

## **e2 (Energy Efficient) Street Lighting Program Update**

### **EXECUTIVE SUMMARY**

The City of Calgary has completed a planned four-year project replacing approximately 84,000 street lights across the city with new energy efficient LED (light-emitting diode) lights a year and a half ahead of schedule and on budget. At a total cost of \$32.6 million to complete, The City of Calgary is expected to save approximately \$5 million a year in electricity consumption as a result of this capital project. Advancing the schedule for this project allowed The City to realize operational savings of almost \$7 million sooner than planned.

The conversion was completed in August 2017 to achieve cost savings and reductions in energy usage. The change to LED fixtures will enable The City to reduce electricity costs by an anticipated \$50 million over a ten-year period. The energy savings from this project will be reinvested in lifecycle maintenance of street light infrastructure in Calgary.

#### **ADMINISTRATION RECOMMENDATION:**

That the SPC on Transportation and Transit recommends that Council receive this report for information.

#### **RECOMMENDATION OF THE SPC ON TRANSPORTATION AND TRANSIT, DATED 2018 FEBRUARY 08:**

That Council receive report TT2018-0076 for information.

### **PREVIOUS COUNCIL DIRECTION / POLICY**

On 2012 December 03, Council approved the recommendations provided by Administration in report TT2012-0343:

1. Direct Administration to provide an update on street light trials, technologies, and proposal for a business case and implementation plan to the 2015 to 2017 business plan cycle, and report back through SPC on Transportation and Transit no later than 2013 December; and
2. Direct Administration to continue to proceed with street light trials and implementation of various technologies, within existing budgetary allocations.

On 2014 January 13, Council approved the recommendations provided by Administration in TT2013-0798:

1. Receive this report for information; and
2. Direct Administration to report back to SPC on Transportation and Transit with a business case and project plan for a City-wide LED conversion no later than 2014 July.

On 2014 July 28, Council approved the recommendations provided by Administration in TT2014-0473. The approved recommendations included that Council:

1. Direct Administration to bring forward a capital funding request of \$32 million in the 2015-2018 Action Plan for city-wide LED conversion;
2. Direct Administration to continue to investigate all funding options, including the possibility of grants, to provide funding for the project; and
3. Direct Administration to report back to the SPC on T&T by 2018 with a program update.

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### **BACKGROUND**

Roadway lighting is part of a safe and efficient road network. It provides night-time visibility of potential hazards for pedestrians and motorists. The City of Calgary follows the lighting level standards of the Transportation Association of Canada (TAC) and the Illuminating Engineering Society of North America (IESNA). These guidelines establish appropriate lighting levels, visibility levels and uniformity of lighting levels for a given class and operational characteristics of a roadway (e.g., traffic volume, speed and potential for pedestrian conflicts).

The City of Calgary continuously investigates new technologies to ensure that Calgary's street light system is efficient, effective and sustainable. There are approximately 96,000 light fixtures owned and maintained by the Roads Business Unit (Roads). There are over 7,000 street lights that the City is expected to assume ownership of through subdivision growth in the next few years. Street lights are also maintained by Calgary Parks and Calgary Transit but the majority of The City's inventory is managed by Roads.

To address Calgary's long-term vision for an efficient and sustainable transportation system, this project was initiated to explore the opportunity to reduce the cost to operate Calgary's street light system which was a primary driver behind introducing more efficient technologies to light Calgary's roads. LED technologies were considered the most feasible technology to achieve the greatest energy and maintenance cost savings.

The Roads Business Unit, with the support of the Corporate Energy Management Office, extensively researched the advancements in light emitting diode technologies prior to the commencement of this project and conducted trials in multiple Calgary communities. Following the approval of the project business case, Council provided direction to proceed with a city-wide retrofit in 2014.

Following the completion of LED trials in 2014, the city-wide retrofit continued in 2015 in southwest Calgary. The initial retrofit locations were in communities already scheduled for lifecycle maintenance of luminaires. In 2016, the project schedule was accelerated at no additional cost due to the availability of contractor crews. This allowed the City to complete the project sooner and realize operating savings. In 2016, the average completion time for crews to complete a retrofit of an entire community was approximately one week.

GE Lighting was selected as the primary supplier of the street light luminaires for the project through a competitive tendering process. CANA Utilities was selected as the primary installer and installed 77,000 fixtures in total. ENMAX Power Services Corporation, Dobbyn Electrical, and Pillar Contracting installed an additional 7,000 fixtures. In total, over 84,000 fixtures were converted to LED.

During the project, the City encountered additional poles that required grounding (safety measure to allow electricity to flow to ground to protect infrastructure) than was originally planned for retrofit due to the age and condition of existing underground wires. The original budget accounted for grounding of 12,000 poles but a total of 25,000 required grounding.

The initial project business case included the replacement of 80,000 fixtures. Due to growth in the street light system resulting from significant residential subdivision growth, changes to servicing agreements and changes to ownership of assets, an additional 4,000 fixtures were included in the city-wide retrofit project.

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There were several efficiencies found during the project that offset additional grounding and growth costs. A specific example was the recycling of high pressure sodium (HPS) fixtures. It was originally anticipated that The City would have to fund the costs to recycle the HPS lights. However, a RFP to recycle existing luminaires was developed and awarded to a local recycling company. Approximately \$160,000 was received for scrap metal for the recycled parts.

In 2013, City street lights consumed over 90 million kilowatt hours (kwhrs) of electricity at a cost of \$12.5 million. By 2017, the projected electricity costs were expected to rise to \$14.3 million if the retrofit had not proceeded. After the successful completion of the project in 2017, street lighting electricity usage was reduced to 54 million kwhrs at a cost of approximately \$8.25 million.

At a total cost of \$32.6 million to complete, The City of Calgary is expected to save approximately \$5 million a year in electricity consumption because of this project. The overall labour costs for the retrofit were approximately \$5.9 million (18% of budget) and materials were approximately \$26.7 million (82% of budget).

### **INVESTIGATION: ALTERNATIVES AND ANALYSIS**

In early 2014, Administration completed LED street light requirement specifications to guide the procurement of LED and lighting control technologies. This document includes best practice guidelines (TAC and IESNA) and experiences from other Canadian jurisdictions.

Calgary's LED specifications are updated annually to keep pace with new development in the industry and to comply with material contracts awarded through MERX to competitively award contracts to service providers. In general, there are no compatibility issues between luminaire manufacturers.

All new subdivisions in Calgary have been designed with LED technology since 2015. The City will continue to procure LED luminaires annually to keep pace with new development and maintenance. The cost to purchase an LED luminaire is now lower than high pressure sodium lights and therefore has not been a concern for developers to incorporate LED into new subdivision design.

Other jurisdictions across Canada that have completed or initiated city-wide retrofits include Edmonton, Lethbridge, Ottawa, Mississauga, and the Halifax Regional Municipality.

### **Stakeholder Engagement, Research and Communication**

During the project, the City received citizen and media inquiries related to the colour temperature of LED lights. This was prompted by reports from a June 2016 American Medical Association (AMA) article that raised a concern that higher colour temperatures above 4000K might have health effects such as impacts to sleep patterns. The AMA article recommended that colour temperatures no greater than 3000K be used for roadway lighting. For comparison, most consumer electronic devices such as smartphones have colour temperatures above 5000K.

The initial specifications of the e2 retrofit project were for fixtures on major roads to have a colour temperature of 4000K or less and residential roads were specified to be 3500K or less. As LED technology is developing quickly, Calgary could quickly adopt the lower colour temperature of 3000K for residential roads. By the end of the project, approximately 47,000 lights were converted to 3000K, 36,000 fixtures converted to 4000K and only a few hundred

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from the early trials were converted to 5000K which are located on major roadways and interchanges. The current specification in Calgary is to install all new fixtures with a colour temperature of 3000K and under.

There have been public concerns regarding flickering lights in Calgary. A flickering light is typically associated with a manufacturing issue such as a driver failure or an issue with poor wire condition. These issues are prioritized as a maintenance item with the City's service provider to be resolved in under seven days.

### **Innovations**

A trial for smart street lights has been initiated in the communities of Copperfield and Valley Ridge to explore the feasibility of using wireless communication to monitor and control street lights. The goals of the project are to monitor outages and flickering lights as a maintenance tool and to proactively identify any over current or voltage issues.

The City has conducted a trial using solar street lights and concluded that permanent solar street lights are not feasible at this point, however The City continues to investigate solar street lights since this is a quickly advancing technology. The City is looking at the potential to use solar street lights as a temporary solution while permanent power is built to specific locations. The locations of possible deployment would primarily be extended light outage locations that require significant infrastructure repair. Other locations are new development areas that have plans for permanent lighting and have significant traffic.

The City recently launched an outage reporting tool in 2016 to enhance the previously used 311 system tracking. This outage map has assisted contract providers to respond to outages quickly while ensuring non-City infrastructure is not serviced. It has also helped to prioritize areas of higher concern like high pedestrian areas, high vehicular traffic areas and flickering lights.

### **Strategic Alignment**

The accomplishments of the e2 LED street lighting project have contributed towards achieving the Transportation Department objectives highlighted in Action Plan 2015-2018, in addition to the Calgary Transportation Plan (CTP), Municipal Development Plan (MDP), 2020 Sustainability Direction (SD) and imagineCalgary (iC) goals including:

- CTP Goal #6: Advance environmental sustainability to reduce the impact of travel on the environment by reducing energy consumption and greenhouse gases.
- CTP Goal #7: Ensure transportation infrastructure is well managed to promote efficiency, preservation, value and a healthy environment.
- MDP Goal: Conserve, protect and restore the natural environment by optimizing infrastructure to reduce the demand for non-renewable energy resources.
- 2020 SD Goal: Sustainable Environment: The protection of air, land and water is recognized as critical for achieving healthy ecosystems within Calgary and this understanding is applied to the way we grow and operate as a city.
- iC Target 67: By 2036, energy consumption is reduced by 30% based on 1999 use.

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### **Social, Environmental, Economic (External)**

LED street lights provide a better-quality light to pedestrians and drivers by emitting light that can improve colour perception, improving the ability for drivers to see and for others to be seen. The City also has a policy to minimize light pollution and energy consumption through the use of lower wattage fixtures which focus lighting to the street level and to recycle all lighting materials.

The transition to LED technology on Calgary roads has minimized light trespass into properties, reducing the negative impacts of street lighting for citizens.

The city-wide LED implementation will reduce operating and maintenance costs for Roads as LEDs have a longer life and consume up to 50% less energy than the replaced fixtures.

### **Financial Capacity**

#### ***Current and Future Operating Budget:***

The conversion to LED street lights will save approximately 40,000,000 kwhrs annually and is expected to save \$5 million annually in operating costs.

Savings resulting from decreased energy expenses and reduced labour costs will be retained by the Roads business unit in the street light operating budget to maintain the network.

#### ***Current and Future Capital Budget:***

The capital costs for this project were \$32.6 million. Funding for the project included a combination of internal reserves and internal financing.

The products used for the project are under warranty for 10 years and have an expected service life of 20 years. Future lifecycle work for these assets will be incorporated into existing capital programs.

### **Risk Assessment**

If this project did not proceed, the City would experience higher energy costs and increased lifecycle costs for the street light network in Calgary.

### **REASON(S) FOR RECOMMENDATION(S):**

Administration has completed this project and is providing a summary update to Council.

### **ATTACHMENT(S)**

1. Attachment 1 – e2 Street Lighting Infographic