



**Smart City  
REV Demonstration Project  
City of Schenectady, New York  
Case 14-M-0101**

**Quarterly Report – Q3 2019**

October 31, 2019

# Table of Contents

1.0	Executive Summary.....	1
2.0	Highlights Since Implementation Plan Filing .....	2
2.1	Major Task Activities.....	2
2.2	Challenges, Changes, and Lessons Learned.....	6
2.3	Stakeholder Engagement and Knowledge Sharing .....	8
3.0	Next Quarter Forecast .....	8
4.0	Work Plan and Budget Review .....	9
4.1	Updated Work Plan .....	9
4.2	Current Budget.....	9
5.0	Quarterly Report Template .....	10
	Appendix A – Updated Work Plan.....	13
	Appendix B – Summary One-Pager.....	14

# 1.0 Executive Summary

---

Niagara Mohawk Power Corporation d/b/a National Grid (“National Grid” or the “Company”) has partnered with the City of Schenectady (“Schenectady” or the “City”) to demonstrate a smart city solution. Using the Company’s outdoor lighting infrastructure as a platform for advanced outdoor lighting services, the Company and the City are deploying smart city technologies and testing the business models that will animate the advanced outdoor lighting and the smart city markets (the “Project”).



The Project is intended to identify innovative smart city solutions that will help the City expand the breadth and efficiency of the services it provides to its residents. This approach aligns with the Company’s efforts to test, scale, and deploy clean energy solutions in line with its *Northeast 80x50 Pathway*, the Reforming the Energy Vision (“REV”) objectives, and the State’s clean energy agenda. Specifically, the partnership between the Company and the City will test whether the Company’s outdoor lighting infrastructure can facilitate the adoption of smart city technologies by deploying approximately 4,275 efficient light-emitting diode (“LED”) outdoor lighting fixtures, network lighting control (“NLC”) nodes, and smart city technologies. The upgrades will effectively turn Schenectady into a smart city, capable of saving energy, more efficiently providing municipal services, and opening the door to further innovation.

During the third quarter of 2019, the Company successfully held vendor-partner kickoff meetings in Schenectady, marking a milestone achievement towards Phase 1 deployment. The Company also procured non-standard 3000 Kelvin (“K”) street lights and smart city technologies. In preparation for Phase 1 deployment, the Company held a contractor training and a pre-construction meeting to encourage successful and efficient implementation. In addition, National Grid conducted another round of field surveys for Zone B smart city technology locations to confirm whether existing pole conditions can accept the technology and if the technology would introduce any compliance issues. Additionally, the Company entered contracts to implement the multipurpose Internet of Things (“IoT”) network. Despite materials delays and workforce availability challenges due to Hurricane Dorian, the Project began installation in Zone B in September 2019. The Company also began testing the accuracy of the NLC node chip meter.

## 2.0 Highlights Since Implementation Plan Filing

---

The tables included in Sections 2.1 and 2.2 below provide detailed descriptions of the major activities completed in the last quarter, as well as the challenges, lessons learned, and risk mitigation strategies from this work.

### 2.1 Major Task Activities

The Company worked on eight significant tasks during the third quarter of 2019.

First, the Company held two vendor kickoff meetings with the City to confirm scope, materials, and timelines for deployment in Zones A and B. The meetings helped ensure project alignment by outlining the roles and responsibilities of each stakeholder.

Second, the Company and the City presented on the Project at the Smart and Secure Cities and Communities Challenge (GCTC/SC3) Expo, which was cohosted by the National Institute of Standards and Technology (“NIST”), the U.S. Department of Homeland Security’s Science and Technology Directorate, and the National Telecommunications and Information Administration (“NTIA”). The Company and the City shared lessons learned and began collaborating with working groups to expand knowledge.

Third, the Company procured non-standard 3000K street lights and smart city technologies. The street lights had a supply chain lead time of two months, while the smart-city technologies had a product lead time of two to three months. Although Hurricane Dorian created a two-week delay in workforce availability, the majority of materials for Zone B were delivered and deployed by mid-September. Meanwhile, the Company anticipates Zone A materials will be delivered in late October.

Fourth, prior to Zone B deployment, the Company revisited the National Electric Safety Code (“NESC”) rule H238B-2 requirements by conducting field surveys for all 250 smart city technology locations in Zone B. The field survey identified a number of locations that either required remediation or that would otherwise violate the NESC rule if the proposed smart city technology were installed. The City requested make-ready service to bring some of the locations into compliance with the NESC for purposes of deploying smart city technology. Toward the end of the third quarter, approximately 200 of the 250 pole locations were deemed suitable for the deployment. The Company will continue to work with the City to determine optimal locations to deploy smart city technology in a manner that will maximize locational value while minimizing the need for make-ready work. For reference, the Company has included the Zone B smart city technology design schematic in Figure 1 below.

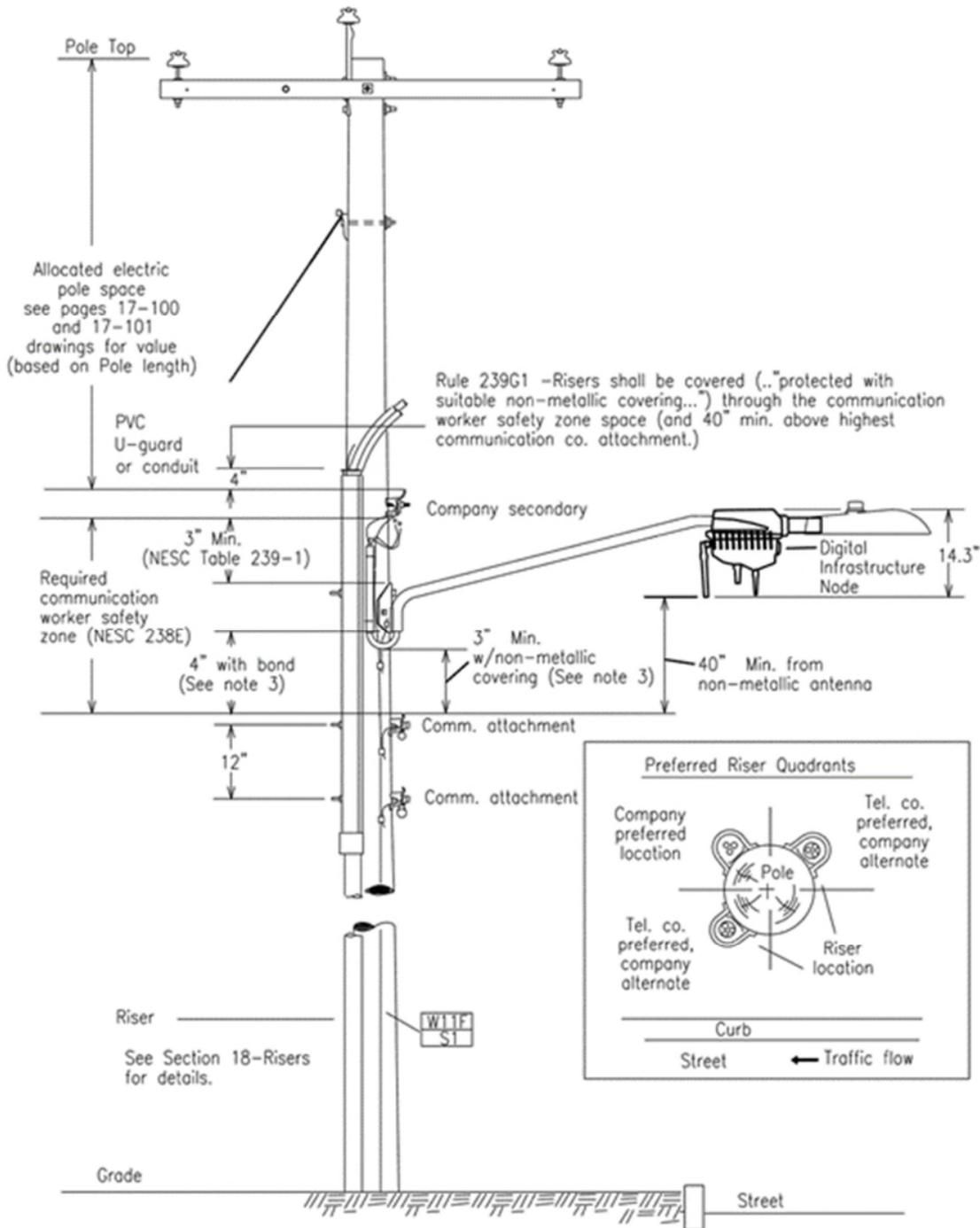


Figure 1. Zone B smart city technology design schematic prepared by National Grid. In adherence to NESC Rule H238B-2, the smart city technology by Current® and GE is treated as a packaged antenna, requiring forty inches of vertical clearance from the last antenna. The forty-inch clearance is also known as the telecommunication workers' safety zone.

Fifth, the Company held both an installation training and a pre-construction meeting with the installation contractor to ensure installation practices to the manufacturer's specifications. The meeting also afforded the Company an opportunity to reiterate various complex Project requirements and expectations. In addition, the Company introduced an activation process and a documentation process using the Fulcrum App – a field data collections application. Although the processes could increase upfront deployment time and cost, the Fulcrum App can reduce overall Project time and cost while also allowing the Company to maintain accurate asset tracking.

Sixth, the Company successfully contracted with Itron Inc. to implement the multipurpose IoT network. The vendor-partner team worked diligently to design the solution and network buildout, leading to first article approval in mid-August. This work allowed the manufacturing of lighting controls and smart city technologies in Zone A. The IoT network is expected to be fully operational before Zone A deployment in October.

Seventh, the Company began testing NLC nodes (Figure 2) to verify vendor product specifications and chip metering accuracy. Preliminary lab tests of GE LightGrid® NLC showed promising test results (Figure 3). The Company will continue to conduct a full laboratory test of NLCs in the fourth quarter of 2019.



Figure 2. Images of a GE LightGrid® NLC being tested.

SLN Type	Test	Volts	Amps	PF	Kh	Pulses	Meter mWh	Std mWh	Registration	Error	Pass/Fail
GE 1	FL	120	2.5	1	0.1	10	995.7497	996	99.97	-0.03	PASS
GE 1	LL	120	0.25	1	0.1	10	958.3675	960	99.83	-0.17	PASS
GE 1	PF	120	2.5	0.5	0.1	10	991.5464	989	100.26	0.26	PASS
GE 2	FL	120	2.5	1	0.1	10	995.7497	999	99.67	-0.33	PASS
GE 2	LL	120	0.25	1	0.1	10	958.3675	961	99.73	-0.27	PASS
GE 2	PF	120	2.5	0.5	0.1	10	991.5464	991	100.06	0.06	PASS
GE 3	FL	120	2.5	1	0.1	10	995.7497	997	99.87	-0.13	PASS
GE 3	LL	120	0.25	1	0.1	10	958.3675	959	99.93	-0.07	PASS
GE 3	PF	120	2.5	0.5	0.1	10	991.5464	989	100.26	0.26	PASS
GE 4	FL	120	2.5	1	0.1	10	995.7497	999	99.67	-0.33	PASS
GE 4	LL	120	0.25	1	0.1	10	958.3675	961	99.73	-0.27	PASS
GE 4	PF	120	2.5	0.5	0.1	10	991.5464	991	100.06	0.06	PASS

Figure 3. Initial meter lab testing results of four GE LightGrid® NLCs. Preliminary results show that all four test nodes passed multiple test parameters.

Finally, the Company began Phase 1 with deployment starting in Zone B. The implementation requires the lighting network, specifically GE LightGrid® Gateways to be installed first, allowing the City to control the converted LED street lights to maximize energy savings and implement dimming schedules as needed. Phase 1 deployment in Zone B also serves as a backdrop for New

York State Comptroller’s press event in Schenectady announcing the publication of the *Smart Solution Across the State: Advanced Technology in Local Governments Report*.<sup>1</sup> The Company supported the press event, including inviting stakeholders to observe the LED street light installation on Congress Street.

The decisions and lessons learned in Phase 1 will inform efforts to expand the successful solution into Zones C, D, and E during Phase 2. Since Phase 2 relies on the Phase 1 outcomes, the Company now expects a delayed start to Phase 2 from July 2019 to January 2020 because of material and workforce delays. The combined delay for Phase 1 is approximately six months. The Company is working with the City to adjust the schedule for each project phase. The updates are included as part of the revised work plan included as Appendix A. Also, the Company provides a further description of general Project milestones below:

Anticipated Start /End Date	Adjusted Start/End Date	Checkpoint/ Milestone	Status	
October 2018 to December 2018		Install LED (Proof-of-Concept Stage; Max. 20 Fixtures)	Completed	
October 2018 to June 2019	October 2018 to December 2019	Install LED & NLC Nodes (Zone A & B; Approx. 2,300 Fixtures) Compare vendor solutions	Delayed Completion	
October 2018 to December 2019	October 2019 to December 2019	National Grid Install Smart City Sensor Nodes (Zones A & B; Max. 100 nodes)	Delayed Completion	
July 2019 to June 2021	January 2020 to June 2021	LED and NLC Node Steady State (Evaluate operational capabilities)	On Track	
July 2019 to December 2019	January 2020 to June 2020	Install LED and NLC Nodes (Zones C, D, & E; Approx. 2,000 fixtures)	Delayed Start	
June 2019 to March 2020	January 2020 to June 2020	National Grid Install Smart City Sensor Nodes (Zones C, D, and E; Max. 100 nodes)	Delayed Start	

<sup>1</sup> See Office of the NYS Comptroller, *Smart Solutions Across the State: Advanced Technology in Local Governments* (September 2019) (available at <https://www.osc.state.ny.us/localgov/pubs/research/smart-solutions-across-the-state.pdf>).

Anticipated Start /End Date	Adjusted Start/End Date	Checkpoint/ Milestone	Status	
October 2018 to June 2020	January 2020 to June 2020	City Install Smart City Device Attachments to Smart City Sensor Nodes (All Zones)	Delayed Start	
October 2018 to March 2019	October 2018 to October 2019	National Grid Implement Multi-Purpose Internet of Things (“IoT”) Mesh Network	Delayed Finish	
October 2018 to December 2019	September 2019 to June 2020	National Grid Install IoT Mesh Network, Sensors, and Meters (Gas ERTs; Temperature Sensors; Environmental Sensors; Etc.)	Delayed Finish	
January 2019 to June 2020	October 2019 to June 2020	Third-Parties Install Sensors (Smart-Home Devices; Electric Vehicle (“EV”) Chargers; Water Leak Sensors; Water Shutoff Valves; Water Meters; Vacant-Home Sensors; Parking Management Sensors; Etc.)	On Track	
September 2019 to June 2021	December 2019 to June 2021	Steady State Review and Evaluations	On Track	

## 2.2 Challenges, Changes, and Lessons Learned

High-level lessons learned to date that the Company will use to inform the ongoing work and future smart city deployments:

1. Smart City technologies are nascent to utility installations. Before installing smart city equipment on utility poles, technology providers should share product specification drawings with the Company to ensure code compliance.
2. Once the utility provides installation guidelines, a field survey must be conducted on the proposed location to ensure existing conditions can safely support the installation. The

NESC H238B-2 requirement for the Current® by GE Digital Infrastructure node added complexity to the project. However, this important lesson learned is a testament to the Company’s strong culture of doing business through safety by design.

3. Upon the deployment of the first few street lights with NLCs, the Company and the City recognized the potential benefits offered through the technology. The lighting platform provides the City with greater control, convenience, and the potential to unlock additional savings through platform capabilities. The Company also recognized the value the technology can bring to enhance outdoor lighting services.
4. Some smart city technologies are manufactured abroad, resulting in longer product lead times. This has created approximately three months of delays. However, the Company used this opportunity to conduct additional due diligence and prepare the installation contractor for success.
5. Depending on the advanced network lighting solution, the installation needs to follow the deployment scheme that is most optimal for the technology. Whether it is a point-to-many-point solution, cellular, or mesh technology, the deployment scheme should involve close communication and guidance from the manufacturer. This allows the technology to function as desired from the start.

The above challenges and lessons learned are also captured in the table below, which identifies the corresponding adjustment to the Zone A and B deployment schedule:

Issue or Change	Strategies to Resolve	Resulting Change to Project Scope/Timeline?	Lessons Learned
Current by GE® Digital Infrastructure node creates deployment complexities in order to ensure NESC code compliance.	The Company is conducting field surveys of all 250 sites to ensure the existing condition can accept the technology and verify that installing the technology will not introduce a safety hazard.	Potential timeline delays; however, the company is proceeding with installation on approved locations. Should make-ready services be required, the Project team will consult with the City.	Utilities play a vital role in enforcing safety and adherence to governing electrical standards.
NLCs can provide the City with many benefits such as greater control, convenience, and the opportunity to unlock greater energy savings. Additionally, the Company also recognizes the potential enhancements to LED conversions by adopting	The Company hopes to engage with DPS Staff to discuss the technology and the opportunity to offer this as a product to outdoor lighting customers.	N/A	NLCs are mature market products that provide an array of both customer and utility benefits.

advanced lighting controls.			
Smart city materials manufactured abroad presented a project delay.	The Company worked with vendor partners to increase project priority within its supply chain to reduce further delays.	Approximately a two-month delay for Zone B and a three-month delay for Zone A.	The Project requires approximately three months for product lead time.
Understanding the advanced outdoor lighting technology requirement is essential and may require additional deployment coordination.	The Company communicated the deployment scheme to the installation contractor.	N/A	Before deployment, manufacture guidelines and best practices should be shared to encourage a fruitful implementation. Contractor training and pre-construction meetings can effectively address technology needs.

### 2.3 Stakeholder Engagement and Knowledge Sharing

The Company will support and participate in upcoming community engagement events. The City aims to host four public events to invite residents, business owners, and stakeholders to learn and provide feedback on the Project and the overall smart city initiative.

### 3.0 Next Quarter Forecast

---

In the fourth quarter of 2019, the Company anticipates completing the following items:

- Install a multipurpose IoT network in Zone A;
- Complete deployment of both advanced street lights and smart city technologies in Zones A and B;
- Complete lab testing of NLCs and prepare the final report;
- Begin planning work for Phase 2 deployment in remaining zones;
- Determine the smart city solution for Zones C, D, and E; and
- Explore additional smart city uses cases.

In addition, based on the continued growth of the NLC market and the Company’s own experience, the Company believes NLCs nodes can offer an array of both customer and utility benefits. As part of its existing LED conversion program, the Company will seek to work with Department of Public Service (“DPS”) Staff to identify additional opportunities for incorporating NLC nodes into customer offerings, driving more significant energy savings and contributing to the State’s energy goals.

## 4.0 Work Plan and Budget Review

### 4.1 Updated Work Plan

The Company made updates to the work plan outlined in the Project Implementation Plan to reflect changes in the status and ongoing workstreams. Given the complexities described above, the Company updated the Project work plan to capture the following components:

1. Extend Phase 1 to December 2019: The Project team anticipates completion of both street lights and smart city technologies around this time, accounting for the holidays;
2. Delay Phase 2 to early 2020: The Project team will work with the City to implement the smart city solution in remaining zones; and
3. Lab testing of NLC nodes to evaluate chip metering accuracy will continue into December 2019.

The updated work plan is included in Appendix A.

### 4.2 Current Budget

Project Task	3 <sup>rd</sup> Quarter Actual Spend <sup>2</sup>	Project Total Spend to Date	Project Budget	Remaining Balance
<b>CapEx</b>				
Smart Lighting	\$0	\$0	\$2,170,000	\$2,170,000
Network	\$88,610	\$88,610	\$390,000	\$301,390
Smart Sensor	\$0	\$0	\$3,100,000	\$3,100,000
Project Support	\$0	\$158,997	\$100,000	(\$58,997)
Lighting System Evaluations	\$0	\$0	\$150,000	\$150,000
Smart City Data Analytics	\$0	\$0	\$100,000	\$100,000
Data Platform	\$3,380	\$3,380	\$250,000	\$246,620
Network Management	\$0	\$0	\$250,000	\$250,000
<b>OpEx</b>				
Smart Lighting	\$0	\$41,167	\$180,000	\$138,833

<sup>2</sup> Invoices will be submitted by vendors following the delivery of all materials. Although most Phase 1 materials were delivered by early September, the Company expects a delay in vendors' submission of invoices.

<b>Project Task</b>	<b>3<sup>rd</sup> Quarter Actual Spend<sup>2</sup></b>	<b>Project Total Spend to Date</b>	<b>Project Budget</b>	<b>Remaining Balance</b>
Network	\$0	\$0	\$715,000	\$715,000
Smart Sensor	\$0	\$0	\$180,000	\$180,000
<b>Total</b>	<b>\$91,990</b>	<b>\$292,154</b>	<b>\$7,585,000</b>	<b>\$7,292,846</b>

## 5.0 Quarterly Report Template

<b>Quarterly Report Template</b>	
<b>Milestones:</b>	
Project Milestones Accomplished:	The Company hosted kickoff meetings for each zone. Following the delivery of most materials, Phase 1 deployment started with LED conversion and smart city technology installation in Zone B. Additionally, the Company entered a contract to implement the multipurpose network.
Next Project Milestone:	Complete installation of LED, NLC, and smart city technologies in Zones A and B. Install multipurpose network in Zone A. Complete NLC node testing. Evaluate deployed solutions to inform Phase 2. Begin Phase 2 discussion with the City to explore new market options and initial findings from the solutions implemented in Phase 1.
<b>Tasks/Timeline:</b>	
Completed Project Tasks Since Last Quarterly Report:	The Company received materials in early September, and contracted with Itron for the deployment of the multipurpose network. The Company also held separate Phase 1 Zone A and B vendor kickoff meetings with the City. The field survey began, ensuring adherence to National Grid safety and governing codes. The Company also began the field installation of LED, NLC, and smart sensors in Zone B, along with testing the NLC nodes.
Changes or Impacts to Schedule Since Last Quarterly Report:	Delayed start of installing LED street lights and NLC nodes in Zones A and B due to material lead times and installation contractor workforce availability challenges.

<b>Quarterly Report Template</b>	
Lessons Learned:	Adequate time is needed during contract negotiations to fully describe the specific legal obligations and the associated risk for each party. The Company can maximize the learning opportunity by aligning any advanced metering infrastructure (“AMI”) portions of the Project with the Company’s pending AMI deployment plan. The number of smart sensors depends on the use-case applications and solution requirements. Any new attachments require review to ensure code and standards compliance. Additionally, field surveys are required to validate compliance with clearance requirements.
Work Stream Coordination:	Coordination occurring among the Company’s Electric Business Unit, and the Customer and IT business functions for purposes of engineering design, review, and deployment.
<b>Risks:</b>	
Identified Risks:	Phase 1 deployment cost is higher than expected, with the increase in smart sensors required to ensure proper solution coverage. The Company anticipates longer delivery times for smart city technologies, because most products are not off-the-shelf and require manufacturing overseas. The installation contractor requires enough work between Zone A and B deployments to ensure schedule continuity. Additionally, make-ready work, such as relocating attachments or new pole installations, could increase deployment cost and impact project timeline.
Risk Mitigation Plan:	The Project will continue to work with vendors to improve and provide weekly updates on material delivery. The Company will also inform the installation contractor on the material forecast and adjust deployment to keep the workforce in Schenectady. In addition, the Company will request additional resources when appropriate to reduce project delays, and it will continue to work closely with the City to identify poles that are optimal for smart city technologies.
<b>Finance:</b>	
Total Spend to Date:	\$292,154
Target Budget Spend:	\$1,388,950
Actual Incremental Spend:	\$91,990
Variance:	(\$1,096,796)
In-Kind and Grant Support (Specifically	Estimated \$150,000 from vendors.

Quarterly Report Template	
for REV Demo):	
<b>Additional Notes:</b>	

# Appendix A – Updated Work Plan

Smart City - Implementation Plan			CY 2018												CY 2019								
Activities	Timing		CY 2018												CY 2019								
	Adjusted Start	Adjusted End	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	
1.00 NG install LED Proof of concept																							
1.10 Install LED Max 20, 3k vs 4k																							
2.00 NLC & LED Installation Phase 1																							
2.10 Develop survey, release survey, analyze	Jan-2019	Apr-2019																					
2.20 Finalize results and provide survey to City	Apr-2019	Apr-2019																					
2.2.1 Milestone City Decision Point	Apr-2019	Apr-2019																					
2.2.2 City signs City Agreement and SOW	Apr-2019	May-2019																					
2.30 Plan, Design, Procure, Legal	Oct-2018	Jun-2019																					
2.40 NG install LED and NLC Nodes Zones A and B; install and commission	Oct-2018	Sep-2019																					
2.4.1 Sign Contract	May-2019	May-2019																					
2.4.2 Vendor Kickoff Meetings with the City	Jul-2019	Jul-2019																					
2.50 Field Installation LED and NLC	Jul-2019	Sep-2019																					
2.60 Evaluate	Jul-2019	Sep-2019																					
2.70 Lab test meters and NLC																							
2.80 Cost Recovery A & B	Jul-2019	Sep-2019																					
3.00 Smart City Sensor Phase 1																							
3.10 NG install smart city sensor nodes Zones A and Zone B Max	Oct-2018	Sep-2019																					
3.20 Plan, Design, Procure, Legal	Oct-2018	Jun-2019																					
3.2.1 Sign Contract	May-2019	May-2019																					
3.30 Pilot Test Install 20 max	Jul-2019	Jul-2019																					
3.3.1 Request Permission from City to proceed	Jul-2019	Jul-2019																					
3.40 Zone A & B Field install	Aug-2019	Sep-2019																					
3.50 Test the first 5 for image quality with Dimming	Aug-2019	Sep-2019																					
4.00 Multipurpose network Phase 1																							
4.10 NG implement Multipurpose network	Oct-2018	Sep-2019																					
4.1.1 Plan, Design, Procure, Legal	Oct-2018	Sep-2019																					
4.1.2 Network Test ****	Jul-2019	Aug-2019																					
4.1.2 Network Field Installation	Oct-2019	Oct-2019																					
4.20 NG install IoT Mesh network, Sensor, and Meters	Oct-2018	Dec-2019																					
4.2.1 Plan, Design, Procure, Legal	Oct-2018	Jul-2019																					
4.2.2 City Acquisition for test sites	Apr-2019	Aug-2019																					
5.00 Energy and attachment as a service Phase 1																							
5.10 Assist the City for 3rd party or City owned attachments																							
5.20 Scoping																							
5.30 Cost Recovery																							
5.40 Evaluate and Decision to move forward Phase 2	Dec-2019	Dec-2019																					
6.00 NLC & LED Installation Phase 2																							
5.10 NG install LED and NLC nodes Zones C, D, E	Jan-2020	Jun-2020																					
5.20 Plan, Design, Procure, Legal	Jan-2020	Feb-2020																					
5.30 Field Installation LED and NLC	Apr-2020	Jun-2020																					
5.40 Cost Recovery All Zones	Jan-2020	Jun-2021																					
5.50 Steady State	Jan-2020	Jun-2021																					
5.60 Energy Calculations and credit; Penetration testing; final eval report	Jan-2020	Jun-2021																					
7.00 Smart City Sensor Phase 2																							
7.10 Install Smart City Sensor Nodes Zones C, D, And E Max 100	Jan-2020	Jun-2020																					
7.20 Cost Recovery for smart city sensor node	Jan-2020	Mar-2020																					
7.30 Plan, Design, Procure, Legal	Jan-2020	Feb-2020																					
7.40 Zone C,D,E field install Smart City Technologies	Mar-2020	Jun-2020																					
7.50 City Smart City Device Attachment to Smart-City Sensor Node	Oct-2018	Jun-2019																					
7.60 City Planning and Procurement	Oct-2018	Mar-2019																					
7.70 City Field Installation	Apr-2019	Mar-2020																					

# Appendix B – Summary One Pager



Smart City Schenectady REV Demo

Q3 2019

Overall Status (Active)

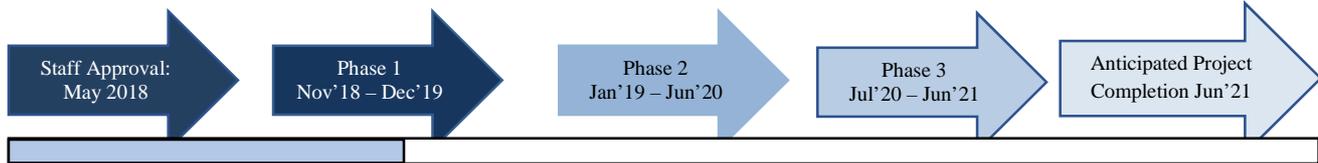
**Project Start Date:** 05/24/2018

**Project End Date:** 06/30/2021

**Budget:** \$7,585,000

**Current Quarter Spend:** \$91,990

**Cumulative Spend:** \$292,154



**Project Summary:** The Project is designed to test whether the Company’s outdoor lighting infrastructure can serve as a platform for advanced services, the deployment of a multipurpose IoT network to enable smart-city technologies, and the business models that will animate the advanced outdoor lighting and smart-city markets.

Cumulative Lessons Learned		
The Customer	Market Partners	Utility Operations
<ul style="list-style-type: none"> <li>• Cities want more than smart lighting alone. The City of Schenectady intends to improve public services, increase public safety, and find ways to save money in the process.</li> <li>• The City and the Company understand the need to engage and inform residents of the project. The project team plans to host four community open-house events in the fourth quarter of 2019.</li> <li>• Conversion to smart LED street lights with NLCs provides greater control, convenience, and opportunity for additional GHG savings that help meet 80 X 50 climate goals.</li> </ul>	<ul style="list-style-type: none"> <li>• Partners are customizing their solutions to meet the needs of both the City and the Company.</li> <li>• Standardization and market advancements would improve network interoperability between smart-city devices.</li> <li>• Upfront costs are significant. However, the cost of future deployment may be lower as the project expands into other zones.</li> <li>• New and disruptive smart-city technologies are emerging on the market. The Project can benefit from new market entrants to offer additional choices and new products.</li> </ul>	<ul style="list-style-type: none"> <li>• Smart City is a complex deployment of diverse smart technologies. Utility involvement consolidates smart cities into a packaged solution.</li> <li>• Installation costs are high. Therefore, deployment cost reductions can be achieved by combining smart-city installation with LED upgrades.</li> <li>• An internal engineering review of smart city solutions is essential. Adequate time is needed to fully ensure the solution meets standard code compliance, data security, and data privacy requirements. Field surveys are also required before installation.</li> </ul>

**Application of lessons learned:** The Company continues to review the responses submitted from the request for information (“RFI”) for advanced street lighting and smart-city products released in the first quarter 2019. The Company believes NLCs offer a range of customer benefits and provide opportunities to enhance outdoor lighting services.

**Issues Identified:** The Company anticipates longer delivery times for smart-city technologies because most products are not off-the-shelf and require manufacturing abroad.

**Solutions Identified:** The Company has requested vendor partners to prioritize manufacturing and delivery schedules to reduce further delays. Most materials arrived early September, allowing deployment to begin mid-September for Phase 1.

**Recent Milestones/Targets Met:** The Company hosted kickoff meetings for each zone. Following the delivery of materials, Phase 1 deployment started with LED conversion and smart-city technology installation in Zone B. Additionally, the Company contracted with Itron to implement the multipurpose IoT network.

**Upcoming Milestones/Targets:** The Company aims to complete Phase 1 deployment in the fourth quarter of 2019. Moreover, the Project team will complete testing of the NLCs and prepare to draft a lab test report. Phase 2 discussions with the City will begin in December to determine the smart city solution for Zones C, D, and E.