

POWER DISTRIBUTION 101:

KNOW YOUR SMART PANELS

Incoming neutral wire

..... Incoming power from utility

Incoming ground wire

..... Main breaker/disconnect

CIRCUIT DIRECTORY	
Generator	2 Microwave
Stove/range	4 Solar PV
Dishwasher	6 Clothes washer
Washing machine	8 Garage
Water heater	10 Air conditioning
Refrigerator	12 ??
Bedroom	14 Master bedroom
Room 1	16 Bathroom 1
Room 2	18 Bathroom 2
Living room	20 Storage
Hallways	22 Water heater
Basement	24 Crawlspace
Lighting	26
	28
	30
	32



Regular circuit breaker

Circuit breaker slot

01 WHAT ARE SMART PANELS?

Smart home electrical panels, or smart circuit breaker panels, are responsive devices that manage power distribution. They act like a **home energy management (HEM) system** that provides **remote energy monitoring and/or control** at the individual circuit breaker level.

From providing **real-time consumption data**, enabling **flexible load control**, and integrating with **solar plus storage**, smart panels allow homeowners to optimize the efficiency and efficacy of their residential energy systems.

03 ELECTRICAL TERMINOLOGY



+ **Home energy management (HEM) system:** A combination of advanced technologies (e.g., smart sensors, thermostats, and appliances) that **monitor, control, and optimize** residential energy consumption and distribution.



+ **Main panel:** A metal service box that connects the main power line to a building. It is the **primary source of electrical distribution** and contains the **main circuit breaker**, which can disconnect power to the building when needed.



+ **Subpanel:** A **secondary electrical panel** that draws power from the main panel to direct electricity in a specific part of a building.



+ **Circuit breaker:** An automatic switch designed to **safely interrupt the flow of electricity** in case the current is abnormally high. This can happen when there is **too much load** and the wires might overheat, or if something is **broken** and makes a faulty electrical contact.



+ **Circuit:** A **closed path of connected components** (e.g., batteries, switches) that conduct electricity.

02 HOW DO THEY WORK?

Electricity from the main utility grid travels to the smart panel, which is composed of (1) **smart circuit breakers**, (2) a smart panel that **connects** to an existing circuit breaker panel, or (3) a **complete replacement panel**. As the central access point for a building, the panel distributes electricity to individual **circuits** and/or **subpanels** that supply the various outlets and appliances in a home. Some smart panels come with a **mobile app** that can reconfigure backed-up appliances, optimize battery storage during power outages, and more.



+ **Load:** The **amount of power** (voltage times current) demanded by electrical appliances at any given moment. Load is measured in units of **watts (W), kilowatts (kW), or megawatts (MW)**. Residential voltage is generally **120 volts (V) or 240 V**. The maximum current for a single circuit in a house is typically **15 or 20 amps (A)**.



+ **Critical load:** Uses of power that are **essential** and should be supplied, if possible, even during a power outage. Smart panels can act as a dynamic **critical load panel**, allowing utility customers to prioritize their loads as needed.



+ **Load management:** The ability to **shift and adjust** the amount of power supplied to **building loads** and other **Distributed Energy Resources (DERs)** at any given moment to meet electrical demand.



+ **Solar plus storage:** A combination of **solar photovoltaic (PV) technology** and **backup battery storage**. During the day, solar panels power the building and charge the battery, which powers critical loads when the panels do not produce enough energy (e.g., at night, on a rainy or cloudy day, during a power outage).

04 MAJOR BRANDS

SPAN

LEVITON®

Schneider
Electric

lumin®

05 WHY SMART PANELS?

Pros

- + Real-time **energy use monitoring**
- + **Flexible load control**
- + Potential for full **solar plus storage** integration
- + May integrate with **existing electrical infrastructure & software**

Cons

- + Higher **initial cost**
- + Initial **learning curve**
- + Potential **security & privacy concerns**