Load-shedding ballasts were installed at the Spence School in New York City in a demonstration project funded by NYSERDA. The ballasts were linked to a building management system, allowing the school to reduce lighting energy consumption by 30 percent when desired. At the click of a button on a laptop or mobile phone, Spence School can now temporarily reduce demand by 261 kW during emergency grid events. "The success of this project shows the huge potential of our new Demand Response Platform," says Stephen Lynch, president of ACE Energy Company, Inc. "This technology will not only reduce Spence School's energy cost but will also make the world a greener, more energy-smart place." Photo courtesy of OSRAM SYLVANIA, Inc.

Load Shedding Ballasts Enable Demand Response Retrofits

by Craig DILOUIE

Demand is the sum of all electric power required to run a building's equipment currently in operation. As equipment is turned on and off, demand rises and falls. Peak demand is the highest level of demand recorded by a demand meter during a given time period. This is the most expensive power the utility has to produce, as the utility must build sufficient capacity to satisfy these short periods or buy the power needed from other sources at market rates. Many utilities pass these costs on to their customers as a demand (kW) charge added to charges for energy consumption (kWh). According to ConsumerPowerline, in fact, demand charges can represent 40 percent of electric utility costs.

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Utilities would rather have their customers reduce their demand peaks instead of their entire load profiles, so many utilities, Independent System Operators (ISOs) and other power providers offer incentives to curtail non-critical loads either at scheduled times or on request during a grid emergency. CAISO (California), ERCOT (Texas), PJM (Northeast), NYISO (New York) and ISONE (New England) are examples of organizations offering demand response programs. These demand response programs give utilities an alternative to building more power plants or buying expensive power from supplemental sources.

Even without tapping into such a program, building owners can reduce costs by shaving their peaks using a strategy called load shedding, either on a schedule or in response to price signals.

Lighting provides good opportunities for load shedding because it usually occurs when daylight is available and is available for year-round demand reduction. Assuming the building's hours of operation will not change, building owners have two options to reduce peak demand with lighting. First, they can shut off non-critical lighting loads either manually (through master switches accessible to the facility operator) or automatically (through a scheduling system such as an intelligent relay panel), and either by space or using some type of bi-level switching scheme. Second, they modify their lighting to be step-switching or dimmable with a central point of control.

Because people need light to work, dimming is preferable to ON/OFF switching in areas lacking daylight. Generally, dimming is also preferable to step-level switching (or ON/OFF switching with daylight available) in occupied spaces in which the occupants perform stationary or critical tasks, such as offices, where changes in light output should be unnoticeable to a high degree. In addition, dimming is more suitable when light fixtures are in the normal field of view and/or lamps are visible to occupants.

How low can you go with dimming? The Lighting Research Center conducted research in which it found that a 40 percent reduction in light levels during (and limited to) a load shedding event will not affect lamp life and is acceptable to most building occupants. LRC found that they could dim the lighting by as much as 40 percent for brief periods without upsetting 70 percent of the building's occupants or hindering their productivity. While 30 percent dissatisfaction sounds high, LRC also found that 90 percent of the occupants accepted the reduction in light levels when they were told that it was being done to reduce peak demand.

For dimming to occur, we need a dimmable ballast. Manufacturers offer various solutions that can realize this strategy, generally classified as low-voltage (respond to signal traveling along low-voltage wiring) or line-voltage (respond to signal traveling along the power line). Low-voltage solutions enable integration with other control strategies such as daylighting control and scheduling. Line-voltage solutions are well-suited for retrofit because no low-voltage wiring needs be installed, just a signal transmitter.

Low-voltage solutions, both analog and digital, include SYLVANIA's QUICKTRONIC POWERSENSE ballasts (continuous dimming), GE's UltraStart (continuous dimming) and UltraMax Load-Shedding Instant Start ballasts (bi-level or 0-10V dimming ballast, 1.18 to 0.71 ballast factor, a 40 percent reduction in both power and light output), Advance's Mark 7 and ROVR ballasts (continuous dimming), and Universal's SuperDim, DaliPro and AddressPro (continuous dimming) and Ballastar ballasts (step-switching and dimming).

Line-voltage solutions include Universal's DemandFlex ballasts and Demand Control Lighting (DCL) control system (enabling individual circuit control so that the load on some circuits can be reduced further than on other circuits—or turned off), Advance's Mark 10 ballasts (continuous dimming), GE's UltraMax Bi-Level Switching or 0-10V Load Shed Instant Start ballasts (step-switching from 1.18 to 0.71 BF), and SYLVANIA's PowerSHED ballast (step-dimming with a one-third reduction in power, operates with a control signal transmitter, located at the control panel, capable of serving hundreds of ballasts).

Some of these solutions can work as stand-alone load-shedding options or can be integrated into a larger control solution that includes load shedding/demand response as well as other strategies such as scheduling, daylight dimming, personal dimming and occupancy sensing.

Overall, load-shedding ballasts offer another retrofit option for NALMCO® members and a means of aiding customers to participate in utility demand response programs.

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