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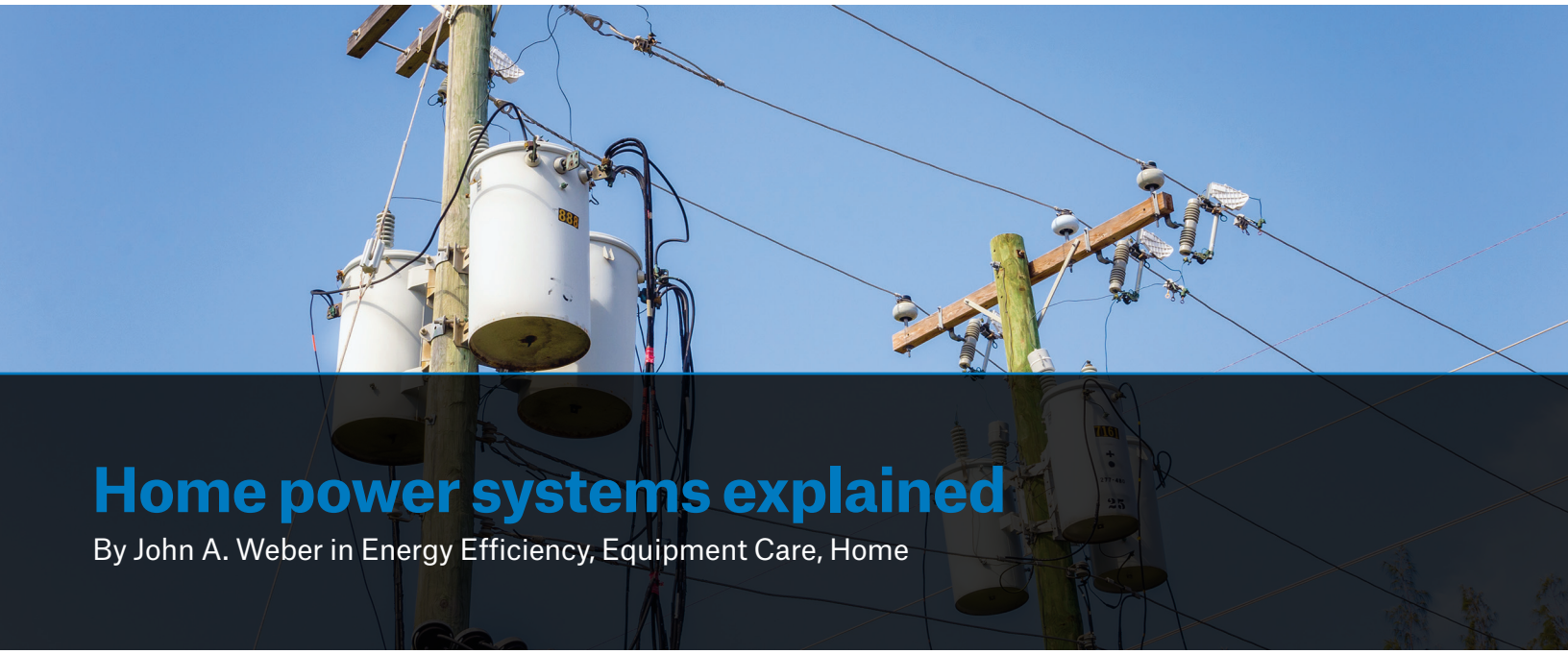

Home power systems explained

By John A. Weber in Energy Efficiency, Equipment Care, Home

HSB, a Munich Re company, is a technology-driven company built on a foundation of specialty insurance, engineering, and technology, all working together to drive innovation in a modern world.

For most of their history, home electrical systems have been of little interest to the average homeowner. Electricity was used in the home and the utility bill was paid every month. However, cost-effective and readily available technology for monitoring and controlling electricity in homes is fueling increased interest in how the typical home electrical system works.

Typical home electrical service

A new home in the United States is wired with the capacity to safely provide power for all of today's modern electrical conveniences. Many appliances in the home are permanently hard-wired during initial construction without the use of plugs, such as the heating and cooling systems and electric water heating units.

Plenty of outlets are provided throughout the home for plugging in portable devices, and wall switches are available to control light fixtures and portable plug-in devices like table lamps. All of these hard-wired and electrical plug connection are powered by the three wires electric utilities supply to a typical U.S. home.

The United States uses a standardized electrical system called single-phase, three-wire, 120/240 volt, 60 cycles per second (Hz). Electrical codes detail how the main electrical panel size must be calculated, and the size refers to the amp rating of the panel. Higher amp ratings mean more simultaneous electrical loads can be operated.

Measuring and billing for electricity usage

The three utility wires are first routed through a metering device owned by the utility. An electrician will install a meter socket during the initial electrical installation, which is designed to accommodate the local utility's meter.

The utility meter measures the power consumption in units of kilowatt-hours (kWh), which can be seen listed on the monthly electric bill. The measured number of kilowatt-hours is combined with the rate structure information to determine a monthly fee.

Some older meters are still read monthly by a "meter-reader" who travels to each home. Most utilities have updated their meters so they can transmit the monthly readings to a roving vehicle or a permanently installed radio or telephone system.

Protection from fires and electric shocks

After the three utility wires pass through the meter socket, they are connected to the main breaker panel usually located in the basement. The main breaker helps to protect the three main wires and the internal components of the breaker panel from overloading and overheating.

Branch circuit breakers are typically in the same panel with the main breaker and help protect the wires from overheating in each of the smaller cables routed throughout the home. Turning off a branch circuit breaker only shuts off power for the outlets or device listed on the panel cover directory.

Newer homes use arc fault circuit interrupters (AFCIs) that protect the wires from overheating and from high-temperature arcing on the circuit wires. Ground fault circuit interrupters (GFCIs) are usually installed at certain receptacle locations where electric shock is more likely, including kitchens, bathrooms, and outdoors.

Electricity available where it's needed

The three incoming utility wires are black, red, and white. All 240-volt equipment is connected to the black and the red wires, and there are two different ways to connect branch circuit wires for the 120-volt devices. 120 volts is available by connecting to either the black and white or red and white wires; both connections will supply 120 volts where needed.

The branch circuits distribute the total amp capacity of the main breaker to locations where permanent or portable devices use the electricity. Cables with smaller-sized wires connect to each branch circuit breaker or AFCI to protect the wires from overheating or arcing.

Branch circuits that supply 120-volt outlets will have a single handle on the breaker, and circuits that supply power to 240-volt loads have two joined handles. Most panels are designed to alternate the 120-volt loads to keep the 120-volt system balanced between the black-white wire and red-white wire options. Most branch circuit breakers in a home breaker panel are either 15 or 20 amp breakers.

Technology for "smarter" home electricity usage

- Today, utility companies are installing "smart meters" in some locations to monitor and control home appliances and manage the overall load on the power grid.
- Electronic devices such as AFCIs and GFCIs are required by electrical codes and integrated into the home wiring system to reduce fires and electric shock hazards.
- Many homeowners are taking advantage of roof-mounted, solar power generation options to reduce their monthly electricity bills.
- LED lighting uses about one-sixth of the energy for the same light output as incandescent bulbs. LED bulbs can be used in new or old wiring installations for cost savings.
- Lights, doors, temperature controls, cameras, audio equipment, and many other devices can be monitored or controlled from your smartphone or tablet.
- The internet and handheld mobile devices allow for many "connected home" products to be used remotely for added convenience.

The Internet of Things (IoT) is driving the development of many new interactive solutions and products for homeowners to measure and control home energy use.

State-of-the-art technology for monitoring and controlling home electricity usage is giving the average homeowner the ability to understand how much each device in their home is costing in real-time energy dollars. All of this is happening through the use of the internet and handheld mobile devices.

Understanding the basic home electrical system and the capabilities of today's home technology solutions will help to apply the right balance of technology and power for personal needs.

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