



13 JUNE 2023  
Maidstone, Kent  
2:30pm



EARLIER IN TRENTON, NJ



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



**Presented by:**

**Captain Richard Birt, (Ret)**

**Las Vegas Fire & Rescue.**



















# Agenda

## We will cover:

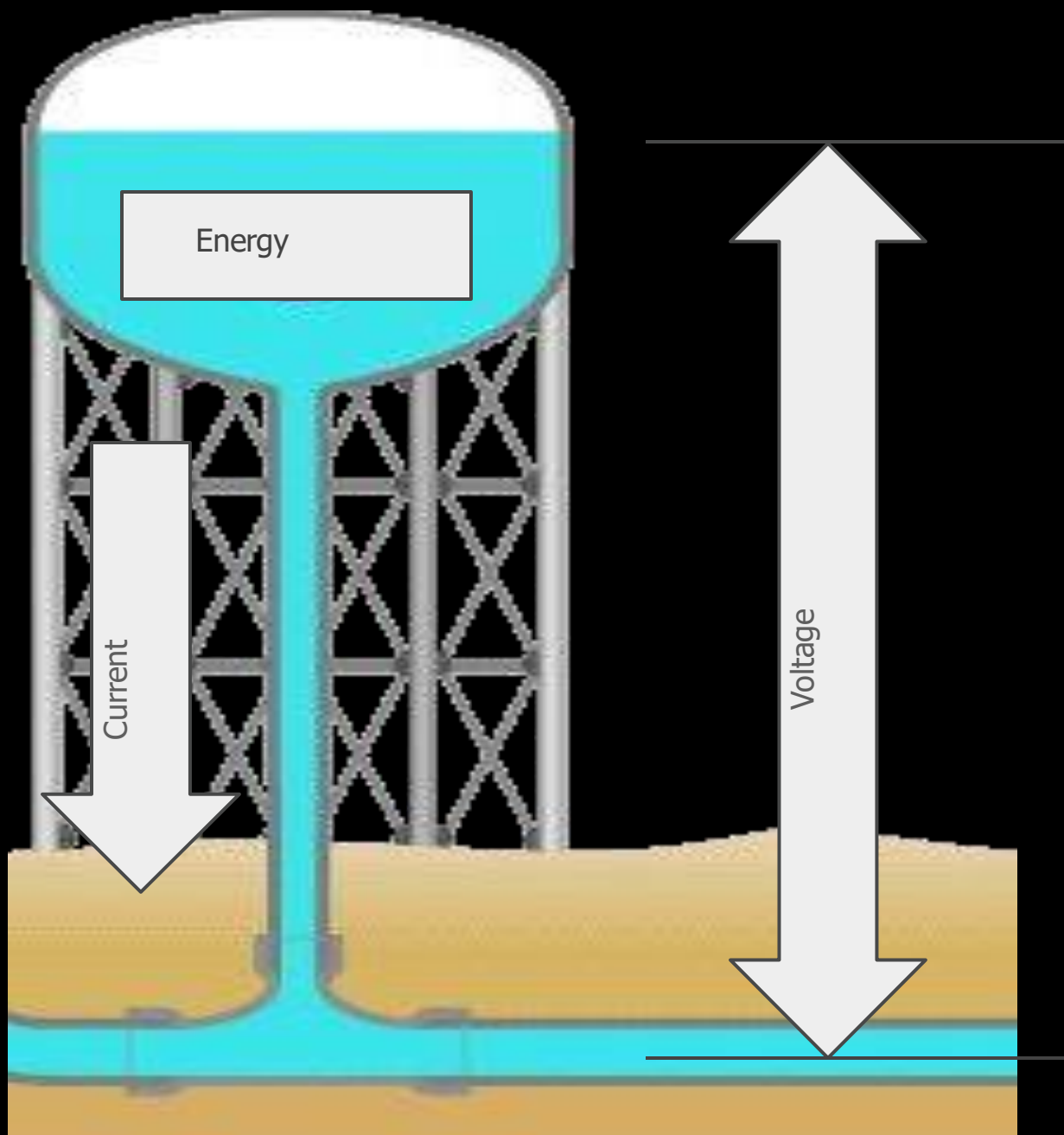
- Residential solar and battery storage equipment fundamentals
- Industry standard installation procedures
- Suppression and ventilation tactics
- How to design an incident action plan to safely respond to these technologies

## 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!**

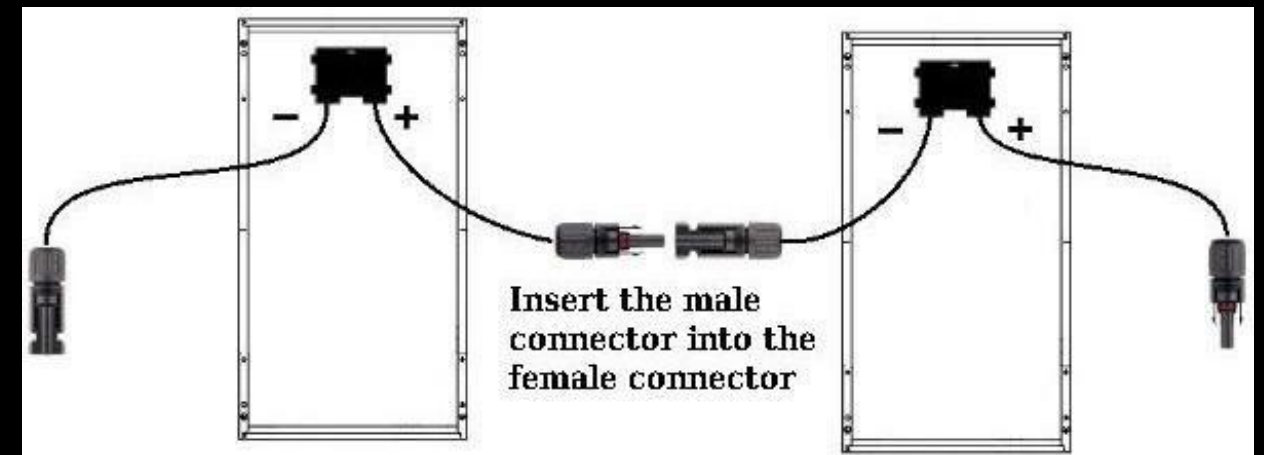
Prevention = Controlling Utilities

# Solar Equipment

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



**Solar Inverters:** Converts DC electricity to 230 volts AC connected to the electrical panel



**Electrical Panels:** Distribution point for 230 V home circuits, connected to the utility





DC input: **60V**  
AC output: **230V**  
Rapid shutdown on PV module: **YES**

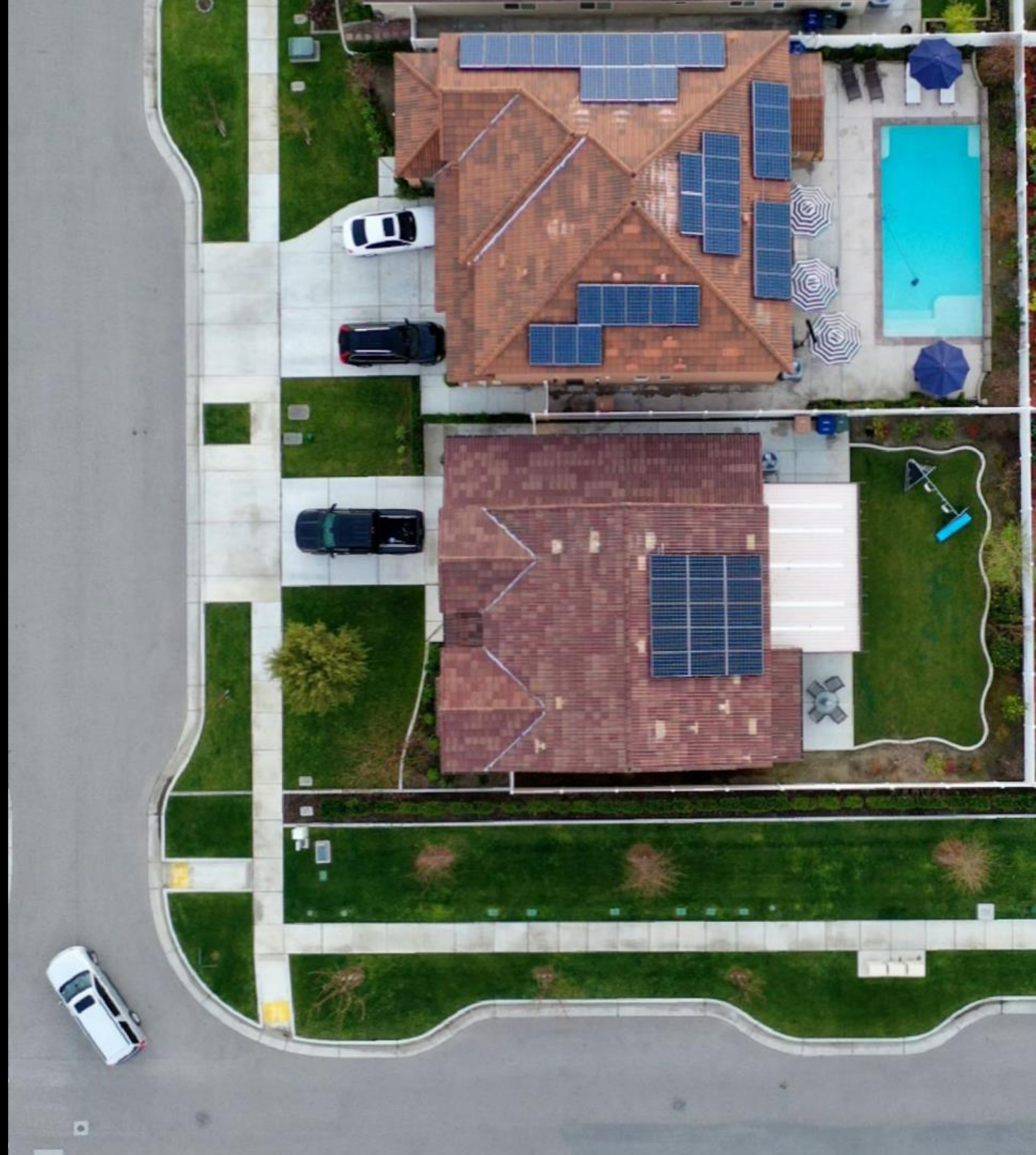


DC input: **600V**  
AC output: **230V**  
Rapid shutdown on PV module: **NO**



# 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.



This installation, or part of it, is protected by a device which automatically switches off the supply if an earth fault develops. Test quarterly by pressing the button marked "T" or "TEST". The device should switch off the supply and should then be switched on to restore the supply. If the device does not switch off the supply when the button is pressed, seek expert advice.

LB6301

**MEM**

Memera 2000  
Type Tested to BS60843 / PL3



WARNING  
Do not work on this equipment until it is isolated from both mains and on-site generation supplies



Do not work on this equipment until it is isolated from both mains and on-site generation supplies

Isolate on-site generator at \_\_\_\_\_  
Isolate mains supply at Inverter in loft



Solar PV  
on roof



PV system - main  
A.C. isolator.

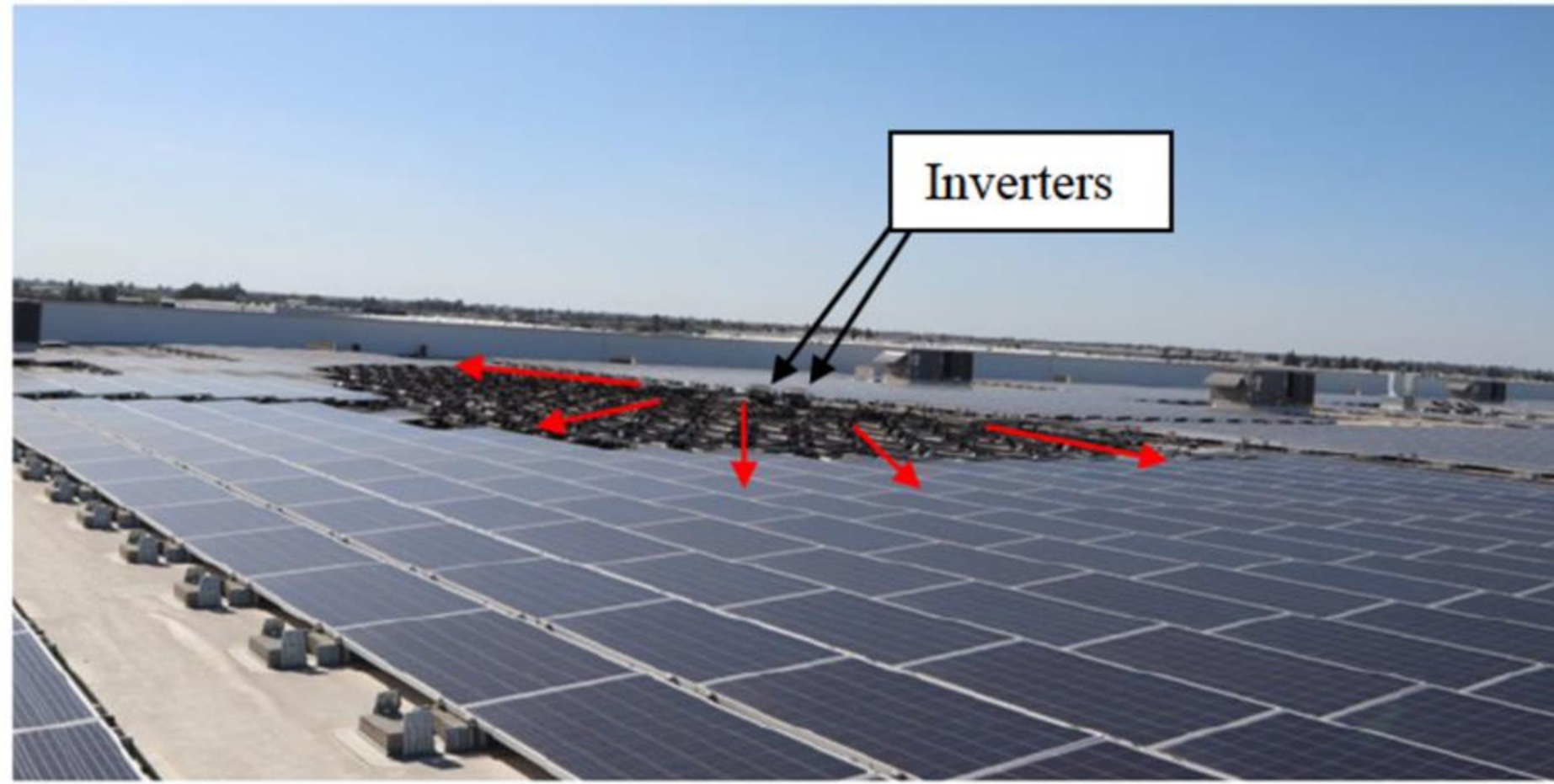
Drone footage



25' X 25' area and fire direction of travel identified by CAPT PERKINS



Inverters













# Battery Cells



Tesla nominal cell voltage: 3.6 Volts



Enphase nominal cell voltage: 3.2 Volts



LG nominal cell voltage: 3.7 Volts

# 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)

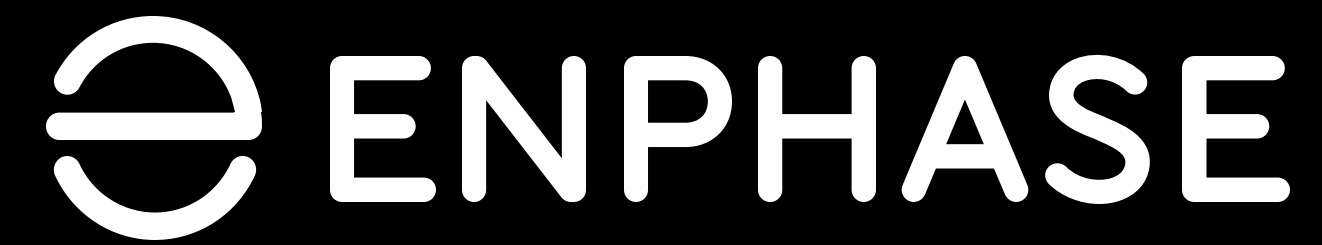
Tests have shown that battery cells start degrading at as low as 93°C. At this temperature, there is the potential to off-gas hydrogen and carbon monoxide which can create an explosive atmosphere in a contained area. **Ventilation is key!**



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It's been a pleasure...





Let's get started - together!