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ELECTRONICALLY REPRINTED FROM MARCH 2012

Case Study

Resorts define an energy strategy



Siemens ROBICON Perfect Harmony VFD-equipped chillers provide the variable capacity needed to accommodate differing demands, thus providing energy savings. Courtesy: Siemens

While most visitors to the MGM Resorts International properties in Las Vegas only see the glitz and glamour, much of the action takes place behind the scenes. In 2006, MGM established the Energy & Environmental Services Division to ensure that the company's impact on the environment is fully defined and that programs and processes are put into place to mitigate any negative environmental impacts. As a result, the company has implemented numerous conservation programs that substantially reduce electricity, gas, and water usage at all of its Las Vegas resorts.

With a renewed emphasis on energy efficiency and sustainability, the MGM team quickly realized the need to upgrade existing chiller plants with variable frequency drives (VFDs) and implement rigid plant operations procedures as a way to increase savings and

become more environmentally responsible. The installation of VFDs allows for the regulation of speed, and thus power used, for the huge chiller motors that cool each resort, while integrated computer systems provide data about how much cooling is needed in a building at a particular moment. Rather than working at 100% capacity, the chillers can run more slowly at lower heat loads, saving a tremendous amount of energy.

The Mirage, MGM's flagship Las Vegas hotel, was first on the team's list for significant upgrades in 2006, so the team sought Siemens' assistance from to cut the resort's HVAC power consumption. Built in 1989, The Mirage has 9,600 tons of air conditioning capacity. Its central plant serves 3,044 hotel rooms, casinos, and a 40,000-sq-ft ballroom, while auxiliary plants cool its 90,000-sq-ft event center. With 20-year-old chillers, including six 1,350-ton chillers operating at 4,160 V and three 500-ton chillers operating at 480 V, an astronomical amount of electricity is required for operation.

The chillers were wasting power by running at full throttle, even when internal building temperatures did not require them to do so. When demand would drop, the veins of coolant inside the chillers would constrict to control the coolant flow, but the chiller motors would keep running at full capacity.

With a perfect opportunity to showcase the performance of its drivetrain solutions, the local Siemens representative recommended that The Mirage deploy two Siemens ROBICON Perfect Harmony 1,300 hp, 4,160 V, lowest available harmonic VFDs to two of



the 1,350-ton chillers in the central plant, and connect a Siemens Sinamics G150 VFD to each of two 500-ton chillers in the auxiliary plant.

To control the VFDs and provide systems interface, 11 sensors were installed on each chiller connecting them to the VFDs, which were managed by energy software programming that the Mirage put in place. Building personnel were instantly able to monitor, measure, and benchmark every kW of electricity and every drop of water running through each chiller. Through the software, the team can monitor the chillers anywhere. Even with 20-year-old chillers, MGM now has one of the most automated chiller plants in the world.

Due to varying usage demands throughout a typical day at MGM's Las Vegas properties, the VFDs, thanks to their patented design using a series of low-voltage cells contained within each drive, can be scaled precisely for a wide range of voltage and output power.

Able to bypass any one cell during operation, the VFDs can maintain the full output voltage necessary to run the process. This cell-based configuration also gives the team easy access to drive components for scheduled maintenance, thus reducing system repair time to minutes. The cell bypass ensures automatic bypass of a failed power cell in approximately 450 milliseconds. Instead of shutting down the entire drive, a process-tolerant protection system (ProToPS) provides a hierarchical system of warnings. This control strategy allows time to evaluate the situation and respond appropriately.

An integral transformer with phase-shifted secondaries provides 18-pulse or better input harmonic cancellation with a power factor above 0.95 under any operating conditions. This eliminates the need for input harmonic filters or power factor correction, and completely removes any common-mode voltages from being

imposed on the motor. The VFDs supply an output voltage so close to perfect sine-wave shape that the older chiller motors can be operated without any additional stress, thus eliminating dV/dt , overheating, and increased torsion.

Through MGM's monitoring capabilities, the team was able to test the chillers and drives, pushing each to the extreme without damaging or compromising the equipment.

The entire chiller solution allowed MGM to reduce costs through increasing system reliability, reducing downtime, reducing equipment setup time, lowering maintenance costs, ensuring smoother operations, increasing energy savings, and managing power control. The net result of these improvements is increased profitability for MGM. **|cse|**

By John Leslie, manager of building automation, MGM Resorts International, Las Vegas.