update

Edison Vindicated

Efficiency tempts computer centers to go DC

Manufacturers and energy efficiency gurus are joining forces to battle the black bricks multiplying in offices and homes, each one providing a dribble of direct current for a distinct electronic or battery-driven device. Their chosen remedy, DC power distribution, promises simpler equipment and significant energy savings. After more than a dozen beta installations worldwide, DC wiring is going commercial as manufacturers start selling the first products challenging AC power's 120-year dominance of electrical distribution.

Standards efforts are coalescing to accelerate DC's commercial adoption, notes Bill Tschudi, an energy efficiency expert at Lawrence Berkeley National Laboratory, in Berkeley, Calif. In November the EMerge Alliance, in San Ramon, Calif., representing more than 70 manufacturers of power equipment, electronics, and building components, certified the first commercial products meeting its standard for 24-volt DC circuits—aimed initially at overhead lighting systems.

And by this month EMerge and the European Telecommunications Standards Institute (ETSI) both expect to issue draft standards for 380-V DC wiring for building-wide power distribution. DC supporters hope to merge the standards in the months ahead. "Our goal is to develop a worldwide standard," says Tschudi.

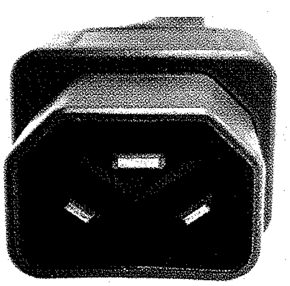
DC distribution's primary attraction—the promise of simpler equipment and significant energy savings—stems from the increasing proportion of electrical loads with DC-based electronic components or batteries. Distributing DC enables replacement of AC-DC converters within individual devices with a smaller number of larger, more efficient converters. LED-lighting installations that run on 24-V DC lines, for example, will require up to 15 percent less energy than the same lights running on fixture-level rectifiers, according to the EMerge Alliance.

DC DATA: A test of DC distribution at a data center at the University of California, San Diego, could show big energy savings.
PHOTO: TOM DEFANTI/PROJECT GREENLIGHT

Losses in the lines limit 24-V DC distribution to 10 meters, so manufacturers are developing 380-V DC wiring to extend similar benefits to entire buildings. Telecommunications firms and data centers are the likely early adopters of 380-V DC.

Today's data centers generally take 480-V AC power from the grid and convert that to DC to charge up a battery-based uninterruptible power supply, or UPS. The secure DC stream is then converted back to AC and transformed to 208-V AC for distribution, only to be rectified back to 380-V DC by the first stage of each server's power supply to charge up power-smoothing capacitors.

DC distribution offers a comparatively simple scheme, whereby a single rectifier turns 480-V AC into 380-V DC that can both charge the UPS and supply the servers. The University of California, San Diego, began testing a 380-V DC data center last year, and in

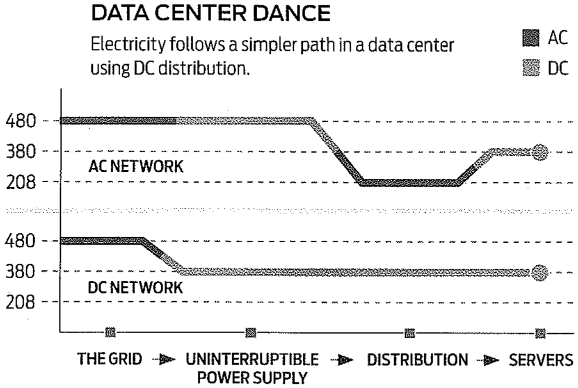


DELTA PRODUCTS CORP.

SPARKLESS PLUGS Nobody thinks twice about unplugging an AC device, but with DC there's a danger. With 60-Hz AC, the voltage zeros out 120 times per second, nipping potential arcs in the bud. But DC's continuous current doesn't have that inherent safety. So manufacturers are building it into the plug itself. Taiwan's Rong Feng Industrial Co., which expects safety certification early this year, adds a short data pin whose early disconnection signals the attached device to shut off. "By the time you unplug the actual power wires, there's no current going through them," says Dennis Symanski, a senior project manager at the Electric Power Research Institute.

DATA CENTER DANCE

Electricity follows a simpler path in a data center using DC distribution.



November, the Electric Power Research Institute (EPRI) and Duke Energy Corp. measured a 15 percent reduction in power consumption in a test of 380-V DC distribution at the utility's Charlotte, N.C., data center. Net energy savings could be twice that, they claim, once the cooler-running equipment's reduced air-conditioning burden is factored in.

The U.S. Environmental Protection Agency's Energy Star program and similar initiatives to drive up the efficiency of AC power supplies should narrow DC's advantage. However, a 2008 analysis by Intel predicts that, even compared with premium high-efficiency AC systems, DC distribution will use 7 percent less power.

Though right now up-front costs are about equal, DC systems' simpler components should also provide a cheaper, more reliable power supply. "The price isn't lower right now, simply because of volume," says Dennis Symanski, EPRI's senior project manager and chairman of EMerge's 380-V DC standards committee.

That volume might come from a combination of solar panel installations and battery-powered vehicles. DC distribution is an efficient means of combining these inherently DC devices, according to Dragan Maksimovic, a power electronics expert at the University of Colorado at Boulder. "PV/DC chargers have a target efficiency of 98 percent. Compared to 90 percent for the round-trip efficiency of inverters, that's a 5-to-1 difference in losses," says Maksimovic. Intel Labs is incorporating a 10-kilowatt solar array and electric vehicle charging stations into a microgrid at its New Mexico Energy Systems Research Center, in Rio Rancho, and the enterprise software firm SAP is doing much the same in Palo Alto, Calif.

Symanski predicts that EMerge and ETSI could harmonize their respective drafts to forge a worldwide 380-V DC standard before the end of the year. If that happens, equipment for 380-V DC power could be available within months.

—Peter Fairley

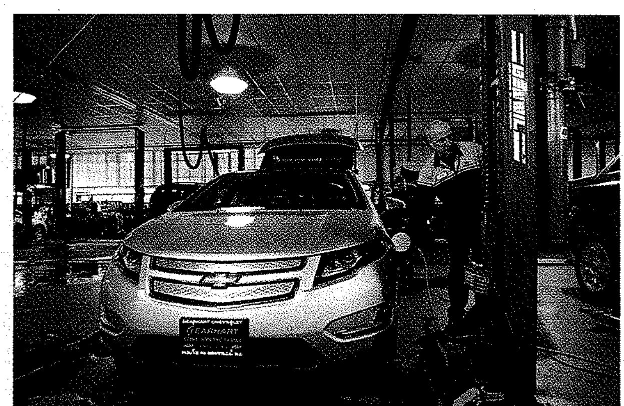
Chevy Volt Sparks a Series of Plug-in Hybrids

Expect many new plug-in cars to use the gasoline engine only as an extra battery

Iconic U.S. car company General Motors turned a page in its history on a cold day this winter in suburban New Jersey. It sold the first production version of its Chevrolet Volt to a retail buyer—a retired pilot named Jeffrey Kaffee. With that sale comes the start of the first real test of consumer appetites for two concepts long in the making: hybrid cars whose battery you can recharge by plugging them in at home, and so-called series hybrid technology.

The Volt is the world's first production series hybrid-electric vehicle. Like a conventional hybrid, it has both an electric traction motor and a gasoline engine. Once its 16-kilowatt-hour battery pack is depleted, the 1.4-liter 4-cylinder engine switches on but does not drive the wheels mechanically. Instead, it turns a 55-kW generator that provides current to the 111-kW electric motor that powers the front wheels. It's not a new concept—minus the battery pack, that's the same way diesel locomotives work. But until now, all hybrid cars have used their gasoline engines in parallel with their electric motors, combining their torque to turn the wheels.

The Volt's series-hybrid credentials came into question briefly last fall when GM power-train engineers revealed that in



PLUGGED IN: A mechanic preps the first Chevrolet Volt for sale.
PHOTO: EMILE WAMSTEKER/CHEVROLET