

This document provides a high-level overview for residents and communities interested in developing local battery storage resources. It is not a replacement for first responder training.