# U.S. Air Force Base Addresses Unique Needs with Advanced Power Management

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The power management needs of Edwards Air Force Base are not ordinary. Located in the Mojave Desert, the massive campus covers 301,000 acres, or roughly 470 square miles. As a matter of perspective, a city the size of Los Angeles could fit within the base boundaries with miles to spare.

Edwards is also home to multiple high-level testing and research facilities. One is the NASA-Dryden Flight Research Center, which is mainly responsible for performing flight research and technology integration, but also supports operations of the Space Shuttle and the International Space Station. Another is the Air Force Flight Test Center, which has played a vital role in virtually every aircraft to enter the Air Force inventory since World War II. The Test Center's mission is to evaluate aerospace systems from concept to combat and conduct research and development for a variety of programs.

The base has 19 runways, including the country's longest, which is located in a lakebed and measures seven-and-a-half miles long. This vast array of landing surfaces can be a huge benefit in safely recovering test aircraft or aircraft returning with in-flight emergencies due to the forgiving length and width of the runways.

Electric utility bills on this massive compound average about $20 million per year. High security requirements, frequent hurricane level winds, torrential rains, aging infrastructure and government-imposed energy reduction mandates all present a unique set of power management challenges. Edwards Air Force Base's facility managers needed a more robust power monitoring system to address these challenges and called on Schneider Electric.

**Reducing Consumption through Better Power Management**

Edwards receives high voltage power of 115kV from the utility and distributes it to its buildings and tenants, such as NASA. In 2003, a PowerLogic® power monitoring system from Schneider Electric was installed to help monitor and manage the high voltage electrical distribution system and usage within its facilities. The PowerLogic® system, with System Manager™ software (SMS), receives, records and analyzes data provided by more than 100 Square D® brand power meters and circuit monitors throughout the base.

As a Federal Government facility, the base is mandated by EPAct 2005 to reduce its electrical consumption by three percent in fiscal years 2007 through 2009, and five percent in years 2010 through 2012. Ron Ryan, Edwards Air Force Base Supervisory Control and Data Acquisition (SCADA) Systems Manager, states the PowerLogic System has been instrumental in measuring and reducing electrical usage in an effort to comply with the federal mandate.

"Our official reported reduction for fiscal year 2007 is 18.1 percent," says Ryan. "Schneider Electric's PowerLogic system plays a big role in day to day — even moment by moment — score-keeping and analysis that we use to strategize our energy reduction efforts."

The base also participates in a demand reduction program with its electric utility, which provides credits on their bill for meeting mutually agreed upon reduction objectives. According to Ryan, in some instances they've received more than $20,000 in credits in a single week.

"With the systems record keeping capabilities, we can show trends relative to influencing factors such as weather, and normalize our data to these factors to determine if we're really being effective with our conservation efforts," Ryan adds. "So if the General says, 'Turn the A/C off when you're not in the room,' we're able to see if that paid off or not. If it wasn't successful at reducing our consumption, we can redirect our efforts and come up with a different strategy."

**Less Downtime and Fewer Wide-Spread Outages**

Improving processes to reduce consumption is only part of the payoff, according to Ryan. Improved reliability and fewer maintenance and repair hours are also major benefits of the Schneider Electric PowerLogic system.

"Before we had the PowerLogic system, we were experiencing wide-spread power outages," Ryan said. "Power mains were opening at the switch stations, and we didn't really have the data to analyze why that was happening. Typically someone would just go out and inspect the feeders. But without having any data to analyze the sequence of events and fault currents, we really did not have any way to determine what needed to be changed to prevent additional power outages."

"After gathering data from the PowerLogic® system, we were able to sit down with the coordination software and plot out our protective devices based on real data. We've been able to isolate faults to the smallest possible area so that we don't have wide-spread power outages."

The base calculates that a power outage costs roughly $200,000 per hour in government payroll. Ryan estimates that the new system has helped the base avoid approximately five hours worth of outages per year since 2003, an estimated savings of $1 million annually.

"Rather than our scientists and engineers being unable to work due to outages, we are able to keep them focused on providing technologies for our war fighters in the field. If you look at some of the things that Edwards has provided in support of the wars in Afghanistan and Iraq, it translates into human lives being saved," adds Ryan.



**Instantaneous Notification**
The remote alarm notifications that are part of the PowerLogic system have also provided a major advantage when trouble-shooting power and weather-related issues in the field, according to Ryan.

"When a power event occurs, I don't have to be standing in front of my computer screen to know what happened," Ryan said. "Text messages come directly to my phone to tell me what breaker opened, and I can immediately contact the folks in the field to let them know where the open breaker is so they don't have to go hunting for it. That brings the power up faster. It's also safer for the people in the field because they're aware of exactly what happened and where to look." Notifications of power events can be sent via multiple communication channels including e-mail, pagers, mobile phones or landlines. The alarms/events can also be filtered so that the proper personnel receive applicable notification.

Providing clean and reliable power to Edwards Air Force Base is made even more difficult by challenging weather conditions. The power monitoring system provides tools to identify and repair weather-related issues quickly.

"We have hurricane force winds and lightning storms here in the desert all the time," Ryan said. "That can be very hard on our primary distribution system. We will have line slap issues caused by the high winds and guide wires will break. We have all kinds of problems caused by the extreme weather. The PowerLogic system helps Ryan and his staff to quickly identify where problems occur and can be addressed without having to send an electrician out to search for them.

"It has provided a lot of power quality analysis that we did not have before. With the power-intensive projects we're doing on a regular basis at Edwards, power quality as you can imagine is a very important issue to us." Poor power quality can shorten the life of various components in the distribution network and impact process equipment reliability — resulting in costly downtime.

**Maintaining an Aging Infrastructure**
Buildings and infrastructure on the base date back to the 1940s. The power monitoring system provides maintenance managers with the information to prompt necessary upgrades to the aging facilities.

"Some of our underground distribution is getting old, so the system can give us good information on where we can direct our resources and how to proactively replace aged lines," Ryan said. "We can tie in our circuit protection devices and relays to our circuit monitors, which will trigger an alarm with pre-emptive disturbance wave forms. That really lets us isolate which phase is having a problem."

**Project Creates a Partnership**
Schneider Electric was assisted by Pojoaque Pubelo Services for the system installation and procurement of the products needed.

Pojoaque Pueblo Services was established to provide Government facilities like Edwards with an easy way to procure quality technical services. Pojoaque Pueblo Services established itself as a woman-owned, HUB Zone certified and tribally owned 8(a) enterprise. This designation

was beneficial to both Edwards and Schneider as Government contracting offices have quotas for awarding business to entities in each of these three categories.

Doing business with Pojoaque Pueblo Services provides Edwards with credit in all three categories simultaneously, and provided Schneider with a valuable partner in installing meters and project management.

**Taking Further Steps against Outages**

Due to the success of the power monitoring system, Ryan has looked to Schneider for additional assistance. Schneider Electric's Engineering Services' Power Systems Engineering team was recently contracted to perform an engineering study aimed at solving more issues related to the once-frequent power outages on the base. The group was charged with engineering a load restoration control scheme that could provide a predictable and sequential restoration of the base's power in the event of an outage.

The Schneider Electric team gathered data on-site and identified areas to improve the electrical system reliability. One area of concern was a lack of system selectivity, which was causing simple events, such as a fault on an aerial line, to turn into a power outage to half the base instead of simply tripping the breaker that fed the line.

The study uncovered the need to update the base's protective relaying to provide better coordination and automation, and made recommendations for upgrading protective relaying at crucial points in the system. Schneider Electric provided detailed budget estimates so Edwards could plan appropriately on when to implement recommendations.

"The Power System Engineering study provided a lot of value, and we're currently in the process of installing new protective relays based on the study data that Schneider Electric provided," adds Ryan.

**Preparing For the Future**

As new buildings, runways and other facilities are added to the base, the Schneider Electric power monitoring system helps to ensure adequate electrical infrastructure is in place to support the new developments.

"We are constantly planning for new facilities and new test programs, and we need to make sure we're able to provide adequate power," Ryan said. "Right now, they are building a brand new runway, so we had to design and plan a new power service for a large concrete batch plant. We need to make sure all the systems are up and running and that we are ready to tactically handle power outage situations, and the PowerLogic system helps us do that."

For Edwards Air Force Base, saving money on the electric bill means more than reducing costs.

"When we don't consume as much electricity, we have more money available for the primary mission of the base – to develop technologies that save lives," Ryan said. "That makes a system like this worth investing in."

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