



COMMONWEALTH *of* VIRGINIA
Department of General Services

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November 13, 2017

The Honorable Emmet W. Hanger, Jr.
Co-Chairman, Finance Committee
Senate of Virginia
Post Office Box 2
Mount Solon, Virginia 22843-0002

The Honorable S. Chris Jones
Chairman, Appropriations Committee
Virginia House of Delegates
Post Office Box 5059
Suffolk, Virginia 23435-0059

The Honorable Thomas K. Norment, Jr.
Co-Chairman, Finance Committee
Senate of Virginia
Post Office Box 6205
Williamsburg, Virginia 23188

Dear Senators Hanger and Norment and Delegate Jones:

The Virginia Department of General Services submits this report pursuant to Item 80 H. in the 2017 Virginia Acts of Assembly which addresses maximizing the use of energy efficient light-emitting diode (LED) lighting when new or replacement outdoor lighting is installed at state facilities. The Virginia Department of Transportation was consulted in the creation of this report. The Department of Transportation roadway lighting criteria and utilization are significantly different from the Department of General Services; therefore the reports are presented individually.

DGS

New Light Fixtures:

The Virginia Energy Conservation Code (VECC), section C405.6 Exterior lighting (mandatory) requires new exterior building grounds lighting, other than low voltage landscape lighting, to be energy efficient. All luminaires operating at greater than 100 watts are required to have a luminous efficacy¹ of 60 lumens per watt unless the luminaire is controlled by a motion sensor or is otherwise exempted under the Virginia Energy Conservation Code, section C405.6.2. The 60 lumens per watt requirement eliminates incandescent lighting from use in all new exterior lighting applications.

Code compliant options available for new installations to meet new exterior lighting applications under the VEC include light-emitting diode (LED) and high pressure sodium or metal halide (HID).

Existing and Replacement Light Fixtures:

An informal survey of state-owned outdoor lighting identifies high intensity discharge (HID) lighting, rather than incandescent as the predominant lighting type currently utilized at state agency facilities.

When comparing LED and HID lighting efficiency, LED's higher system efficacy and slower lumen depreciation combine to provide substantially higher overall efficiency with LEDs compared to HID sources.

The Virginia Department of General Services has established a policy in its Construction and Professional Services Manual that encourages the use of the most efficient and cost effective lighting replacement device in existing light fixtures that contain incandescent bulbs. Consistent with Executive Order #31 issued by Governor McAuliffe in 2014 and Budget Amendment Item 80 #1(c) enacted by the 2017 General Assembly directing the use of LED technology when installing new or replacement outdoor lighting, the Department of General Services (DGS) has replaced approximately 75% of the DGS Capitol Square outdoor lighting. Replacement lighting on Capitol Square grounds, open parking areas and in parking decks resulted in an estimated savings of 266,500 watts of installed load or \$2,848/year³. Cost savings are low due to outdoor lighting consuming energy at night-time, during off-peak load time periods; the Commonwealth's electricity rate service schedule and off peak savings combine for a minimal effect on the overall electric cost.

In summary, consistent with state law and direction from both the Governor and the General Assembly, the Department of General Services is transitioning exterior lighting to energy efficient LED type. Three-quarters of Capital region exterior lighting that falls under the purview of DGS has been converted to LED. Additional conversion projects are underway or in planning.

VDOT

Background

The Virginia Department of Transportation (VDOT) maintains approximately 50,000 outdoor lights within the VDOT right-of-way, which includes roadway lights (typically on freeways and interchange ramps, or mounted atop traffic signal support poles); parking-lot lights within VDOT-owned park and rides, rest areas/welcome centers, and weigh stations; underbridge lights; and guide sign illumination lights. Additional VDOT-owned outdoor lights are located at VDOT facility parking lots (District, Residency, and Area Headquarters), inside tunnels, and attached to structures near airport runways or over navigable waterways for aerial/marine navigation purposes.

Pole-mounted and post-top lights on arterials, collectors, and neighborhood streets are typically owned and maintained by the locality or by the electric utility, not VDOT.

Most existing VDOT-owned lights use High Pressure Sodium (HPS) or other types of High-Intensity Discharge (HID) technology, however, VDOT is implementing Light Emitting Diode (LED) lighting as described herein.

The benefits of switching to LED lighting include:

- Energy savings benefits: LED lights consume approximately 50% less wattage than their comparable HPS counterparts, thus reducing VDOT's energy bills and the agency's carbon footprint.
- Operational benefits: HPS lights typically must be replaced every five years. In contrast, VDOT installs LED lights that are warrantied for ten years and are expected to last 15 or more years before requiring replacement. VDOT light replacements can be expensive due to the need to close down shoulders or lanes and mobilize crews with bucket trucks to the scene. By switching to LEDs, VDOT can significantly reduce its future operations & maintenance expenditures, reduce the delays and the safety risk to motorists and VDOT employees/contractors that arise whenever VDOT must close down a shoulder or lane.
- Safety benefits: LED lights use a crisper, whiter light than HPS lights which have a yellowish hue. This allows drivers to better distinguish dark objects at night, and allows emergency responders to better identify vehicle colors. VDOT is currently developing policies for appropriate LED Correlated Color Temperatures (CCTs) that balance the need for maximizing benefits to roadway users while minimizing potential impacts to residents and the environment.
- Lighting controls: LED lights can be connected to a Lighting Controls System (LCS) which allows owners to remotely monitor, manage and dim LED lights. Dimming of HPS lights is not feasible, and thus using LCS with HPS lights will not provide the maximum benefit for lighting management. Advantages of LCS for outdoor lighting include:
 - Additional energy efficiency – approximately 15% additional energy efficiency above and beyond the efficiencies achieved by switching to LED technology.
 - Remote monitoring – LCS allows users to easily manage inventory, receive automatic notification of outages, and track energy consumption to a high degree of accuracy. With traditional HPS lights, VDOT must periodically do a labor-intensive drive-by assessment to identify outages.
 - Remote operation – ability to remotely turn on, turn off, or dim the lights.

VDOT LED Migration – Current Status

VDOT has taken the following steps to maximize the use of LED light fixtures for outdoor roadway lighting:

- In 2015 the Virginia Transportation Research Council (VTRC) completed a multiyear evaluation of LED lighting. This study included a field evaluation of multiple LED

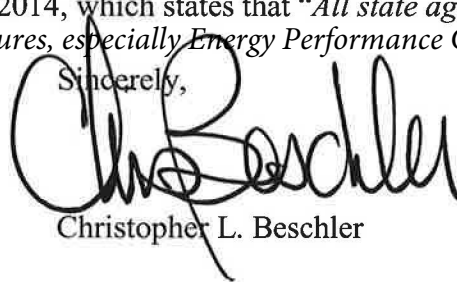
manufacturers as well as traditional HPS fixtures.² The study concluded that LED lighting achieves the energy savings promised by manufacturers, and will result in a Return on Investment (ROI) between 3.25 and 5.76 over a 25-year period. This study, and other LED research works were the basis for development of VDOT's standard specifications for conventional pole LED lighting.

- In June 2017, VDOT's Chief Engineer issued a memorandum initiating VDOT's LED Strategic Migration Program. This program includes the following elements:
 - Directs that LEDs shall be used for all roadway projects advertised after the date of the memorandum, and that contracts already in advertisement or construction should be amended whenever feasible to use LED lighting.
 - Directs that existing lights be replaced with LED lights when they reach the end of their existing service life, as budgets allow. All future lighting maintenance contracts will be structured to facilitate LED implementation. Districts are also encouraged to develop contracts for comprehensive lighting replacement.
 - Development of additional technical guidance for the proper design and installation of LED lighting.
- VDOT has already implemented LED lighting at numerous locations, including:
 - All lights in VDOT's Staunton District
 - Various sections of Richmond-area Interstates, including the I-95 James River Bridge and the I-64 Shockoe Valley Bridge
 - Three recently-reconstructed I-95 rest areas/welcome centers in Caroline and Greensville Counties
 - The Telegraph Road Park & Ride in Northern Virginia

Replacement of Existing HPS Lights

VDOT is currently considering options for implementing large-scale replacement of existing HPS fixtures with new LED fixtures. One potential option under consideration is an Energy Performance Contract (EPC) as defined in § 11-34.3 of the *Code of Virginia*. The use of an EPC to deliver energy savings improvements would be consistent with Governor Terence McAuliffe's Executive Order #31, issued in October 2014, which states that "*All state agencies should proactively pursue energy efficiency measures, especially Energy Performance Contracting, to reduce energy consumption.*"

Sincerely,



Christopher L. Beschler

¹ The study is available at: <http://vtrc.virginiadot.org/PubDetails.aspx?PubNo=16-R6>

² Luminous efficacy is a measure of how well a light source produces visible light. It is the ratio of luminous flux to power, measured in lumens per watt in the International System of Units (SI).

³ Estimate based on 2,665 lighting units, 100W LED vs 200W HID = 266,500 watts. Therefore, 266.5 kilowatts X 12 Hr./day X 365 Days/year X 0.244 cents/kWh X \$/100 cents = \$2,848.14