



Investment Grade Audit for the Municipality of Temagami

LED Streetlighting Conversion

December 17, 2019

O-1822 P-1039

Primary Contact

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December 17, 2019

Craig Davidson
Treasurer / Administrator
Municipality of Temagami
7 Lakeshore Drive
P.O. Box 220
Temagami ON P0H 2H0

Dear Mr. Davidson,

We are pleased to present this Investment Grade Audit of the streetlight network for the Municipality of Temagami.

We have concluded our detailed analysis of your streetlight system to reflect the proposed upgrade to LEDs based on our GIS/GPS mapping. The existing streetlights to be upgraded to LEDs under the scope of work of the IGA presented are currently consuming 72,446 kWh. By upgrading to LEDs, your projected annual energy consumption will fall substantially to 19,924 kWh, resulting in 52,523 kWh of energy savings, equivalent to 72 % consumption reduction.

The total project cost is \$70,452 including allowances for rewiring, fusing, arm replacement and other installation allowances listed in Section 7.2. – Allowances, in addition to a recommended spare inventory, as depicted in Appendix A. The estimated available incentives are \$3,832 from IESO.

We look forward to moving your project to the next phase. We will arrange for a conference call to discuss the contents of this report in the next few days, but until then please feel free to contact us should you have any questions.

Best regards,



Angelos Vlasopoulos, Chief Executive Officer
avlasopoulos@realtermenenergy.com

1. EXECUTIVE SUMMARY

Technical/ Environmental Assessment	Title	Municipality of Temagami LED Streetlight Conversion
	Baseline	80 HID ⁽¹⁾ Cobrahead fixtures, 10 HID Decorative fixtures Total demand: 16.8 kW Annual energy consumption: 72,446 kWh Annual operating hours: 4,320
	Technology Employed	Smart ready LED Fixtures
	Technology Provider(s)	Cree, Acuity Brands
	Technical Specifications	7-PIN, Smart ready fixtures Color temp: 3,000K Average life ≥ 100,000 hours CRI ≥ 70, IP ≥ IP 65
	Fixture Warranty	10 years
	Annual Energy Savings	52,523 kWh (72%)
Financial Assessment	Financing Scheme	Capital Purchase (Temagami-financed)
	LED Upgrade Project Cost	\$70,452
	Incentive from IESO	\$3,832
	Net Project Cost	\$66,619
	LED Luminaire Life Expectancy	23 Years
	Payback Period	3.8

(1) – High Intensity Discharge

2. INTRODUCTION

RealTerm Energy has examined in detail the Municipality of Temagami's existing streetlight network records to produce this Investment Grade Audit. Our analysis included the following stages:

- Evaluate existing GPS/GIS data of the entire streetlight inventory of the Municipality
- Apply appropriate LED-based lighting designs
- Update the replacement LED fixtures from the desktop review
- Examine in detail the Municipality's utility bills
- Examine detailed maintenance records of the Municipality
- Establish baseline results for energy consumption and maintenance costs
- Revise estimated project costs and savings potential

A summary of our findings is shown below:

	IGA RESULT
Number of Fixtures	90
Type of Fixture	HPS/LED
Energy Savings (%)	72%
Energy Consumption (kWh)	72,446
Projected Annual Energy Costs	\$19,106
Annual Maintenance Cost (5-year average)	\$3,179
Average Annual Cost per Fixture	\$248
Total Annual Operating Cost	\$22,285
Total Project Costs	\$70,452
Incentives (IESO)	\$3,832
Net Project Costs <u>after</u> Incentives	\$66,619

3. GPS MAPPING

RealTerm Energy conducted a complete GIS inventory of the Municipality of Temagami's streetlights and used the information derived from this review to develop a detailed picture of Temagami's current streetlighting network which includes the following:

- Accurate count of all fixtures and fixture types
- Wattage of each existing fixture
- Length of fixture arms, fixture heights, setbacks from roadway, pole spacing, etc.
- Exact GPS coordinates
- Road classifications
- Utility pole ID numbers (when available)

From this data, we established a profile of Temagami's streetlight inventory and defined key parameters such as demand and energy consumption. This then allowed us to accurately estimate energy savings potential associated with the LED upgrade.

A detailed breakdown of the revised lighting inventory, obtained from the GIS/GPS audit is presented below:

3.1. GPS Inventory (Actual)

TYPE	SYSTEM WATTAGE	QTY	DEMAND (kW)
COBRAHEAD FIXTURES			
Cobrahead - HID 150W	190	77	14.6
Cobrahead - HID 250W	310	3	0.9
Subtotal (Cobrahead)		80	15.6
DECORATIVE FIXTURES			
Decorative - Shoe Box - HID 100W	130	7	0.9
Decorative - Shoe Box - LED 100W	100	3	0.3
Subtotal (Decorative)		10	1.2
TOTAL		90	16.8

4. LED REPLACEMENT INVENTORY

The reduced demand following the LED streetlight upgrade will directly impact annual energy consumption, measured in kWh. Our findings show that the demand will be reduced by 12.2 kW. This will result in energy savings of 72% over the current consumption, equivalent to 52,523 kWh annually. The table below illustrates the proposed changes to Temagami's inventory, based on our examination of the GPS data and lighting design results (see next page for more details on our design methodology).

Following input from the Municipality, our design team developed photometric design plans utilizing 3,000K color temperature. The 3,000K fixtures warm color offers pedestrian comfort without compromising the safety and visual acuity required in higher classified roads and areas of high pedestrian activity.

4.1. LED Replacements (Actual, Post-Upgrade)

LDC	TYPE	WATTAGE	QTY	DEMAND (kW)	DLC*	COLOUR-TEMP.
COBRAHEAD FIXTURES						
Hydro One	33W_XSPSM D HT 2LG 5L 30K7 UL SV N Q4	33	36	1.2	DLC	3,000K
Hydro One	49W_XSPSM D HT 2LG 8L 30K7 UL SV N Q4	49	18	0.9	DLC	3,000K
Hydro One	49W_XSPSM D HT 3ME 8L 30K7 UL SV N Q4	49	7	0.3	DLC	3,000K
Hydro One	81W_XSPMD D HT 2ME 12L 30K7 UL SV N Q6	81	15	1.2	DLC	3,000K
Hydro One	156W_XSPLG D HT 2ME 24L 30K7 UL SV N Q6	156	4	0.6	DLC	3,000K
Subtotal (Cobrahead)			80	4.3		

LDC	TYPE	WATTAGE	QTY	DEMAND (kW)	DLC*	COLOUR-TEMP.
DECORATIVE FIXTURES						
Hydro One	36W_ATB0 20BLEDE53 MVOLT R2 3K BK NL UMS-BK P7 PCLL	36	10	0.4	DLC	3,000K
Subtotal (Decorative)			10	0.4		
TOTAL			90	4.6		

*DLC-listed products are LED products that have been tested at a DLC-approved laboratory and comply with specified performance and energy efficiency criteria. These products are eligible for IESO incentive. For further information please visit the DesignLights Consortium website at www.designlights.org.

5. LED LIGHTING DESIGN

RealTerm Energy's technical evaluation team reviewed the collected geospatial dataset and formulated a hybrid approach to completing the roadway designs for Temagami. After evaluating the configuration of each light fixture for road classification, pedestrian activity, pole spacing, mounting height, arm length and curb setback, we have concluded that Temagami can achieve the same or better lighting levels as those under its current streetlights. We have implemented a design solution of selected LED luminaires that follows RP-8-2018 recommendations, where the recommendations are possible within the existing infrastructure configuration (RP-8 is a recommended, though not required, practice for roadway illumination).

The reason that a portion of Temagami's luminaires do not meet RP-8 may be due to several factors, including:

- Inadequate pole spacing (poles are spaced too far apart),
- Insufficient mounting height, or
- Missing light fixtures (at essential locations to eliminate gaps).

Our analysis concludes that in all instances where RP-8 could not be achieved with a new LED fixture, this was already the case for the existing fixture. In such instances, photometric design has been utilized to select an LED luminaire for which the wattage and distribution pattern combine to meet or exceed the existing lighting levels.

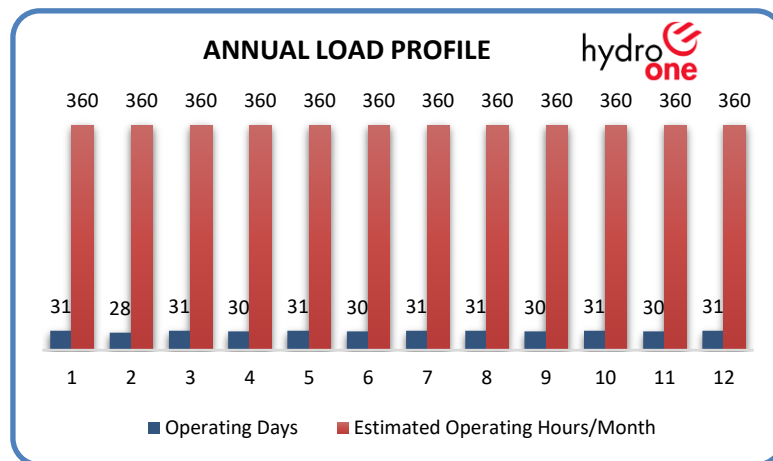
Based on the replacement luminaires detailed in the following pages, we anticipate that the impact on the Municipality's annual energy consumption will be as follows:

PARAMETER	IGA Results	%
Current Annual Energy Consumption (kWh)	72,446	
Projected LED Annual Energy Consumption (kWh)	19,924	
Annual Savings (kWh)	52,523	72%

6. ENERGY AND COST SAVINGS ANALYSIS

6.1. Hydro One's Load Profile

Streetlights are generally not metered, but rather deemed to be 'on' and are therefore billed based on a load profile, determined by the utility company. The annual load profile is a critical part of the Baseline calculation, used to project the actual energy consumption and future energy savings that will be realized after the upgrade. The load profile utilized by Hydro One, Temagami's utility company, appears on the right.

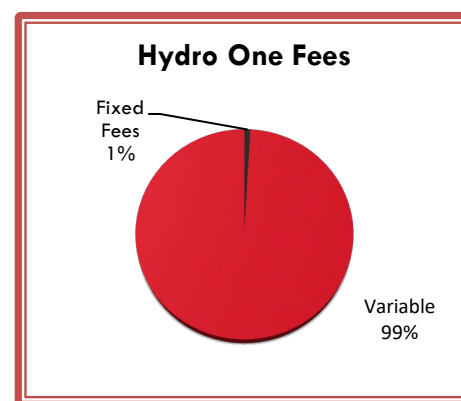


6.2. Baseline Energy Calculations

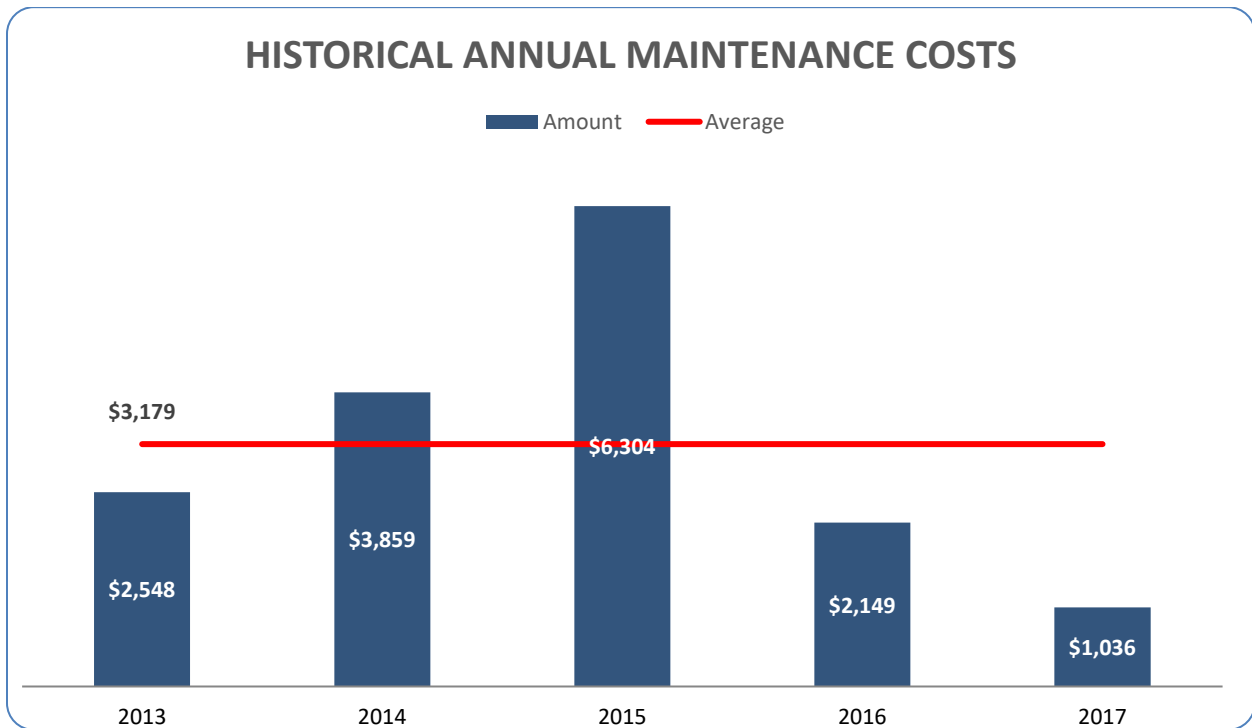
Utilities charge two types of fees: fixed and variable. Fixed fees are constant both before and after the upgrade as they are charged on a per connection basis. Variable fees are based on consumption and therefore decrease following an upgrade to LEDs. Higher fixed fees as a percentage of the total bill result in lower potential dollar savings post-upgrade.

In the case of Hydro One, the fixed fees are almost negligible, close to 1%. Since Hydro One has very low fixed fees, then almost all the demand savings will show up in the municipality's billing.

	Fixed Fees	Variable Fees	Total Energy Cost
Before	\$34	\$19,073	\$19,106
After	\$34	\$5,245	\$5,279
Savings	-	\$13,827	\$13,827



6.3. Baseline Maintenance Analysis

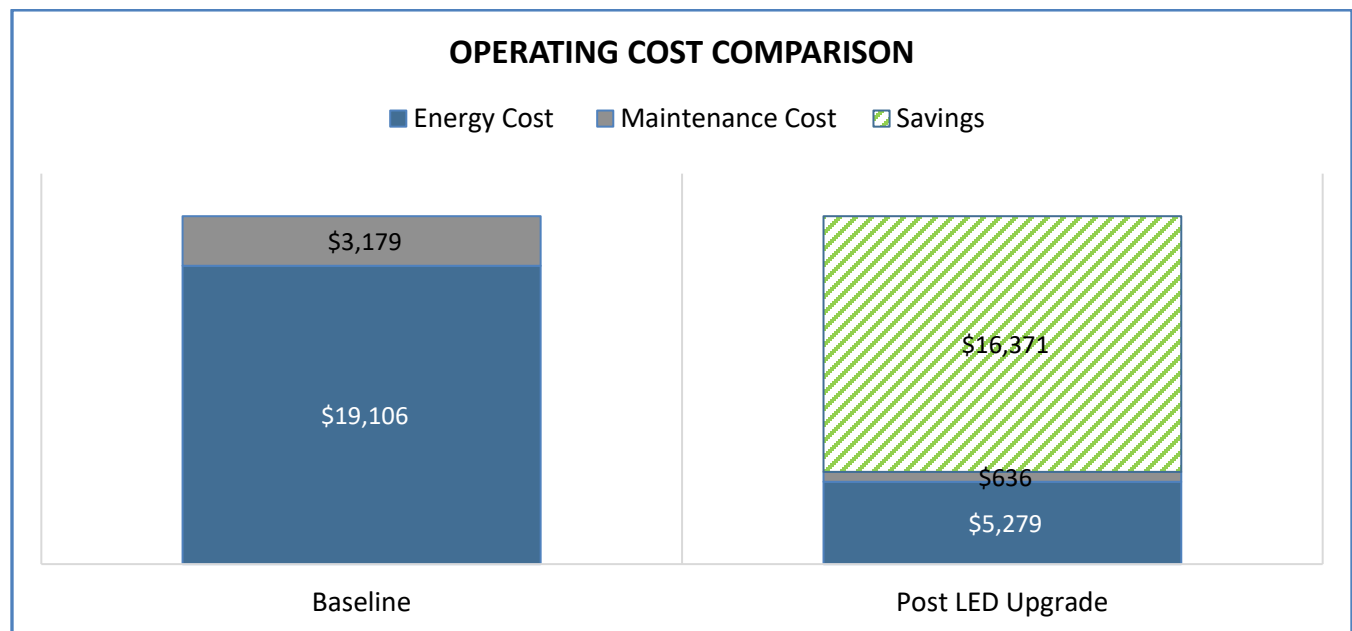


We have examined the maintenance costs for the past 5 years (2013-2017) when data was provided by the municipality and applied an inflation adjustment. The average is \$3,179 per annum, which equates to roughly a cost per fixture of \$35.30 (prorated for the scope of fixtures included in this IGA). This average is in line with the average expenditure we have compiled for Ontario communities of similar size. We conservatively estimate that ongoing LED maintenance will equate to 80% savings over current HPS expenditures, or approximately \$2,543 in savings in the first year.

Different manufacturers propose varying estimates for ongoing maintenance costs of LED fixtures. While it is unrealistic to assume that no annual maintenance will be required, the fixtures themselves do not contain components that require periodic replacement (such as HPS bulbs and ballasts). While actual maintenance costs are likely to be a mere fraction of our estimate in any given year, we recommend incorporating this figure into municipal budgets to account for periodic cleaning or other eventualities over the life of the fixture and not covered under the manufacturer's 10-year warranty.

6.4. Energy and Maintenance Cost Comparison

PARAMETER	BASELINE	POST LED UPGRADE	VARIANCE	PERCENT
Number of Fixtures	90	90	-	-
Annual Electricity Consumption (kWh)	72,446	19,924	52,523	72%
Annual Electricity Costs	\$19,106	\$5,279	\$13,827	72%
Annual Maintenance Cost	\$3,179	\$636	\$2,543	80%
Total Streetlights Expenditures	\$22,285	\$5,915	\$16,370	73%
Average Annual Cost per Fixture	\$248	\$66	\$182	73%



7. PROJECT COSTS: CAPITAL PURCHASE

In a Capital Purchase financing option, or a “Design, Upgrade and Transfer”, the Municipality arranges the financing of the project. Typically, this would be from a source similar to Infrastructure Ontario which has low-cost interest rates.

7.1. Project Costs, Savings and Investment Return

PROJECT COSTS	
Number of Fixtures	90
Total Project Costs	\$70,452
Incentive	\$3,832
Net Project Costs	\$66,619

Note regarding the available incentives:

*The above incentive amount is calculated using the Save on Energy Program Prescriptive Worksheet for Exterior Lighting Version 7.0 in force from April 2019. The **Save on Energy** programs are powered by the Independent Electricity System Operator (IESO).*

This amount of the incentive may vary in 2019 at the sole discretion of the Utility.

INVESTMENT RETURN

The payback period of the project, before including any financing costs is **3.8 years**.

7.2. Allowances

The total project cost includes provisional allowances as detailed below:

Provisional Items	Cobrahead		Decorative and Other	
	%	Quantity	%	Quantity
Re-wiring	45%	36	-	-
Re-fusing	100%	80	100%	10
Fuse Holder Replacement	45%	36	-	-
Installation in Proximity to High Voltage Situations	15%	12	-	-
Arm Replacement	1%	1	-	-
Secondary Connection Refresh	45%	36	-	-
Re-establishing Connection Between Arm and Pole	2%	2	-	-

Billing of Provisional Items

The work covered by the allowances listed above are recommended as they will minimize the likelihood of service calls over the life of the fixtures, greatly reducing maintenance costs. During the installation phase, if additional work is required, the Municipality will be notified first before allowances are exceeded. Any additional work must first be authorized by the municipality and will be handled as a change order.

Luminaires near high voltage wires within a restricted zone:

In the case of cobrahead fixtures located near high voltage wires within a restricted zone, we have identified 3 different approaches to address and solve the issue while ensuring safety. The exact quantity of the fixtures located within the restricted zone can only be identified in the installation phase.

1. Safety is always the number one priority, and to that end, we will assess each location with the goal of relocating the affected luminaire to a safe location. This may involve the services of an engineer and additional costs imposed by the Hydro One both of which will become a pass-through to the Municipality. However, we anticipate that there is a return to the Municipality through lower maintenance costs (fewer service calls) to the luminaire in the future.
2. Engage the services of high voltage crews to replace the existing luminaires. This option comes at a premium price, and is not recommended, as it does not solve any future access issues.
3. RealTerm Energy supplies the fixtures only (uninstalled), and the Municipality can work in conjunction with the local utilities to organize the installation.

If, during the installation, we find luminaires near high tension wires within a restricted zone, we will work with your municipal staff to determine which approach the Municipality prefers.

8. FINANCIAL APPRAISAL OF THE CAPITAL OPTION

8.1. Loan Costs

Infrastructure Ontario offers loans at favorable rates to most municipalities seeking to improve their civic infrastructure. Interest rates vary with market conditions and are set at the prevailing rate at the time the loan is advanced. The table below summarizes payment options that would be available to fund the project through Infrastructure Ontario.

Please note these rates change daily and are submitted below for evaluative and budgeting purposes.

CAPITAL COST*	TERM (YEARS)	INTEREST RATE	ANNUAL PAYMENT	COST OF BORROWING
\$64,909	10	2.39%	\$7,300	\$8,088

* Investment cost less IESO rebate

8.2. Net Savings After Financing Costs

Year	1	2	3	4	5	6	7	8	9	10
Annual Savings	\$16,371	\$16,836	\$17,315	\$17,808	\$18,316	\$18,838	\$19,375	\$19,927	\$20,496	\$21,081
Loan Repayment	\$7,300	\$7,300	\$7,300	\$7,300	\$7,300	\$7,300	\$7,300	\$7,300	\$7,300	\$7,300
Cash Flow	\$9,071	\$9,536	\$10,015	\$10,508	\$11,016	\$11,538	\$12,075	\$12,627	\$13,196	\$13,781
Cumulative Cash Flow	\$9,071	\$18,608	\$28,623	\$39,131	\$50,148	\$61,686	\$73,761	\$86,389	\$99,585	\$113,366

We have assumed that an Infrastructure Ontario loan with an amortization term of 10 years would optimize the overall savings potential to the Municipality.

As can be seen, there are significant net savings from the outset of the project, net of financing costs.

9. CALCULATION ASSUMPTIONS

1. The electricity cost savings were calculated based on Hydro One's current rates valid at the date of the preparation of this IGA. This information can be obtained online on the Ontario Energy Board website¹. The annual energy savings of the new LED streetlighting system were calculated based on the data collected by the GIS/GPS mapping. Any changes in the data obtained will change the energy consumption and cost savings.
2. In Ontario, electricity rates reflect the wholesale electricity price. For the municipality's streetlight rate, the supply rate is based on the LAS supply rate with the applicable Global Adjustment (updated monthly). In our calculation for the supply rate we used is \$0.0240/kWh (as per the LAS program) and for Global Adjustment we used \$0.1076/kWh. The Global Adjustment prices are the average prices of the last 12 months. The current and the historic Global Adjustment prices are available on the IESO website².
3. We have assumed that the saveONenergy program will continue to be in effect as promised, using the currently published rates (those used for the preapproval), and that there will be no unexpected delays on the part of our partners, which would prevent us from meeting the deadline for the Township to receive this incentive. While we will do everything, we can to meet the requirements of this program and to gain this incentive for the Township, RealTerm Energy cannot take responsibility for those aspects which are outside of its control.
4. After the first year, the energy and maintenance costs' inflation rates are 3% and 2%, respectively.
5. The final project inventory and associated energy savings are subject to change based on modifications to the scope of work (i.e. removed/added luminaires, field design changes, etc.) outlined in this IGA report and are to be confirmed in the Final Installation Report (FIR) following the completion of the project close-out. The FIR will then be used to complete the billing change to the Utility/LDCs to reflect the actual installed LED inventory which ultimately will determine the actual energy and cost savings.

¹ Ontario Energy Board. Electricity Distribution Rate Applications. Retrieved December, 2019, from

<http://www.ontarioenergyboard.ca/OEB/Industry/Regulatory+Proceedings/Applications+Before+the+Board/Electricity+Distribution+Rates>

² Independent Electricity System Operator. Price Overview - Monthly Average Hourly Prices, By Year. Retrieved December, 2019, from

<http://www.ieso.ca/Pages/Power-Data/price.aspx>

10. GREENHOUSE GAS REDUCTION

ESTIMATED GREENHOUSE GAS REDUCTION*	IGA Results
Current Annual Energy Consumption (kWh)	72,446
Projected LED Annual Energy Consumption (kWh)	19,924
Annual kWh Savings	52,523
Estimated Annual GHG Reduction (metric tonnes)	1.6
GHG Reduction over Luminaire Life (metric tonnes)	37.4

* GHG emissions depend on the electricity supply mix of the jurisdiction and time of use. These have been calculated using the most current, verified emissions factors found in the average emissions for 2019, released by The Atmospheric Fund 2019 Edition of "A Clearer View on Ontario's Emissions – Electricity Emissions Factors and Guidelines".



11. CONCLUSION AND RECOMMENDATION

We have implemented a designed solution of selected LED luminaires that conforms to RP-8-2018 guidelines for as many of the streetlight locations as possible.

This combination of LED luminaires will result in energy consumption savings of 52,523 kWh per year over the incumbent HPS fixtures, which is equivalent to 72% energy savings.

If the Municipality of Temagami chooses to move forward with the Design, Upgrade and Transfer option, the total project cost will be \$70,452, which includes the upgrade of some elements of the lighting infrastructure such as fuses, fuse holders, wires, davit arms and secondary connections as stated in section 7.2 - Allowances. The Municipality should expect a payback period of 3.8 years with an IESO Incentive of \$3,832.

The next steps to start the implementation of this new technology and start seeing energy and maintenance savings are as follows:

- Meeting to review IGA with staff and RealTerm Energy team
- Approval of the IGA
- Submit IESO rebate (prepared by RealTerm, but municipal staff must submit)
- Review contract to proceed with project
- Sign contract

12. TERMS AND CONDITIONS

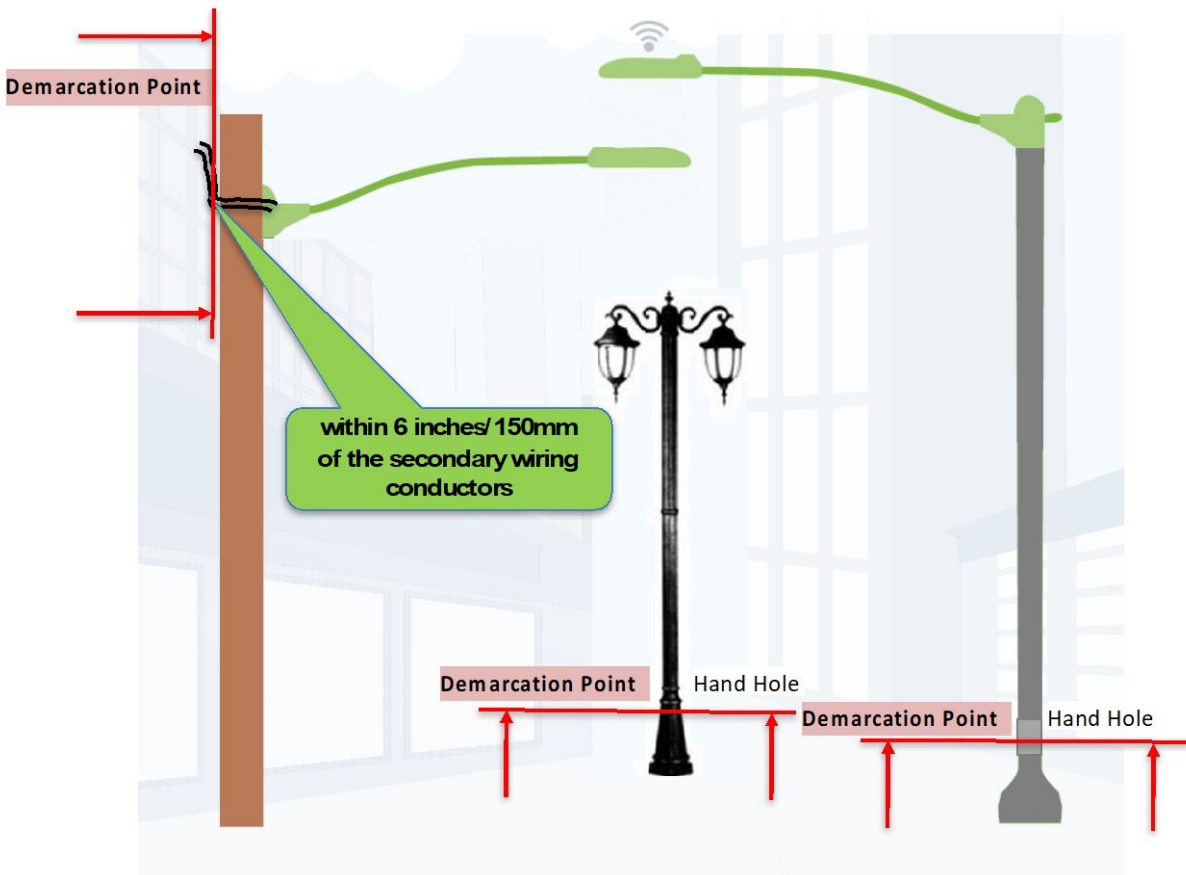
The total project cost includes the following scope of work:

1. Data collection including GIS/GPS mapping of the existing and proposed luminaires.
2. Photometric Lighting Designs.
3. Remove 80 existing HID cobrahead luminaires and supply and install 80 cobrahead LED luminaires with photocell controllers.
4. Remove 10 existing HID/LED decorative luminaires and supply and install 10 decorative LED luminaires with photocell controllers.
5. All provisions and allowance detailed on Section 7.2 – Allowances.
6. A recommended list of Spare fixtures (appendix A).
7. ESA permits and inspection of work.
8. Recycling of the removed HID luminaires.
9. Project management.
10. Provide the Municipality with a copy of the GIS data once installation is complete to include the final LED Inventory installed, date, type, location, etc. The documents will include: Excel file, KMZ file and GIS Shape Files.
11. Commissioning.
12. Completing billing change(s) on your behalf based on the new LED lighting system installed by RealTerm Energy and based on the information provided by the Municipality and Utility regarding the metered and unmetered lights. RealTerm Energy assumes that the information provided by both parties are accurate and reflects the current state of the actual inventory.
13. Applying on your behalf for the available IESO incentives. The final incentive amount will be determined by the Utility and is not guaranteed by RealTerm Energy.
14. RealTerm Energy and our Installation Contractor warrant all workmanship completed within the work area for a period of one (1) year following the completion date of the installation.
15. The Luminaire are covered by their manufacturer's warranties for 10 Years.
16. The photocells are covered by their manufacturer's warranty for 10 years (PCLL, for Decoratives) and 12 Years (TRS-2, for Cobraheads).
17. If material/equipment ordered is removed from the installation scope of work after being ordered, the ordered material/equipment that was not installed will remain in possession of the Municipality after the installation is complete and RealTerm Energy will not provide credit for the uninstalled material/equipment.
18. This IGA is valid until February 14, 2019.
19. The total project cost is in Canadian dollars and does not include the HST.

For greater clarity, the scope of work set forth herein shall constitute the sole and entire scope of work for the Project and supersedes all prior and contemporaneous understandings, agreements, representations and warranties, both written and oral, with respect to the Project. The Parties have not relied on any statement, representation, warranty or agreement of the other Party or of any other person acting on such Party's behalf, including any representations, warranties, or agreements arising from statute or otherwise in law, except for the representations, warranties, or agreements expressly contained in this Agreement. Without limitation of the foregoing, the parties acknowledge and agree that the following items are not included in the scope of work and nor the total project cost:

1. Any cost related to upgrading your existing lighting/electrical systems to provincial and or federal standards.
2. Any cost related with the replacement of the existing relays for the group-controlled streetlights (controller box).
3. Any fees related to the connections to the secondary bus in the unlikely case that your Utility insists on charging a fee.
4. Any other fees which may be charged by a third party.
5. Any costs related to works beyond the Demarcation Point, described as follows:
 - Work performed on the electrical system by RealTerm Energy will be confined to the Luminaire and an area between the agreed upon "*Demarcation Point*" (in the majority of cases a point within 6 inches/150mm of the secondary wiring conductors) on what is referred to as the "Tail". This is the location at which a Fuse and Fuse Holder should exist and acts as a disconnect to allow easy service, protect the new luminaire and wiring from voltage surges and provide a safe working environment. In the event that a Fuse and Fuse Holder do not exist, they will be installed.
 - For Decorative Poles and Stand-Alone underground fed units the "*Demarcation Point*" is located at the base of the pole in the "Hand Hole". Where Overhead feeds are in use, the "*Demarcation Point*" is located at the base of the arm holding the fixture, where the connection is made to the secondary wires.
 - If RealTerm Energy dispatches a maintenance contractor and the required repairs are outside of the work areas, we will recommend a solution and communicate this information to the Client for approval before proceeding.

13. SCOPE OF WORK DIAGRAM



The foregoing excluded items and any other items not included within the scope of work may be provided by RealTerm Energy at an additional cost pursuant to a separate written agreement or amendment between the parties only. The above list of exclusions is not meant to be exhaustive, as network site conditions vary, and shall not operate in any way to limit the exclusions of this paragraph or imply any obligation or duty on the party of RealTerm Energy to complete any work other than the specifically defined scope of work set forth herein.

Craig Davidson
Treasurer / Administrator
Municipality of Temagami
7 Lakeshore Drive
P.O. Box 220
Temagami ON P0H 2H0

The information contained herein will form part of the Installation contract documents as well as the Scope of Work for the LED Streetlighting conversion project. The undersigned is authorized to sign on behalf of the Municipality and accepts the entirety of this Investment Grade Audit P-1039_IGA_Report_Temagami_ON_CAN-LAS-2019-12-17.

Authorized Signature

Name (please print)

Title (please print)

Date

APPENDIX A: RECOMMENDED SPARE INVENTORY

Recommended Spare Inventory

A summary list of the recommended inventory spares is presented below (Luminaires, Photocell) and is based on the material specified in the IGA Report.

Summary of Spare Material		
Part Number	QTY	Material Type
33W_XSPSM D HT 2LG 5L 30K7 UL SV N Q4	1	LED Luminaire
49W_XSPSM D HT 2LG 8L 30K7 UL SV N Q4	1	LED Luminaire
81W_XSPMD D HT 2ME 12L 30K7 UL SV N Q6	1	LED Luminaire
36W_ATB0 20BLEDE53 MVOLT R2 3K BK NL UMS-BK P7	1	LED Luminaire
PCLL (1), TRS-2 (3), comes with above listed fixtures	4	Photocell

Notes:

- Spare Material will be sent directly to the Municipality, accordingly additional freight charges have been estimated. Upon approval of this IGA, RealTerm Energy will contact the Municipality in order to request designated shipping address.
- Should the Municipality wish to include an alternative breakdown (type and quantity) of spare material, the list above and associated cost can be adjusted accordingly.

Cost of Spare Material	
Number of Fixtures (Spare)	4
Total Cost of Spare Fixtures (Included in IGA Project Cost)	\$1,711
Total Project Cost	\$68,741
Total Project Cost with Spare Material	\$70,452

Benefits of including spare material

For a relatively minimal added cost to the overall project, the inclusion of spare inventory is greatly recommended for the following main reasons:

- 1) Quicker and more cost-effective maintenance and replacement of failed material under warranty. Having spares allows for a single trip to the pole for both removing and installing the new material, as opposed to waiting for replacement material to be sent by the manufacturer, potentially weeks later and resulting a second mobilization of the contractor.
- 2) Ability to include any uncaptured and/or added lights to the scope of work during the installation. This avoids having to do separate purchase orders and standalone (more costly) mobilizations of the installer.
- 3) Benefit from the economies of scale from the main project for material cost.

APPENDIX B: SITE SPECIFIC FIXTURE REPLACEMENTS

Type	Qty.	Replacement	Before	After
Cobrahead	61	Cree XSPSM		
Cobrahead	15	Cree XSPMD		
Cobrahead	4	Cree XSPLG		
Shoe Box (3 existing LED, 7 existing HID)	10	Acuity ATB0		

Note: The above images are for illustration purposes only.

APPENDIX C: LUMINAIRE SPEC SHEETS

- The Luminaire Spec Sheets are attached in a separate electronic file.

APPENDIX D: LUMINAIRE PRODUCT WARRANTY

- The Luminaire warranty documents are attached in a separate electronic file.

APPENDIX E: LIGHTING DESIGN LAYOUTS

- The designs of the proposed LED luminaires are attached in a separate electronic file.

APPENDIX F: STREETLIGHT INVENTORY

- The streetlight inventory Excel file is attached in the electronic zip file.
- The Webmap version of the inventory can be accessed by clicking on the below link using the username and password provided below:
 - Insert link: <https://arcg.is/10uHbf>
 - Username: guest012
 - Password: guest2018

APPENDIX G: STANDARD CONTRACT

- The standard contract document is included as a separate electronic file.