

Traffic Signal Conversions Get Green Light

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The convergence of light emitting diode (LED) advancements, new federal energy mandates and the development of special funding programs have given the traffic signal market a green light for growth.

Historically, inexpensive but inefficient incandescent bulbs lit up traffic signals. In the late 1990s, utility companies around the country started offering incentive programs to retrofit systems with efficient lamp technologies. Communities in energy restrictive areas, such as California, Arizona, Colorado, Minnesota and Pennsylvania, led the charge to convert to LED technology.

New federal requirements

In 2000, the Consortium for Energy Efficiency's (CEE) Traffic Signal Initiative was launched to increase installations of energy-saving traffic signal replacements and expand awareness of LED technology as a high-efficiency lighting source. In helping establish an industry-accepted definition of high efficiency, CEE adopted the Energy Star traffic signal specification.

Earlier this year, the Department of Energy (DOE) adopted new minimum standards for traffic lights: "Pursuant to Section 135(c)(4) of EPACT 2005, new subsection 325(z) of EPCA (42 U.S.C. 6295(z)) now requires that traffic signal modules and pedestrian modules manufactured on or after January 1, 2006, meet the performance requirements specified in the Energy Star program requirements for traffic signals, version 1.1, which preclude the maximum wattage and nominal wattage of these modules from exceeding certain specified levels. See 70 FR 60417; 10 CFR section 431.226(a)."

Although not restricted to any particular LED technology, the purpose of the specification is to provide the minimum performance requirements for the replacement of 8- and 12-inch LED vehicle traffic signal

modules included in the "Vehicle Traffic Control Signal Heads," published in the most recent Equipment and Materials Standards of the Institute of Transportation Engineers (ITE). These standards also apply to any new modules.

Communities that have not voluntarily upgraded to LEDs now are tasked with securing resources to make the conversion. According to Energy Star data, the market potential is large and growing daily. Although there is no current data to determine exactly how much of the market has been converted, across the country there are approximately 7.5 million vehicle traffic signals (circular) indications, 1.5 million arrow indications and 2 million pedestrian indications (hand/man combinations).

New budget approach

The change to energy-efficient technologies requires a new approach to state, county and municipal planning and budgeting because, prior to LEDs, most jurisdictions re-lamped incandescent systems on a semi-annual or annual basis, according to Tom Brahms, executive director and CEO of the Institute of Transportation Engineers (ITE).

"A significant portion of the conversions to date from incandescent to LED were funded by rebates from utility companies. With the DOE mandate, there's a new reality that many of the current LED arrays are now in need of replacement, and the cost to do so is significant and often not budgeted. On the positive side of LEDs, there is a power-consumption savings and a labor or contractor savings by not having to relamp the intersections once or twice a year," Brahms said.

Since 1998, the prices for LEDs produced by diode manufacturers have dropped consistently, but they still are considerably higher in cost than conventional incandescent bulbs. While the cost of technology has come down, power prices have risen, making now an ideal time to perform conversions.

"The latest ITE-compliant material ranges from around \$50 to \$100 for vehicular modules, to over \$200 for technology such as the countdown pedestrian signals," said Mark Engel, management analyst for Republic Intelligent Transportation Services, a Novato, Calif.-based electrical contractor.

"Energy-wise," said Mark Lyons, senior traffic engineer with the Arkansas Highway and Transportation Department (AHTD), "LEDs use about one-tenth the energy. For instance, in a signal that uses 11 amps with incandescent bulbs, you drop back to approximately 2 amps with LED."

Despite the higher initial cost of LEDs, energy savings far outweigh the investment and offer the potential to save local governments a tremendous amount of energy and money. According to the DOE, a 12-inch LED signal uses 25 watts or less, compared to 150 watts for an incandescent bulb in a comparable application, depending on size, color and type. In fact, DOE data indicates that if all the nation's traffic signals were converted to LEDs or a similar energy-efficient technology, 3 billion kWh of electricity would be saved annually.

"LED signals do not 'wash out' in the morning and afternoon when the sun is shining directly into them, and they've proven to be very reliable. We have experienced only seven failures out of hundreds in the field since we started the project two years ago," said Perry Franklin, public works department traffic division superintendent, Fayetteville, Ark.

Additionally, LED traffic signals typically last an average of five to seven years, compared to two to three years for incandescent bulbs. However, ITE is conducting research to more accurately determine when LEDs need to be replaced.

"LED light output gradually diminishes, and on occasion, there are 'strings' of LEDs that fail. There is a need to determine at what point the LED array [signal head] no longer provides the light output that motorists need to process the indication and react by taking the correct action. And, needless to say, the motorist is heterogeneous with different vision and reaction times, and all licensed motorists need to be taken into account," Brahms said.

Successful projects

Many larger communities have dedicated budgets to purchase LED traffic signals. However, smaller communities have not been able to afford the upgrades without state assistance.

In 2006, the Arkansas Energy Office set aside funding for LED traffic signal installations. In partnership with the AHTD, a grant totaling \$346,000 allowed for the conversion of 97 intersections in 52 communities ranging from Little Rock to towns with only one signalized intersection. The grant covered the installation, but maintenance will fall to the municipalities.

AHTD conducted a survey to identify retrofit locations and coordinated the bid and installation process through a procurement contract. According to Lyons, the procurement contract versus the fixed contract allowed for conversion expansion. Lyons said the total cost of intersections averaged \$3,000 for furnishing and installing eight three-section stop/go signal heads and two five-section turning signal heads.

"We had a certain number of dollars, and we wanted to get as much coverage as possible. With an open-ended structure, we could write the contractor a purchase order for all the new locations, which included a fee for mobilization and the signal heads," Lyons said.

For the Arkansas project, Republic Intelligent Transportation Services has purchased and installed hundreds of thousands of LED traffic-signal retrofit kits for more than 100 public agencies since 1998.

In 1995, when Portland, Ore., first looked at the LED option, green LEDs were not available, and red LEDs were expensive. In 2001, LED prices had dropped by more than half, and two local electric utilities, PGE and Pacific Power, were offering special incentives for energy-efficiency projects completed before 2002. The price drops and utility funding allowed for the replacement of nearly all the red and green incandescent traffic signal lights. After a massive three-month retrofit of 13,300 signals, the annual energy and maintenance savings was \$400,000, and net payback was less than three years.

Even at the lower LED prices, retrofitting Portland's traffic signals was projected to cost \$2.2 million, but like a lot of cities, the funds were not allowed for a project of that magnitude. A leasing agreement spread the capital costs out to more closely align with the energy and maintenance savings of the retrofit.

The terms of the lease allowed the city to use contracted electrical labor with Portland, Ore.-based Electrical Construction Co. to complete the project before the end of 2001 and still claim rebates from the utilities. According to Bill Kloos, signals and street lighting division manager for the Portland Office of Transportation, the lease option also allowed the city to benefit from a state business energy tax credit that amounted to 35 percent of the energy project's total cost.

"Since the completion of the project, the state of Oregon has revised its administrative rules to allow the sharing of tax credits without a lease arrangement. Today, any equipment supplier or installation contractor can provide a tax credit 'pass-through' equal to 27 percent of the project's cost," Kloos said.

Contracts and certifications.

The bidding process for securing retrofit and/or new construction projects typically follows the exact procurement process for LED technologies as they have for previous bid.

"It's just another project," Kloos said. Prequalified traffic signal contractors can follow bidding opportunities online for nearly every state's projects through a listing of formal solicitations.

"To get on the bidders' list, we ask contractors to fill out an application on our Web site. Once they're on the list, we automatically send out bid information. The same Web page lists the projects we're bidding," Lyons said.

Although the conversion of conventional technologies to LEDs does not typically require a special certification, Kloos and Republic ITS regional manager, Andrew Poster, P.E., T.E., P.T.O.E., do not recommend this type of work to contractors who do not have specific expertise and field experience.

“Completing a LED retrofit project is a complex endeavor involving heavy liability, mobilization costs, thorough traffic control and expert staff. Many of today’s traffic signals are highly sophisticated systems, including coordination, communications, radar and video detection, and a wide variety of controller technologies,” Poster said.

One training source Poster recommends—for contractors who have never performed traffic signal work—is the International Municipal Signal Association, which focuses on educational programs for traffic signals, signs and markings, work-zone traffic control, municipal and interior fire alarm systems, public safety dispatcher, and flagging.

“If a company doesn’t seem to have a signal background, we’re not going to prequalify them for traffic signal contracts with the city of Portland,” Kloos said.

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