cupied areas have the lights shut off all of the time. An electrical contractor was hired to splice switches into each redundant circuit. A little trial and error revealed the best configuration for our needs; almost two-thirds of the lighting now is turned off a majority of the time. Lights are simply turned back on during periods of maintenance, tours, or any other need for additional lighting

In addition to shutting off circuits, we have also replaced critical lighting with more efficient bulbs and fixtures. GT enclosure lighting has been replaced with fluorescent bulbs and the maintenance shop had the high-pressure sodium lights replaced with fast acting fluorescent fixtures. All had better lighting at a reduced energy use.

Results. With two-thirds of our lighting secured, most of it high-pressure sodium, a large parasitic load is averted. The project has a net savings is $22,474.89 per year and easily paid for itself in just a few months.

Design

Eliminating outages caused by potential-transformer failures

Redhawk Power Plant

Arizona Public Service Co

Challenge. We operate a combined-cycle facility with two 2 × 1 units comprised of GE Frame 7FA combustion turbines and Alstom steam turbines. Generator terminal voltage is 18 kV and is stepped up to 500 kV through the station transformers. We use 18-kV ABB generator breakers to synchronize to the grid. Included in the breakers are potential transformers whose primary windings are connected to the line side of the generator breaker. These transformers provide the line-side voltage signal for generator synchronizing.

We had experienced a handful of forced outages caused by failure of the potential transformers. Upon failure, the affected generator could not be synchronized to the grid, resulting in a forced outage. In addition to the potential transformers located inside the generator-breaker housing (used for synchronizing), there is a set of distribution transformers used for isolated-phase-bus ground detection alarm-only signal to the DCS. These transformers, enclosed and located at grade elevation, never had experienced a failure.

The failed potential transformers in the generator breaker are presently made in Italy with a 12- to 16-week lead time. Following the failures, we attempted to perform root-cause analysis both in-house and along with the manufacturer. Neither of us was able to determine the root cause.

The generator breakers are physically located 25 ft above ground in direct sunlight in a Southwest desert location. Typical daytime temperatures in the summer easily reach 115F. The distribution transformers mounted on the ground are shaded and never see the sunlight and thus are considerably cooler during the summer. We theorized the failures could be caused by the extreme heat in summer and decided to use the set of distribution transformers located on the ground level.

Solution. Our electrical engineering department reviewed the idea of using the distribution transformers mounted on the ground level and retiring in place the set of potential transformers located in the generator-breaker housing. The study found that in addition to the appropriate wiring, conduit, and recommissioning of the Alstom Syncrotac generator synchronization system, there would have to be additional small 1:1- ratio auxiliary transformers added to the system. The extra transformers were necessary to isolate the synchronizing signal from the bus ground detection alarm signal. Since the system modification, we have had no additional forced outages relating to the failure of voltage-signal producing transformers.

Results. The system changes were made in 2006, and since then we have not had any other forced outages resulting from potential-transformer failures.

Redhawk Power Plant

1060-MW, gas-fired, two 2 ×1 combined cycles located in Arlington, Ariz
Plant manager: Ben Preusser
Key project participants:
Frank Perkins, Production Supervisor
Peter Russell, Plant Engineer

Flooded-cell battery system replaces VRLA to improve reliability

Wolf Hills Energy LLC

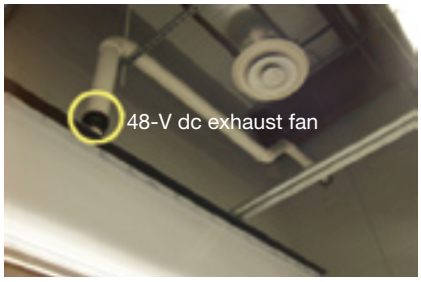
Owned by Tenaska Power Fund

Operated by NAES Corp

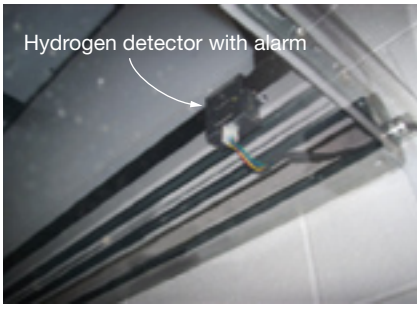
Challenge. Valve-regulated lead/acid batteries (VRLAs) are widely used for backup and direct-current control systems. The advantage of VRLA systems is that they are sealed, inexpensive, and can be installed in environments common with other electrical equipment. In recent years, however, unexpected failures of VRLA systems have caused many companies to rethink their use.

Solution. Many companies have returned to the more traditional and proven lead/acid flooded-cell battery technology. It is generally considered more reliable and has a longer life expectancy but requires ventilation and detection for hydrogen release and separation criteria to mitigate

32. Flooded-cell battery system has Teflon® hood for electrical insulation, ventilation holes at the base to ensure air flow across the batteries, and special hinges (circles) to facilitate removal of doors for maintenance



33. Positive ventilation is provided by a continuously operating 48-V dc fan



34. Safety is assured by hydrogen detector equipped with an alarm

35. Weather hood guards ventilation system against the elements

36. Wolf Hills personnel designed and constructed the replacement battery system

Wolf Hills Energy LLC

250-MW, gas-fired, five-unit peaking facility located in Bristol, Va
Plant manager: Richard Evans
Key project participants,
from left to right in Fig 36:
Lloyd Montgomery, O&M Technician
Michael Beverley, Lead O&M Technician
Les Chase, Principal Engineer
Russ Pope, O&M Technician
Michelle Stevens, Administrative Assistant
Duane Davidson, O&M Technician

potential electrical hazards. The installation described below creates the systems separation and safety required while using the same space as the VRLA system.

Key-system components are the following:

- Sealed containment cabinet with easily removable doors (special hinges circled) to facilitate maintenance (Fig 32).
- Electrically insulated construction.
- Continuously operating 48-V dc fan (Fig 33).
- Hydrogen detector with alarm (Fig 34).
- Weather hood protects ventilation system against the elements (Fig 35).
- Ventilation holes at base of cabinet ensure full system air flow.

Results. The design and installation of this system was creative in that it used existing space, cost-effective since another building or different location was unnecessary, and all of the design and construction was done by plant personnel (Fig 36). The estimated cost for outside engineering and construction was $53,000. The total actual cost was approximately $7000 by using in-house engineering and plant labor.

Wireless solution improves productivity

Federal Electric Commission of Mexico

Laboratory Analysis Group

Challenge. The Federal Electric Commission of Mexico (CFE) manages over 140 powerplants in Mexico. To keep the plants running efficiently, our Laboratory Analysis Group (CFE Lapem) travels to each plant to determine its thermal efficiency. When our group of technicians and engineers arrive they install from seven to 25 instruments, depending on the size of the plant and its configuration, to make key measurements that feed a thermal-efficiency model. The model helps to pinpoint steps that can be taken at the plant to boost efficiency.

There are five working groups of technicians and engineers to cover all the plants. With wired instruments, it takes 15 days to install and commission the devices, take the readings, and tear it down (including traveling and reporting). Because of reporting and other activities, our employees need a week without travel before they are sent to the next plant, so we can only cover 50 plants each year. The group had to reduce the turnaround time at each plant to provide more of the required assessment services annually.

Solution. CFE Lapem needed instrumentation that was easy to install, especially in hazardous locations. We also needed instrumentation that would communicate reliably in such dense infrastructure. Line of sight is not possible. It was also important that the transmitters gave accurate, reliable data since the thermal efficiency model is only as good as the information it receives.

Emerson Process Management's wireless solution was easy to install and very easy to use. The AMS (asset management system) interface is user-friendly. Wireless instrumentation gave us the ability and flexibility to perform the required services with a reduction in both time and cost.

One of our working groups has started to use Emerson wireless pressure, temperature, and DP flow transmitters instead of the standard wired instruments. They utilize one 1420 Smart Wireless Gateway, a PC with AMS, and up 25 wireless transmitters.

CFE Lapem uses the data to determine unit heat rate and equipment efficiency—including condenser, cooling tower, boiler, turbine, auxiliary equipment—as well as energy losses in the process. Plan is to acquire 75 pressure transmitters, 105 temperature transmitters, and six gateways to be used by every working group.

Results. The five working groups were not able to cover 100% of the demand for assessment services for all the country's generating units. Using wireless instrumentation, the average turnaround time was only 10 days, instead of 15. This means the one group using wireless technology can perform 10% more services within the same time frame, which represents annual increased revenue of $512,000.

This does not include the increased revenue for CFE from the resulting improvement in power production, and the reduction in travel expenses for CFE Lapem. Wireless technology will help the group cover 100% of the assessment needs for CFE.

Once all working groups implement wireless instrumentation, we expect to increase the productivity of the CFE Lapem by 40% and increase the number of services from 50 to 75 per year. Considering that the price for each service is $55,000, CFE Lapem will achieve additional revenue of $1,375,000 per year without any additional personnel.

Federal Electric Commission of Mexico (CFE)

Laboratory Analysis Group
GT-based generating capacity of nearly 20,000 MW
Key project participants:
Oscar Matinez Mejia