Impact Evaluation Report for the LED Street Lighting Program

National Grid

Prepared for Niagara Mohawk d/b/a National Grid
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1 EXECUTIVE SUMMARY

This document is the evaluation report for Niagara Mohawk Power Corporation's d/b/a National Grid ("National Grid" or "Company") LED Street Lighting program. The LED Street Lighting program provides incentives for replacing inefficient street lighting lamps/luminaires, which include high pressure sodium, mercury vapor, and metal halide technologies, with high efficiency LED lamps/luminaires. Some street lighting in National Grid's service territory is owned by the company and some is owned by customers, typically municipalities. Company-owned street lighting is eligible for the program because the reduced energy consumption of LED equipment is realized by the customers in the form of lower monthly bills. The objective of this impact evaluation is to determine the Verified Gross Savings (VGS) totals for the period of investigation and VGS Realization Rates (VGS RR) for annual electricity (kWh) savings in accordance with The New York State Evaluation, Measurement & Verification Guidance (CE-05)[1] and Gross Savings Verification Guidance (CE-08).[2] The VGS RR is the ratio of verified gross savings to gross savings and indicates the realized savings of the program relative to the gross savings claimed by National Grid in its quarterly Clean Energy Dashboard submissions to the New York Department of Public Service. The peak demand definition for New York is non-holiday weekdays, June through August, during the hour ending 5pm. Because LED streetlighting operates on a dusk-to-dawn schedule, there are no electric demand savings associated with this program, and electric demand savings (kW) were not evaluated.

The Ridgeline Energy Analytics team conducted separate impact evaluations of the LED Street Lighting program for 2022 and 2023. This report presents the results of the two studies. National Grid implemented several changes to its gross savings procedures for 2023 based on preliminary findings from the 2022 impact analysis. As a result, some of the issues discussed in the 2022 study were no longer relevant for the 2023 analysis. Table 1 shows the results by year.

Table 1: Evaluation Results by Program Year

Program Year	Gross Savings MWh	VGS Realization Rate	Verified Gross Savings MWh	Relative Precision at 90% Confidence Level
2022	10,856	0.9029	9,802	0.33%
2023	6,147	0.9623	5,915	1.48%

The VGS RR improved from 2022 to 2023, increasing from 90.29% to 96.23%. The difference between verified gross savings and gross savings for 2023 came almost entirely from a wattage configuration issue in National Grid's InDemand Project Tracking Database for 130W LED lamp/luminaires.

[1] New York State Department of Public Service Staff Guidance, CE-05: Evaluation, Measurement & Verification Guidance New York State (Issued November 1, 2016).
[2] New York State Department of Public Service Staff Guidance, CE-08: Gross Savings Verification Guidance (Issued August 23, 2019)

2 INTRODUCTION

This document is the evaluation report for Niagara Mohawk Power Corporation's d/b/a National Grid ("National Grid" or "Company") LED Street Lighting program. The LED Street Lighting program provides incentives for replacing inefficient street lighting lamps/luminaires, which include high pressure sodium, mercury vapor, and metal halide technologies, with high efficiency LED lamps/luminaires.

Some street lighting in National Grid's service territory is owned by the Company and some is owned by customers, typically municipalities. Streetlighting customers are billed based on the specific lighting equipment/facilities installed as outlined in the Company's Tariff (PSC No. 214)[3] ("Tariff"). The LED Street Lighting energy efficiency program provides incentives to Company-owned or Customer-owned lighting (Service Classification 2 or 3 under the Tariff).

2.1 GLOSSARY

- **Ballast**: A device used with an electric-discharge lamp to obtain the necessary circuit conditions for starting and operation. The ballast interacts with the lighting mechanism to control, regulate, and ultimately stabilize the light output of the lamp. All fluorescent and HID light sources require a ballast for proper operation. LEDs do not.
- **Equipment**: A general reference to customer owned, operated and maintained devices or components specific to the character of service.
- **Facilities**: A general reference to company owned, operated and maintained devices, components, or infrastructure assemblies specific to the service classification character of service.
- **High Intensity Discharge (HID)**: A family of lamps including HPS, LS, MH and MV which produce various color spectrums of light by means of applying an electric arc within a transparent quartz arc tube incorporating tungsten electrodes and various compositions of gas and metal elements.
- **High Pressure Sodium (HPS)**: A HID lamp that produces a slightly yellow-colored light.
- **Lamp**: The component which, when energized, produces the light output, and is typically comprised of a base, electrodes, filament or arc tube and glass envelope, and is also referred to as a bulb.
- **Lamp/luminaire**: The specific combination of a lamp or other light source and luminaire based upon their unique requirements.
- **Light Emitting Diode (LED)**: A solid-state or semiconductor device that creates optical radiation through electroluminescence which is transmitted in conjunction with phosphors and biased in a forward direction to produce broadband, visual spectrum white light.
- **Low**-Pressure Sodium (LS): A HID lamp that produces a monochromatic, amber-colored light.
- **Luminaire**: The assembly incorporating multiple elements to support, energize and control the light source and the optical system comprised of the reflector and/or refractor to manage and direct the light output.
- **Metal Halide (MH)**: A HID lamp technology that produces a white light.
- **Mercury Vapor (MV)**: A HID lamp that produces a blue-white light.

[3]PSC No 214 Niagara Mohawk Power Corporation D/B/A National Grid Schedule For Electric Service Street, Highway, Roadway And Other Outdoor Lighting Weblink

- **Nominal Wattage**: Lamp manufacturers publish nominal wattage ratings for their lamps. When high intensity discharge lamps are operated with a ballast, the actual wattage is higher.
- **Rated Wattage**: The actual electric power draw of a fixture inclusive of the ballast and lamp. The difference between nominal and rated wattage is the often referred to as the "ballast factor". For example, a metal halide with a 400-Watt nominal wattage has a 458 Watt rated wattage.

2.2 DESK REVIEWS

The study used a desk review methodology to review the Company's gross savings calculations and estimate verified gross savings. The evaluation looked at how wattage and operating hours were determined, and checked for data entry errors that could affect the savings calculation. The following sections describe the methodology used to evaluate the LED Street Lighting program and the findings from that effort.

3 METHODOLOGY AND ANALYSIS

3.1 METHODOLOGY: 2022 PROGRAM

The Ridgeline team initially selected a sample of 12 applications, completed by 11 distinct National Grid accounts, from the population of 67 applications. The initial sample accounted for 6,995 MWh of the 10,856 MWh (64%) of the gross savings reported for the program in 2022. Review of project documentation revealed that one of the sampled projects was split across two 2022 applications totaling 264 MWh and a larger 2021 application (1,643 MWh). The evaluation team elected to include the full scope of this sampled project in the evaluation. Table 2 provides summary statistics for both the initial and expanded sample frames.

Table 2: Application Count and Savings, Population vs Sample

Sampling Frame	Program Metric	Population	Sample
Initial	Application Count	67	12
	Gross Savings (MWh)	10,856	6,995
Expanded	Application Count	68	13
	Gross Savings (MWh)	12,498	8,638

The Ridgeline team performed a desk review for each sampled project. The desk review consisted of reviewing both an export from the Company's InDemand project tracking database ("Project Tracking Database") and Company records of the specific lighting equipment/facilities associated with each customer account, in the form of a spreadsheet referred to as a "BOT" file.

The BOT files include a row for each retrofitted street light lamp/luminaire and include details on the baseline technology and lamp wattage, the retrofitted technology and wattage, and other details pertaining to the equipment/facilities location and ownership. The BOT file includes the nominal wattage of the replaced lamp/luminaire but not the rated wattage.

The rated wattage for each lamp/luminaire is determined from the lamp type and nominal wattage based on the Tariff. Table 3 shows the nominal and rated wattages by lamp type from the Tariff. The rated (billable) wattages are based on average manufacturer specifications for Company-owned assets,

so are appropriate for use in both billing and energy savings calculations. Rated wattage and nominal wattage are the same for LED lamp/luminaires.

Table 3: Nominal and Rated Wattages – Street Lighting Tariff

Lamp Billable Wattages

High Intensity Discharge (HID)

Lamp Type	Lamp Size (W)									
	50	70	100	150	175	200	250	400	700	1000
Mercury Vapor (MV)	-----	-----	130	-----	211	-----	307	477	784	1095
High Pressure Sodium (HPS)	61	86	118	173	-----	-----	304	470	-----	1106
Metal Halide (MH)	-----	-----	-----	-----	207	-----	295	451	-----	1078

Lamp Type	Lamp Size (W)				
	35	55	90	135	180
Low Pressure Sodium (LS)	63	84	131	182	229

Verified gross savings were calculated for each lamp/luminaire of the sampled projects and those savings were summed to calculate a total verified savings for each project. The savings total for each project was calculated using the baseline wattage and the wattage of the replacement LED.

The equation below is used to compute annual kWh savings for each Street Lighting project.

$$\Delta kWh = \frac{Units * (Watts_{baseline} - Watts_{LED})}{1{,}000} * Operating\ Hours$$

For example, where a 100 Watt High Pressure Sodium (HPS) was replaced with a 36 Watt LED, the evaluator took the 100W baseline nominal wattage from the BOT file and looked up that wattage under Lamp Size in the Tariff (Table 3). The Lamp Size corresponds to a "Lamp Billable Wattage" of 118W. This was used as the baseline rated wattage. Filling in the equation from above, we have the following:

$$\Delta kWh = \frac{1 * (118 \quad - 36)}{1{,}000} * 4{,}173.25\ hours$$

The New York TRM also lists rated wattages for various lamp types and nominal wattages for various lighting technologies. Table 4 compares the tariff and TRM rated wattages and the prevalence of each baseline lamp type and wattage combination in the 2022 evaluation sample. The three technologies represented in the Lamp/Luminaire Type Removed column are High Pressure Sodium (HPS), Metal Halide (MH), and Mercury Vapor (MV).

Table 4: Tariff and TRM Baseline Wattages and Prevalence in Sample

Lamp/Luminaire Type Removed	Lamp/Luminaire Wattage Removed (Nominal)	Tariff Rated Wattages	TRM Rated Wattages	Count in Sample	
HPS	24	29[4]	29	1	1
HPS	70	86	95	4,554	13,188
HPS	100	118	138	7,650	
HPS	150	173	188	984	
HPS	250	304	295	2,777	3,447
HPS	400	470	465	668	
HPS	1000	1,106	1,100	2	
MH	100	128[5]	128	1	117
MH	175	215	215	114	
MH	400	458	458	1	
MV	100	130	125	0	
MV	175	211	205	1	
MV	250	307	290	0	
MV	400	477	455	0	
MV	1000	1,095	1,075	0	

The most common lamp/luminaire types in the sample, 70-, 100-, and 150-watt HPS, have lower deemed wattages in the tariff than in the TRM. The opposite is the case for HPS lamps/luminaires at wattages of 250, 400, and 1,000. The total count of those lamp/luminaire types is substantially lower in the sample.

The tariff defines street lighting hours of operation as 4,170 for non-leap years and 4,183 for leap years. Verified gross savings for the tariff-based method used a weighted average 4,173.25 hours because leap years have an extra day in February with 11 operating hours and every fourth year is a leap year.

Figure 1 shows that National Grid calculated savings for the street lighting project in 2021 based on 4,170 annual hours of operation, while in 2022, multiple different hours of operation values were used. The use of 4,380 annual hours of operation was more common in the calculation of reported savings for 2022 projects, used roughly 75 percent of the time and 4,170 hours used for the remaining projects. Based on discussions with National Grid, we understand that the use of 4,380 annual hours of operation was an unintended change associated with a programming update to the Project Tracking Database.

[4] Wattage not represented in tariff or TRM; extrapolated from other input-to-nominal ratios for other HPS.
[5] Wattage not represented in tariff; set equal to TRM values.

Figure 1: Annual Hours of Operation Used for Reported Savings Calculation - Population

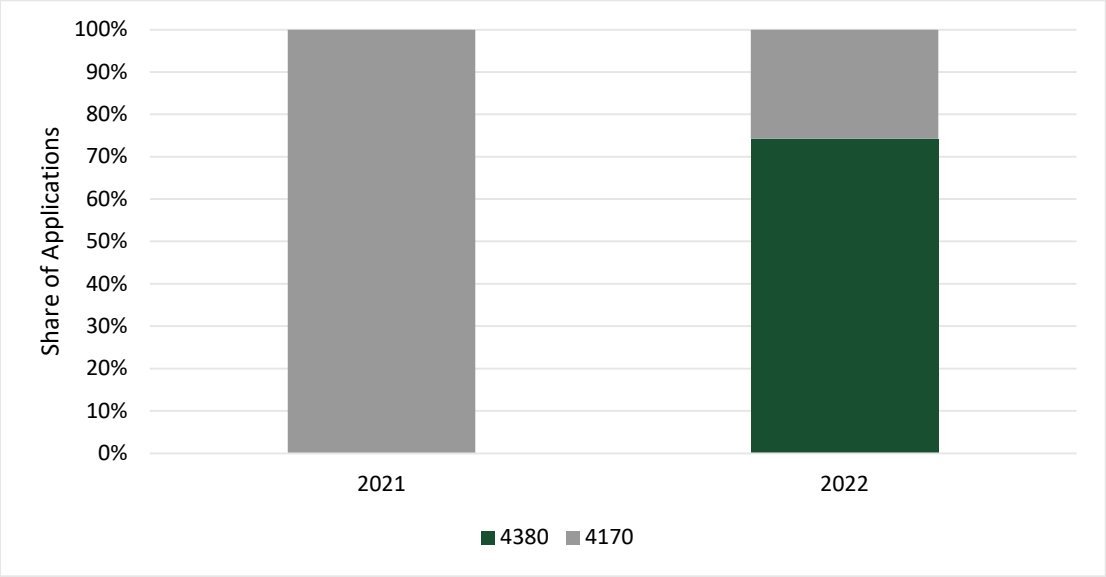

Table 5 shows the annual hours of operation used in the sampled projects.

Table 5: Annual Hours of Operation Used for Reported Savings Calculation - Sample

Application Number	Annual Hours of Operation used in Reported Savings	Customer or Company Owned
14069314	4380	Customer
14008252	4380	Customer
13815232	4380	Customer
13744323	4380	Company
14008756	4380	Customer
13454478	4170	Customer
14042290	4170	Customer
13142892	4170	Customer
13806531	4380	Company
13673815	4380	Company
13496092	4170	Company
13578478	4170	Company
13771078	4380	Company

Verified gross savings are calculated using tariff wattages and tariff operating hours. We believe the Tariff method is appropriate for this evaluation because it better reflects the removed

equipment/facility specifications and bill impacts on the Company's Street lighting customers. The TRM[6] does not have a specific operating hours assumption for street lighting. Rather, the TRM provides the general statement below about default operating hours for exterior lighting. Use of the tariff hours is in line with the TRM guidance to use building specific operating hours where available.

"The average lighting operating hours are defined by building type, as shown in the table below. These are typical average values for the building types shown. Use building specific operating hours where available. For exterior lighting, the default annual operating hours are 4,380 hrs/yr (12 hours per day)."

A final step in the desk review was to spot check the proposed lamp/luminaire model numbers provided in the BOT files against manufacturer spec sheets or Design Lights Consortium (DLC) listings to ensure the product's wattage matched the wattage shown in the BOT file.

3.2 METHODOLOGY: 2023 PROGRAM

A primary difference in the way National Grid calculated and reported gross savings for 2023 as compared to 2022 was adopting consistent use of baseline wattages and operating hours from the tariff and not mixing with the use of TRM values. The Ridgeline team sampled 12 applications from the population of 67 applications in 2023. The sample accounted for 3,335 MWh of the 6,147 MWh (54%) of the gross savings reported for the program in 2023. Ridgeline also reviewed the full 2023 population data to confirm the data showed tariff hours used on all projects. Table 6 provides summary statistics for both the initial and expanded sample frames.

Table 6: Application Count and Savings, Population vs Sample

Program Metric	Population	Sample
Application Count	67	12
Gross Savings (MWh)	6,147	3,335

Just as with the 2022 program, the Ridgeline team performed a desk review for each sampled project. The desk review consisted of reviewing both an export of each project's data from the Project Tracking Database and individual "BOT" file spreadsheets provided to the team for each sampled project. The BOT files include a row for each retrofitted street light lamp/luminaire and include details on the baseline technology and wattage, the retrofitted technology and wattage, and other details pertaining to the equipment/facilities location and ownership.

In line with the approach taken for the 2022 program, verified gross savings were calculated for each lamp/luminaire of the sampled projects and those savings were summed to calculate a total verified savings for each project. The savings were calculated using the provided LED wattages and rated wattages from the tariff corresponding to the nominal wattages shown in the BOT files. National Grid staff utilized tariff wattages and operating hours consistently for 2023 applications.

[6] Case 15-01319, In the Matter of the New York State Technical Resource Manual, New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs- Version 11 (Issued October 6, 2023; effective Jan 1, 2024).

Table 7 shows the baseline wattages and the prevalence of each baseline lamp type and wattage combination in the sample. The four technologies represented in the lamp/luminaire Type Removed column are High Pressure Sodium (HPS), Metal Halide (MH), and Mercury Vapor (MV), and Incandescent (INC).

Table 7: Tariff Baseline Wattages and Prevalence in Sample

Lamp/Luminaire Type Removed	Lamp/Luminaire Wattage Removed (Nominal)	Tariff Rated Wattages	Count in Sample
HPS	24	29[7]	0
HPS	70	86	1628
HPS	100	118	4189
HPS	150	173	477
HPS	250	304	813
HPS	400	470	231
HPS	1000	1,106	1
MH	100	128[8]	0
MH	175	215	7
MH	400	458	0
MV	100	130	95
MV	175	211	30
MV	250	307	0
MV	400	477	10
MV	1000	1,095	1
INC	105	105	64

To calculate verified gross savings a value of 4,173.25 hours of operation, corresponding to the tariff-stipulated hours, was applied to the wattage reduction for each retrofitted lamp/luminaire. The value of 4,173.25 hours was used to account for the weighting of leap year hours (4,183 hours) and non-leap year hours (4,170 hours). National Grid staff utilized 4,170 hours for the sampled projects.

A final step in the desk review was to spot check the proposed lamp/luminaire model numbers provided in the BOT files against manufacturer spec sheets or Design Lights Consortium (DLC) listings to ensure the product's wattage matched the wattage shown in the BOT file.

[7] Wattage not represented in tariff or TRM; extrapolated from other input-to-nominal ratios for other HPS.
[8] Wattage not represented in tariff; set equal to TRM values.

4 RESULTS

4.1 2022 PROGRAM RESULTS

Calculating verified gross savings for the sample using the tariff-based method resulted in a realization rate of 90.29%. Applying that realization rate to the total reported gross savings results in a total verified gross savings for the program of 11,284,758 kWh with a relative precision of ±0.33% at the 90% confidence level. Table 8 shows these results.

Table 8: Verified Gross Savings Results - 2022

Gross Savings (kWh)	Realization Rate	Verified Gross Savings (kWh)	Relative Precision (90% Confidence)
12,498,496	90.29%	11,284,758	0.33%

Table 9**Error! Reference source not found.** provides project-level gross savings, gross verified savings, and realization rates using tariff-based assumptions. Appendix A shows results calculated using TRM rated wattages and operating hours assumptions as a point of comparison.

Table 9: Verified Savings for Sample Projects

Project (Application Numbers)	Gross Savings (MWh)	Verified Gross Savings (MWh)	Application Realization Rate
14069314	4,324	4,148	0.96
14008252	851	816	0.96
13815232	533	308	0.58
13744323	381	347	0.91
14008756	309	289	0.94
13454478, 14042290, 13142892	1,907	1,575	0.83
13806531	116	107	0.92
13673815	95	90	0.95
13496092	75	76	1.01
13578478	36	35	0.96
13771078	10	10	0.95

Projects with gross savings calculated with an assumed 4,380 operating hours have an application-level realization rate less than 1.0 since verified gross kWh savings use the tariff operating hours of 4,173.25. Another factor contributing to the difference is that when the information in the BOT files is input by the National Grid team into its Project Tracking Database, there are specific wattage selections available in InDemand for streetlighting. Staff entering the information into InDemand may select an LED wattage different than the LED wattage listed in the BOT file because they are referencing the nominal wattage.

Most projects in the sample resulted in a realization rate near 100%. However, application number 13815232, had a substantially lower realization rate. There are several contributing factors to this low realization rate, which include the following:

- A quantity of 33 lamp/luminaires being retrofitted from 100-watt HPS to 40-watt LED were recorded as a 1,000-watt HPS baseline. This entry error contributed to an approximate 140 MWh overstatement of savings.
- A quantity of 104 lamp/luminaires were retrofitted with 130-watt LEDs, however the LEDs were recorded as zero proposed watts in InDemand. This meant the savings was calculated as the full wattage of the baseline lamp/luminaire for all 104 of these lamp/luminaires. This contributed to overstating savings by roughly 65 MWh for this project.
- The wattage ranges used in the tariff for customer-owned causes confusion in the data entry into InDemand. A quantity of 476 38-watt LEDs was entered as 35-watt LEDs. This further contributed to the low realization rate.

The last item in the list above is not unique to application 13815232. As noted above, the way in which InDemand is configured requires user selection of wattages that may not match the lamp/luminaire rated wattage. This has an impact on most or all application-level realization rates in the sample.

Error! Reference source not found. Table 10 shows that street lighting is only operational at night, thus no summer peak demand savings were reported and verified peak demand savings were also zero.

Table 10: Gross and Verified Gross Peak Demand Savings

Gross Peak Demand Savings (MW)	Verified Gross Peak Demand Savings (MW)
0.0	0.0

Error! Reference source not found. Table 11 shows a comparison of the total number of lamp/luminaires retrofitted by application number from the associated BOT file and the extract from the Project Tracking Database.

Table 11: Comparison of Retrofitted Lamp/Luminaire Counts – BOT files vs. Project Tracking Database

Application Number	Quantity in BOT File	Quantity in Project Tracking Database	Exact Match
14069314	7,000	6,999	No
14008252	1,517	1,517	Yes
13815232	755	755	Yes
13744323	876	944	No
14008756	493	493	Yes
13454478[9]	4,819	4,819	Yes
14042290	346	346	Yes
13806531	470	470	Yes
13673815	174	174	Yes
13496092	159	159	Yes
13578478	115	115	Yes
13771078	29	29	Yes
TOTAL	**16,754**	**16,820**	**No**

Most quantities match exactly between the BOT file and the Company's Project Tracking Database except for three application numbers. Application number 14069314 is only different by one lamp/luminaire. Application number 13744323 the Project Tracking Database has 68 more lamp/luminaires which are missing from the BOT file. Application number 13454478 represents a 2022 "true-up" of a project submitted in 2021 under application number 13142892. The applications associated with this project included a shared BOT file between application 13454478 and 13142892 (the 2021 application; not shown here) and a second BOT file for application number 14042290. The total lamp/luminaire quantity in the Project Tracking Database for application number 13142892 matches the quantity in the shared BOT file, while the quantity in the Project Tracking Database for application number 13454478 totals to 609, which could be inferred to be the "true-up" lamp/luminaires from the original BOT file. As described previously, the Ridgeline team evaluated this project in its entirety by folding the 2021 application into the sample since there was no clear way to map the BOT file entries to the different applications.

[9] Quantity in Project Tracking Database for 13454478 is drawn from application number 13142892 because that represents the full quantity whereas 13454478 is a subset.

4.2 2023 PROGRAM RESULTS

Calculating verified gross savings for the 2023 sample resulted in a realization rate of 96.23%. Applying that realization rate to the total gross savings results in a total verified gross savings for the program of 5,915,872 kWh at a relative precision of ±1.48% at the 90% confidence level. Table 12 shows results.

Table 12: Verified Gross Savings Results - 2023

Gross Savings (kWh)	Realization Rate	Verified Gross Savings (kWh)	Relative Precision (90% Confidence)
6,147,477	96.23%	5,915,872	1.48%

Error! Reference source not found. Table 13 shows project-level gross savings, gross verified savings, and realization rates.

Table 13: Verified Savings for Sample Projects

Project (Application Numbers)	Gross Savings (MWh)	Verified Gross Savings (MWh)	Application Realization Rate
14472522	808	654	0.81
15031916	631	633	1.00
14458785	488	421	0.86
14027305	465	465	1.00
14200403	304	276	0.91
14907392	304	304	1.00
14445867	127	128	1.01
13832893	58	58	1.00
14770434	52	52	1.00
14945282	50	51	1.01
14225353	30	30	1.00
14659202	19	19	1.00

One issue identified in the 2022 analysis remained for 2023 that affected realization rates for three of the sampled 2023 applications: 14472522, 14458785, and 14200403. These projects included a quantity of 543 lamp/luminaires that were retrofitted with 130-watt LEDs; however, the LEDs were recorded as zero proposed watts in InDemand. This meant the savings was calculated as the full wattage of the baseline lamp/luminaire for all 543 of these units. This contributed to overstating savings by roughly 295 MWh across the three projects. The remaining nine projects had realization rates close to 1, indicating the savings was accurately calculated by National Grid staff.

Error! Reference source not found. Table 14 shows that, as expected, because street lighting is only operational at night, no summer peak demand savings were reported and verified peak demand savings was also zero.

Table 14: Gross and Verified Gross Peak Demand Savings

Gross Peak Demand Savings (MW)	Verified Gross Peak Demand Savings (MW)
0.0	0.0

Error! Reference source not found. Table 15 shows a comparison of the total number of retrofitted lamp/luminaires by application number from the associated BOT file and the extract from the Project Tracking Database. All quantities in the sampled projects matched between the BOT files and the Project Tracking Database.

Table 15: Comparison of Retrofitted Lamp/Luminaire Counts – BOT files vs. Project Tracking Database

Application Number	Quantity in BOT File	Quantity in Project Tracking Database	Exact Match
14472522	1,402	1,402	Yes
15031916	1,594	1,594	Yes
14458785	1,337	1,337	Yes
14027305	1,256	1,256	Yes
14200403	524	524	Yes
14907392	608	608	Yes
14445867	206	206	Yes
13832893	183	183	Yes
14770434	144	144	Yes
14945282	140	140	Yes
14225353	107	107	Yes
14659202	45	45	Yes
TOTAL	**7,546**	**7,546**	**Yes**

5 RECOMMENDATIONS

Table 16 provides the Ridgeline team's recommendations to improve the LED Street Lighting program. Some recommendations were addressed or partially addressed between the 2022 and 2023 program years. Indicated in the table are the current statuses of the effort to address each recommendation.

Table 16: Summary of Key Findings and Recommendations

Recommendation	Description of the Issue	Current Status
Apply tariff hours-of-use consistently to all LED Street Lighting projects.	In 2022, National Grid used 4,170 annual hours of operation to estimate gross savings for some projects and 4,380 hours for others. The 4,380 value is the NYS TRM assumption for exterior dusk-to-dawn lighting.	In 2023, all projects used 4,170 annual hours of operation. Since the tariff shows 4,170 hours for non-leap years and 4,183 hours for leap years, we recommend using the average (4,173.25) to calculate gross savings as this is the average annual operating hours over the life of the LED streetlighting equipment. The Ridgeline team also recommends National Grid propose incorporating a specific mention of street lighting tariff hours into V12 of the NYS TRM.
Consider aligning NYS TRM and tariff baseline wattages for HID lamp/luminaires.	The baseline wattage assumptions in Tariff 214 for HID depart from industry standard assumptions for several key lamp/luminaire types. The NYS TRM wattage tables are more consistent with industry standard practice.	In 2023, all projects used tariff-defined baseline wattages. Ridgeline used these tariff wattages to compute the VGS RRs. We recommend National Grid discuss this issue with the TRM Management Committee to either add language to the TRM regarding the use of street lighting tariff assumptions for gross savings calculations, or revisit tariff wattages in cases where the tariff and NYS TRM differ by more than 5%.
Fix the Project Tracking Database issue that causes a zero wattage to be assigned to SLED130 proposed lamp/luminaires.	In 2022 and 2023 there were lamps/luminaires retrofitted with 130-watt LEDs, however the LEDs were recorded as zero proposed watts in the InDemand system. This meant the savings were calculated using the full wattage of the baseline lamp/luminaire for each lamp/luminaire rather than the difference between the baseline and LED wattage.	This issue remained in 2023 and should be investigated and corrected in InDemand.

Consistently track the installed LED make and model number in the BOT file.	This simple change would allow for verification of Design Lights Consortium (DLC) certification. National Grid should also require customer-owned projects to check DLC-listed input wattages and use those wattages in the BOT files.	BOT files for 2023 projects included entries in a column titled "New Lamp Item No Installed," which appears to indicate a designation of the model install. However, the entries appear to be an internal naming scheme, not a manufacturer's product identifier. There also remained several BOT files in 2023 that had no entries in the indicated column. National Grid should ensure there is a clear way to identify the specific manufacturer and model number for each proposed lamp/luminaire being installed.
Revisit the process used to create Project Tracking Database entries from BOT files.	The BOT files contain granular lamp/luminaire-level data with actual LED wattages. To create measure records in the Project Tracking Database, National Grid staff first create pivot tables in Excel and then map the groupings to the nearest Wattage. The manual pivot table process is subject to human error and associating with the correct range wattage as outlined in the tariff reduces the precision of the gross savings and could result in bias of the wattage selection. The National Grid team members calculating savings should ensure the BOT files used contain all relevant criteria regarding the luminaires being retrofitted, including ballast wattage.	National Grid should continue to work towards a streamlined method to transmit BOT file data into the Project Tracking Database at the lamp/luminaire-level.

APPENDIX A: TRM-BASED SAVINGS ESTIMATES

The verified gross savings in this report follow the operation hours and rated wattage assumptions from the Company's Street Lighting tariff. The Company calculated gross savings using rated wattages from the tariff and a mix of tariff and TRM operating hours in 2022 due to a Project Tracking Database error. Table 17 shows a calculated realization rate using operating hour and rated wattage assumptions from the NYS TRM. If TRM operating hours and baseline wattages had been used to calculate gross savings, the VGS RR would be 104%. The TRM-based method used the TRM stipulated hours of 4,380.

Table 17: 2022 Savings using TRM Hours and Wattages

Gross Savings (kWh)	Realization Rate	Verified Gross Savings (kWh)	Relative Precision (90% Confidence)	Method
12,498,496	103.91%	12,986,575	0.90%	TRM

We believe the Tariff method is appropriate for this evaluation because it better reflects the bill impacts of the Company's Street lighting customers. The TRM[10] does not have a specific operating hours assumption for street lighting. Rather, the TRM provides a general statement about default operating hours for exterior lighting.

"The average lighting operating hours are defined by building type, as shown in the table below. These are typical average values for the building types shown. Use building specific operating hours where available. For exterior lighting, the default annual operating hours are 4,380 hrs/yr (12 hours per day)."

Table 18 provides project-level gross savings, gross verified savings, and realization rates using the TRM-based assumptions for 2022 projects.

[10] Case 15-01319, In the Matter of the New York State Technical Resource Manual, New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs- Version 11 (Issued October 6, 2023; effective Jan 1, 2024).

Table 18: Verified Savings for Sample Projects – TRM Method

Project (Application Numbers)	Gross Savings (MWh)	Verified Gross Savings (MWh)	Realization Rate
14069314	4,324	4,689	1.08
14008252	851	937	1.10
13815232	533	369	0.69
13744323	381	392	1.03
14008756	309	326	1.05
13454478, 14042290, 13142892	1,907	1,864	0.98
13806531	116	153	1.32
13673815	95	100	1.06
13496092	75	90	1.20
13578478	36	45	1.23
13771078	10	11	1.14

As indicated in the tables, use of the tariff-based method produces generally lower verified savings than reported gross savings.

In 2023 the Company calculated gross savings using rated wattages from the tariff and operating hours from the tariff. If TRM operating hours and baseline wattages had been used to calculate gross savings, the realization rate would be 118%.

Table 19: 2023 Savings using TRM Hours and Wattages

Gross Savings (kWh)	Realization Rate	Verified Gross Savings (kWh)	Relative Precision (90% Confidence)	Method
6,147,477	1.1789	7,095,289	1.21%	TRM