



Renewable Energy & Public Safety

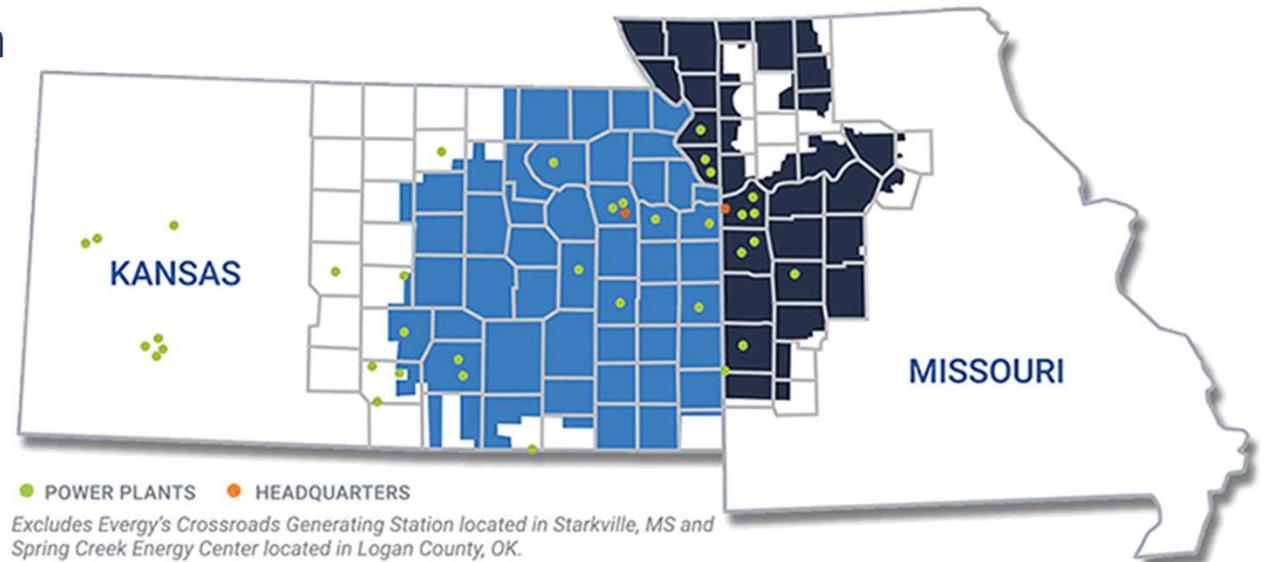
Tim Boswell, Lead Safety Coordinator

Beverly Figge, Safety & Training Analyst II



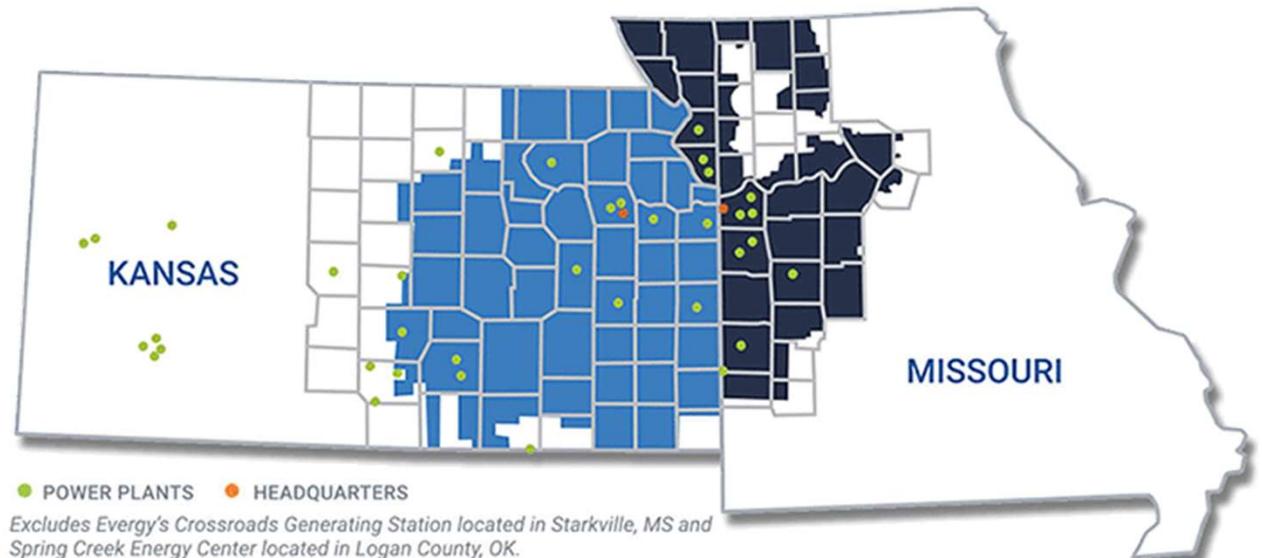
Who is Evergy

- Safety – key Evergy value
- Electric company only – we produce and deliver electricity
- Generation
 - 46 owned generation facilities
 - 20,000 megawatts
 - 8 types of generation
 - Fossil
 - Nuclear
 - Gas
 - Oil
 - Solar
 - Wind
 - Water
 - Biogas



Who is Evergy

- 900 Substations
- 13,700 miles of transmission lines
- 52,200 miles of distribution lines
- 66,000 square miles of service territory
- 1.7 million customers
- 5,100 employees



Public Safety Outreach Approach



Classroom Presentations

- **Audience:** Contractors, first responders, businesses, schools, conventions and more.
- **Subject:** General, overhead, underground and substation electrical safety.
- **Delivery:** Live classroom PowerPoint presentation with/without hot trailer demo.
- **Leader:** Tim Boswell, Lead Safety Coordinator.
- **Resources:** PowerPoint Presentations, visual props.



Classroom Presentations

A Guide To Overhead Power Line Accident Prevention



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K.S.A. 66-1709-1716	7
M.O.A. 319.075-090	11

K.S.A. 66-1709-1716.

Sec. 1709. This act may be cited and shall be known as the overhead power line accident prevention act.

Missouri – Title XXI PUBLIC SAFETY AND MORALS

Chapter 319

Effective - 28 Aug 1991

319.075. Citation of law. — Sections 319.075 to 319.090 may be cited and shall be known as the "Overhead Power Line Safety Act".

Live Demonstrations – Electrical Hot Trailer

- **Audience:** Contractors, first responders, businesses, schools, conventions and more.
- **Subject:** General, overhead, underground and substation electrical safety.
- **Delivery:** Hot trailer demo with live electrical events.
- **Leader:** Tim Boswell, Lead Safety Coordinator.
- **Resources:** Live trailer, trained line workers.



Live Demonstrations – Electrical Hot Trailer

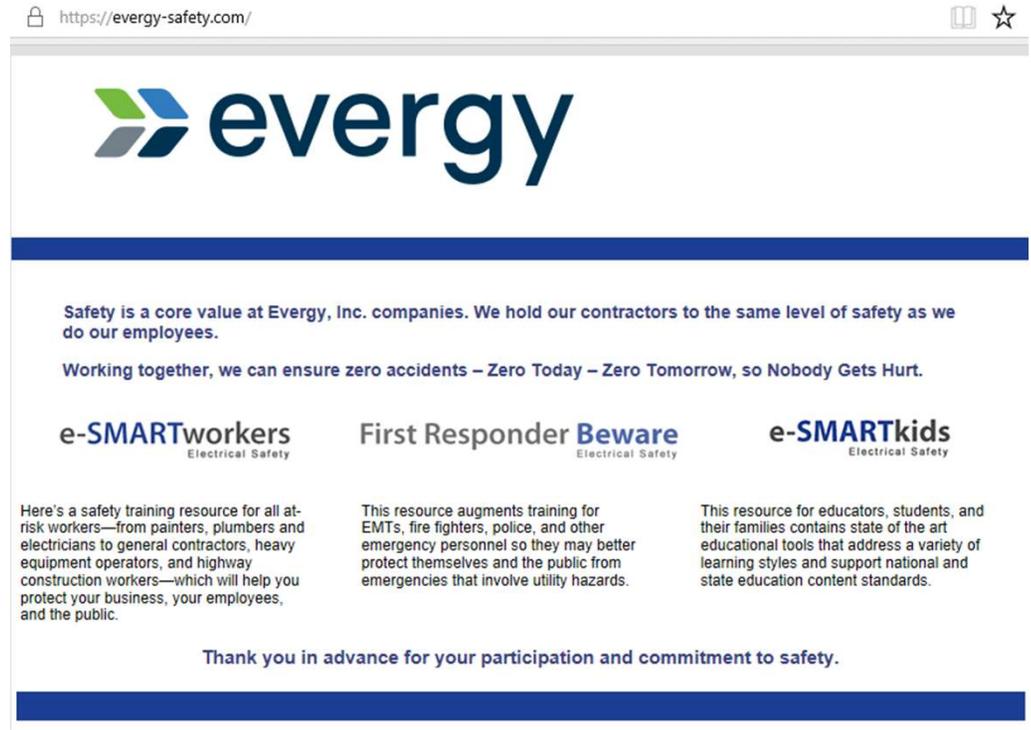


Live Demonstrations – Electrical Hot Trailer



Evergy-Safety.com

- **Audience:** Contractors, first responders, schools (educators, students and parents).
- **Subject:** Electrical safety resources and training for utility related hazards.
- **Delivery:** Online with option to print or request additional training materials training.
- **Leader:** Safety & Training Team
- **Resources:** Beverly Figge, Safety and Training Analyst, all other resources online and provided directly to requestor.



The screenshot shows the homepage of Evergy-Safety.com. At the top, there is a browser address bar with the URL "https://evergy-safety.com/" and a star icon. Below the address bar is the Evergy logo. A dark blue horizontal bar separates the header from the main content. The main content area features a paragraph stating: "Safety is a core value at Evergy, Inc. companies. We hold our contractors to the same level of safety as we do our employees." Below this is another line: "Working together, we can ensure zero accidents – Zero Today – Zero Tomorrow, so Nobody Gets Hurt." There are three columns of content, each with a heading and a brief description: 1. "e-SMARTworkers" (Electrical Safety) with a description: "Here's a safety training resource for all at-risk workers—from painters, plumbers and electricians to general contractors, heavy equipment operators, and highway construction workers—which will help you protect your business, your employees, and the public." 2. "First Responder Beware" (Electrical Safety) with a description: "This resource augments training for EMTs, fire fighters, police, and other emergency personnel so they may better protect themselves and the public from emergencies that involve utility hazards." 3. "e-SMARTkids" (Electrical Safety) with a description: "This resource for educators, students, and their families contains state of the art educational tools that address a variety of learning styles and support national and state education content standards." At the bottom of the main content area, there is a line of text: "Thank you in advance for your participation and commitment to safety." A dark blue horizontal bar is at the very bottom of the page.

Evergy-Safety.com



e-SMARTworkers
Electrical Safety

- workers
- trainers

Welcome!

Evergy invites you to become an e-SMART worker. Check out our training tips, videos, and case studies. Each of these is designed to help you and your team work safely around electrical lines.

Workers

- Safe Practices
 - Dig Safely
 - Look Up and Live
 - Videos

Safe Practices

Dig Safely



Electrical Safety

ELECTRICAL SAFETY CERTIFICATION

Resources

Home

first responder beware®

WELCOME

Firefighters, police and EMTs are typically first on the scene in an emergency and face the greatest risk from electrical hazards.

Understanding the potential dangers and learning how to deal with them correctly makes your crew and the public safer.



e-SMARTkids
Electrical Safety

- kids
- teachers
- parents

Welcome!

Evergy invites you to become an e-SMART kid. Becoming e-SMART means learning about electricity and how to use it safely and wisely. Check out our games and activities, and you'll be on your way!

Kids

- Electrical Safety-SMART!
- Games
- Electrical Safety World

Get SMART!

Electrical Safety-SMART!



Internal Use Only

Updated First Responder Safety

- **Annually evergy** mails electric safety awareness information to approximately 1900 first responder organizations in the service territory.
- **Mailer:** Outreach includes an educational poster for the workplace and a detachable electrical safety visor card
- **Website:** Encourages first responders to visit website at:
 - <https://evergy-safety.com/firstresponder/>

The collage displays three safety materials:

- Poster:** Titled "Stay Safe While Saving Others: Electrical Safety for First Responders". It includes emergency contact numbers (911, 800-383-1183 for Kansas Central, 888-471-5275 for Kansas Metro, Missouri Metro & Missouri West) and sections on overhead power lines, downed power lines, and handling substations.
- Visor Card:** Features the "first responder beware" logo and the text "Protect yourself, your team and the public. Urge your team to follow the enclosed electrical safety tips when responding to emergencies." It also includes the evergy logo.
- Reference Guide:** Titled "Electrical safety" and "Keep this card in your vehicle visor as a quick reference guide." It provides detailed instructions on power line safety, substation and transformer emergencies, and handling downed power lines/vehicle contact.

Updated First Responder Safety

Electrical Safety

This information from Evergy helps emergency responders learn to safely identify and respond to incidents that involve electric power lines and other facilities. It includes a series of educational topics that you can complete at your own pace.

Evergy may distribute electricity in your department's response area. If Evergy is not the local electricity provider at an incident scene, please coordinate your electrical incident response with the local electric utility.

Electrical Safety

- ▶ Electrical Safety Basics
- ▶ The Electric Distribution System
- ▶ Fires Involving Electric Facilities
- ▶ Downed Power Lines
- ▶ Solar PV System Basics
- ▶ Solar PV Incident Response Tactics
- ▶ Incidents Involving Battery Energy Storage Systems



Updated First Responder Safety

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1

- ▼ Solar PV System Basics
 - Roof-Mounted PV Systems
 - What Is Solar Power?
 - Variation in PV Systems
 - PV Hazard Awareness
 - Ground-Mounted PV Systems
 - Grid-Tied PV Systems
 - Off-Grid PV Systems
 - Hybrid PV Systems
 - Arrays
 - Inverters
 - Conduits
 - Batteries
 - Meters
 - Labeling and Signage
 - Structural Risks
 - Electrical and Chemical Risks
 - Review

2

- ▼ Solar PV Incident Response Tactics
 - Response Summary
 - Notify and Work With Evergy
 - Size Up the Scene
 - What to Look For
 - Communicate the Hazard
 - Wear PPE and SCBA
 - Keep Your Distance
 - Isolate the PV System
 - Safely Cover PV Arrays
 - Extinguish the Fire
 - Battery Hazards
 - Risks of Structural Failure
 - Incident Termination
 - Review

3

- ▼ Incidents Involving Battery Energy Storage Systems
 - BESS Battery Types
 - Current Uses of Li-ion Batteries
 - Know the Hazards
 - Li-ion Battery Structure
 - Understanding Thermal Runaway and Propagation
 - Four Stages of Battery Failure
 - Stage 1: Abuse
 - Stage 2: Off-Gassing
 - The Tipping Point
 - Stages 3 and 4: Smoke and Fire Generation
 - Anticipating Thermal Runaway and Battery Failure
 - Determining the Stage of Battery Failure
 - Tactical Considerations for Mitigation
 - Tactical Considerations for Containment
 - Battery Management Systems
 - Response Guidance and Intervention Tactics
 - Utility-Scale and Large Commercial Installations
 - Evacuation and Isolation
 - Team Safety Considerations
 - Review

first responder beware®

WELCOME

Firefighters, police and EMTs are typically first on the scene in an emergency and face the greatest risk from electrical hazards.

Firefighters, police and EMTs are typically first on the scene in an emergency and face the greatest risk from electrical hazards.

Understanding the potential dangers and learning how to deal with them correctly makes your crew and the public safer.



Electrical Safety Online Certification Course

Earn a certificate that demonstrates your knowledge of electrical safety with this **FREE** online course.



Incidents Involving Battery Energy Storage Systems (BESS)

You will learn the stages of battery failure, response tactics for each stage, and how to protect yourself, your team and the public during incidents involving residential, commercial and utility-scale systems. Use the menu on the left to learn how battery energy storage systems work and the risks they pose to first responders.



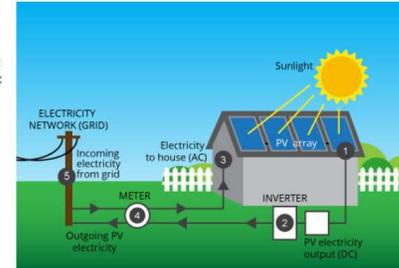
Electrical Safety Content

- Electrical safety basics
- Electric distribution system
- Fires involving electrical facilities
- Downed power lines
- *Solar PV system basics*
- *Solar PV incident response tactics*
- *Battery Energy Storage Systems*

Grid-Tied PV Systems

Most PV systems today are *grid-tied* (also known as *grid-connected*). This means that the surplus electricity these systems create can be directed into the larger electrical grid. Grid-tied systems contain a utility meter through which the current must flow to reach the grid. The current first passes through an inverter, which converts DC into AC. Then any AC current that is not used locally goes into the grid through the meter.

Current industry standards require every grid-tied system to have a safety feature that shuts the system down to prevent it from backfeeding into the grid if nearby circuits lose power.



← Previous Topic

Next Topic →

Fires Involving Electric Facilities

Use the menu on the left to learn about response tactics for fires that involve electric substations, transmission lines, distribution lines and vaults, plus tips for protecting yourself from electrical contact when fighting structure fires. This section also covers some of the exposure risks and environmental hazards associated with electric facilities.



← Previous Module

Next Module →

Electrical safety certification

This self-directed training program helps emergency responders learn to safely identify and respond to incidents involving electric power lines and other facilities. It includes a series of educational modules that you can complete at your own pace, followed by online interactive quizzes that test your understanding of the training material.

Successfully complete all four modules with a score of 80% on the quizzes, and you will earn a personalized Certificate of Completion. This certificate demonstrates mastery of a subject area and may satisfy additional training hours required by your department.

Evergy may provide electricity in your department's response area. If Evergy is not the local electricity provider at an incident scene, please coordinate your electrical incident response with the local electric utility.

Please note: This training reflects industry best practices but is not intended as a substitute for formal tactical training or your organization's guidelines. Please consult with your training officer to ensure all appropriate formal training has taken place, and be sure to follow your department's SOPs/SOGs.

To begin the course, you must start with Module 1. A module is considered complete when you have completed all of its topics and passed its quiz. Completed modules are indicated by a check mark. You may leave the program at any time and return to resume where you left off.

Course Content

Expand All | Collapse All

Modules	Status
1 Module 1. Electrical Safety Basics	<input checked="" type="checkbox"/>
2 Module 2. The Electric Distribution System	<input checked="" type="checkbox"/>
3 Module 3. Fires Involving Electric Facilities	<input checked="" type="checkbox"/>
4 Module 4. Downed Power Lines	<input checked="" type="checkbox"/>
5 Module 5. Solar PV System Basics	<input checked="" type="checkbox"/>
6 Module 6. Solar PV Incident Response Tactics	<input checked="" type="checkbox"/>
7 Module 7. Incidents Involving Battery Energy Storage Systems	<input checked="" type="checkbox"/>

Take this Course

Certificate of Completion



Evergy Employee Safety



Operations Solar Systems Training



In this training we will cover the following:

 Background

 What is Solar?

 Why is Solar Expanding in Popularity?

 The Impact of Private

 A Look At Evergy Customer Solar Installs

 Process for Net Metering & Parallel Generation

 Applicable Tariffs

 Technical Requirements

 Basic System Components

 Photovoltaic Systems

 Examples

 Solar Wall of Shame

Background – Why is this important?

- Solar is expanding in popularity in America
- Our service territory currently has over 100 installations monthly with over 900 applications waiting for approval
- Safety and Training

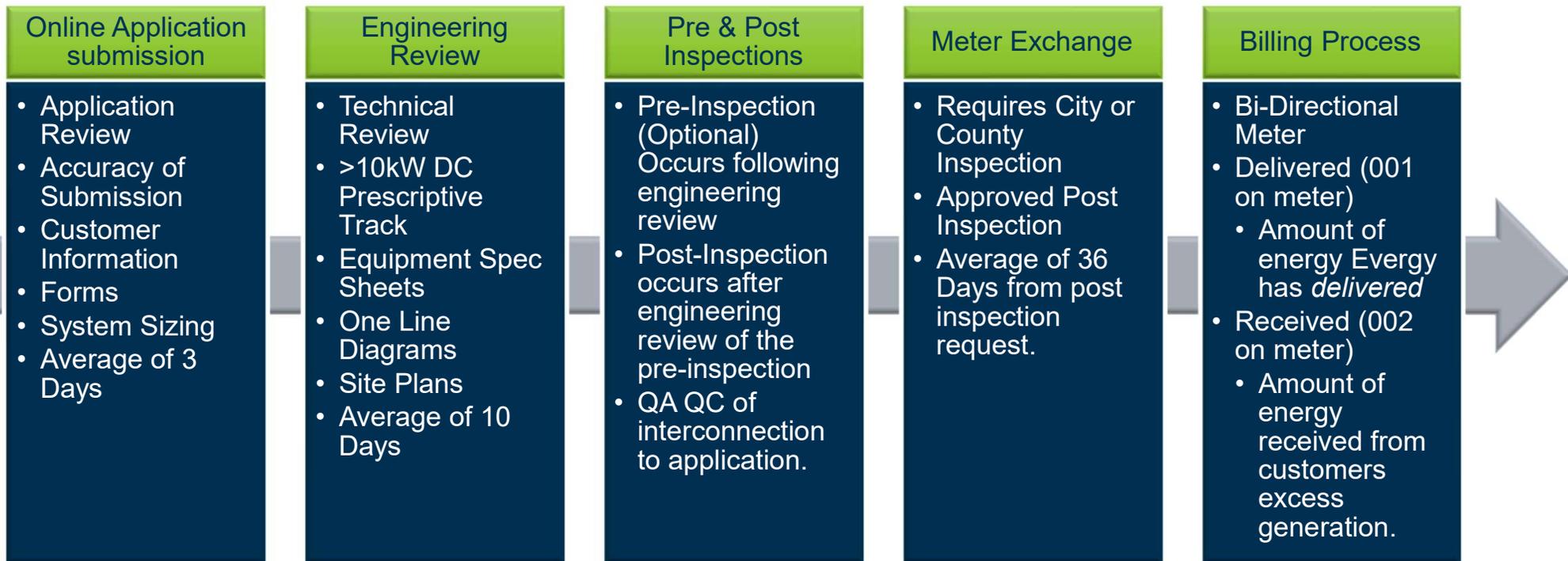




Drivers for Customer Solar Adoption

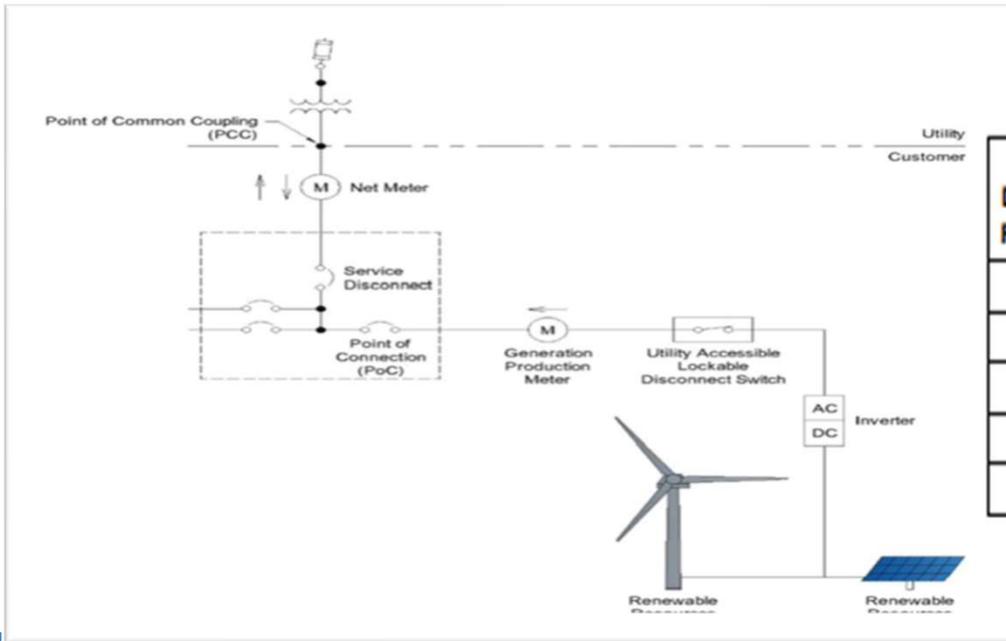
- **Solar panels increase home value**
- **Government rebates & tax credits**
- **Bill reduction & consistency**
 - **Pay Everygy less each month (on average 50%)**
 - **Pay a consistent amount to solar installer**
 - **Retirement or planning for life on a fixed income**
- **Environmental**
- **Increased use in electric vehicles**
- **Solar vendor growth**
 - **Vendors have exploded in recent years as well, from 3 active companies to 10+ in the last four years.**

What Process Do Evergy Customers Follow



Technical Requirements: *Load Side Distributed Energy Resources*

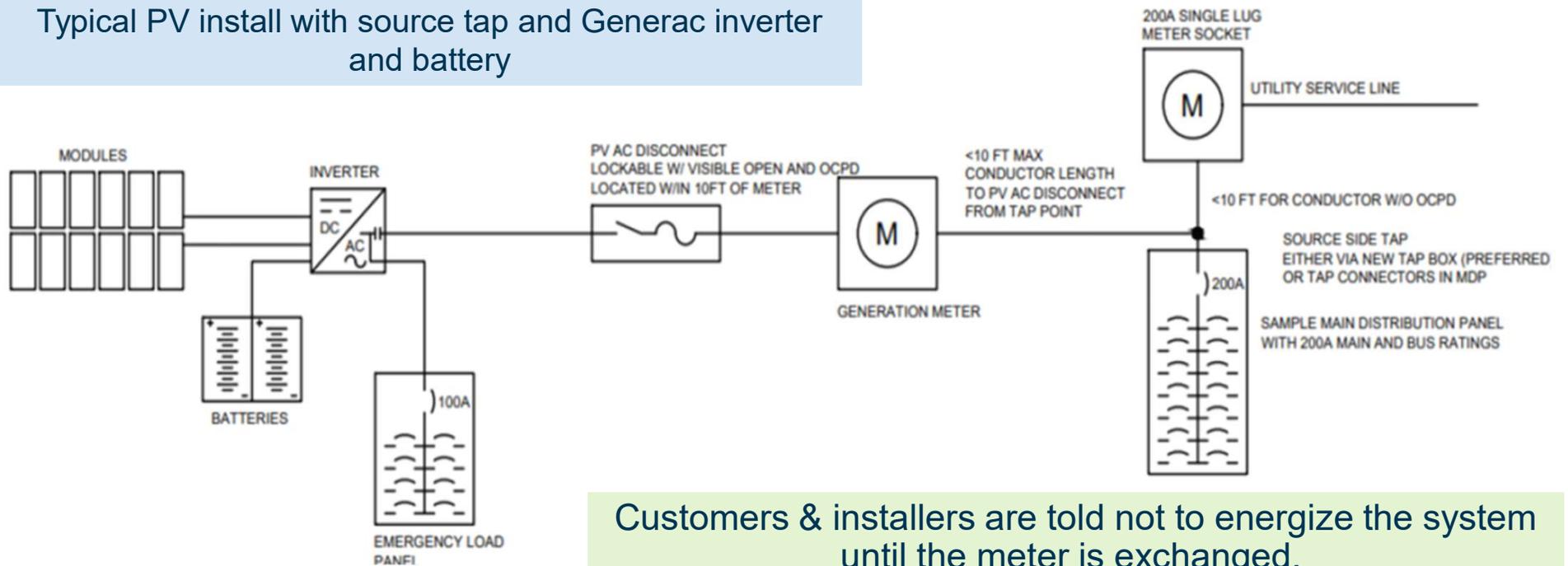
- Must be installed according to NEC rules with properly labelled and rated breakers
 - Local jurisdiction may have requirements above and beyond those in the code.
- Point of connection can be in the customers load panel where the NEC 120% rule will apply.



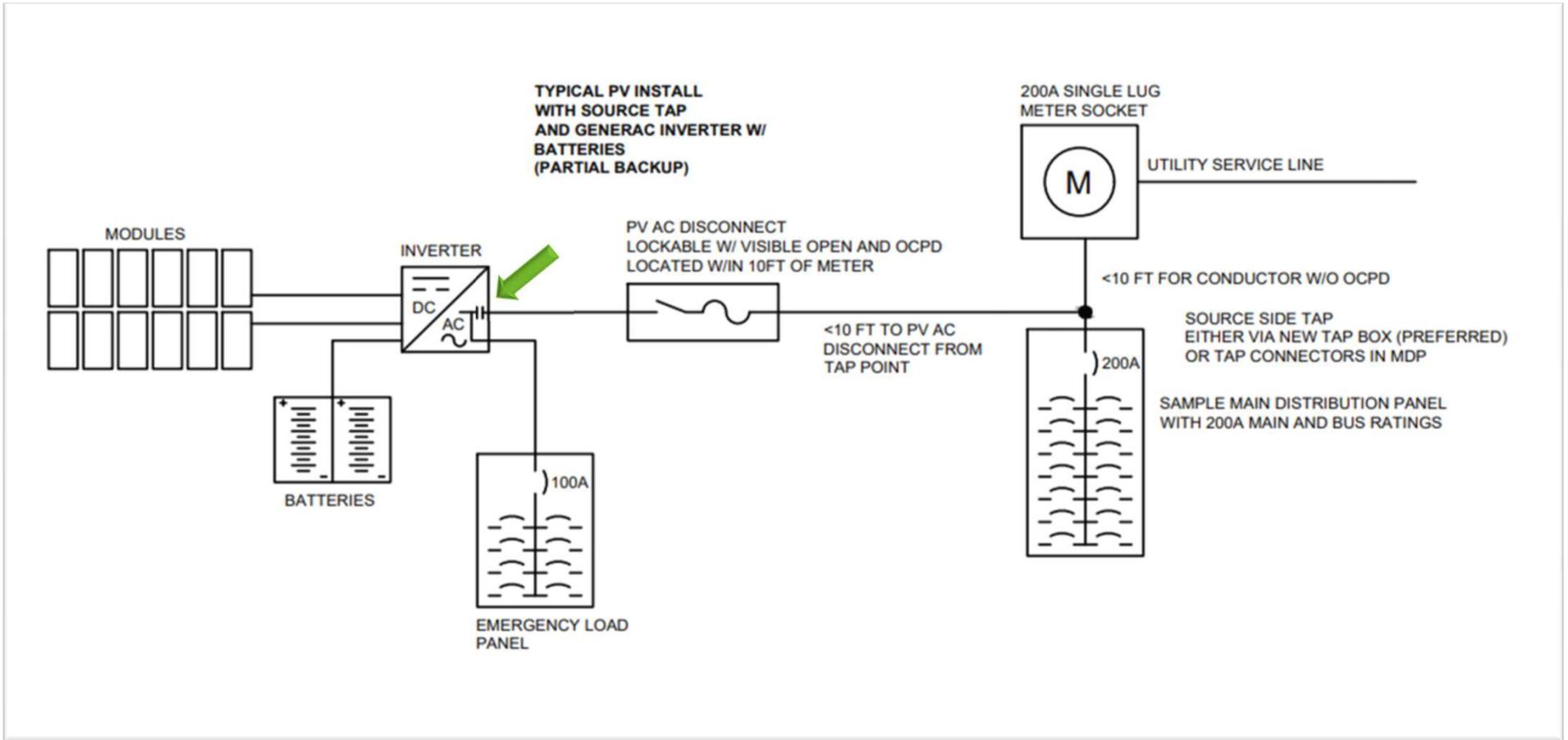
Main Disconnect or Feeder Circuit	Bus	Branch Circuit	1Ø 120/240 V	3Ø 120/208 V	3Ø 277/480 V
100 A	100 A	20 A	3.84 kVA	5.76 kVA	13.30 kVA
100 A	125 A	50 A	9.60 kVA	14.40 kVA	33.24 kVA
200 A	200 A	40 A	7.68 kVA	11.52 kVA	26.59 kVA
200 A	225 A	70 A	13.44 kVA	20.16 kVA	46.54 kVA
400 A	400 A	80 A	15.36 kVA

Technical Requirements: *Battery Energy Storage Systems*

Typical PV install with source tap and Generac inverter and battery



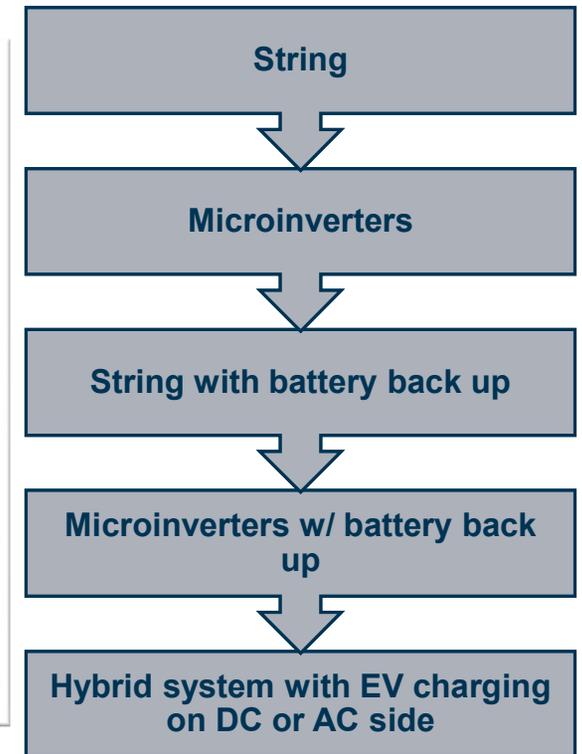
Photovoltaic Systems



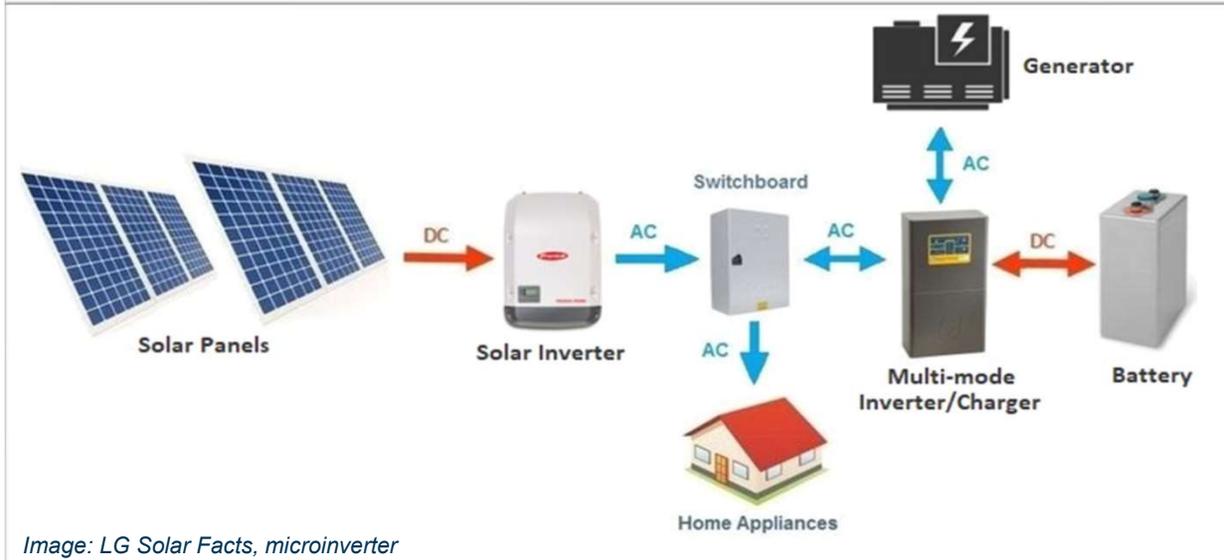
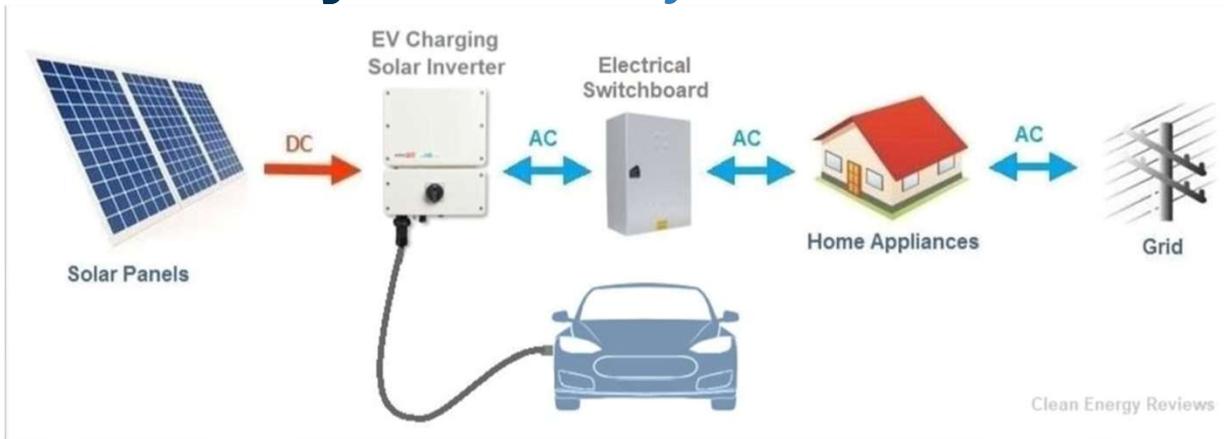
Photovoltaic Systems



Image: LG Solar Facts, microinverter

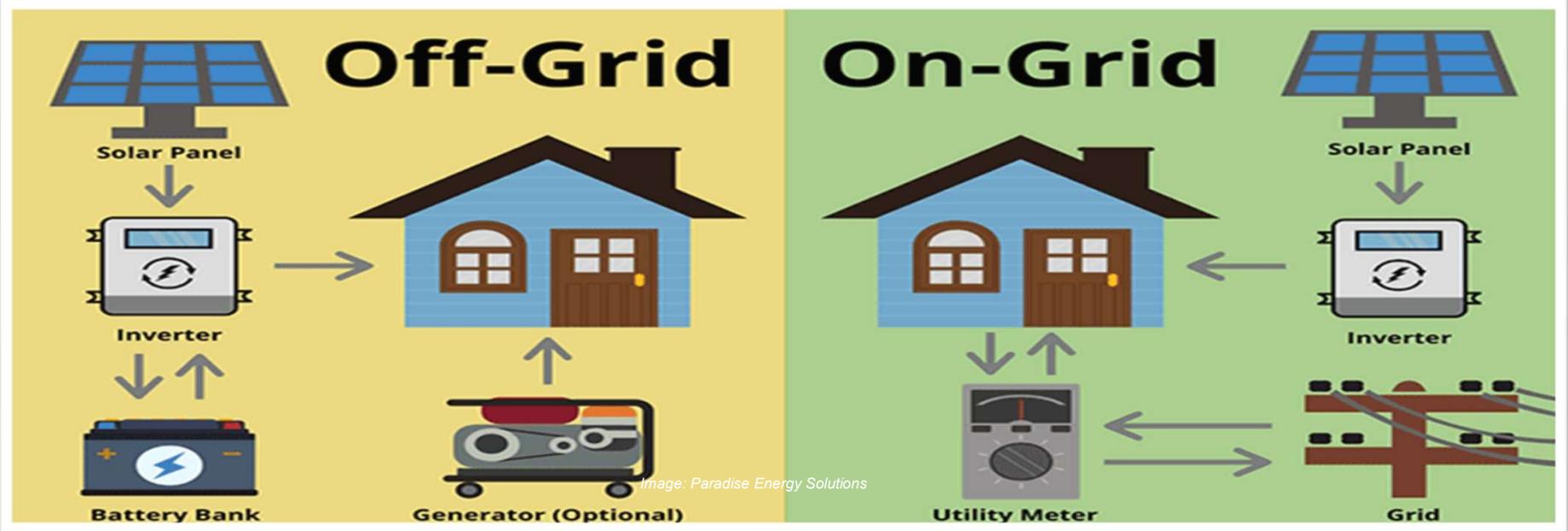


Photovoltaic Systems: *Hybrids*



Hybrid system
with EV charging on
DC or AC side

Photovoltaic Systems



Off Grid

- No connection to local utility network.
- Could be a dual generation, where solar feeds one piece of property and we feed another.

On Grid

- Connected to feed back onto electrical utilities network.
- Also allows users to purchase from utility when panels aren't producing enough to match needs
- Most Systems (all systems we will interact with)

Photovoltaic Systems: *Grid Tied*



Photovoltaic Systems: *Grid Tied Inside View*



Photovoltaic Systems: *Stand Alone Systems*



All off-grid systems & some newer hybrid systems contain batteries to store DC power.

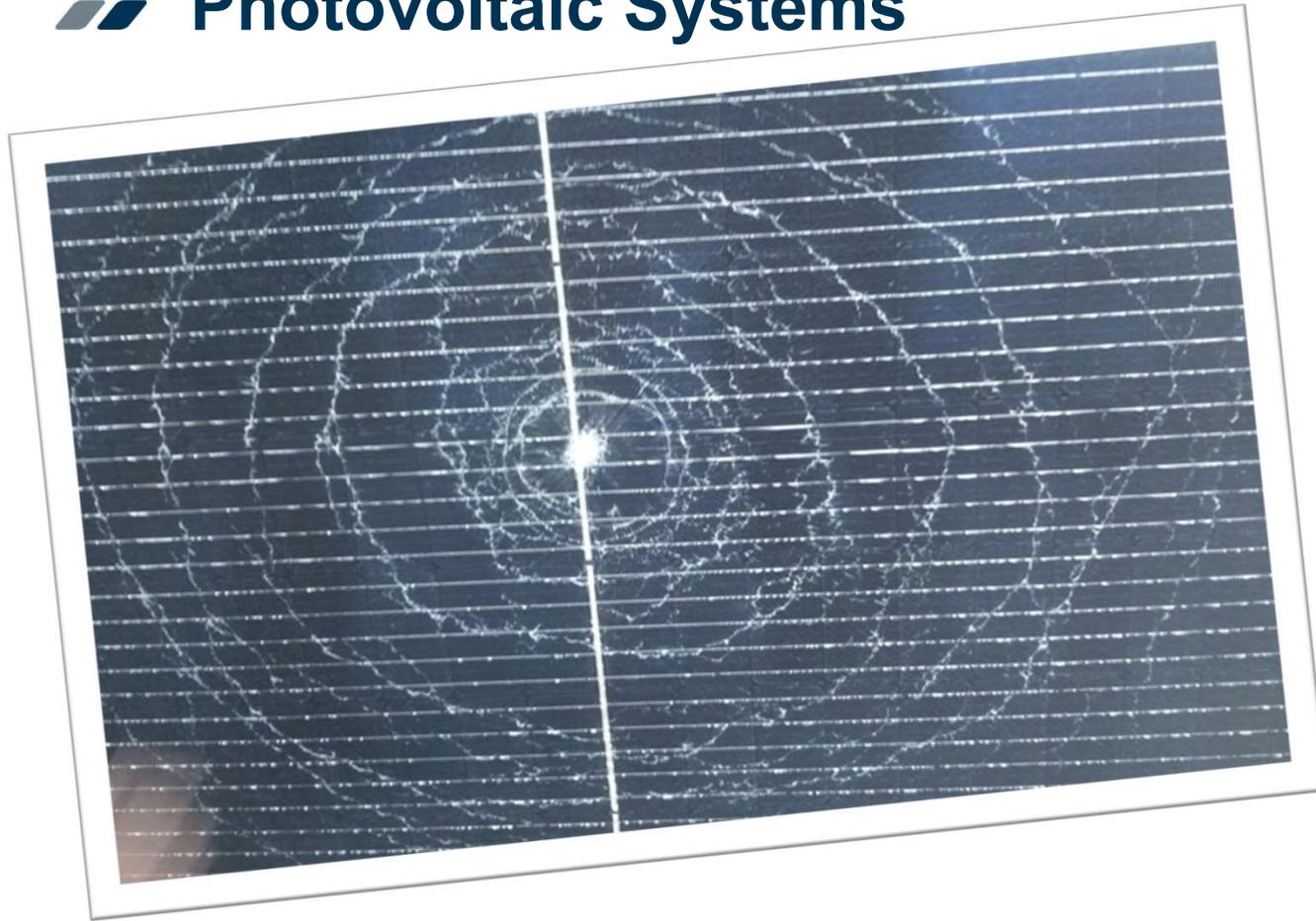
Photovoltaic Systems: *Stand Alone Inside View*



All off-grid systems & some newer hybrid systems contain batteries to store DC power.



Photovoltaic Systems



These panels are durable, but they do have durability limits.

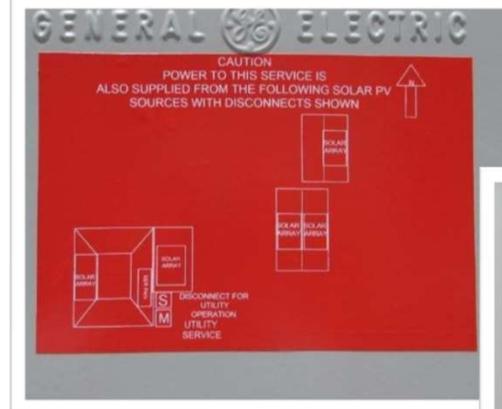
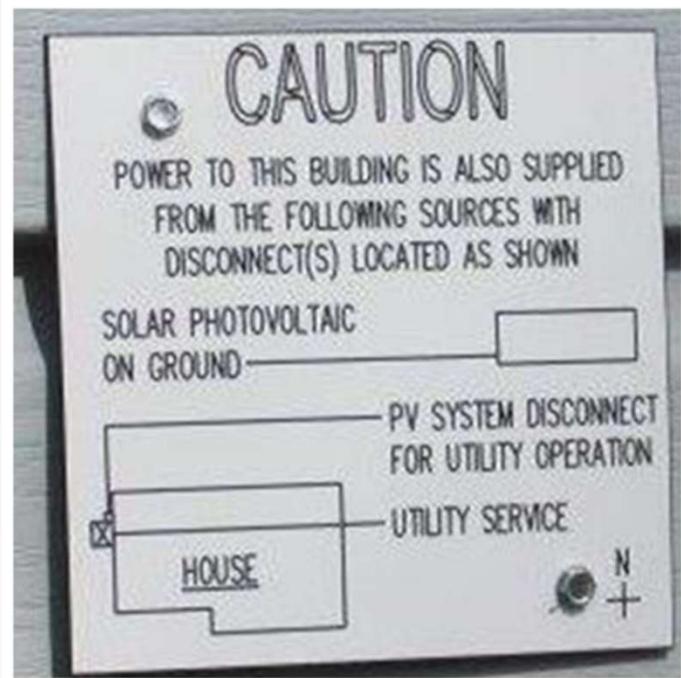
May be damaged by:

- Direct flame contact
- Very large hail
- Extreme winds
- And even a 6lb ball peen hammer (as shown in the image here)

Remember: Always assume solar cells are producing electricity even though they may be damaged.

Basic System Components: Labelling

The National Electrical Code requires all PV systems to have special labeling and signage.



Basic System Components: *Labelling*



According to the UL 1741SA & Company Tariff Standards, conduits must be labelled every 10 ft as shown in the example here.

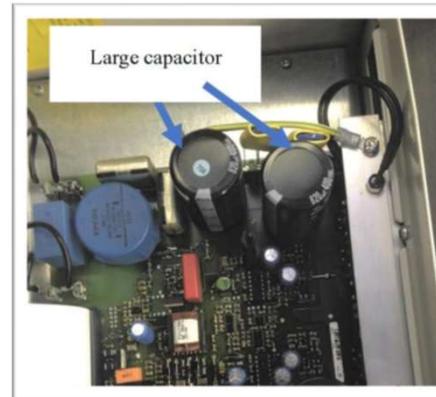
This applies to both internal & external conduits.

Basic System Components: *Inverters*



Inverters store direct current inside capacitors. The capacitors discharge the stored electricity when inverters are de-energized, but until this process is complete, they can still deliver an electrical shock.

Always treat inverters as if they contain dangerous voltage.



Summary: Safety Around PV Systems

PV Systems appear harmless, and the amount of power contained is not always obvious

- Even a small PV System can generate enough electricity to injure or kill
- Damaged panels still pose shock hazards
- PV Systems do not need direct sunlight to produce electricity



Summary: Safety Around PV Systems

Code compliance: Some systems may not be entirely code-compliant, particularly if someone inexperienced installed them.

- Each PV system can vary considerably in appearance, which is why it is crucial to become familiar with all the features and components of PV systems
- As local codes vary, every code-compliant system may have different safety features.



Summary: Safety Around PV Systems

There is one universal rule when responding to an emergency involving a PV system: **ALWAYS** assume that all PV components are energized. Even if it is dark, the panels are covered or the system is powered down, voltage remains inside. To stay safe, treat the whole system as if it is always energized.



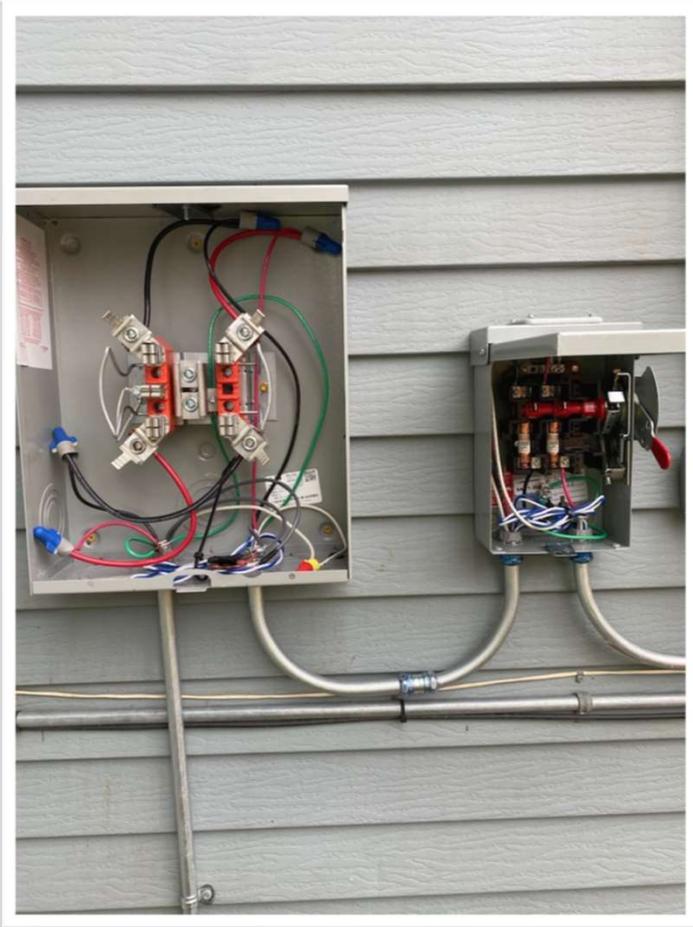
Summary: Safety Around PV Systems

- PV Systems can be string, microinverters, use battery back ups, or can be a hybrid system with EV charging on the DC or AC side.
- Systems can be on grid, off grid, roof mounted, or ground mounted
- PV Systems generally consist of:
 - Arrays
 - Inverters
 - Conduit
 - Combiner Boxes
 - Battery Back-ups
 - Meters
 - Disconnect Switches.
- Metering: AC/DC buy back metering
- System inspections on East vs West Responsibility
 - City / County Involvement
- Disconnects
 - Where do they land in the system
 - Changes to submitted blueprints of system components & its directory from solar arrays.

Not all installers are the same...

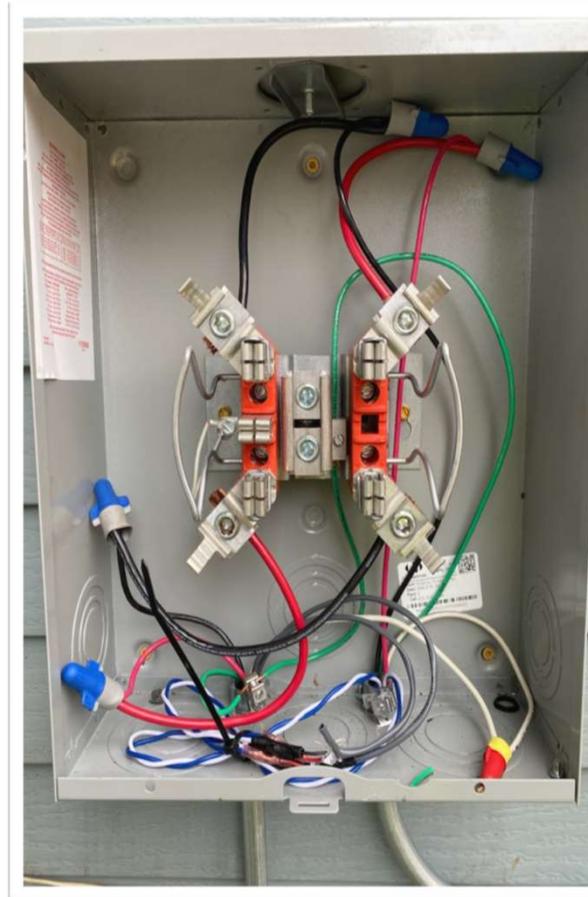
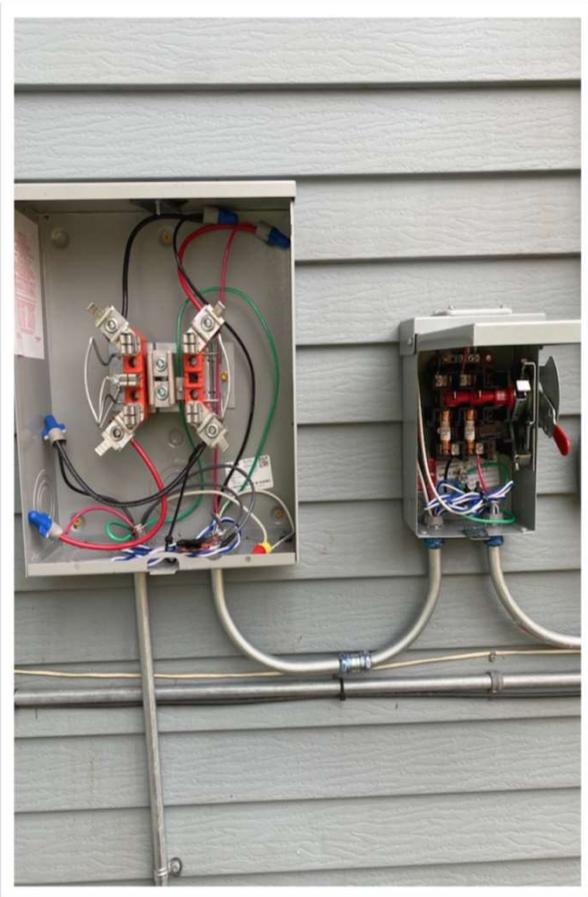


Not all installs are the same...



What can we see wrong in these images?

Not all installs are the same...

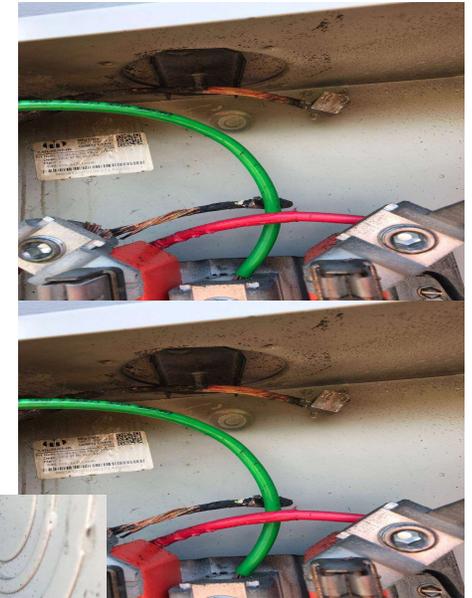
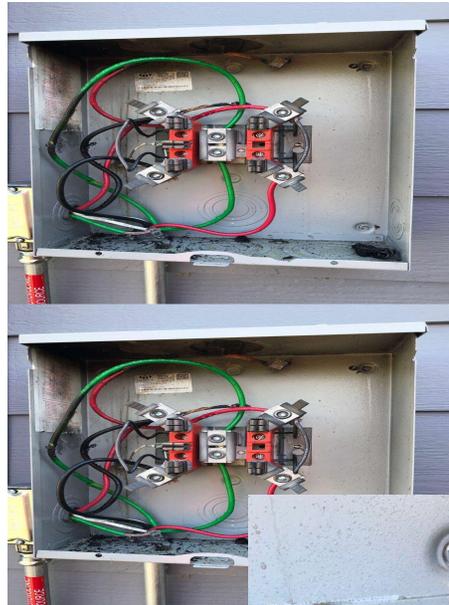


Answer:

- Wire nuts in generation can
- Too many conductors in 1/2" conduit
- Use of generation can as raceway for relay wires
- Meter can lugs allow #6-350kcmil wire, they are using #10 and splicing #6 onto ends
- Red and black wires don't match on line & load side

Not all installs are the same...

- Installer used insulated block connectors instead of re-running an adequate length of wire. The wire came out of the connector and faulted on the meter can causing a flash on the side of the customer's home.
- This occurred early on in our program.



Not all installs are the same...



- With the average cost of a solar system installation in our region costing the customer approximately \$30,000, we can't help but be surprised at the window AC unit at this property.
- *Note the red labelling.

Questions?

