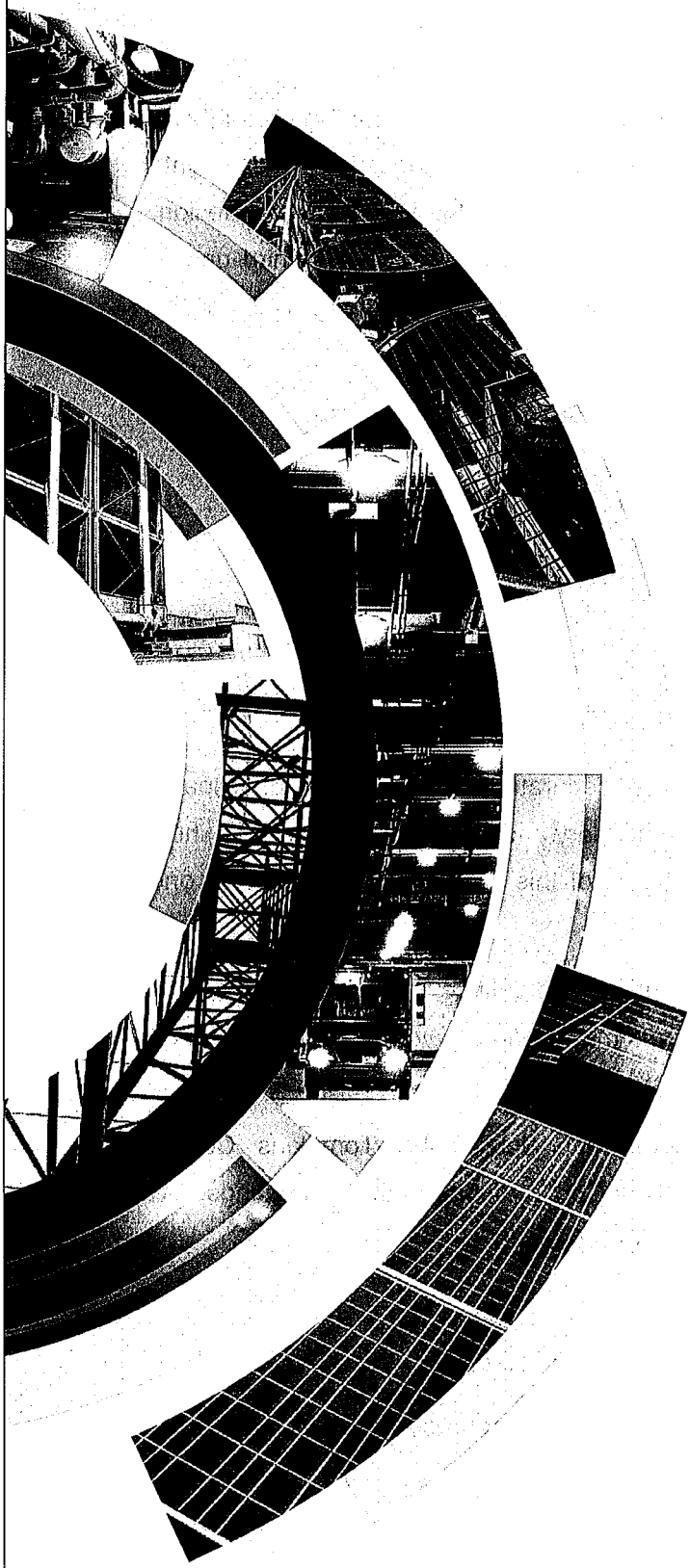


The New York Power Authority

In Cooperation with the

Village of Trumansburg

Village of Freeville

Town of Ithaca

Town of Newfield

Town of Caroline

Town of Ulysses

NYPA's Energy Efficiency Program for Tompkins County LED Street Lighting Upgrade

ES-ESN-0786

ES-ESN-0805

ES-ESN-0845

ES-ESN-0848

ES-ESN-0869

ES-ESN-0870

NEW YORK STATE OF OPPORTUNITY. | NY Power Authority

B. EXECUTIVE SUMMARY

The New York Power Authority (NYPA) contracted with Guth DeConzo Consulting Engineers, PC (Guth DeConzo) to perform design services for the implementation of the Street Lighting Upgrades in Tompkins County. The first part of this design included the Village of Cayuga Heights and the Village of Dryden. The Town of Dryden was originally included in the second design, however due to some missing pertinent documentation, it will be considered the third design in the Tompkins Aggregation LED Lighting Project. This second design will include the following municipalities in Tompkins County:

- Village of Trumansburg (ES-ESN-0786)
- Village of Freeville (ES-ESN-0805)
- Town of Ithaca (ES-ESN-0845)
- Town of Newfield (ES-ESN-0848)
- Town of Caroline (ES-ESN-0869)
- Town of Ulysses (ES-ESN-0870)

The executive summaries and project estimates are separated out for each municipality mentioned above and then totaled into one executive summary and one project estimate to show the economics combined for Tompkins County. The rest of this aggregate will be under one common report.

This design milestone is the 90% submission. This submission defines the opinion of probable cost, the means of implementation, projected annual and maintenance savings which are related to the upgrade of the respective village street lighting system.

Project meetings have been periodically held since the July 2019. Tompkins County representatives, as well as staff from NYPA and Guth DeConzo, attended these meetings. All field work for this phase of design was completed as of February 2020.

This 90% submission includes the following:

- Design narrative, stating design intent, assumptions, and findings.
- Point by point analysis, providing a basis of design for each representative roadway type.
- Final project economics, executive summaries and project costs.
- Detailed utility bill analysis.

Finalize project scope, performing photometric analysis to inform design selections.

ENERGY EFFICIENCY MEASURES (EEMS) OVERVIEW

There is one main energy conservation measure for this project. This measure is:

- EEM 1 - LED Street Lighting Upgrade

DESIGN NARRATIVE

The intent of this narrative is to provide the design criteria used for the LED Street Lighting upgrade for the County of Tompkins. The scope includes a one for one fixture replacement of the existing high intensity discharge (HID) street lights to an equivalent LED roadway fixture. As outlined below, there are several roadways where fixtures are sporadically spaced and/or under illuminated per IES RP-8-18 "Roadway Lighting" standards. Additional fixtures are not being added to the scope to provide a more consistent and acceptable level of roadway lighting. The criteria from IES RP-8-18 "Roadway Lighting" is utilized as the defining standard.

It was established that there are approximately four different roadway types and six different intersection types throughout the seven municipalities within this project scope. The representative locations were surveyed to define existing conditions. The survey included identification of existing luminaires, height of fixtures, length of arm, spacing between fixtures, width of road, and distance of pole from the roadway. Once the survey was complete, a point by point photometric analysis using AGI32 and Visual software was completed to determine the appropriate LED roadway fixture required to meet the RP-8-18 standards.

Roadways are typically, individually classified as a major (highway/thruway), collector (connecting road that allows traffic to move from local roads to major roads (highway/thruway), or local (residential roads). Each of these roads are then evaluated and assigned a pedestrian conflict class of high, medium, or low. These two important factors set a foundation for the design parameters that are used in this report. Explained in further detail on the following page is how roadway class and pedestrian conflict is incorporated into the design parameter. Please see the roadways that were used for this evaluation below:

- Westhaven Road - (Town of Ithaca)
- Winner Circle - (Town of Ithaca)
- Main Street - (Town of Newfield)
- Main Street (Rte. 366) - (Village of Freeville)
- Slaterville Road (Rt. 76) - (Town of Caroline)

- E. Main Street (NY-96) - Decorative Fixtures - (Village of Trumansburg)
- Elm Street & Whig Street - (Village of Trumansburg)
- Main Street & Shaffer Road - (Town of Newfield)
- Trumansburg Road & Colgrove Road (Rt. 96) - (Town of Ulysses)
- Valley Road & Elm Street - (Town of Caroline)
- Railroad Street (Rt. 38) & Fall Creek Road (Rt. 105) - (Village of Freeville)
- State Highway 96 & Hector Street - (Village of Trumansburg)

Using the Luminance method, the IES RP-8-18, has four main design criteria parameters for evaluating street lighting:

- Avg. Luminance (L_{avg}); $(^{cd}/_{m^2})$
- Avg. Uniformity Ratio (L_{avg}/L_{min})
- Max. Uniformity Ratio (L_{max}/L_{min})
- Max. Veiling Luminance Ratio (LV_{max}/L_{avg})

Each design parameter is based on the Street Classification and Pedestrian Area Classification. Below is Table 3 from IES RP-8-18, which provides the parameter values:

ANSI/IES RP-8-18: Lighting Design Criteria for Streets					
Street Classification	**Pedestrian Area Classification**	**Average Luminance (Lavg)**	**Average Uniformity Ratio (Lavg/Lmin)**	**Maximum Uniformity Ratio (Lmax/Lmin)**	**Max. Veiling Luminance Ratio (LVmax/Lavg)**
Major	**High**	1.2	3.0	5.0	0.3
	Medium	0.9	3.0	5.0	0.3
	Low	0.6	3.5	6.0	0.3
Collector	**High**	0.8	3.0	5.0	0.4
	Medium	0.6	3.5	6.0	0.4
	Low	0.4	4.0	8.0	0.4
Local	**High**	0.6	6.0	10.0	0.4
	Medium	0.5	6.0	10.0	0.4
	Low	0.3	6.0	10.0	0.4

The following variables are used to develop the photometric model:

1. Lumen output of fixture (Wattage of fixture)
2. Spacing between fixtures
3. Mounting height of fixtures
4. Road type (Reflection)
5. Set back of fixture from road
6. Arm length
7. Fixture optics (Light Distribution)
8. Color Temperature of Fixture

Of these variables mentioned above, the red variables are already defined variables that can't be changed without significant scope or cost impact. The green variables can be easily changed through equipment selection.

As described in Section C, the existing light fixture layout has spacing of over 200' which prevents that roadways to conform to all IES guidelines. Appendix J.2 shows the photometric analysis would conform if fixtures were added. At this time no fixtures are suggested to be added and the calculations are utilized to verify that the (L_{avg}) and (LV_{max}/L_{avg}) values to conform to IES guidelines in the areas of illumination.

Appendix J.2 shows each design scenario and describes the existing conditions, assumptions and the results that were achieved. These results were dictated to conform to (L_{avg}) and (LV_{max}/L_{avg}) values from IES.

TOTAL PROJECT SUMMARIES

The following are the economics for the six municipalities within this project scope and one for Tompkins County, including all six of the municipalities. The economic summaries are shown below:

Total Project Summary
New York Power Authority - Energy Efficiency Program
Town of Ulysses LED Street Lighting Upgrade

ES-ESN-0870 September 8, 2020

Project Cost: Initial CPC

Fixture Count	
Cobra head:	9
Post top:	0
Flood Light:	1
Total:	**10**

Construction Costs:	$5,413.74	
Allowances:	$0.00	
Smart Cities Technology:	$0.00	
Bonds by Electrical Contractor:	$32.80	
Subtotal:	**$5,446.54**	
Contingency 10%:	$544.65	
Subtotal:	**$5,991.19**	
Abatement Design & Monitoring:	$0.00	
Hazardous Waste Disposal Cost:	$40.00	
Environmental Subtotal:	**$40.00**	
Audit, Design, & Construction Mgt:	$836.47	(See Note #1)-Excludes Bonds by Electrical Contractor
NYPA Project Mgt. & Administrative:	$1,030.15	(See Note #2)
Project Management Subtotal:	**$1,866.62**	
Utility Asset Buyout Cost:	$7,242.00	(See Note #5)
Utility Device Disconnect Deposit Bond:	$217.26	(See Note #6)
Utility Subtotal:	**$7,459.26**	
Project Subtotal:	**$15,357.07**	
Interest During Construction (IDC):	$614.28	(See Note #3)
Total Project Cost:	**$15,971.36**	

Estimated Energy Savings — **Environmental Benefits: 4.5 Metric Tons**

Estimated Electrical Savings:		Estimated Fuel Savings:			MMBtu Savings:	Cost Savings:
kWh Savings:	8,127	Natural Gas:	0	Therm	0.0	$0.00
kWh Cost Savings:	$588.77	Oil Savings:	0	gal	0.0	$0.00
Monthly kW Savings:	2.0	Steam (150 psi):	0.0	MLbs	0.0	$0.00
kW Cost Savings:	$0.00	Water:	0.0	Kgal	0.0	$0.00
Total Electrical Savings:	**$588.77**		**Total Fuel Savings:**		**0.0**	**$0.00**

Total Energy Savings:	**$588.77**	Ownership Savings:	**$1,194.48**	Est. Total Savings:	**$1,783.25**

Simple Payback

Total Project Cost With IDC:	$15,971.36	
Total NYPA Grants:	$0.00	
Total Estimated Rebates:	($3,250.80)	(See Note #7)
Net Project Cost:	**$12,720.56**	
Total Est. Annual Savings:	$1,783.25	
Estimated Annual Utility Fees:	($195.60)	
Estimated Annual Service Contract:	($200.00)	(See Note #4)
Net Est. Annual Savings:	**$1,387.65**	
Simple Payback:	**9.17**	

Project Financing

TOTAL AMOUNT FINANCED:	$15,971.36	(Utility Rebates & Incentives Not Included)
Interest Rate:	4.00%	(See Note #8)
Years Financed:	16.0	
Number of Payments:	192	
Annual Debt Service to NYPA:	**$1,353.09**	
Monthly Debt Service to NYPA:	**$112.76**	
Total Project Cost after Financing:	**$21,649.38**	
Total Annual Savings:	$1,387.65	
Payback With Financing:	15.60	
Annual Cash Flow:	**$34.57**	

Notes:

1. Audit, Design, & Construction Mgt represents a cost of 14.0% of the direct Construction and Asbestos Abatement cost and are applied to contingency to provide budget estimates. Final costs will exclude unused contingency and will be calculated at end of project based on final material and labor costs and applicable abatement costs.
2. NYPA Project Mgt. & Administrative represents a fee of 15.0% of all project costs except IDC.
3. Interest During Construction (IDC) is estimated based on a 4% of the total project cost. See Section B.
4. Yearly Service Contract includes estimated contract value of $20 per fixture per year.
5. Utility Asset Buyout Cost is taken from the NYSEG Streetlighting Facilities Sales Proposal dated September 8, 2020.
6. The Utility requires a certificate of deposit for fusing, the cost of this deposit is estimated at 3% the purchase price.
7. Estimated Utility Rebates and Incentives are coordinated between the Customer and the Utility. Customer's financial obligation to NYPA excludes this credit.
8. Interest rate is estimated at 4.00% long-term conservative estimate. The actual interest rate is variable and is adjusted on January 1 annually.

Town of Ulysses - Town of Ulysses LED Street Lighting Upgrade
Incremental Payback Calculation
ES-ESN-0870

Project Phase: Initial Customer Project Commitment (CPC)

EEM #	EEM Description	Project Cost			Annual Cost Savings			Simple Payback	
		Total	Base Case	Net Incremental	Total	Base Case	Incremental	Total	Incr
1	LED Lighting Upgrade	$ 15,971	$ 7,242	$ 8,729	$ 1,388	$ -	$ 1,388	11.51	1.00
	Totals	**$ 15,971**	**$ 7,242**	**$ 8,729**	**$ 1,388**	**$ -**	**$ 1,388**	**11.51**	**6.29**

9/8/2020

Town of Ulysses

Town of Ulysses - Ownership Savings				
Equipment Type	**Quantity**	**Monthly Equipment Charge per Quantity**	**Total Monthly Charge**	**Total Yearly Charge**
NYSEG Account #: 1001-3629-489 - Tarrif 121 - SC03				
150W HPS cobra head light	1	$ 8.15	$ 8.15	$ 97.80
NYSEG Account #: 1001-3629-471 - Tarrif 121 - SC03				
150W HPS cobra head light	5	$ 8.15	$ 40.75	$ 489.00
250W HPS cobra head light	4	$ 8.15	$ 32.60	$ 391.20
Standard pole	1	$ 12.26	$ 12.26	$ 147.12
Standard bracket 16' and over	2	$ 2.89	$ 5.78	$ 69.36
		Sub Total:	$ 99.54	$ 1,194.48
		Estimated Pole Attachment Fee:	$ (286.88)	$ (3,442.56)
		Grand Total:	**$ (187.34)**	**$ (2,248.08)**
Estimated Pole Attachment Calculation				
Fixtures on metal/decorative poles - 0				
Fixtures on wood poles (Utility Owned under Service Classification 3) - 10 Street Lighting Fixtures				
Total Street Lighting Fixtures = 10 (includes all accounts)				
Annual Tariff Pole Charge- = $19.55				
Total Cost per month for one pole ($19.55/12months) = ($1.63)				
Total Cost per month (all street light fixtures) - ($19.55/12months) = ($1.63) x (10)=$16.30				
Total Annual Pole Fee ($16.30 monthly cost x 12months) = ($195.60)				

Ulysses

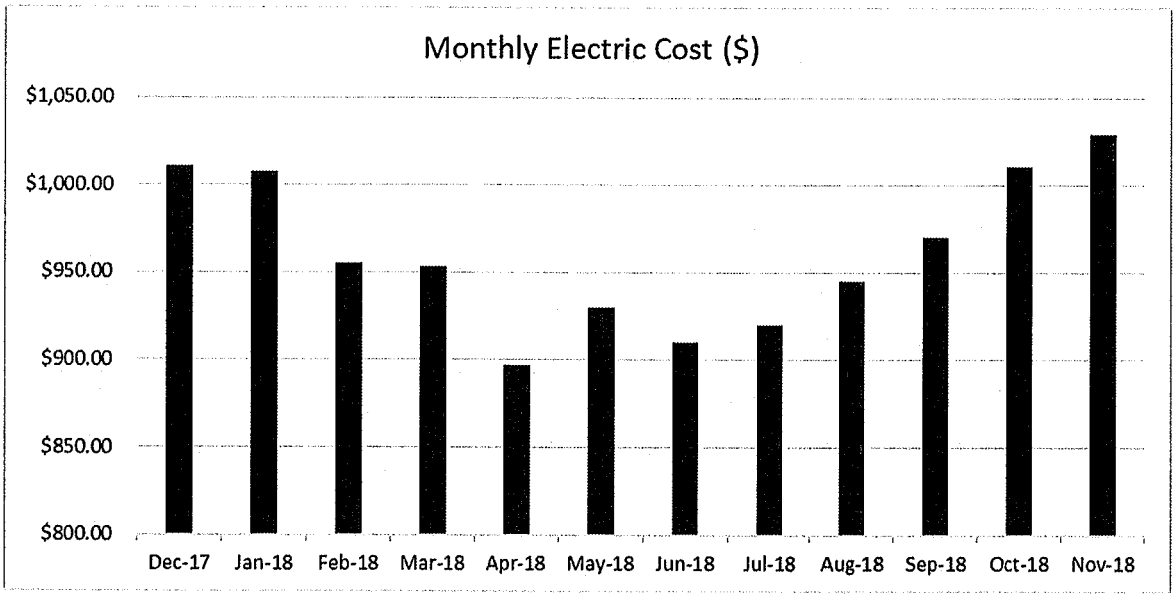
Existing Tariff Rates

Existing Tariff Rates (SC3)		
SBC Charge ($/kWh)	$	0.00593
RDM Charge ($/kWh)	$	(0.01390)
Transition Charge ($/kWh)	$	0.00427
Mechant Function Charge ($/kWh)	$	0.00299
Electrical Supply ($/kWh)	**$**	**0.05146**
Electrical Delivery ($/kWh)	$	0.02342
"All-In" - Delivery ($/kWh)	**$**	**0.01972**
Total Energy Cost ($/kWh)	**$**	**0.07417**

Proposed Tariff Rates

Proposed Tariff Rates (SC4)		
SBC Charge ($/kWh)	$	0.00578
RDM Charge ($/kWh)	$	(0.01390)
Transition Charge ($/kWh)	$	0.00342
Dynamic Load Management Charge ($/kWh)	$	0.000018
Mechant Function Charge ($/kWh)	$	0.00299
Electrical Supply ($/kWh)	**$**	**0.05146**
Electrical Delivery ($/kWh)	$	0.02987
"All-In" - Delivery ($/kWh)	**$**	**0.02519**
Total Energy Cost ($/kWh)	**$**	**0.07964**

The summary of the monthly electrical cost ($) for the town is shown in the graph below:



Street Lighting Billings for Town of Ulysses

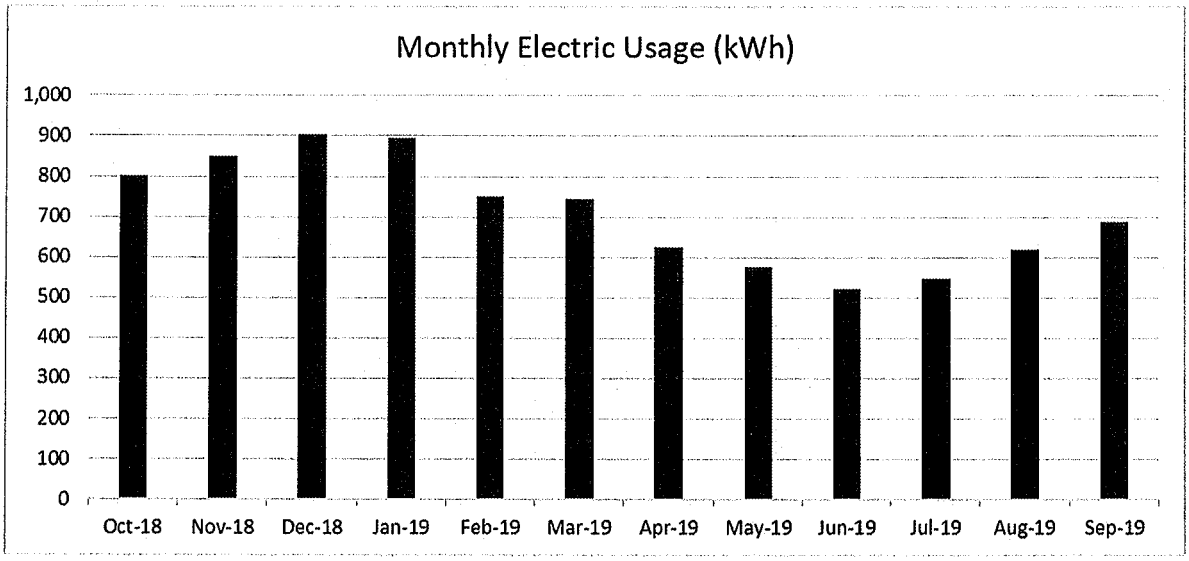
The Town of Ulysses street lighting has electricity delivered by NYSEG and supplied by Energy Cooperative of America. The existing street lighting falls under Public Service Commission (PSC) No. 121 "Electricity" under Service Classification No.3.

NYSEG currently owns all the existing street lighting and the town pays a monthly luminaire charge for each fixture on top of delivery and supply charges.

The following table below provides the 12-month billing history for the town's street lighting account. The totals for all months are provided in bold at the bottom of the table.

Utility Bill Analysis							
Account# 1001-3629-471 PSC.121 (SC3)							
Billing Month	Total Electric Usage (kWh)	Delivery Charge ($)	Delivery Rate ($/kWh)	Facility Charge ($)	Supply Rate ($/kWh)	Supply Charge ($)	Total Energy Cost ($)
Oct-18	800	$ 18.74	$ 0.02342	$ 99.54	$ 0.05146	$ 41.18	$ 159.46
Nov-18	851	$ 19.93	$ 0.02342	$ 99.54	$ 0.05146	$ 43.79	$ 163.26
Dec-18	906	$ 21.21	$ 0.02342	$ 99.54	$ 0.05146	$ 46.60	$ 167.35
Jan-19	895	$ 20.97	$ 0.02342	$ 99.54	$ 0.05146	$ 46.08	$ 166.59
Feb-19	750	$ 17.56	$ 0.02342	$ 99.54	$ 0.05146	$ 38.58	$ 155.67
Mar-19	744	$ 17.41	$ 0.02342	$ 99.54	$ 0.05146	$ 38.26	$ 155.22
Apr-19	626	$ 14.66	$ 0.02342	$ 99.54	$ 0.05146	$ 32.22	$ 146.42
May-19	577	$ 13.52	$ 0.02342	$ 99.54	$ 0.05146	$ 29.71	$ 142.78
Jun-19	523	$ 12.24	$ 0.02342	$ 99.54	$ 0.05146	$ 26.90	$ 138.68
Jul-19	549	$ 12.86	$ 0.02342	$ 99.54	$ 0.05146	$ 28.25	$ 140.65
Aug-19	620	$ 14.52	$ 0.02342	$ 99.54	$ 0.05146	$ 31.90	$ 145.96
Sep-19	689	$ 16.13	$ 0.02342	$ 99.54	$ 0.05146	$ 35.45	$ 151.12
Oct-19	901	$ 21.10	$ 0.02342	$ 99.54	$ 0.05146	$ 46.37	$ 167.01
Nov 18 - Nov 19:	**8,529**	**$ 199.76**	**$ 0.02342**	**$ 1,194.48**	**$ 0.05146**	**$ 438.93**	**$ 1,833.17**

The summary of the monthly electrical usage (kWh) for the town is shown in the graph below:



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