



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

Quarterly Report – Q4 2018

January 31, 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 *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.

In the fourth quarter of 2018, the Company filed its Project Implementation Plan, goals and schedules, as well as the core team supporting this work. The 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 solutions proposed by partner vendors to address code compliance, solution architecture, digital risk, and security. Also, the project team completed the installation of the proof-of-concept LED installation on lower Union Street to test color preference and dimming schedules.

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

During the fourth quarter of 2018, the Company completed several major Project tasks, including a National Electric Safety Code (“NESC”) compliance review and survey. The review included a preliminary analysis of the AT&T/General Electric® (“GE”) Digital Infrastructure node by the Company’s Standards Engineering team, which found a compliance requirement related to NESC rule H238B-2. The NESC rule prohibits packetized antennas in the communication worker safety zone. Installing Digital Infrastructure nodes on distribution poles in the City may require make-ready work to comply with the NESC rule. The Company’s Distribution Design team surveyed 12 locations identified by the City to determine potential make-ready costs. The survey results will be available in the first quarter of 2019 and will help inform whether deploying such technologies in these areas will cost more to comply with the NESC. The Project team will review and determine whether the solution would be cost-effective.



The Company also installed 18 LED luminaires on Lower Union Street as a proof-of-concept. Nine of the LED luminaires on one block are 3000 Kelvin (warm), and another nine, which were installed on a separate block, are 4000 Kelvin (cool). The goal of the proof-of-concept deployment is to install two color temperature street lights and solicit feedback from residents on the color temperature and dimming preference. The Project team began developing a survey during the fourth quarter with the goal of administering the survey in the first quarter of 2019.

In addition, the Company initiated contract negotiations with its vendor partners for Phase 1 of the Project, with Presidio looking to provide services to Zone A and AT&T for Zone B. Given the complexity and the scope of the Project, it has taken longer than expected to outline the appropriate roles and responsibilities of each party. The Company will continue to work with the vendor partners to reach agreement in the next quarter and move toward deployment.

Finally, National Grid began its information technology (“IT”) solution review process, with the Company engaging with both vendor partners to review the proposed solution architect. The review ensures the proposed solution meets the Project needs, including data security and data privacy. The Company also gathered 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.

A further description of general Project milestones and Project status is set forth below:

Anticipated 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	Install LED & NLC Nodes (Zone A & B; Approx. 2,300 Fixtures) Compare vendor solutions	Delayed Start	
July 2019 to December 2019	Install LED and NLC Nodes (Zones C, D, & E; Approx. 2,000 fixtures)	On Track	
July 2019 to June 2021	LED and NLC Node Steady State (Evaluate operational capabilities)	On Track	
October 2018 to December 2019	National Grid Install Smart City Sensor Nodes (Zones A & B; Max. 100 nodes)	Ontrack	
June 2019 to March 2020	National Grid Install Smart City Sensor Nodes (Zones C, D, and E; Max. 100 nodes)	On Track	
October 2018 to June 2020	City Install Smart City Device Attachments to Smart City Sensor Nodes (All Zones)		
October 2018 to March 2019	National Grid Implement Multi-Purpose IoT Mesh Network	On Track	
October 2018 to December 2019	National Grid Install IoT Mesh Network, Sensors, and Meters (Smart Electric Meters; gas ERTs; Temperature Sensors; Environmental Sensors; Etc.)	On Track	
January 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	Steady State Review and Evaluations	On Track	

Keys	Status
	On track
	Delayed Start; At Risk of On-Time Completion; Or Over-Budget
	Terminated/Abandoned Checkpoint/Milestone

2.2 Challenges, Changes, and Lessons Learned

The Project began in earnest with the filing of the Project Implementation Plan last quarter. 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:

- National Grid is well positioned to offer the City advanced lighting control creating greater opportunities for energy savings by implementing best street light practices.
- Smart city solutions are unique and must be specifically tailored to address the needs and interests of the customer (*i.e.*, the City). 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 for use by the Company. Such standards 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 quickly evolving. Standardization of the networks for smart city solutions could address the fragmented marketplace, promote interoperability, and resolve the lengthy review process.
- 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 project team is working with vendor partners and the City to determine the core software and functionality needs.	Deployment in Zones A and B anticipated in the first 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 and municipal customers (*e.g.*, the City of San Diego, Florida Power and Light, and Georgia Power) to identify and incorporate best practices from their respective smart city / advanced street lighting deployment experiences.

3.0 Next Quarter Forecast

In the first quarter of 2019, the Project team plans to complete work on the following items:

- Finalize the make-ready costs for the AT&T/GE Digital Infrastructure node. This work will also inform any potential additional make-ready work required for other attachments to existing distribution poles to accommodate such nodes in accordance with the NESC.
- Finalize and administer on 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 other zones.
- Conclude contract negotiations with both vendor partners for Phase 1 deployment.
- Finalize LED conversion incentives and payments with the City.
- 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 not made any updates to the work plan submitted last quarter as part of the Project Implementation Plan.

4.2 Current Budget

Project Task	4 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	\$0	\$0	\$390,000	\$390,000
Smart Sensor	\$0	\$0	\$3,100,000	\$3,100,000
Project Support	\$158,997	\$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	\$158,997	\$158,997	\$7,585,000	\$7,426,003

5.0 Quarterly Report Template

Quarterly Report Template	
Milestones:	
Project Milestone Accomplished:	Project Implementation Plan filed October 24, 2018. Installed eighteen LED street lights on Lower Union Street (Stockade Community).
Next Project Milestone:	Develop and administer LED color and dimming preference survey. Finalize solution architect review and complete contract negotiations with vendor partners. Develop and implement deployment plan for Phase 1.
Tasks/Timeline:	
Completed Project Tasks Since Last Quarterly Report:	Filed Project Implementation Plan and completed installation of eighteen LED luminaires as proof-of-concept.
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.
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.
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 to facilitate contract negotiations. Continue listen, test, learn approach to refine the advanced street light offering and smart city solutions.
Finance:	
Total Spend to Date:	\$158,997
Target Budget Spend:	\$100,000
Actual Incremental Spend:	\$158,997
Variance:	(\$58,997)
In-Kind and Grant Support (Specifically for REV Demo):	\$0
Additional Notes:	