Plug-In Solar Systems: Key Information for the BPU

Overview of technology, safety, regulations, impacts, policy options and resources

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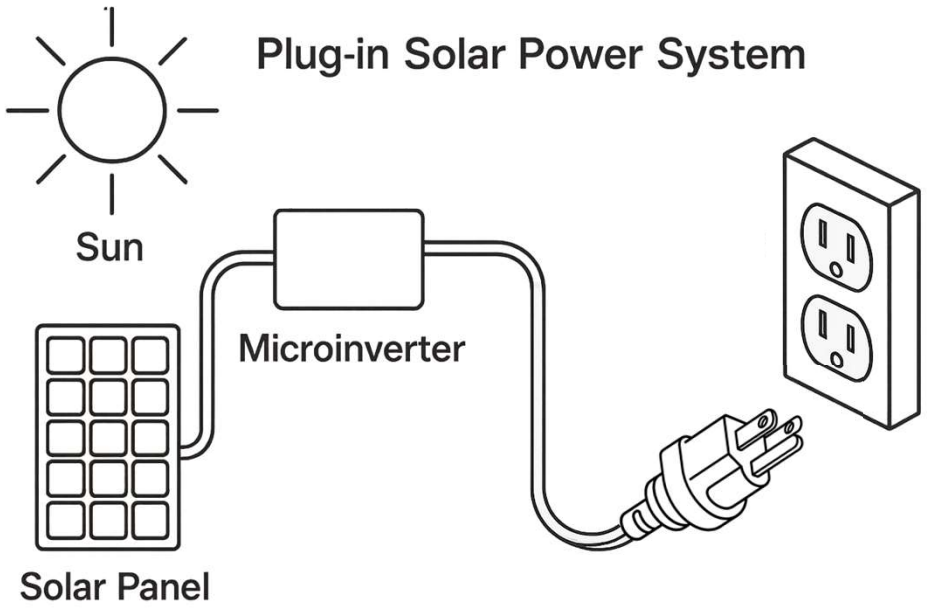
What Are Plug-In Solar Systems?

- Small photovoltaic (PV) systems designed to plug directly into a standard household outlet
  - Typically, 300–1200 watts of capacity per unit
  - Often marketed as DIY, low-cost, simple-to-install solar options
  - Do not require traditional rooftop solar permitting in some jurisdictions
  - Intended to lower household metered electricity consumption

Technology Overview

- Consist of PV panels + microinverter + power cord
  - Microinverter synchronizes output with household grid voltage
  - Output is backfed into home circuits through a branch circuit
  - Reduces household net load during solar production



Components are not to scale

History of Laws in Europe and the United States

- Europe: Germany pioneered plug-in solar regulations (mid-2010s). 1.2 million systems
- EU nations standardized safety rules permitting plug-and-play systems
- Widespread adoption due to simplified grid interconnection
- United States: Patchwork of state-level policies
  - UTAH Section 2. § 54-15-601 is enacted to read:
    - Exempts 1200 W max power output plug-in solar systems from state interconnection requirements and net metering program requirements
    - Device shall include a device or feature that prevents the system from energizing the building's electrical system during a power outage
    - Restricts “electrical corporations” from requiring approval, fees, or additional equipment beyond what’s integrated into these system
    - Waives “electrical corporations’” liability for damage or injury caused by these systems
  - Some states restrict outlet-connected solar due to safety standards

Safety Considerations

- Risk of overloading branch circuits if improperly used – "**breaker masking**"
  - Potential fire hazards from non-certified equipment
  - Backfeed concerns during outages if anti-islanding fails
  - Can be mitigated by plugging into a dedicated branch circuit
- Lack of a compatible ground fault circuit interrupters (GFCI)
- The lack of a comprehensive Underwriters Laboratories (UL) standard ***was*** an issue, has been dealt with by UL 3700 in December 2025

Breaker Masking

Power distribution circuits require protection for wiring and devices connected to it, and this is usually in the form of circuit breakers. When a system sends power back into the wiring through an outlet, it adds current to the existing branch circuit without the upstream circuit breaker detecting it. The breaker only monitors electricity flowing in the circuit from the panel, so it can't account for the extra power being added from the solar unit. That means the combined current from the grid and the plug-in solar system can exceed what the wires and connected devices were designed to handle — even though the breaker never trips.

https://www.solarpowerworldonline.com/2026/02/balcony-plug-in-solar-panels-are-we-ready-for-this-new-era-of-accessible-energy/

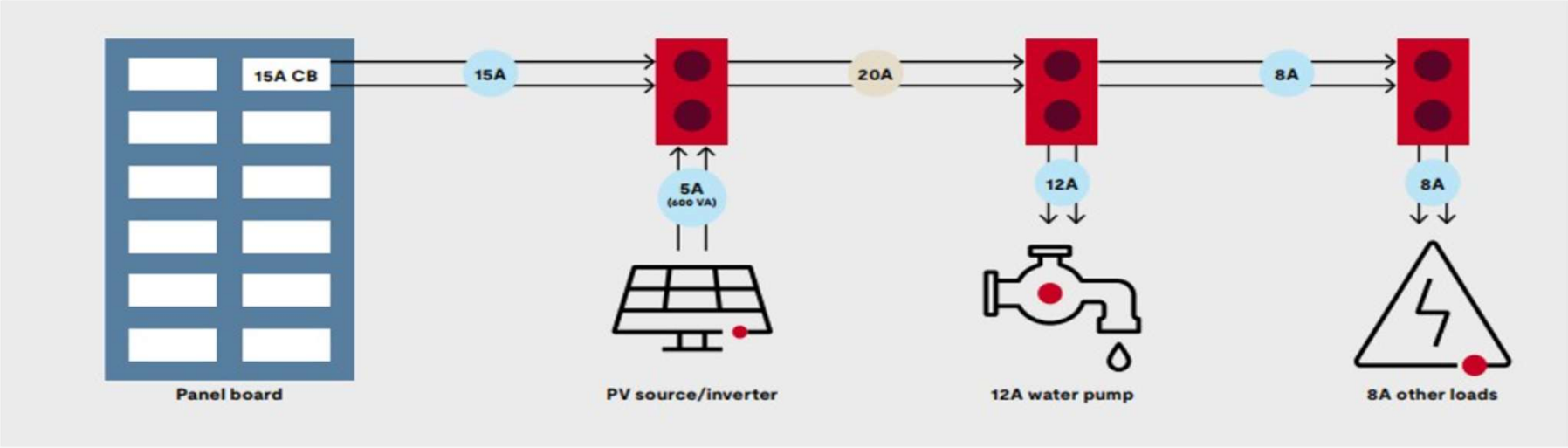


Figure 3. Branch circuit in an overload scenario with PIPV

Source: UL Solutions

Regulatory Landscape

- Some states classify plug-in solar as appliances, not generation systems
- Other jurisdictions require permits and utility interconnection approval
- NM Construction Industries Division (CID) has safety concerns
  - Many of these units are not UL-listed and lack sufficient technical documentation
  - The systems are not currently recognized or specifically addressed within the NEC
  - There is concern that the systems may exceed the capacity of existing branch circuits
  - Homes constructed prior to 2005 may have #14 AWG exterior general wiring, which could create overload or safety issues
- Los Alamos Community Development Department and DPU rules apply
  - County requires a permit for roof and ground mounted PV panels
  - DPU distributed generator interconnection agreement currently applies to plug-in solar systems
- Underwriters Laboratories
  - UL 1741 safety standard for inverters and interconnection system equipment, prevents "islanding," where an inverter continues to feed power into the grid during an outage, which could injure utility workers
  - UL 1741 SA/SB: These supplements go beyond basic shutdown to include smart grid functions like voltage/frequency ride-through and active power management
  - UL 3700 white paper and testing criteria addressing the safety implications of Plug-In PV (PIPV) systems, such as balcony solar, published December 11, 2025
- NEC compliance may be required for safe operation

Consumer Considerations

- Low upfront cost compared to rooftop solar
  - May reduce bills modestly depending on household load patterns
  - Limited generation capacity limits financial impact
  - Unclear eligibility for incentives or tax credits in many areas
- Suitable for renters, buildings with old roofing, temporary occupancy

Utility Grid Impacts

- Minimal impact at small penetration levels
  - Unmetered exports possible
  - Reverse power flow could affect transformer loading and cause voltage fluctuations on distribution feeders in rare cases
  - Difficult for utilities to track adoption and system locations without interconnection agreements
- If current interconnection agreement is applied to plug-in systems staff workload could be burdensome

Utility Business & Operations Impacts

- Shadow PV adoption affects revenue models
- Revenue erosion due to lowered metered consumption
  - Can mitigate with increased fixed and/or demand charges to capture distribution system operation costs
  - If average residence uses 650kWh/month, a 1kW PV system with 22% capacity factor will generate 0.22kW*730hrs/month = 161kWh/month, 25% of usage
  - If 2,000 metered premises used 1kW plug-in solar systems, 2,000*161kWh/month = 322,000kWh/month, 3.2% of average monthly County load
- How to handle power exports? DPU interconnection agreement compensates for exported energy, may need to revise this rule

Shadow Adoption Considerations

- Accessibility could lead to shadow adoption, where a plug-in solar is used without an interconnection agreement
- Under current DPU rules, exported energy is compensated only with an interconnection agreement
- Existing interconnection agreement holders with solar systems could use plug-in solar systems to increase compensated energy exports beyond the agreement

Liability Considerations

- How can DPU and County assert that they are not liable for any damage or injury caused by plug-in solar systems?

Interconnection Options for Consideration

- Require interconnection agreement under existing DPU rules, County permitting, and NM CID permitting and inspection
  - $500 one-time fee under DPU fee schedule to supply and install an electric meter that records and reports exported energy
  - Other fees for County and NM CID permits and inspections
  - Provides compensation for exported energy under rule E-5
- Require interconnection ***registration*** for plug-in systems
  - Establish clear permitting and system requirements but waive the ***interconnection agreement and fee***
  - Allow limited plug-in capacity with safety guardrails
  - Enables data collection to improve grid planning
  - No compensation for exported energy
  - Would include liability and indemnification
- Waive interconnection agreement for plug-in solar
  - Consider plug-in solar as an appliance with safety considerations regulated under UL, NEC, NM CID and County permitting
  - No compensation for exported energy
  - Potential issues with liability and indemnification

Other Ideas for Consideration

- Increase demand charge to cover all fixed electric distribution costs; this eliminates the cost-shifting from customers with PV to those without PV
- Limit the plug-in system size per premises
- Must enable AMI meter functions to use plug-in solar systems, no opt-out
- Public safety education about plug-in solar systems
  - Inform about what's permitted, best practices and safety risks
  - Can be too much of a good thing - using larger or multiple systems increases probability of breaker masking
  - Proper securement so they don't fall or blow away in the wind
  - Utility may provide no compensation for exported energy – public needs to "right size" their system
  - Consider portable solar generators as an alternative

Information Sources

- https://www.ul.com/ Underwriters Laboratories (UL Solutions):
  - Safety Considerations for Plug-In Photovoltaic (PIPV) Systems: https://www.ul.com/insights/safety-considerations-plug-photovoltaic-pipv-systems
  - Testing and Certification Framework: https://www.ul.com/news/ul-solutions-debuts-testing-and-certification-framework-safer-plug-solar-across-united-states
- https://www.brightsaver.org/
  - Democratizing Solar white paper: https://www.brightsaver.org/whitepaper?srsltid=AfmBOorDzv93BLdki9lUW_jbjeqS1nIxKFQjadP4tU8gVB_eHlBztn8V
  - States that have announced plug-in solar bills: https://www.brightsaver.org/publicly-filed-states?utm_source=substack&utm_medium=email
  - https://www.npr.org/2026/03/12/nx-s1-5737287/solar-panels-utilities-energy-saving?utm_source=substack&utm_medium=email
- https://www.volts.wtf/ Volts
  - What's the deal with balcony solar? https://www.volts.wtf/p/whats-the-deal-with-balcony-solar?utm_source=publication-search
  - Legislative bill tracker and utilities opposition: https://www.volts.wtf/p/volts-community-thread-28-iran-bend?utm_source=publication-search
- https://www.wired.com/story/why-balcony-solar-hasnt-taken-off-in-the-us/#:~:text=One%20concern%20is%20a%20phenomenon,of%20breaker%20masking%20causing%20harm
- https://www.solarpowerworldonline.com/2026/02/balcony-plug-in-solar-panels-are-we-ready-for-this-new-era-of-accessible-energy/

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