RESILIENTPOWER

A project of CleanEnergyGroup

Solar+Storage Fire Safety Training: Single and Multifamily Residential

January 12, 2021

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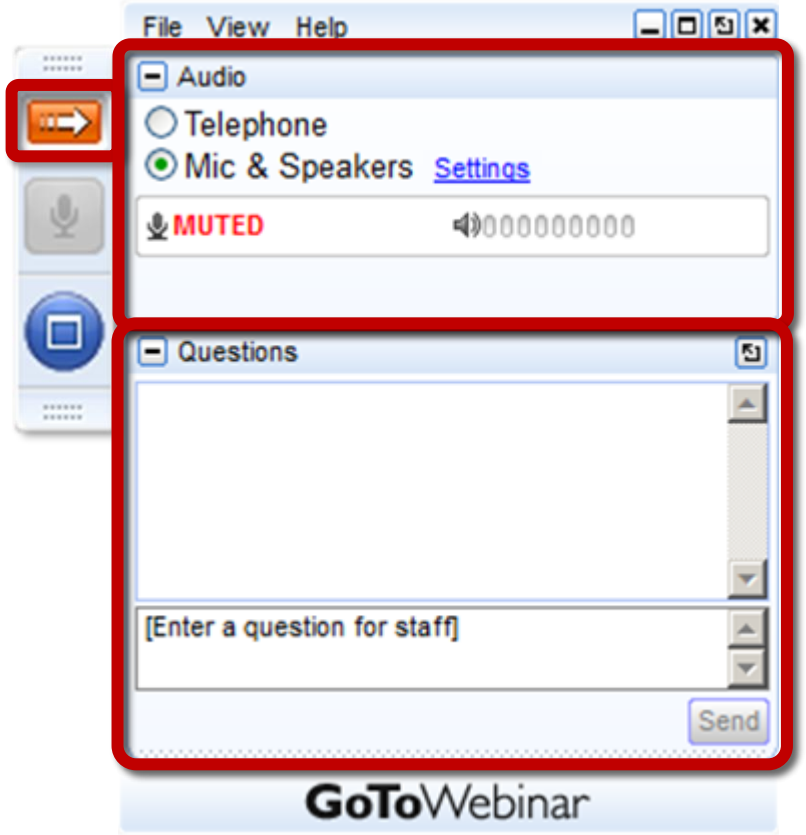
Innovation in Finance, Technology & Policy

WEBINAR LOGISTICS



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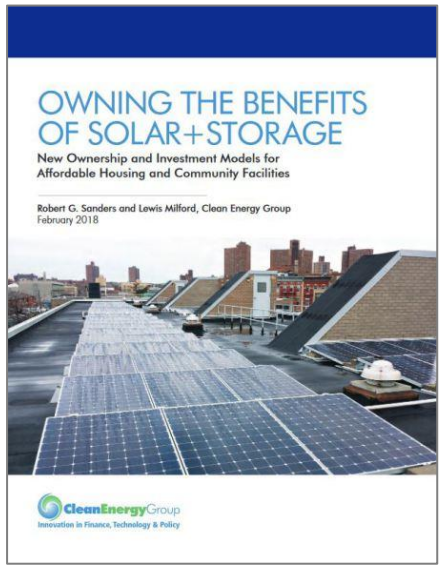
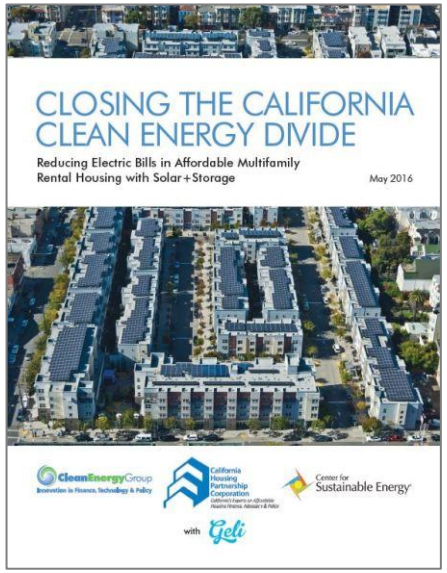
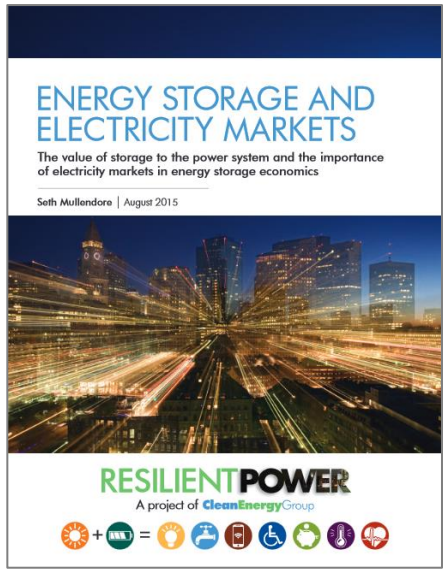
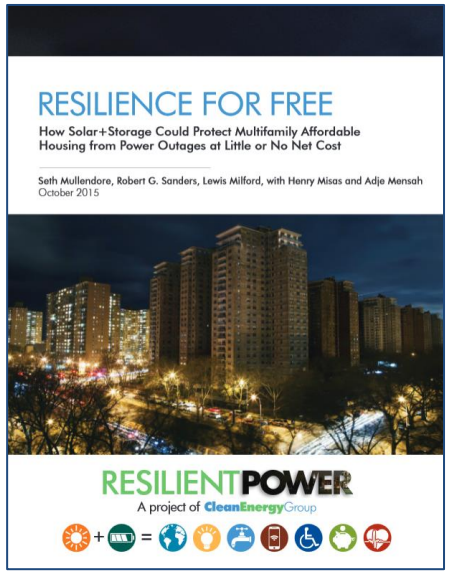
THE RESILIENT POWER PROJECT

- Increase public/private investment in clean, resilient power systems (solar+storage)
- Protect low-income and vulnerable communities, with a focus on affordable housing and critical public facilities
- Engage city, state and federal policy makers to develop supportive policies and programs
- Visit www.resilient-power.org for more information and resources









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WEBINAR SPEAKERS

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Innovation in Finance, Technology & Policy

How first responders can safely respond to residential ESS systems

Presented by

Captain Richard Birt of Las Vegas Fire & Rescue

and Sunrun Inc.

January 2021

Disclaimer: This session is for informational purposes only, and Sunrun does not make any representation that it is complete or that the materials will be accurate in the future. The information in this deck came from LG Chem, NFPA, GTM, Sunrun and Tesla.

Agenda

We will cover:

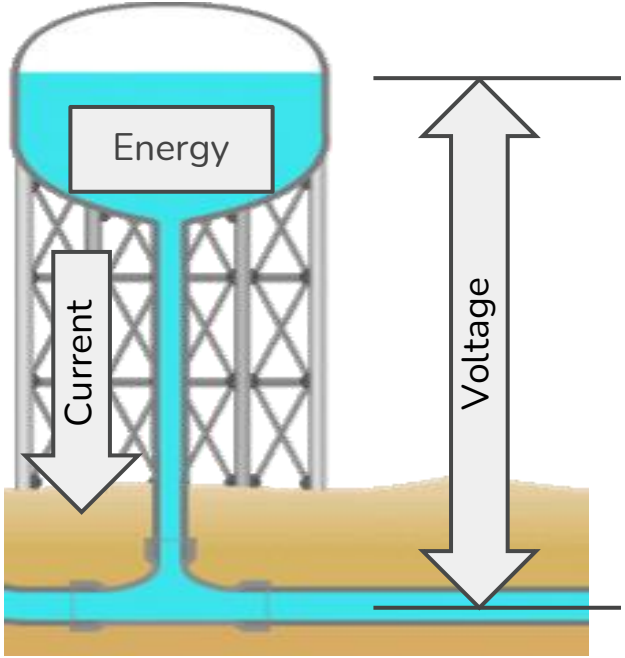
- Residential solar and battery storage equipment fundamentals
- Industry standard installation procedures
- Suppression and ventilation tactics
- How to design an incident action plan to safely respond to these technologies

We will practice:

- Identifying key risks and shutoffs to control utilities safely
- Resolving dynamic scenarios that involve solar and/or battery storage equipment

By the end of the class, you will be able to design an incident action plan with strategies & tactics to be prepared for fires that involve residential solar and battery storage devices.

Practical Example of Electricity



Power (kW) = Voltage x Current

- Voltage (electrical potential) is represented by the height of the water making potential for flow
- Current is the flow of water through the pipe

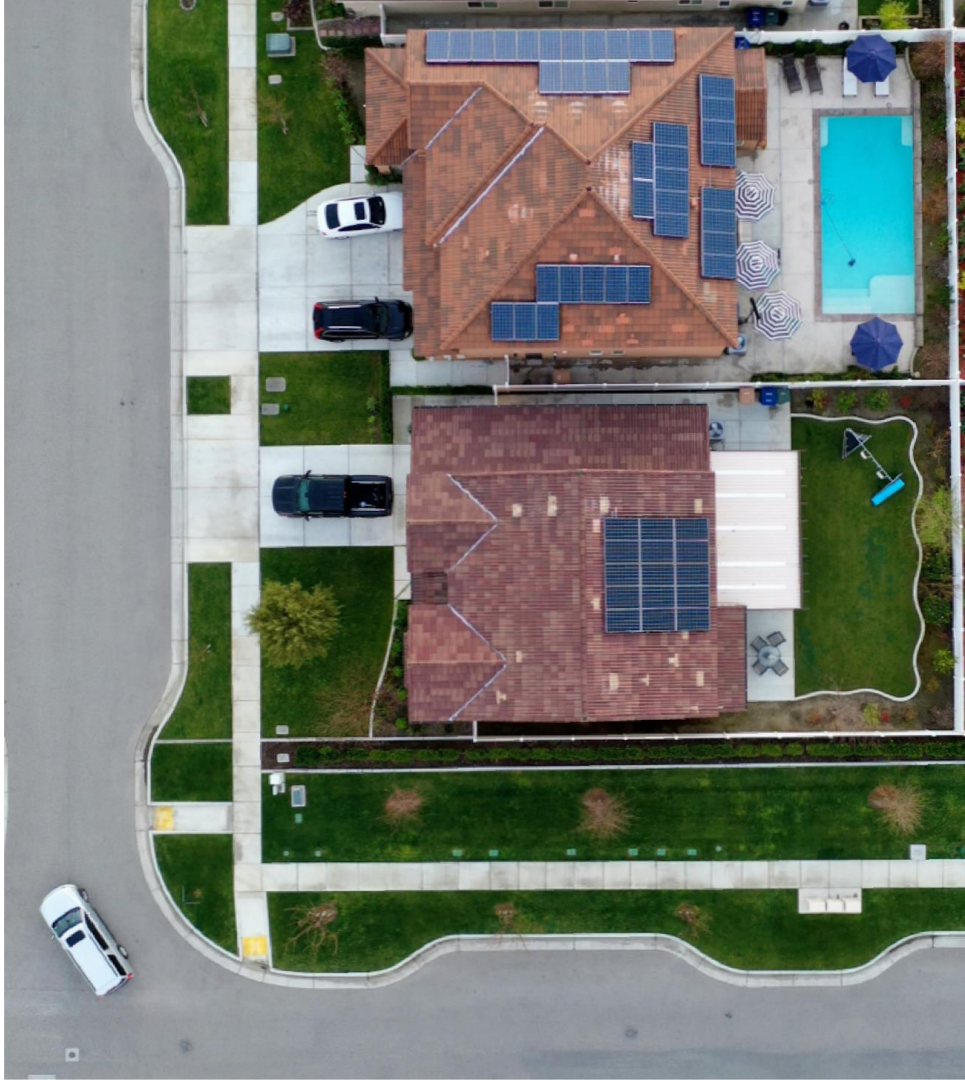
Energized Circuits

- The water doesn't flow until the pipe is connected to the tower (completing the circuit)
- The water, like electricity, will find the path of least resistance
- Don't let your body be the pipe!

Prevention = Controlling Utilities

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.

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

Disconnecting the Grid

- Follow your Standard Operating Procedure for disconnecting from the grid

Stop the flow of electricity from the electrical utility's main panel to the house

Disconnecting the Solar Panels

Handled disconnect -Sunrun primarily installs equipment like this today

Inverter integrated DC disconnects - Older technology

Stop the flow of electricity from the solar panels to the house

Disconnecting the Batteries

Handled disconnect (left)

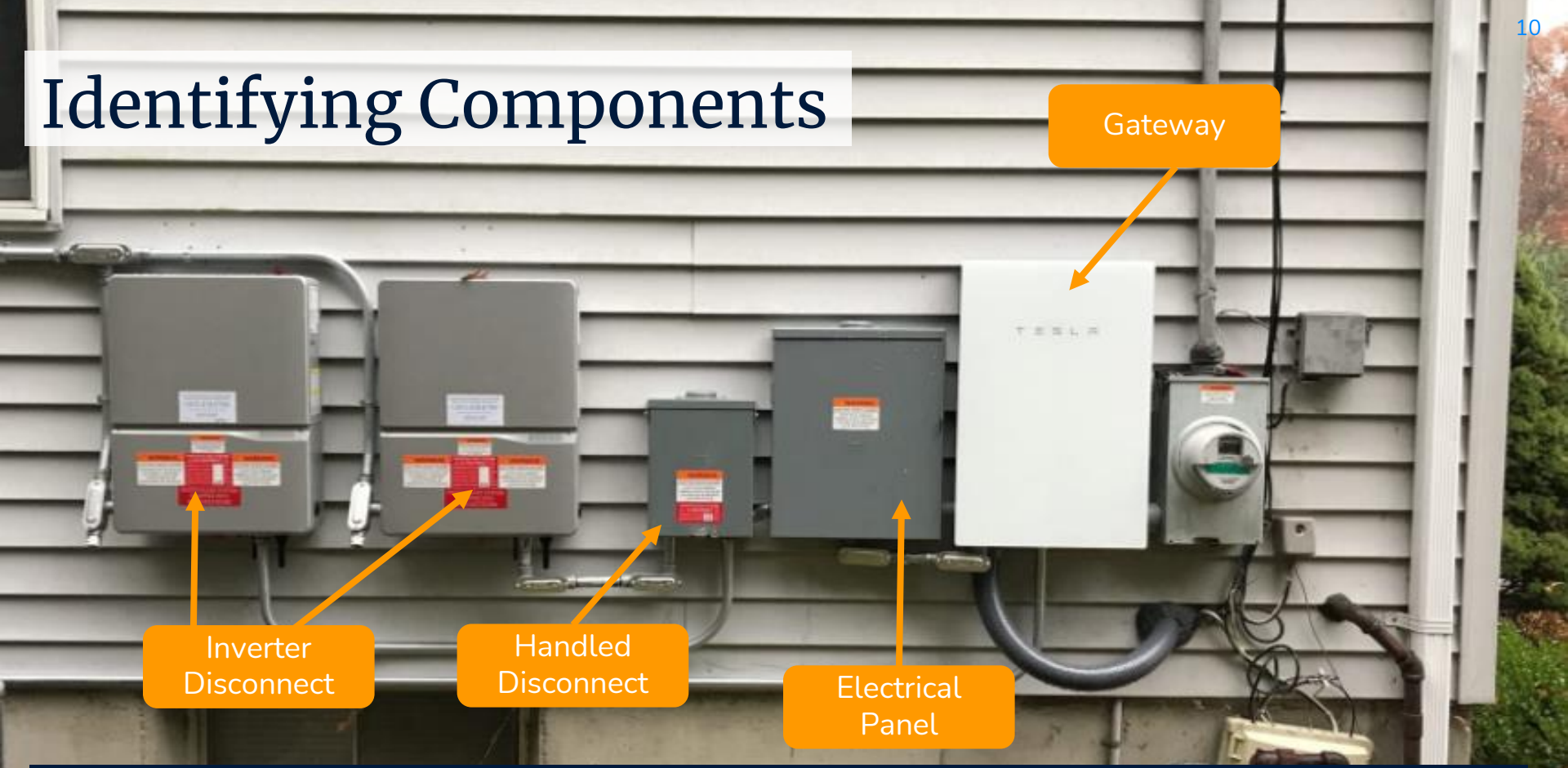
- Mechanical means of disconnecting
- Could be one per battery or one for multiple batteries

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

Identifying Components



Opportunity to shut off power at inverters, handled disconnect, and gateway.
In the basement - shut off power at the main panel.

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

Extinguishing Solar Panels

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

1. Use a **straight stream** from **20' away** flowing at a minimum of **100-150 GPM**

1. After the fire is extinguished, **do not touch the panels** because of an electrical shock hazard

1. If it's possible to cover the solar panels without touching them, use 3mm black plastic sheeting or traditional canvas tarp

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 at all costs

1. 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

1. 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**

1. 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.

Full Tesla Report can be found here.

Safety – Tesla Recommendation

The Tesla Energy Product should then be monitored for evidence of continued smoke venting. Application of high volumes of water from a safe distance may help cool the unit and prevent further reaction or a fire from developing. If a fire develops and visible flames appear, the Incident Commander should determine whether an attempt will be made to suppress the fire (aggressive firefighting) or allow the battery to burn until it self-extinguishes, while protecting surrounding materials (defensive firefighting). Tesla recommends that copious volumes of water be used to fight a fire involving Tesla Energy Products. Virtually all fires involving lithium-ion batteries can be controlled with water. To date, water has been found to be the most effective agent for controlling lithium-ion battery fires. Water will suppress flames and can cool cells, limiting propagation of thermal runaway reactions. If water is used, electrolysis of water (splitting of water into hydrogen and oxygen) may contribute to the flammable gas mixture formed by venting cells, burning plastic, and burning of other combustibles.

Gaseous agents such as CO_2 or Halon, or dry chemical suppressants may temporarily suppress flaming of lithium-ion battery packs, but they will not cool lithium-ion batteries and will not limit the propagation of cell thermal runaway reactions. Metal fire suppressants such as LITH-X, graphite powder, or copper powder are not appropriate agents for suppressing fires involving lithium-ion battery packs as they are unlikely to be effective.

A battery fire may continue for several hours and it may take 24 hours or longer for the battery pack to cool. A lithium-ion battery fire that has been extinguished can re-ignite due to the exothermic reaction of constituent materials from broken or damaged cells. To avoid this, remove sources of ignition and cool the burned mass by flooding with water.

The batteries can re-ignite for up to 24-hours.

Full Tesla Report can be found here.

Scenarios for Discussion

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; have a qualified electrician remove them
- Remember, the battery can rekindle within 24 hours (or more)

- **BONUS**: Check out this article to help you develop your own Standard Operating Procedure

Thank you for attending our webinar

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Applying New Data from NREL's State and Local Planning for Energy (SLOPE) Platform
Wednesday, January 27, 1-2pm ET

Designing Hybrid Combined Heat and Power Systems: An Introduction to New Features in NREL's REopt Lite Tool
Tuesday, March 2, 2-3pm ET

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