EPRI

2023



Residential Energy Storage System

SAFETY GUIDELINES

WHAT TO INSTALL:

Install ESS systems from reputable manufacturers whose equipment is listed as **certified** to UL 9540[1] and UL 1741[2]

Make sure that ESS battery, inverter, controller and photovoltaic system components are **compatible** as recommended by all associated manufacturers

WHO TO INSTALL:

Installers should be **licensed** electricians

Installers should be **certified** by the ESS manufacturer

HOW TO INSTALL:

Installation should follow manufacturer's **instructions**

Installation should be performed according to locally adopted building **codes and standards**. The most up-to-date common requirements are usually based on:

- 2021 International Residential Code: Section R328 Energy Storage Systems[3]
- 2023 NFPA 855: Standard for the Installation of Energy Storage Systems - Chapter 15[4]
- 2023 NFPA 705: National Electrical Code[5]



WHERE TO INSTALL:

Install in a **safe** location

- Outdoors (most preferred)
- Indoor in a detached garage
- Indoor in an attached garage

Mount ESS on **non-flammable material**, such as masonry, metal, gypsum, etc.

Follow manufacturer's **clearance** recommendation or provide a minimum **3' clearance** around the ESS to allow for adequate cooling and prevent the spread of fire



1. Avoid areas subject to **flooding** or water leaks from above
   Avoid areas subject to **snow** accumulation. Place outdoor ESS above typical maximum snow level.
2. Avoid areas subject to **temperature extremes**, such as south-facing walls in hot climates. Do not place near heating equipment
3. Avoid areas subject to **interference** from children, pets and wildlife
   Avoid areas subject to **falling** items
4. Avoid areas subject to accidental **vehicle impact**. If in a space with vehicles, put bottom of ESS above hood level or install barriers to prevent impact
5. Avoid **proximity** to flammable vegetation or other flammable materials

ABOUT ESS HAZARDS:

Residential energy storage systems (ESS) using lithium-ion batteries can present safety challenges for homeowners and firefighters. While the failure of residential ESS lithium-ion batteries is a rare event, fire and explosion **hazards** have already occurred. This guide provides steps homeowners and ESS installers can take to **minimize** these hazards.

ESS are electrical devices that can pose shock hazards when in unsafe conditions, such as when wet or damaged. Like laptops, cellular phones, e-bikes, electric vehicles and power tools, residential ESS contain lithium ion batteries which can fail and experience thermal runaway. Thermal runaway failures result in rapid heating, ejection of hot material and the release of flammable and toxic gas, which can create **fire** and **toxic gas/smoke** hazards. Thermal runaway of all the lithium ion cells within a residential ESS unit can release a volume of flammable gas similar to a 20 lb propane tank, commonly used in backyard grilling. Thermal runaway also presents an **explosion** hazard if the resulting flammable gas accumulates in an enclosed space, and then ignites. The force from an explosion could cause bodily injury or death and property damage, including broken windows, structural compromise and the spread of debris. Fortunately, thermal runaway failures are unlikely. Homeowners and ESS installers can take ***simple actions*** to reduce both the likelihood and consequences of ESS failures.

WHAT YOU CAN DO:

Register your ESS with the manufacturer and **connect** it to WiFi to allow monitoring. Stay up to date on any firmware updates and safety recalls.

Have working **smoke detectors**. Check regularly and change the batteries as needed.

Check regularly to make sure that the manufacturer recommended **clearance** or 3' feet of clearance is maintained. Remove objects and debris, especially **flammable** material.

Trim **vegetation** that may be growing near the ESS, especially close to the **clearance zone**.

Keep a **fire extinguisher** handy in your house. You will not be able to stop thermal runaway of your ESS. But if you can extinguish a non-ESS fire while it is small you can prevent the ESS and the rest of your house from becoming involved. **DO NOT** attempt to stop an ESS fire with a fire extinguisher.

In case of fire, smoke, gas, or chemical odor **evacuate** and call 911.

In case of abnormal behavior, damage or swelling of ESS equipment call **technical support** or qualified technicians.

These simple actions can reduce the likelihood and consequences of ESS hazards.

LEARN MORE ABOUT ENERGY STORAGE SAFETY

REFERENCES:

1. https://www.shopulstandards.com/ProductDetail.aspx?productId=UL9540_2_S_20200227
2. https://www.shopulstandards.com/ProductDetail.aspx?productId=UL1741_3_S_20210928
3. "Section R328 Energy Storage Systems," in 2021 International Residential Code (IRC) | ICC Digital Codes, ICC, 2021. Accessed: Jan. 31, 2023. [Online]. Available: https://codes.iccsafe.org/content/IRC2021P2/chapter-3-building-planning#IRC2021P2_Pt03_Ch03_SecR328
4. "NFPA 855: Standard for the Installation of Stationary Energy Storage Systems." https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=855 (accessed Jan. 31, 2023)
5. "About the NEC" https://www.nfpa.org/nec/ (accessed May 9, 2023)

June 2023

EPRI

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