

SUBMISSION FOR THE TRANSPORTATION ASSOCIATION OF CANADA'S
SUSTAINABLE URBAN TRANSPORTATION AWARD 2007

Nomination: CITY OF WELLAND & WELLAND HYDRO
LED STREETLIGHT CONVERSION PROGRAM – LIGHTING THE
WAY FORWARD TO A GREEN COMMUNITY

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The City of Welland is centrally located in Southern Ontario's Niagara Region, approximately 30 km from Niagara Falls, Ontario, with a population of just over 50,000. The Council of the Corporation of the City of Welland adopted six Strategic Priorities for 2007 through 2012 that will work towards improving the level of service provided to our citizens and build on the City's valuable assets, resources, and growth opportunities.

With the concerns of hydro consumption in Ontario, energy and power authorities have been encouraging municipalities and the public to become more efficient with their energy uses.

Between 2005 and 2006, the Corporation of the City of Welland and Welland Hydro partnered together to complete the conversion of all existing incandescent traffic signals to Light Emitting Diodes (LED's), in an attempt to reduce power consumption and reduce costs associated with power usage. As an incentive, Welland Hydro was willing to cover 25% of the costs associated with the conversion program. However, due to its success and funding available, this cost increased to 60%.

At the completion of this program, decreases in power consumption and associated costs were identified (*attachment #1*). The cost savings associated with the reduced power consumption has totalled an estimated \$7,668 per calendar year and reduced power consumption by 11079 watts per day. Overall this reduced power consumption specific to traffic signals by 66%.

As a result of the traffic signal conversion success, staff from both organizations began exploring alternative street lighting technology. The City of Welland currently has an inventory base of 6573 streetlights. The total power consumption cost to operate these streetlights, is \$372,676.48 for a one year period. The maintenance and capital costs for the same one year period is an additional \$178,952.85, bring the total cost of operations, maintenance and capital costs to \$551, 579.33.

In 2006, staff began reviewing various LED lighting fixtures from various companies and in December of that year, the City installed its first LED test fixture. This 100 watt LED was used to replace the existing 150 watt High Pressure Sodium (HPS) streetlight. Welland Hydro staff monitored the installation which was completed on a local residential municipal roadway. Welland Hydro ensured the device would be compatible with a retro-fit installation and the City began to move forward with a plan to retro-fit an entire municipal roadway with LED Streetlight fixtures.

In 2007, the City of Welland released a Request for Proposal for the supply of 50 LED streetlights. A total of four companies submitted proposals for review and consideration. Based on the review completed by City staff, City Council approved the contract to Lumecon LLC.

The installation took place on Fitch Street, between South Pelham Road and Prince Charles Drive and is designated as a minor collector roadway (*September video*). In 2005, Fitch Street had the unfortunate distinction to be named in the CAA's top 20 worst roads in Ontario. In 2006, the City of Welland began reconstruction of the roadway, which included designated left turning lanes and the City's first on-street designated Bike Route. Following the path of roadway improvements, it was the decision of staff to designate Fitch Street for the installation of the LED streetlight pilot project (*attachment #2*). On October 31, 2007, Welland Hydro began the installation of 47, 90 watt LED streetlights (*November video*).

Due to the vast attention this project generated, the City of Welland decided to undertake third party validation. In January 2008, GreenTBiz was retained to undertake and administer a third party validation which included a public perception survey and on-site testing. This validation included the undertaking of lighting tests and comparisons of the effectiveness of LED light fixtures and HPS fixtures. A public survey was also circulated to area residents and an on-line survey was made available on the City of Welland's website requesting feedback on various aspects of the new LED streetlights. It was felt that this information would be greatly beneficial to both the manufacturers of the LED's and other municipalities that are interested in pursuing a similar type projects to reduce power consumption.

Between December 5, 2007 and February 23, 2008, an online survey was available through the City of Welland and greenTbiz websites. On January 22 & 23, 2008 a door-to-door survey was conducted. The following is a summary of the public perception survey.

- 74 door-to-door surveys were completed
- 123 online surveys were attempted
- 73% of all respondents preferred the new LED streetlights, 17% preferred the HPS and 10% had no preference
- cited reasons for LED preference included energy savings, cost savings, brighter light, whiter colour and decreases glare
- negative responses included LED not bright enough and decreases visibility, produces a patchy distribution along road, sidewalk and yard.
- 36.5% believed lighting had improved and 36.5% believed it had not improved.
- 44% believed that the quality of light had improved through less glare, improved colour, increased brightness and visibility

On February 21, 2008, Lighting Sciences was contracted by greenTbiz to complete the third party on-site testing (*attachment #3*). In addition, Lighting Science completed lab testing in late January 2008 on both the R20 and R30 models after 1000 hours of use and compared them to a new R20 fixture (*attachment #4*).

In summary, the following highlights the significant findings from the technical validation report:

- The luminaries are classified as Type III, very short.
- As the luminaries have a full cut-off rating, they are Dark Sky compliant.
- Lumen output is relatively low for a roadway luminaire.
- Luminaire contains 24 CREE XRE LEDs contained within, running at 1 amp
- The correlated colour temperature (CCT) is 7000K, this result in the device being relatively close to daylight.
- There was no lumen depreciation at 1000 hours
- There was an acceptable increase in lumens at 1000 hours.
- The R20 model, the CCT shifted from 5991K to 7005K

Welland Hydro conducted a power consumption report for the streetlight installation. It was determined that the installation of the LED streetlights reduced power consumption by 5255 watts per day and resulted in a yearly savings of \$1816. This figure of savings does not account for savings in maintenance or capital costs. In addition, when you apply it to the entire street lighting inventory, the potential savings for a complete system change would be \$253,980.00 and reduce power consumption by 52% (*attachment #5*). For residents in the City of Welland, an increase of \$250,000 to an operating budget, results in a 1% tax hike.

One area of interest that is regularly reviewed is the capital cost comparisons between LED and HPS products. Initial purchase (capital) costs for LED can exceed HPS costs by double or triple the amount. It is projected that the lifespan of an LED fixture is typically 15 years, however, due to the cold weather conditions of Canada, it is expected that the LED product could exceed 20 years. When an analysis is completed comparing both products over the potential life span of the LED, substantial savings are expected for both maintenance and energy (\$20,806,141) by utilizing an LED product (*attachment #6*).

Utilizing the City of Welland's inventory of 6573 streetlights, the cost to retrofit the entire system utilizing HPS products (including cobra head) is \$1,446,060 and \$3,615,150 for LED products. The initial capital investment is much higher in cost and would even be higher considering a full exchange of HPS cobra heads would not be completed. However the LED cost is constant and based on the cost savings over the life span of the product, buy back on the initial investment would be between 3 and 4 years.

Interest in this project has been overwhelming. Staff has been contacted by municipalities throughout Canada and the United States. In addition, private companies have been contacting city staff to inquire about the products used and for the potential savings that may be passed to their personal businesses. As with all projects of this nature, there are those that oppose the project and those that support the project.

Many residents have contacted the City or submitted written notices in the local newspaper congratulating the City for their forward thinking in addressing environmental issues and reducing costs. The City has also received tremendous support from the International Dark Sky Association, who was consulted prior to the implementation of this project, and the Niagara Centre, Royal Astronomical Society of Canada. On December 4, 2007, the City of Welland received a Certificate of Recognition from Mr. Peter Love, Chief Energy Conservation Officer, Conservation Bureau.

One of the biggest issues that has surrounded LED lighting, is that the lighting it replaces, fails to meet a similar lighting distribution pattern. Many organizations have adopted the RP-8 guideline for a street lighting policy. In order to meet the requirements of RP-8 in an LED retro-fit application, additional lighting would be required.

In this case, the City of Welland has not adopted a Street lighting guideline and when the existing HPS lighting layout was reviewed, it was determined it failed to meet the RP-8 guideline. Prior to the installation of lighting, staff reviewed RP-8 and discussed the issue with various lighting professionals. It was determined, that there is currently no documentation that states a municipality is legally required to meet the RP-8 guideline. In fact, many municipalities that have adopted "Green" Plans, and simply do not provide lighting on various roadways. Some of examples of this are Kelowna, BC, Palm Springs, Calif., New Symrna, FL.

The City of Welland recognizes this issue, and it is our hope and desire, that the LED Community will understand that for many municipalities this is a main issue that needs to be addressed in order for them to enjoy the benefits of this technology.

The LED industry recognizes that advantages this technology brings to municipalities and the environment. LED technology is advancing at an alarming rate in which changes are occurring in 3 month spans. The time for change has come and the City of Welland is prepared to move forward to assist our environment and provide the most appropriate technology for our residents. We hope that our support of this technology and the great interest it has generated, provide the manufacturers with the incentive to continue to perfect their products so all municipalities can reap the rewards and still meet their adopted standards and policies.

Where do we go from here, the City of Welland is moving forward with plans to adopt LED technology in all new lighting applications. The City of Welland recently updated its Engineering Standards in which all HPS Cobra Head installations slated for new subdivisions will be changed to LED lighting applications.

In addition, the City of Welland is beginning reviewing Decorative Street Lighting Applications and encouraging LED manufacturers to addressing these demands. Currently, to the best of our knowledge, Lumecon has been addressing decorative street lighting in Ann Arbor Michigan, and CRS Electronics (Welland, Ontario) has recently developed and LED engine that can be retro-fitted into decorative devices.

Traffic Signal Power Consumption Report
City of Welland

INTERSECTION LOCATION	INCANDESCENT POWER CONSUMPTION (watts)	LED POWER CONSUMPTION (watts)	REDUCTION IN POWER CONSUMPTION (watts)
Broadway at Canal Bank	1082	364.8	717.2
Dain Ave/Plymouth Rd at Ontario Rd	928	365	563
Denistoun St at Lincoln St	1120	319.8	509.2
Crowland Ave at Lincoln St	1382	356.4	1025.6
First Ave at Thorold Rd	442	316.4	125.6
Hellems Ave at Lincoln St	1262	356.4	905.6
Fitch St at Willson Rd	1262	356.4	905.6
Ontario Rd at Southworth St	1262	356.4	905.6
Crowland at Hagar	1905	581	1324
King at Lincoln	2195	793	1402
King at Ontario	1385	641	744
King at Regent	670	292.4	377.6
Lincoln at Welland Canal	670	292.4	377.6
Ontario at Wright	1262	356.4	905.6
Total	16827	5747.8	11079.2
Costs \$ per month	970	331	639
Costs \$ per year	11640	3972	7668

Cost per month = watts/1000*24*30*.08

Attachment #2



HPS – Fitch
Street



LED – Fitch
Street

Area 1 Illumination Measurements in Lux

Point	¼ of West Bound Lane	¾ of West Bound Lane	¼ of East Bound Lane	¾ of East Bound Lane
Eastern Pole	17.3	17.2	13.1	9.6
4 m	13.4	11.9	9.4	6.9
8 m	6.2	5.8	4.8	3.9
12 m	2.7	2.6	2.5	2.2
16 m	0.8	0.8	1.1	1.3
20 m	0.6	0.6	0.8	1.0
24 m	1.8	1.8	1.9	1.9
28 m	4.2	4.2	4.0	3.4
32 m	9.6	8.9	7.3	6.3
36 m	20.4	18.1	13.9	10.3
Western Pole	25.4	24.2	18.7	13.2
Average	Maximum	Minimum	Max/Min	Average/Min
7.6	25.4	0.6	42.33	12.67

R30 Fitch Street

Area 2 Illumination Measurements in Lux

Point	¼ of West Bound Lane	¾ of West Bound Lane	¼ of East Bound Lane	¾ of East Bound Lane
Eastern Pole	13.8	15.9	14.8	12.4
3.8 m	11.4	11.8	10.7	8.7
7.6 m	5.9	6.1	5.9	5.2
11.4 m	2.9	3.0	3.0	2.7
15.2 m	1.2	1.4	1.5	1.6
19.0 m	0.4	0.6	0.9	1.1
22.8 m	1.2	1.4	1.6	1.6
26.6 m	2.8	2.9	2.9	2.7
30.4 m	6.0	6.2	5.6	4.9
34.2 m	11.2	11.3	10.1	8.3
Western Pole	12.6	14.8	13.8	11.7
Average	Maximum	Minimum	Max/Min	Average/Min
6.3	15.9	0.4	39.75	15.75

R20 Fitch Street

Area 3 Illumination Measurements in Lux

Point	¼ of West Bound Lane	¾ of West Bound Lane	¼ of East Bound Lane	¾ of East Bound Lane
Eastern Pole	15.5	31.4	12.7	6.2
3.8 m	10.9	19.9	11.0	6.0
7.6 m	7.1	12.7	9.3	3.3
11.4 m	3.8	7.2	5.4	2.7
15.2 m	2.5	5.7	5.6	3.0
19.0 m	2.2	5.2	6.2	3.4
22.8 m	2.9	6.2	5.9	3.2
26.6 m	4.7	8.4	5.3	3.0
30.4 m	5.7	8.8	6.0	2.9
34.2 m	9.3	17.2	8.8	5.1
Western Pole	13.0	23.1	10.9	5.4
Average	Maximum	Minimum	Max/Min	Average/Min
8.1	31.4	2.2	14.27	3.68

150 Watt HPS
Clare Avenue

Lab Comparison of Aged and New LED Luminaires

Luminaire	Aged R30 1,000 Hours	Aged R20 1,000 Hours	New R20
Photometric Test Report Number	LSC D096	LSC D095	LSC D097
Light Output (Lumens)	4343	3818	3293
CIE 1931 x	0.317	0.304	0.321
CIE 1931 y	0.341	0.328	0.343
CCT	6233 °K	7005 °K	5991 °K
CRI	71.5%	71.5%	71.3%