



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

Quarterly Report – Q1 2019

April 30, 2019

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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 first quarter of 2019, Project team continued to build and design the project for Phase 1 deployment by engaging with the City and partner vendors. In parallel, numerous functional teams within the Company are reviewing proposed solutions, addressing code compliance, solution architecture, as well as digital risk and security. The Company continued contract negotiations with vendors. At the same time, the Project team drafted an agreement between the Company and the City delineating Project responsibilities. Lastly, the project team launched the lighting color preference survey to collect feedback from residents along lower Union Street, where proof-of-concept LEDs were installed during the fourth quarter of 2018.

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 six major tasks during the first quarter of 2019. First, the Project team completed its evaluation of the AT&T/General Electric® (“GE”) Digital Infrastructure nodes, analyzing 12 locations identified by the City to determine whether make-ready work is necessary

for node installation. The Company's review concluded that National Electric Safety Code ("NESC") rule H238B-2, which prohibits packetized antennas in the communication worker safety zone, did not apply to the twelve locations identified by the City, as the locations met the minimum requirements for the telecommunications worker's safety zone.

Second, the Company launched the lighting color preference survey to solicit feedback from residents along Lower Union Street, where 18 LED luminaires (9 at 3000 Kelvin and 9 at 4000 Kelvin) were installed during the fourth quarter of 2018. The Company will conclude the survey once it receives the desired number of responses – likely within the next quarter. The survey results will inform the City on the LED color selection to proceed with the LED conversion.










Third, the Company engaged with the City to finalize its LED wattage selection for a portion of its conversion project. The City adjusted the wattage preference for approximately 450 street lights. The adjustment provides the City with greater control and convenience once NLC nodes are installed, which could lead to additional savings opportunities and carbon reductions through lighting adjustments.



Fourth, the Company began designing the multipurpose network in preparation of lab testing in the second quarter of 2019. The lab test is required prior to deploying NLC nodes, smart sensors and electric meters. The multipurpose network will enable the City to operate the advanced street lighting system (*e.g.*, dimming) once the LEDs and NLC nodes are installed.

Fifth, the Company continued contract negotiations with its vendor partners for Phase 1 of the Project, with Presidio® looking to provide services to Zone A and GE to Zone B. Given the complexity and the Project scope, the negotiations have taken longer than expected. The Company will continue to work with the vendor partners to reach agreement in the next quarter and move toward deployment.

Finally, National Grid continues its information technology ("IT") solution review process, with the Company engaging with vendors to review the proposed solution architect. The review ensures the proposed solution meets the Project needs, including data security and data privacy. In addition, the review helps the Company identify contract gaps and offer risk mitigation strategies. The Company also continued to gather Project requirements to review solutions after Phase 1 deployment. The review and analysis will inform the Project team and the City whether the installed solution delivers the anticipated benefits and whether the solution is scalable to other zones of the City.

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. Because Phase 2 relies on the Phase 1 outcomes, the Company now expects Phase 2 will be postponed into September 2019 due to the above-mentioned delays. The Company is working with the City to adjust the start/end dates and update the timing of the components of each project phase. The updates are included as part of the revised work plan included as Appendix A. In addition, 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 September 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 September 2019	National Grid Install Smart City Sensor Nodes (Zones A & B; Max. 100 nodes)	On Track	
July 2019 to June 2021	July 2019 to September 2019	LED and NLC Node Steady State (Evaluate operational capabilities)	Delayed Completion	
July 2019 to December 2019	October 2019 to March 2020	Install LED and NLC Nodes (Zones C, D, & E; Approx. 2,000 fixtures)	Delayed Start	
June 2019 to March 2020	December 2019 to March 2020	National Grid Install Smart City Sensor Nodes (Zones C, D, and E; Max. 100 nodes)	Delayed Start	
October 2018 to June 2020	October 2018 to June 2020	City Install Smart City Device Attachments to Smart City Sensor Nodes (All Zones)	On Track	
October 2018 to March 2019	October 2018 to September 2019	National Grid Implement Multi-Purpose IoT Mesh Network	Delayed Completion	
October 2018 to December 2019		National Grid Install IoT Mesh Network, Sensors, and Meters (Smart Electric Meters; gas ERTs; Temperature Sensors;	On Track	

Anticipated Start / End Date	Adjusted Start/End Date	Checkpoint Milestone /	Status
		Environmental Sensors; Etc.)	
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.)	Delayed Start 
September 2019 to June 2021	December 2019 to June 2021	Steady State Review and Evaluations	On Track 

2.2 Challenges, Changes, and Lessons Learned

As the Company and the City begin deploying the LED street lights, NLC nodes, and smart city devices, there will be additional lessons learned. At this initial stage, there are a few high-level takeaways the Company will use to inform the ongoing work and future smart city deployments:

- Smart city solutions are unique and must be specifically tailored to address the needs and interests of the customer. The customization process and the associated engineering/code review can take considerable time.
- Smart city technology is new, and, therefore, requires additional review to develop standards, which are important to ensure the installation of sensors and attachments adhere to codes, as well as data security and data privacy requirements.
- The Project provides vendor partners the opportunity to deploy technology on a small scale of approximately 5,000 street lights. However, the lessons learned, and the successes of the solution, will potentially impact more than 200,000 street lights across the Company’s service territory.
- Communication networks that connect smart city sensors and hardware devices are quickly evolving. Standardization of the networks for smart city solutions could address the fragmented marketplace, promote interoperability, and resolve the lengthy review process.
- The multipurpose network requires design upfront to ensure interoperability with the NLC nodes, smart nodes, and electric meters. Since the multipurpose network controls all three elements, the multipurpose network needs to consider the various communications protocols during design and deployment of any smart city technology.
- Utility involvement in developing a single packaged smart city solution may help cities recognize the value streams and benefits more quickly.

- Activation fees for devices and software are significant. The cost of future deployment may be lower as the Project enters other zones of the City.

The challenges and lessons learned reflected above are 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
Delayed installation of LED street lights and NLC nodes because of customizing the solution, reviewing and complying with standards, and finalizing agreements for deployment.	The Company is working with vendors and the City to determine core software and functionality needs, as well as IT-related issues, impacting contract negotiations.	Deployment in Zones A and B anticipated in the second quarter of 2019.	Tailoring smart city solutions and negotiating agreements may require additional lead time, given the relative newness of the technology.

2.3 Stakeholder Engagement and Knowledge Sharing

The Company engages in weekly meetings with the City to discuss the Project and tailor the solution to meet the City’s needs. Together, the City and the Company are actively engaging with the vendor partners to understand and evaluate the solution offerings, including a review of the technical capabilities of the devices. In addition, the Company has engaged other utilities (*e.g.*, Duke Energy, TECO Energy, and Georgia Power) to identify and incorporate best practices from their respective smart city / advanced street lighting deployment experiences.

The Company identified community engagement strategies to promote the project in the community to raise awareness and encourage feedback. The Company will propose an engagement plan to the City for its preliminary review and further development, focusing on: 1) increasing Project awareness; and 2) driving community engagement. This effort will include local events discussing the Project and LED conversions, press releases, updates to the City’s webpage, and customer surveys.

3.0 Next Quarter Forecast

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

- Conclude color temperature and dimming preferences (min. 30 responses) in the proof-of-concept area. The feedback will inform the City’s decision to proceed with either warm or cool color temperature street lights in all zones.
- Conclude contract negotiations with both vendor partners for Phase 1 deployment.
- Finalize LED conversion incentives and payments with the City.
- Execute purchase orders with vendors to begin manufacturing and shipment.

- Lab test and install multipurpose network in one zone.
- Begin installing LED street lights and NLC nodes in Zone A and B.
- Begin planning work for NLC node and smart city solution deployment in remaining zones.
- Explore additional smart city uses cases to assist with deployment of sensors, cameras, etc.

4.0 Work Plan and Budget Review

4.1 Updated Work Plan

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

1. Finalize color temperature selection by the City;
2. Contract with the City;
3. Customize the smart city solution for the City;
4. Procure street lights, NLC nodes, and smart sensors;
5. Procure, design, and install multipurpose network;
6. Combine LED street light conversion, installation of NLC nodes, and smart sensors; and
7. Evaluate the solution deployed in Phase 1 for the City to determine the successful solution for Phase 2.

The updated work plan is included as Appendix A.

4.2 Current Budget

Project Task	1 th Quarter Actual Spend	Project Total Spend to Date	Project Budget	Remaining Balance
CapEx				
Smart Lighting	\$0	\$0	\$2,170,000	\$2,170,000
Network	\$30,653	\$30,653	\$390,000	\$359,347
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	\$0	\$0	\$250,000	\$250,000
Network Management	\$0	\$0	\$250,000	\$250,000
OpEx				
Smart Lighting	\$0	\$0	\$180,000	\$180,000
Network	\$0	\$0	\$715,000	\$715,000
Smart Sensor	\$0	\$0	\$180,000	\$180,000
Total	\$30,653	\$189,650	\$7,585,000	\$7,395,350

5.0 Quarterly Report Template

Quarterly Report Template	
Milestones:	
Project Milestone Accomplished:	Administered LED color and dimming survey.
Next Project Milestone:	Finalize color selection with the City to advance LED conversion. Contract with the City to establish mutual commitments and expectations. Finalize solution architect review and complete contract negotiations with vendor partners with IT support. Develop and implement deployment plan for Phase 1.
Tasks/Timeline:	
Completed Project Tasks Since Last Quarterly Report:	City adjusted and finalize the LED wattage selection. Began design of the multipurpose network.
Changes or Impacts to Schedule Since Last Quarterly Report:	Delayed start to installing LED street lights and NLC nodes in Zones A and B due to ongoing work with vendors to scope the solution and negotiated contracts.
Lessons Learned:	Adequate time is needed to fully ensure smart city solutions comply with applicable codes and data security requirements. Standardization of the smart city network will likely improve interoperability and reduce deployment time, as well as costs.
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.
Risks:	
Identified Risks:	Delays due to customization of smart city solutions, which leads to multiple rounds of solution architecture review. IT identified solution gaps and risks for both the Company and the City.
Risk Mitigation Plan:	Dedicate additional resources to work closely with the City and vendor partners to streamline the solution selection and review process. Engage an external firm and IT to facilitate contract negotiations. Continue listen, test, learn approach to refine the advanced street light offering and smart city solutions.

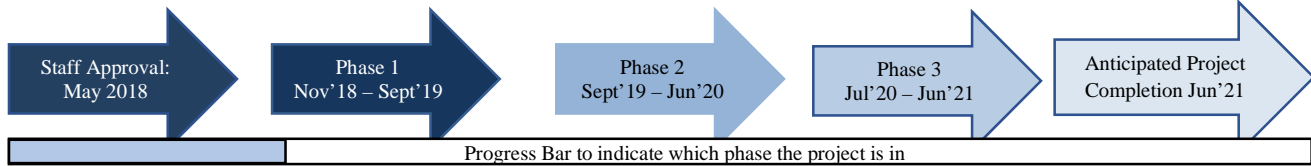
Quarterly Report Template	
Finance:	
Total Spend to Date:	\$189,650
Target Budget Spend:	\$100,000
Actual Incremental Spend:	\$189,650
Variance:	(\$89,650)
In-Kind and Grant Support (Specifically for REV Demo):	Estimated \$150,000 from vendor providers
Additional Notes:	

Appendix B – Summary One Pager

Project Start Date: 05/24/2018
Budget: \$7,585,000

Project End Date: 06/30/2021
Current Quarter Spend: \$30,653

Cumulative Spend: \$189,650



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 Low-Power Wireless Personal Area Networks 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"> Cities want more than smart lighting. Schenectady wants to improve public services, increase public safety, and find ways to save money. Schenectady and the Company understand that project success depends upon informing and engaging residents of the project’s capabilities and future potential. 	<ul style="list-style-type: none"> Partners are customizing their solutions to meet the needs of both the City and the Company. Internal engineering review of smart city solutions is important. Adequate time is needed to fully ensure the solution meets standard code compliance, data security, and data privacy requirements. Standardization and market advancements would improve network interoperability between smart city devices. 	<ul style="list-style-type: none"> Utility involvement consolidates deployment of diverse smart technologies in to a single packaged solution. Initial costs are significant, but the cost of future deployment may be lower as the project expands in to other zones. Deployment cost reductions can be achieved by combining smart city installation with LED upgrade. Conversion to LED streetlights provides significant savings that help meet the 80x50 goal.

Application of lessons learned: As a result of Project learnings, the Company issued a RFI for advanced street lighting and smart city during Q1 2019 to identify at-scale solutions that will assist in meeting customer needs, energy efficiency targets, and GHG reduction goals, while providing a new “utility of the future” business opportunity.

Issues Identified: The smart city solution for Schenectady is highly customized to meet the specific needs of the City, which requires multiple rounds of review by the Company’s IT team to understand and address issues, including digital risk and security. Extended contract negotiations with the City and vendor partners are causing project delays.

Solutions Identified: The Company dedicated additional resources to the project to work closely with the City. The Company has also involved the City and an external legal firm who specializes in smart city technology to support contract negotiations. Partner vendors are working closely with the City to finalize selection of use-cases.

Recent Milestones/Targets Met: The Company released a lighting preference survey. The City adjusted lighting conversion selection to increase wattage at specific zone areas. The Company drafted an agreement and statement of work with the City to establish a mutual understanding of the project scope and commitments by both parties.

Upcoming Milestones/Targets: Use lighting preference survey to determine lighting color temperature. Conclude solution architect review and finish contract negotiations with vendors. Develop the deployment plan for Phase I.