CleanEnergyGroup

Solar+Battery Storage Fire Safety Part 1: Residential and Commercial Solar+Storage

June 4, 2025

www.cleanegroup.org

Webinar Logistics

We are now using Zoom Webinars!
Thank you for your patience as we get used to this platform. We encourage you to provide feedback in the post-webinar survey or via email.

All attendees are in “listen only” mode – your webcam and microphone are disabled.
The Chat function is also disabled.

Submit questions and comments via the Q&A panel 

Automated captions are available 

Speaker bios will be made available in the Chat

This webinar is being recorded. We will email you a webinar recording within 48 hours. This webinar will be posted on CEG’s website at www.cleanegroup.org/webinars

Clean Energy Group

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Climate Resilience and Community Health

Distributed Energy Access and Equity

Energy Storage and Flexible Demand

Fossil Fuel Replacement

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Resilient Power Project

Building the foundation for energy resilient communities.

USDN urban sustainability directors network

footprintproject.org™

AMERICAN MICROGRID SOLUTIONS

ELEVATE

GEMINI ENERGY SOLUTIONS

Rooftop solar installation in Dorchester, MA. Credit: Resonant Energy

www.resilient-power.org

CleanEnergyGroup

Technical Assistance Fund

Providing technical support to build local resilience.

GEMINI ENERGY SOLUTIONS

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ELEVATE

AMERICAN MICROGRID SOLUTIONS

Clean Coalition

USDN urban sustainability directors network

Solar installation in Puerto Rico. Credit: Solar Responders

www.cleanegroup.org/initiatives/technical-assistance-fund

Webinar Speakers

Solar+Battery Storage Fire Safety Part 1: Residential and Commercial Solar+Storage

Olivia Tym

Project Manager,
Clean Energy Group
(Moderator)

Richard Birt

Retired Captain, Las Vegas Fire & Rescue
Founder, Solar and Fire Education (SAFE)

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Upcoming Webinars

Resilient Power for North Carolina: Solar+Storage Efforts in the Wake of Hurricane Helene (June 25)

Solar+Battery Storage Fire Safety Part 2: Utility-Scale Projects and EVs (July 8)

Community Storage: SMUD's Energy StorageShares Program (July 17)

Read more and register at www.cleanegroup.org/webinars

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First Responder Safe Response for Solar + Energy Storage Systems (ESS)

Presented by:

Captain Richard Birt, (Ret)

Las Vegas Fire & Rescue.

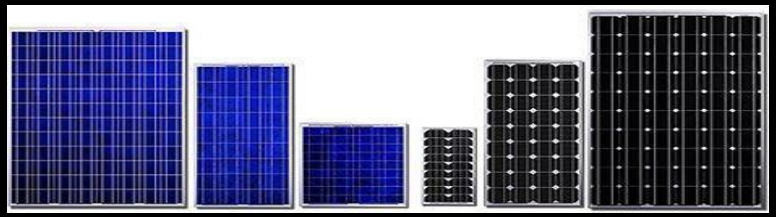
Founder of Solar And Fire Education.


OutBack
Power Systems
OutBack
Power Systems
xantrex
xantrex
xantrex
SW Series Inverter/Charger

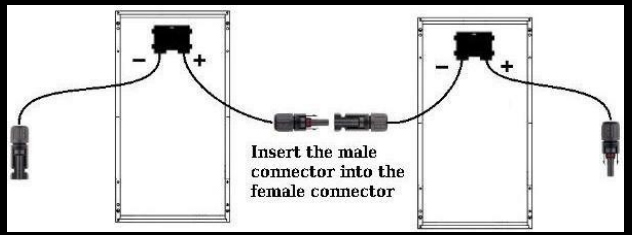

US LIGHT
Pb

Solar Equipment

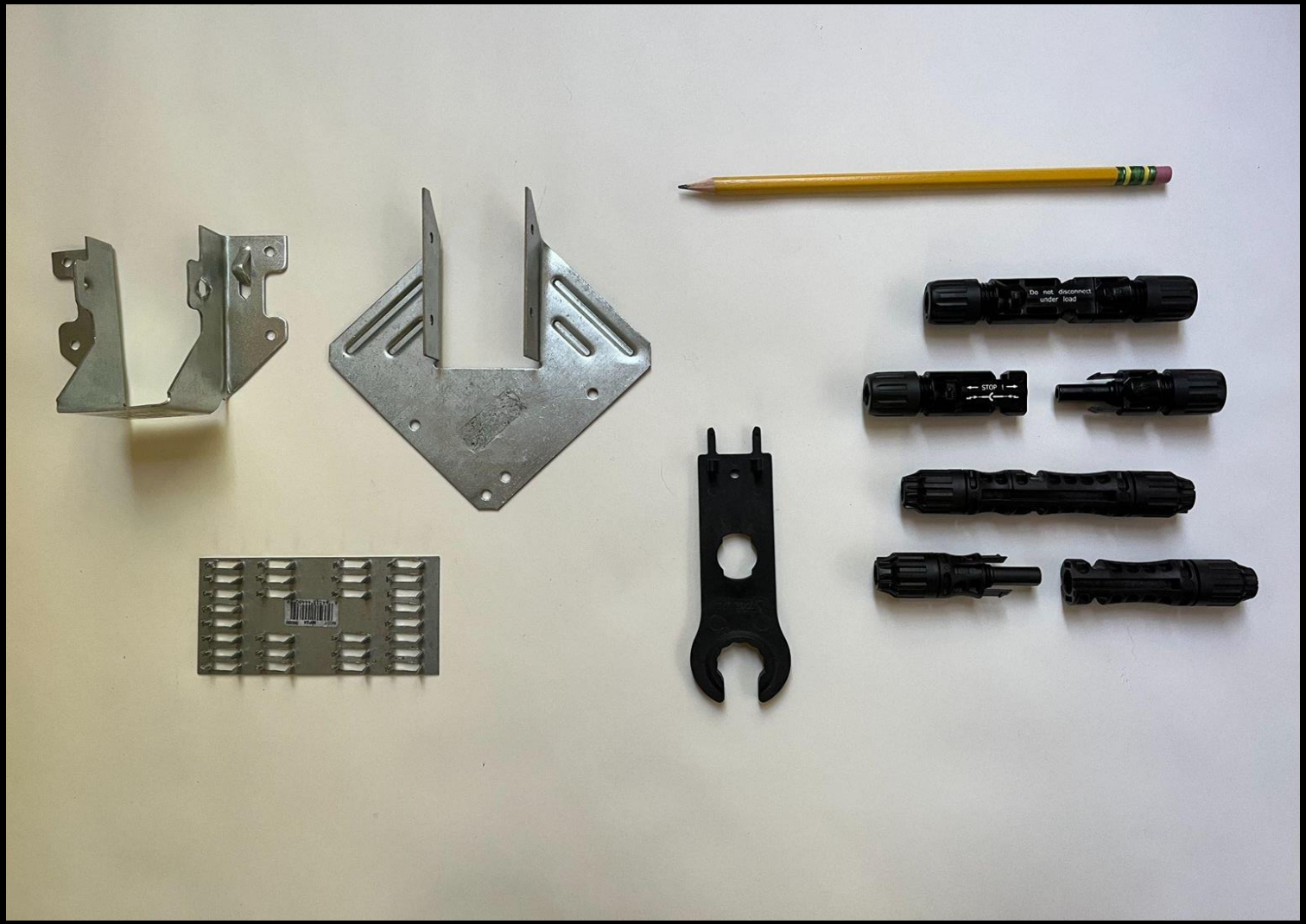
Solar Panels: Generates DC electricity at ~37 volts/panel & up to 600 volts for the system



Solar Inverters: Converts DC electricity to 240 volts AC connected to the electrical panel

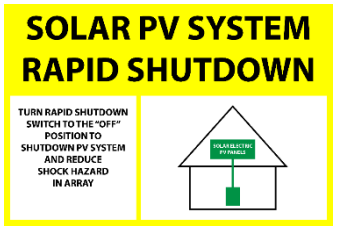


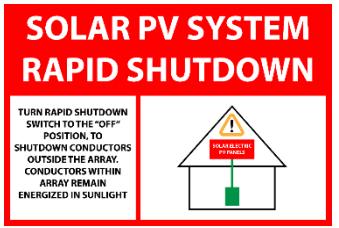
Electrical Panels: Distribution point for 120V & 240V home circuits, connected to the utility


Do not disconnect
under load
STOP

690.12 Rapid Shutdown Signage

- **Originally introduced in 2014**
  - Array boundary 914 mm (3 ft)
  - Introduced labeling
- **2017 NEC**
  - Reduced array boundary to 315 mm (1 ft)
  - Improved labeling
- **2020 NEC**
  - Specifically called out UL 3741
- **2023 NEC**
  - Removed 690.12(B)(3)(3) – exposed wiring methods





ENPHASE.

Home Battery Storage

Typically homes with battery storage have solar, too.

	Tesla Powerwall	LG Chem	Enphase IQ Battery	
Voltages	**240V AC**	**400V DC**	**240V AC**	
Amps	21	12.5	5.3	16
kWh	13.5	9.3	3.36	31.08

With a battery, the house may still be energized even if there is no power from the grid.


MAIN
PANEL
GATEWAY
ENPHASE
ESSENTIAL
LOADS
ENPHASE
ENCHARGE


ENPHASE

Battery Cells

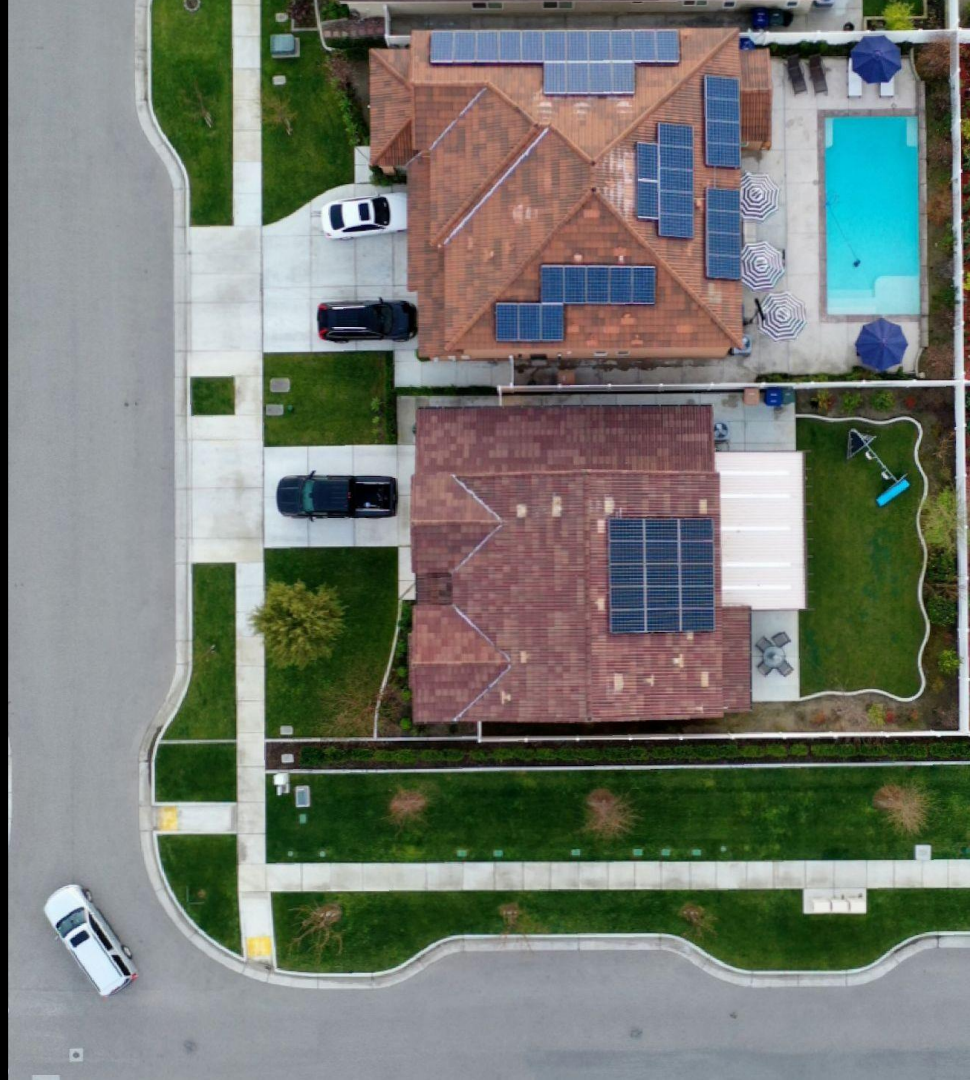
Tesla nominal cell voltage: 3.6 Volts

Enphase nominal cell voltage: 3.2 Volts

LG nominal cell voltage: 3.7 Volts

How to Control Electrical Utilities Safely on a working fire

The way the fire service has been doing this for the last 100 years has changed with the introduction of solar and batteries.



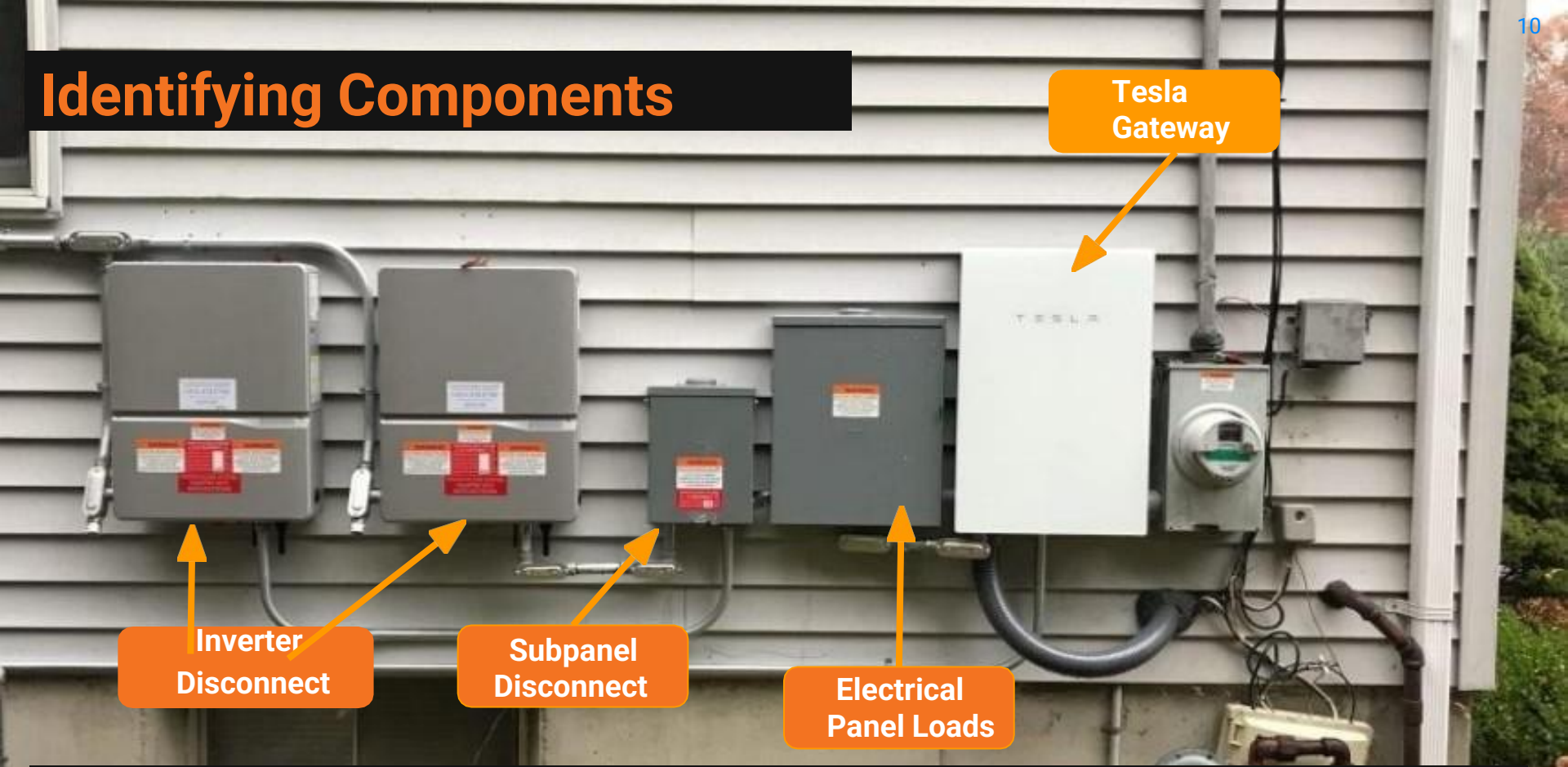
Utility Basics - How do we know?

- How do firefighters know if there are multiple power sources on site?
  - **Labels** at the meter, main panel, generation panel, and/ or backup panel
- **Three sources of power**
  - **Grid electricity** - this has not changed. Go to the main panel and shut off the AC/ DC breaker box coming from
  - **Solar**
  - **Battery**
- How do you stop the flow from the sources below?

De-energize all solar and storage equipment.

If storage is confirmed on site identify the specific switch/breaker and shut off.

Identifying Components



Opportunity to shut off power at inverters, subpanel disconnect, and gateway.

In the basement - shut off power at the main panel. In this picture above- Disconnect for Home is also in the Tesla Gateway

Disconnecting the Batteries

Handled disconnect (left)

- Mechanical means of disconnecting
- Could be one per battery or one for multiple batteries

Battery switch (right)

- Electrical means of disconnecting
- Only need one for multiple batteries
- Has an indicator light when it's off

Stop the flow of electricity from the battery to the house

Critical First Step: Ventilation

- Locate the battery
- If the battery is in an enclosed area and exposed to 200 Fahrenheit and above, the battery may start degrading and off-gassing
- It is **critical** at this point to make sure the area the battery is stored in is adequately ventilated before entering

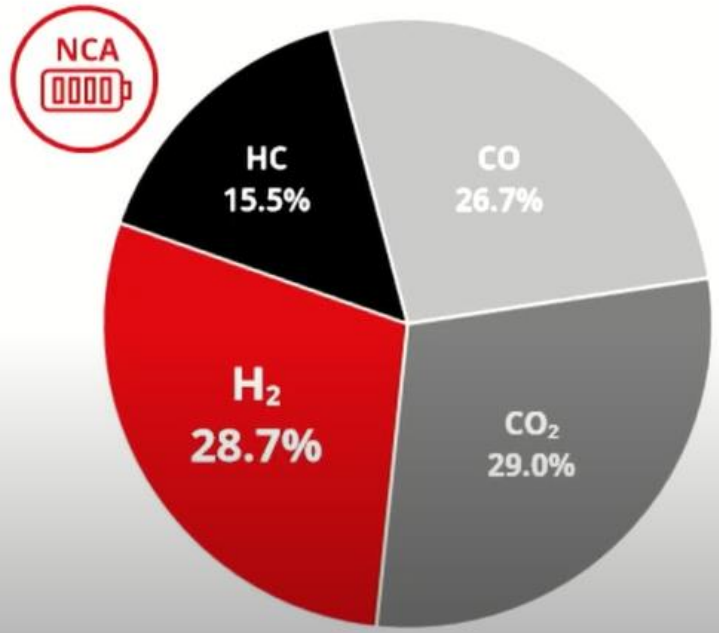
Battery Chemistry

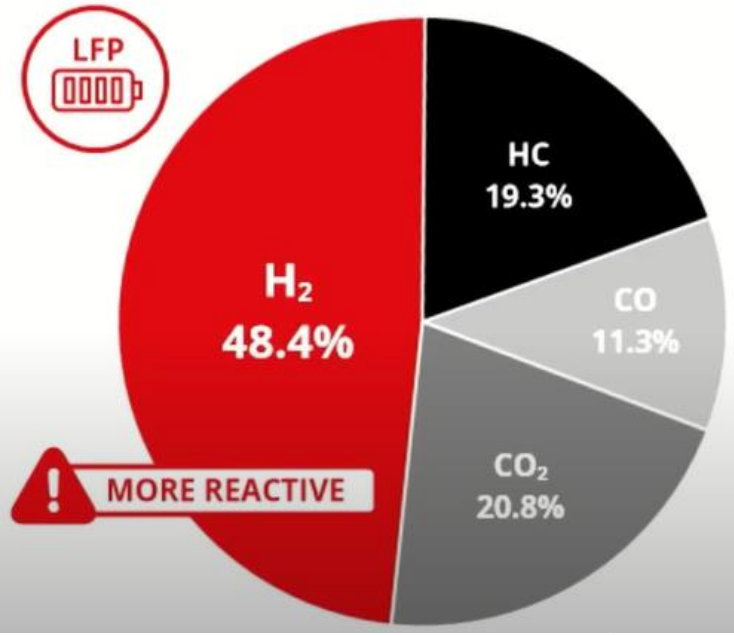
	LG CHEM	Enphase IQ Battery	TESLA Powerwall
Battery Chemistry	Lithium Nickel Manganese Cobalt Oxide	Lithium Iron Phosphate	Lithium Nickel Cobalt Aluminum Oxide
Thermal Runaway Temperature	210°C	270°C	150°C
Products of Combustion	Carbon Monoxide (CO) & Hydrogen (H)	Carbon Monoxide (CO) & Hydrogen (H)	Carbon Monoxide (CO) & Hydrogen (H)

Tests have shown that battery cells start degrading at as low as 150 degrees C. At this temperature, there is the potential to off-gas hydrogen and carbon monoxide which can create an explosive atmosphere in a contained area. **Ventilation is key!**

Thermal Runaway

Gas Concentration





Thermal Runaway

Explosibility

BURNING VELOCITY (cm/s)

PROPANE	NCA	ETHYLENE	LFP	ACETYLENE
46	51	80	112	166

MAXIMUM CLOSED VESSEL DEFLAGRATION PRESSURE (psi-g)

PROPANE	NCA	ETHYLENE	LFP	ACETYLENE
115	113	116	122	154

Tactics and Strategies on how to Safely Extinguish a Solar Panel and Battery Fire

Extinguishing Solar Panels

If there is a roof on fire with solar panels involved, these are the steps to safely extinguish the fire:

1. Use a **straight stream** from **20’ away for the initial attack and knock down the fire.**
2. After the fire is extinguished, **do not touch the panels** during daylight hours. Overhaul operations involving solar panels during the day should be done after de energizing the panels.
3. If it’s possible to cover the solar panels without touching them, use 3mm black plastic sheeting to cover the panels after the fire has been extinguished and the panels have cooled.

Vertical Ventilation of a Roof with Solar Panels

1. Firefighters should stay away from solar panels and the conduit running to the inverter or charge controller if there is no rapid shutdown.

2. If the firefighters can find an area on the roof that is clear of the above components, they can safely cut a hole for ventilation

3. If it is impossible to find a safe area on the roof to cut (clear of the solar panels and conduit), then horizontal ventilation should be the tactic used

Always assume the solar panels and conduit are energized

Extinguishing a Battery Fire

1. If the battery is on fire, approach it from the side using either:
   a. A **straight stream** from **20’ away** flowing at a minimum of **100-150 GPM**
   b. A **fog pattern** from **10’ away** flowing at a minimum of **100-150 GPM**

2. After the battery fire has been extinguished, **cool the battery** to ambient air temperature using the same attack line with copious amounts of water

1. Once the battery has been extinguished and cooled it needs to be **removed from the residence by a qualified electrician** because of the potential to rekindle

Battery Firefighting Points

- **Extinguishing Medium**:
  - NFPA, LG Chem, and Tesla recommend **copious amounts of water** to cool the cells and stop thermal runaway (TR)

    Chemicals or foam should not be used to extinguish Lithium-ion batteries

  Electrical Shock Hazard: According to DNV GL's 3rd party testing there is no electrical shock hazard from extinguishing with a hose.

  Airborne Hazards: Burning or hot batteries will release toxic vapors. Responders **must wear full PPE, including SCBA,** and take appropriate measures to protect the public. Use fog streams or PPV fans to direct vapors.

Use water when aggressively firefighting. Be mindful of gases generated during firefighting.

5 Key Takeaways

Isolate the 3 sources of power entering the home.

Ventilate, if the battery is exposed to heat in an enclosed environment

Use water!

Do not touch the solar panels or the battery, have a qualified electrician remove them.

Remember, the battery can rekindle depending on the chemistry.