



Figure 2. While HID electronic ballasts can save energy, they are especially useful for applications requiring good color stability, such as this grocery store. Photo courtesy of GE Lighting.

EYE Lighting, which allows users to continue using mercury lamps by enabling them to operate independently of eliminated mercury ballasts. The product operates very similarly to a 175W mercury lamp, with about 10 percent less light output, and operates on a pulse-start metal halide ballast. Pending energy legislation in Congress, however, would eliminate mercury vapor lamps starting January 1, 2016. Users would presumably replace any last remaining mercury lamps with other suitable HID lamps should this legislation become the law of the land.

Another example of energy legislation affecting HID lighting is the Energy Independence and Security Act of 2007. Starting in 2009, the Act began requiring a minimum efficiency for ballasts sold in new 150-500W metal halide light fixtures, with some exceptions. The legislation has increased demand for pulse-start lamps. Metal halide is 50 percent of the HID lamp market so there is a big potential for savings if efficiency can be improved.

The most efficient choice is electronic ballasts. Not only are these ballasts highly efficient, they are typically smaller, lighter and provide superior lumen maintenance and color stability. Sylvania's Quicktronic metal halide electronic HID ballast, for example, operates at a ballast efficiency of 94 percent, generating up to 25 percent energy savings over magnetic ballasts. The product utilizes a low-frequency square wave shape, popular for small-wattage ceramic metal halide and now expanding into higher wattages, which enables operation of both quartz and ceramic lamps in 250-350W, and producing less wear and tear on the lamps. If matched with ceramic lamps, the system is competitive with T5HO and T8HO in terms of light output and wattage, according to Sylvania.

California has taken the Energy Independence and Security Act rules and made them even tougher with Title 20 regulations covering 150-500W metal halide fixtures, with some exceptions, that went into effect January 2010. California is interesting for two reasons. First, it is the eighth largest economy in the world and the largest state economy in the United States. Second, it is a bellwether for energy legislation trends. Basically, the ballast must be even more efficient or use lighting controls such as an occupancy sensor that reduces lamp power by at least 40 percent within 30 minutes of vacancy, or daylight harvesting controls that reduce lamp power by at least 40 percent in response to available daylight. The intent appears to push end-users towards use of electronic ballasts and controls. As a result, we can expect growth in demand for higher-efficiency ballasts, both electronic and magnetic, and ballasts capable of bilevel switching.

Regarding electronic ballasting and control, why not have it both ways? Some electronic HID ballasts are dimmable, such as GE's UltraMax eHID Ballast, which operates at 94 percent efficiency and can dim to 50 percent of lamp power. It uses low-frequency square wave technology to operate both quartz and ceramic metal halide lamps in 250-400W and also avoid short lamp life and poor lumen maintenance associated with high-frequency lamp operation. And it is dimmable, enabling the ballast to operate reliably with energy management strategies such as daylight harvesting and demand response.

Alternatively, users in California can stick with magnetic ballasts that are more efficient, as the energy standards are technology neutral. In some applications, magnetic might be preferable, such as in applications where electronic ballasts are not yet available or where the alternative has a form factor requiring modification of the light fixture. In addition, electronic ballasts are still proving themselves in extreme environments—high temperatures, surges, etc.—in which magnetic ballasts have already proven themselves as a rugged, reliable option. One example of a Title 20-compliant magnetic ballast is the Philips Advance 250W magnetic pulse-start ballast with a 90 percent efficiency and form factor allowing instant availability to those who want to specify this ballast, as it drops into any 250W fixture design. What's more, it has an "A" UL Temp Code, meaning the fixture manufacturer does not have to resubmit their product to UL.

The overall trend towards higher efficiency and controls will increasingly focus demand on electronic ballasts and controls, however. Electronic ballasts,

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What's New in Lamps and Ballasts: HID

by Craig DiLouie

Craig DiLouie, principal of ZING Communications, Inc. (www.zinginc.com), is a consultant, analyst and reporter specializing in the lighting and electrical industries, and a regular contributor to LM&M.

At LIGHTFAIR 2010, Howard Wolfman, formerly with Sylvania and now a consultant with Lumispec Consulting, and I had the pleasure of presenting the venerable "What's New in Lamps and Ballasts" seminar. We sent out questionnaires to a large number of lamp and ballast manufacturers and incorporated the responses into the presentation to provide a roller skate tour of recent lamp and ballast innovations within the context of current trends. The event is always well attended and this year we had more than 450 attendees.

In the fall issue of *LM&M*, we covered fluorescent lamps and ballasts. In this article, we're going to talk about HID. As with fluorescent, HID also is being influenced by energy codes and legislation. For example, the latest energy codes cover virtually every outdoor lighting application, and HID lighting is now being targeted by efficiency legislation. Meanwhile, smaller HID sources are proving highly competitive in track lighting and similar applications where both high efficiency and a point source is needed.

As a result, HID lamps and ballasts are undergoing several significant trends, including higher efficiency, smaller size and improved color.

Large-Wattage Systems

We are in an era of regulated energy efficiency; legislation is a major driver in both supply and demand for HID lighting. Take mercury vapor, for example. Mercury vapor is the least efficient HID source and is not specified very often anymore, but still has a large installed base. The Energy Policy Act of 2005 eliminated manufacture and import of these ballasts starting in 2008.

It's time for owners of these systems to start upgrading them to high-pressure sodium or white light if they have not already. In some applications, however, the end-user may want or require the green spectrum of mercury vapor lighting, which can render multiple hues of green well in landscape lighting applications. For these situations, there are products such as Moon Pulse from

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Figure 1. HID electronic ballasts offer energy savings and improved lamp performance compared to magnetic systems. Photo courtesy of GE Lighting.



currently representing about 15 percent of ballast shipments by dollar volume, are common for operation of small-wattage pulse-start metal halide lamps. In larger sizes, offerings are limited, but growing. And with growth comes innovation in addition to greater availability.

Here's an example of innovation: remote ignition capability up to 50 ft. from the socket. This feature of Metrolight's SmartHID ballast supports retrofit applications where previously the ballast was required to be placed inside a fixture envelope designed for magnetic ballasts, creating an environment conducive to high failures due to heat. Remote installation of the ballast, which operates 175-450W pulse-start metal halide and 100-400W high-pressure sodium lamps, now allows for the ballast to be placed away from the heat source, stabilizing the operating environment of the system. What's more, the ballast also features front-end surge protection and arc-to-ground protection, enabling reliable performance for outdoor applications that have issues with unstable power fluctuations.

Another innovation is GreenTek Lighting's Ceramivision 250, an electronic HID ballast, designed for 250W ceramic metal halide lamps, that is compatible with the DALI digital communication protocol. This provides flexibility to lighting designers interested in networking HID systems with other lighting systems.

While on the subject of larger-wattage HID, here's an option for existing buildings where the owner does not want to replace the ballast no matter how compelling the case for replacement is, but would be open to a lamp retrofit that saves energy and also improves color quality: Philips' new Energy Advantage Ceramic Metal Halide Lamps with All-Start technology, a direct retrofit to 250W and 400W lamps operating in any orientation on either probe-start and pulse-start metal halide ballasts. Benefits include energy savings up to 18 percent with an improvement in color quality (85-90 CRI) and rated life of 20,000 hours.

Small-Wattage Systems

While larger lamps are expected to be a growth market for electronic HID ballasts, most electronic ballasts are designed for lamps smaller than 150W. The biggest trends in this segment have been continuing miniaturization, improved color quality and other innovations that are increasing availability of ceramic metal halide as an alternative to halogen.

Due to the low cost of miniaturization, electronic HID systems continue trend smaller towards a goal of making the ballast "disappear," driving smaller fixture designs, reducing ceiling clutter and opening new track lighting and other applications for low-wattage ceramic metal halide systems as an alternative to incandescent and halogen sources. With extremely compact components, ceramic metal halide fixture designs are approaching the form factor and size of low-voltage MR16 halogen systems.

Here's an example: Sylvania's Metalarc Powerball 15W T4 CMH and Super Mini Ballast. The 15W lamp produces comparable light output to a 12V 50W MR16, providing savings of up to 32W per lamp, and 25 percent energy savings compared to 20W ceramic metal halide systems. This product allows HID to be substituted for lower-wattage halogen lamps where the 20W system might be considered too bright.

Another example is GE's eHID Micro ballasts in one 20W and two 39W models. One of the 39W models is the same size as the highly compact 20W model, opening up new applications in this larger track lighting segment. And the Micro Series by Universal Lighting Technologies measures about 1/16 the size of a standard electronic HID Ballast, with the smallest case configuration being 2.99 in. L x 1.3 in. W x 1.1 in. H.

Smaller-wattage ceramic metal halide lamps must compete with halogen in a variety of environments where color is important. Of particular interest is the ability of the light source to render saturated reds, requiring a high R9 factor. (The color rendering index is based on an average of the R1 to R8 palette. R9 through R14 are saturated colors commonly found in retail environments. Halogen sets the bar with an R9 of 100.) Many new low-wattage ceramic metal halide lamps are claiming high R9 values—such as the EYE Cera Arc Natural Red from EYE Lighting, which has an R9 rating of 80—rendering reds well, ideal for display lighting in food, flower, clothing and other applications.

Meanwhile, self-ballasted ceramic metal halide continues to improve as a category, making this technology more competitive against the incandescent and halogen sources it is intended to replace. Here are two examples from Sylvania: a PAR30 long-neck self-ballasted CMH and a self-ballasted PAR38 now available with a unique 15-degree beam angle. This goes to show it is not always about providing equivalent performance for less energy—often, technology enables manufacturers to offer better performance as well.