

Success Story: NextEnergy



Eaton 9395 helping to save the lives of U.S. troops

Product:

Eaton® 9395 UPS

Location:

Detroit, Mich.

Market Served:

Renewable Energy

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*- Max Dorflinger,
director of program delivery*

Background

Launched in 2002, NextEnergy is a nonprofit organization whose mission is to become one of the nation's leading catalysts for alternative and renewable energy. By bringing promising technologies to maturity in the marketplace, the company seeks to accelerate the impact and profitability of this increasingly important industry. Already managing millions of dollars of research projects, NextEnergy is developing new technologies for power generation, transportation and fuels.

A New Innovation

In 2004, the United States military began a collaboration with NextEnergy to design and manufacture a "mobile micro grid." This initial product concept evolved over the years into a device now known as an Electronic Power Control and Conditioning (EPCC) module.

"It acts like a power hub," says Max Dorflinger, director of program delivery for NextEnergy. "You can concurrently interconnect up to eight different kinds of electrical power generators or input power sources to it and it aggregates all of the power inputs while creating a single clean power output."

The device not only accommodates a variety of generator types, but renewable power sources and exported power from hybrid electric and electric vehicles, as well. "You can put all kinds of different, incompatible power sources together," Dorflinger explains. "You can take a 50 Hz generator and a 60 Hz generator — plus sources of wind power, solar, fuel cells and exported vehicle power — and aggregate them to a single output."

In this manner, military personnel have immediate access to reliable, convenient, mobile power in the field. Plus, because the innovative product saves fuel through managing power sources and loads, it saves money while supporting increasingly prevalent green initiatives.

But perhaps the most critical advantage is the device's "force protection" benefits. "Not only are there fuel savings, but it reduces the number of times that our forces need to be

put in harm's way," Dorflinger emphasizes. "When it comes to our soldiers, it saves lives. It helps and protects them, because you don't need to rely on so many convoys constantly bringing in fuel."

Partnering Technologies

When NextEnergy first began developing the EPCC, it was working with an inverter company to supply a key component of the product. But contractual and technical difficulties stalled the relationship, prompting NextEnergy to seek a different supplier.

"We were looking at all kinds of inverter manufacturers and came across a generator distributor who was a rep for the Eaton® line, Coffman Electrical Equipment," Dorflinger recalls.

Based on the technical specifications of the EPCC, the rep firm recommended that NextEnergy implement the Eaton 9395 UPS within the module.

"We weren't initially seeking a UPS," Dorflinger acknowledges. "But when we were bidding out the project, that was Coffman's approach. "We did some investigation and found the 9395 to be a very good product that we believed would serve our needs with very little engineering development. And that has proven to be true."

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The Solution

Delivering an unprecedented level of reliability and energy savings, the 9395 was just making its way off the production line in the fall of 2007 when NextEnergy purchased a pair of 275 kVA units to incorporate within its first EPCC test module. "I think we actually bought serial numbers one and four," Dorflinger recalls.

The company has since deployed five other 9395s, which are modified to meet the specific requirements of the EPCC product line. "The UPS is our core, main subsystem for the module," Dorflinger explains. "The 9395 serves as the main output device. We utilize the input port on it, and draw power from the DC storage bus where you typically have batteries."

Where batteries would reside when used in a standard UPS application, NextEnergy instead connects its input ports — converters that enable compatibility among the different types of generators — and a bank of ultra capacitors, which provide short-term ride-through capabilities when generators are attached.

"Generators typically have to be oversized greatly so they won't experience large dips in frequency and voltage," Dorflinger notes. "With the ultra capacitors tied to the DC storage bus in the UPS, we take care of the ride-through and the input power sources don't see large swings in the load, which increases reliability."

The EPCC module allows the connected equipment to run more efficiently, significantly minimizing fuel usage. "We can control what's connected to them, managing the entire generation mix to maximize the efficiency," Dorflinger says. "And since we allow for renewable power and solar to be brought into the mix, it offsets fuel usage even further. One of our targets is to save as much fuel as possible."

The flexibility of the EPCC is a boon for military users, as they can easily attach a wide range of equipment types, without worrying about power compatibility issues. "We don't care about voltage or frequency," Dorflinger says, noting that the EPCC can accommodate voltages ranging from 24V to 600V and frequency variations from DC to 440 Hz. "It basically decouples all of that and converts it all to DC, drawing power from the UPS's DC storage bus," he explains. "Since it can take in such a wide range of voltages and frequencies, the EPCC is not only great for different types of generators but a natural way to take in renewable sources, as well."

The 9395 Advantage

The 9395 delivers the industry's best performance combination of high efficiency, low input current distortion and high power factor. A unique circuit design keeps input current THD low and input power factor near unity without compromising overall efficiency. As a result, the UPS allows maximum transfer of power between the power source and the protected load and is exceptionally compatible with multiple power sources, especially auxiliary generators. "The active rectification performs very well on the input port," Dorflinger points out.

On the output side, the 9395's ultra high-speed switching pulse width modulation (PWM) inverter enables the unit to provide its full rated power capability, regardless of the load's power factor. "The output is transformer-less, which was a big factor for us and very important," says Dorflinger. "The output is superior — the output wave it creates is very good and very clean. You really need a nice clean sine wave to run this stuff."

The exceptional line conditioning capabilities of the 9395 enabled NextEnergy to eliminate its original plans to supplement the EPCC module with additional conditioning measures. "We always intended on having some AC line conditioners to give the EPCC module the ability to support large steps in load without affecting the output voltage," Dorflinger says. "But it turns out we didn't need them because the 9395's over-current capability provides upwards of three times the rated current."

The UPS also boasts the smallest weight and footprint of any UPS in its class — 50 to 60 percent less than competitive units — making it ideal to be housed within the EPCC module's 20-foot ISO container.

For its initial test unit, NextEnergy purchased two 275 kVA UPSs, then opted for a 550 kVA model within its beta unit. "We bought the first two because it was our test mule, and we were looking to see if we needed the redundancy of the units," says Dorflinger.

While both configurations fit within the product's enclosure, the company has migrated toward using the pair of units. "We liked using the two 275 kVAs as a better option because of the redundancy, and the fact that they give us a little more flexibility due to having two DC storage buses," explains Dorflinger. "That way, we can connect more equipment."

One of the most valuable aspects of utilizing the 9395 within the EPCC module is the fact that NextEnergy is able to easily implement modifications to the unit. "The nice thing about the 9395 is that a lot of the features that we needed developed were already there in some format," explains Dorflinger. For example, in order to perform properly, the EPCC requires the ability to pull specific power from the various input ports — a feat that is accomplished using the UPS's DC storage bus. "We utilize the unit's battery test mode feature in a unique way," says Dorflinger.

The ability to synchronize the UPS to the utility grid and transition on and off the grid is a variation NextEnergy is currently exploring. "The internal Eaton engineering group has finished development that enables EPCC functionality," Dorflinger reveals.

Future plans

NextEnergy has also expressed interest in the new 1100 kVA 9395 model. "We believe there's an application for a multi-megawatt version of what we're creating here," Dorflinger reveals. In the meantime, the company is focusing on fine-tuning the specifications of its EPCC production model, which Dorflinger estimates will take another year or two to complete. "The gamma unit is a more rugged version of our initial prototype," he says.

The results of a recently completed lifecycle analysis on the EPCC were positive, demonstrating clear benefits and monetary merits for the military. "It saves fuel and increases reliability — and it doesn't use any batteries," Dorflinger notes. "The EPCC makes for a natural path for including renewable sources in your power mix, because it takes care of all of the power conditioning. It's definitely green that way."

Originally funded by the U.S. Army's Tank- Automotive Research, Development and Engineering Center (TARDEC), the project's second phase is now being administered by the Defense Logistics Agency (DLA), although TARDEC remains involved. Primarily intended for use by the Army, at least initially, Dorflinger says the innovative product could potentially be deployed in all branches. "We believe there are applications throughout the military," he says.

NextEnergy envisions viable commercial applications for the EPCC, as well. "Electric utilities would be a customer," Dorflinger notes, adding: "It allows one to manage power very effectively, regardless of the source."

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