



**Distributed Generation Interconnection
REV Demonstration Project
Case 14-M-0101**

Quarterly Report – Q2 2019

July 30, 2019

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1.0 Executive Summary

On October 19, 2018, Niagara Mohawk Power Corporation d/b/a National Grid (“National Grid” or the “Company”) filed a Revised Implementation Plan (the “Revised Implementation Plan”) for the Distributed Generation Interconnection REV Demonstration Project (the “Project”) in Case 14-M-0101.¹ The Company designed the initial phase of the Project to test alternative solutions for increasing the pace and scale of interconnecting distributed generation (“DG”) systems above 50 kW through upfront investments in common upgrades at two substations (Peterboro and East Golah) coupled with a cost-allocation methodology aimed at removing barriers for DG interconnection applicants. The Company proposed to expand the Project’s scope to test: 1) whether the cost-allocation approach can be used to facilitate DG development in targeted areas, such as landfills and brownfields; 2) strategies for proactively and constructively engaging communities and municipalities in the DG development process; 3) whether replacing coupling capacitor voltage transformer (“CCVT”) equipment with optical voltage transformer (“VT”) equipment in a 115-13.2 kV substation will reduce the time to install zero-sequence overvoltage (“3V₀”) protection equipment; and 4) the potential for switched-source technology to increase hosting capacity through active power flow control (*i.e.*, diverting power production to adjacent feeders).

The expanded approach enables the Company to build on the Project’s early successes without losing momentum. Additionally, the items tested in the Revised Implementation Plan will further help the Company refine its approach for scaling the DG interconnection cost-allocation model in a manner best suited to facilitate the efficient development of DG across the State. The purpose of this quarterly report is to provide an update on the initial phase of the Project, ongoing work on the second phase of the Project regarding efforts to target deployment in certain areas, as well as community outreach to help reduce permitting and zoning delays by addressing local municipal concerns.

2.0 Highlights Since Previous Quarter

2.1 Initial Phase of the Project

2.1.1 Major Task Activities

National Grid completed construction of common upgrades at the Peterboro and East Golah substations in late 2017, ahead of schedule. The work included the installation of 3V₀ protection² and load tap changer (“LTC”) controller upgrades to two transformers at each substation. During

¹ Case 14-M-0101, Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, *Niagara Mohawk Power Corporation d/b/a National Grid Distributed Generation Interconnection REV Demonstration Project – Revised Implementation Plan* (filed October 19, 2018) (“Revised Implementation Plan”).

² 3V₀ protection is required where delta primary-wye grounded secondary power transformers can experience backfeed under light load conditions from sources on the electric distribution system (*e.g.*, DG projects).

the design and construction phases, the Company marketed the increased hosting capacity and the Project’s cost-allocation mechanism to DG developers. With these efforts, the Company was able to secure a sufficient level of DG interconnection applications for each substation to fully subscribe the available hosting capacity.

2.1.2 Queue Status

Below is the queue status for the East Golah and Peterboro substations. For East Golah, five projects are currently under construction, two are in the interconnection agreement process, two are in the Coordinated Electric System Impact Review (“CESIR”) process, and one is in the preliminary study process. Likewise, for Peterboro, the Company interconnected one project, four are in construction, two are in the interconnection agreement process, two are in the CESIR process, and one is at the application submittal stage. The Company adjusted the timeline for a few projects due to the addition of battery storage systems.

East Golah					
Case Number	Status	Step	Sub-Step	Queue Date	Size of Generator(kW)
00102158	Construction	In Progress	Design and Engineering (100%)	3/8/2016 0:00	1992
00171687	Construction	In Progress	Design and Engineering (100%)	3/23/2018 11:54	5000
00171907	Construction	In Progress	Design and Engineering (100%)	3/23/2018 13:57	3000
00171666	Construction	In Progress	Design and Engineering (100%)	3/13/2018 10:48	4000
00172238	Construction	Not Started		4/5/2018 15:40	5000
00187820	Agreement	Draft		7/5/2018 12:01	5000
00191001	Agreement	Construction Quote	Payment Processed	8/3/2018 9:52	350
00221274	Study	Draft		5/9/2019 13:31	5000
00224877	Study	Hold	Study Hold	5/13/2019 13:58	2200
00229610	Preliminary Study	Preliminary Results Delivered	Pending Customer Decision	6/18/2019 13:37	1450
Peterboro					
Case Number	Status	Step	Sub-Step	Queue Date	Size of Generator(kW)
00102114	Connected	Final Approval Sent	Reconciliation Complete	6/22/2016 1:00	1400
00170433	Construction	In Progress	Design and Engineering (100%)	2/27/2018 13:06	1980
00170444	Construction	In Progress	Design and Engineering (100%)	2/21/2018 16:18	3000
00172193	Agreement	Submitted		3/26/2018 9:17	5000
00173939	Construction	In Progress	Design and Engineering (25%)	4/19/2018 11:14	5000
00173942	Construction	In Progress	Design and Engineering (25%)	4/19/2018 11:38	5000
00190582	Agreement	Draft		7/27/2018 9:40	2900
00199116	Study	In Progress	Internal Study	10/29/2018 10:39	3600
00199512	Study	Hold	Study Hold	12/5/2018 12:39	400
00231372	Application	Hold	Application Hold		5000

2.1.3 Challenges, Changes, and Lessons Learned

At its core, the Project has shown that reducing upfront cost barriers, providing increased certainty, and shortening construction timelines can simplify the interconnection process for DG developers. As expected, these changes increased developer interest in interconnecting DG projects in the areas where the common substation upgrades were installed using the Project’s cost-allocation method. The Company also found that hosting webinars, developing the mapping portal, and meeting with

developers through the Interconnection Policy Working Group (“IPWG”) and New York State Energy Research and Development Authority (“NYSERDA”) processes helped DG developers better understand the Project and drove interest in submitting interconnection applications. Although successful, the Company’s experience with the initial roll out of the Project, as well as developer feedback, revealed potential opportunities for improvement; namely, the ability to target development in certain areas (*e.g.*, landfills and brownfields), the potential benefits of proactive outreach with communities to educate and address DG project construction concerns (*e.g.*, local moratoria), as well as opportunities for additional technology to reduce construction time and increase hosting capacity. The Company sought to address these challenges with new strategies as part of the Revised Implementation Plan.

2.1.4 Cost Recovery

The Company’s actual spending on the initial phase of the Project was \$1,751,259, slightly above the initial estimated budget of \$1,581,351. With the common substation upgrades complete, the Company is now working through DG project construction at East Golah and Peterboro with the DG applicants and recovering the substation upgrade costs associated with those projects. To date, the Company has recovered \$1,452,226.83 from DG applicants who initiated the interconnection process at the initial substations. The Company further expects to fully recover the remaining balance in 2019 as the individual DG projects are completed and interconnected. If any additional payments are received in excess of the total Project spend from developers who initiated the interconnection process, the overpayment will be refunded once the remaining part of the Project is reconciled.

2.2 Second Phase of the Project

2.2.1 Major Task Activities

National Grid filed the Revised Implementation Plan in October 2018. In the second phase of the Project, the Company is testing the common-upgrade cost-allocation concept by expanding the Project to areas with municipal landfills and brownfield sites that have high DG (or DG coupled with energy storage) development potential. The sites have drawn interest from municipal officials and the DG developer community. Likewise, NYSERDA has redesigned the NY-Sun MW Block Program to include a new \$0.10/kW incentive adder for solar projects on landfill/brownfield sites, enhancing the economics of developing DG projects in these areas. Furthermore, developing DG projects on the sites may offer multiple benefits to municipalities by reducing energy costs, meeting local sustainability commitments, and providing an additional stream of revenue via lease payments, all while preserving farmland. Also, the proactive outreach to communities and municipalities in these targeted areas will accelerate the pace of DG development by addressing local concerns and permitting delays. Finally, the Company is deploying new technology, such as optical VT, in these targeted areas to test whether it can reduce construction times and increase hosting capacity.

Below is the project milestone schedule that was included in the Revised Implementation Plan, updated to include changes, adjustments, and the status of each milestone.

General Project Milestones	Start Date	Finish Date	Status
Milestone			
Provide funding numbers	11/1/2018	11/15/2018	Completed
Finalize engineering analysis of landfill sites	11/1/2019	11/15/2018	Completed
Substation design	11/15/2018	4/30/2019	Completed
General Project Milestones	Start Date	Finish Date	Status
Begin general outreach to municipalities & Industry (4 Sites)	1/1/2019	12/31/2019	Commenced Jan 2019
Order long-lead materials	12/1/2018	12/19/2018	Completed
Begin marketing existing "DG ready sites" - 26 Sites	1/1/2019	3/31/2020	Commenced Jan 2019
Outreach to eleven (11) landfill counties along with NYSERDA	1/1/2019	12/31/2019	Commenced Jan 2019
Outreach to fifteen (15) landfill counties along with NYSERDA	1/1/2019	3/31/2020	Commenced Jan 2019
Substation Milestones for Cedar, Indian River, Prospect Hill and Butler			
Milestone	Date		
3V ₀ design and engineering	11/15/2018	4/30/2019	Completed
Civil work	7/1/2019	7/31/2019	Commenced July 2019/Completed at Prospect Hill
Electrical work	8/1/2019	9/30/2019	Commenced at Prospect Hill
Relay work	10/1/2019	11/30/2019	
Anticipated completion date		12/31/2019	
Switch-Source Technology			
Milestone	Date		
Procurement - Switch Source PO issued	11/15/2018	12/15/2018	Completed
Team assignment	11/1/2018	11/15/2018	Completed
Project Kick off	1/31/2019		Completed
Project Cancelled June 30, 2019			

2.2.2 Municipal / Community Engagement

In collaboration with NYSERDA, the Company identified twenty-six landfill/brownfield sites located near a section of the Company's system where substation upgrades have already been installed to accommodate DG projects. National Grid began outreach efforts with local communities in the areas to help them develop their landfill/brownfield sites for DG installations and the Company is planning to host an interactive distributed energy resource ("DER") event that will bring together distributed energy developers, property owners, municipal officials, policy makers and professionals for educational sessions and networking.

National Grid along with NYSERDA, the New York Solar Energy Industry Association, and the Center for Creative Land Recycling will also be hosting a Network Solar Summit - Renewable Energy Implementation in Syracuse on October 3, 2019 to help animate the implementation of renewable generation, particularly on brownfield and landfill sites. This free, interactive workshop will bring together stakeholders with different backgrounds, levels of knowledge and preparedness to implement renewable projects.

The event will focus on National Grid's infrastructure investments and cost-allocation methodology, land remediation and reuse, renewable energy regulations and resources. The planned outcome from this event is to provide municipalities /communities, developers and private land owners the critical information and public/private sector contacts to assist in evaluating the feasibility of new projects and move such projects in the pipeline to the next step.

In addition, the Company added the DG-ready sites to its feeder-level mapping portal to help developers identify locations that are well-suited for DG development. Any DG applicant seeking to develop one of the sites would proceed under the existing Standardized Interconnection Requirements ("SIR").³ The Company's approach tests whether proactive efforts, including outreach with municipalities to address development concerns, reduces permitting delays and accelerates the pace of construction in the targeted areas.

2.2.3 Scaling Common Upgrade Cost Allocation Model

The Company also worked with NYSERDA to identify four substations where common upgrades are required before DG projects (or DG coupled with energy storage) would be capable of interconnecting from nearby landfill/brownfield sites. As with the initial phase of the Project (*i.e.*, East Golah and Peterboro), National Grid proposes to upgrade the distribution system at four substations, making them ready for future DG applicants to interconnect.⁴ The investment will include the installation of 3V₀ protection and LTC controller upgrades for the transformer banks below:

³ Cases 18-E-0018 *et al.*, In the Matter of Proposed Amendments to the New York State Standardized Interconnection Requirements (SIR) for Small Distributed Generators, *Order Modifying Standardized Interconnection Requirements* (issued October 18, 2018) ("SIR Order").

⁴ If this method is approved for use across the service territory, the costs of the upgrades would be reflected in the Company's net utility plant and depreciation expense reconciliation mechanism.

Substations	Added Hosting Capacity	Area Landfill/Brownfield Sites Served	Anticipated Construction
Cedar	17 MW	Fort Ann, Queensbury, Evans Mills, and Moreau in Washington, Warren, Jefferson, Colonie, and Saratoga counties, respectively	March 2020
Indian River	20 MW		
Butler	17 MW		
Prospect Hill	17 MW		

The Company completed the design work on the above four locations, and the Project is ahead of schedule. The Company is also replacing CCVTs with optical VTs at the Prospect Hill Substation, testing whether such equipment reduces construction time for 3V₀ installations. If the construction time is reduced, the Company will seek to scale this approach in other areas where it plans to install 3V₀ equipment.

The Company also began marketing and outreach efforts with the DG community. In November 2018, National Grid presented the Project to developers as part of the IPWG. The Company also hosted an educational webinar and plans to conduct more outreach sessions to customers / developers this year to foster interest in integrating DG (or DG coupled with energy storage) to National Grid’s system. The Company also continued outreach with municipalities where the upgrades will be constructed, and it began a marketing campaign for the project sites. Finally, the Company has organized or participated in various events to promote DG in its service territory, including the 2019 New York Solar Summit (May 6), the Company’s Energy Solutions Summit (June 11), the Community Solar Power Summit in Philadelphia (July 18 and 19). Also, as mentioned, the Company is planning a Network Solar Summit – Renewable Energy Implementation in Syracuse (October 3).

2.2.4 Switch-Source Tie Controller

To further increase hosting capacity, the Company proposed testing a smart-tie switch product named the “Switch-Source Tie Controller.” The controller uses power electronics-based switching to connect two feeders of different voltage amplitudes and angles, which allows the device to pass real and reactive power between a heavily loaded feeder and a more lightly loaded one. The Company was researching this technology by installing one 3.74 MVA switched-source device at an existing primary open location between the Butler 13.2kV (wye) 36_38_36251 feeder and the 4.8 kV (delta) McCrea St 36_38_27226 feeder. Although the Company’s analysis identified several promising benefits, the protection scheme it requires has proven too costly compared to the potential value of the technology at this time. Specifically, the Company designed a new protection scheme to protect customers from any negative effects that may result from the switch-source tie controller. The protection scheme included the ability to disconnect the device from both feeders in the loss of service – an approach often referred as Direct Transfer Trip (“DTT”) – as well as effective grounding protection, advanced relaying, and metering. The Company is highly optimistic that within the next few years the vendor will be able to address the unpredictability. However, until such issues are better understood, the Company has cancelled this portion of the project.

2.2.5 Financial Summary

As shown in Section 4, the Company estimates total common upgrade costs of \$2,826,180 for the four substations identified in the Revised Implementation Plan (*i.e.*, Cedar, Indian River, Butler, Prospect Hill). The amount, which will initially be funded using the Company's REV demonstration project budget, includes capital and marketing costs.

The Company will recover the initial REV demonstration investment through a one-time pro-rated fee charged to all applicants (not just the first applicant) with DG systems above 50 kW⁵ who connect to the upgraded substation transformer banks.⁶ The fee will be based on the Company's estimated common system upgrade costs (subject to true-up once actual costs are known) for each of the substations divided by a factor that represents the total substation transformer bank capacity at each location.

3.0 Next Quarter Forecast

As set forth in Section 2, with the common substation upgrades complete at East Golah and Peterboro, the Company is now recovering substation upgrade costs as applicants complete the DG project construction process. The Company anticipates recovering the remaining costs for the initial phase of the Project in the next quarter. For the work in the Revised Implementation Plan, the Company will continue its marketing efforts for the landfill and brownfield sites, as well as the four substations, where upgrades are planned. In addition, the Company will evaluate the optical VT equipment installed at the Prospect Hill Substation.

4.0 Work Plan and Budget Review

4.1 Updated Work Plan

There are no updates to the work plan since the Company filed the Revised Implementation Plan in October 2018.

4.2 Current Budget

A current budget based on the Revised Implementation Plan is provided in the table below:

⁵ The 50-kW threshold would apply to an aggregate amount of DG service.

⁶ DG applicants would still bear full responsibility for their respective site-specific and distribution line upgrade costs. The pro-rated fee for the substation common upgrades would be due at the same time as the fees associated with the DG applicant-specific upgrades, including distribution line upgrade costs.

Current Spend to Upgrade the Four Substations in Phase Two			
Station	Total Estimated Funding	Spend	Delta
Cedar	\$508,000.00	\$120,401.00	\$387,599.00
Indian River	\$508,000.00	\$93,912.00	\$414,088.00
Butler	\$508,000.00	\$106,929.00	\$401,071.00
Prospect Hill	\$508,000.00	\$198,560.00	\$309,440.00
Tax Liability Applied to Capital Improvement	\$202,980.00	\$51,980.20	\$150,999.80
Total Funds for Marketing the existing "DG Ready" Sites	\$62,400.00	\$8,500.00	\$53,900.00
Total Funds for Marketing the Four Sites	\$28,800.00	\$18,000.00	\$10,800.00
Total Funds to Pilot Switched - Source Technology at Butler Substation	\$500,000.00	\$209,431.45	\$290,568.55
Total Estimated Funds	\$2,826,180	\$807,713.65	\$2,018,466.35

5.0 Quarterly Report Template

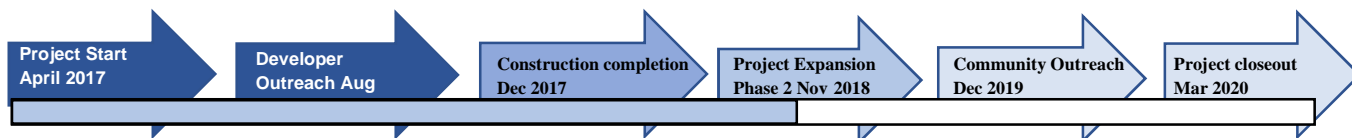
Quarterly Report Template	
Milestones:	
Last Project Milestone:	Design completed /Drawings issue to the field.
Next Project Milestone:	Construction complete
Tasks/Timeline:	
Completed Project Tasks Since Last Quarterly Report:	Civil construction commenced / Civil construction at Prospect Hill is completed

Quarterly Report Template	
Changes or Impacts to Schedule Since Last Quarterly Report:	Protection analysis for switch-source technology identified major protection upgrades for safely operating the device. The cost /time required to implement the required protection upgrades exceed the benefit it will bring to customers, and therefore the Company cancelled that portion of the project.
Lessons Learned:	Ensuring that a working prototype for a device is available for protection analysis /review.
Risks:	
Identified Risks:	Protection analysis identified major system upgrades requirement for switched-source technology. As a result, the switch-source portion of the project has been cancelled
Risk Mitigation Plan:	N/A
Finance:	
Total Spend to Date (Initial Phase and Revised Implementation):	\$2,558,972.65
Forecast Spend:	\$1,848,553.35
Queue Status Update:	
East Golah	Five projects (21MW) are currently under construction.
	Two projects (5.35MW) are in the interconnection agreement process.
	Two projects (7.2MW) is in CESIR study.
	One project (1.45MW) is in application status
Peterboro	One project (1.4MW) has been interconnected.
	Four projects (14.98MW) are in construction
	Two projects (7.9MW) are in the interconnection agreement process
	Two projects (4MW) are in the CESIR process
	One project (5MW) is in the application process

Quarterly Report Template	
Cedar	One project (2MW) is in construction
Butler	Two projects (9.96MW) are in the CESIR process
Indian River	Five projects (10MW) are in the CESIR process
	Six projects (27.5MW) are in the preliminary analysis process
	One project (5MW) is in application status

nationalgrid Distributed Generation Interconnection(3V0) 6/30/19 (2Q2019) On track (Active)

Project Start Date: 4/24/2017 **Project End Date:** 3/30/2020 **Budget:** \$4,407,531
Customer Payments to Date: \$1,452,226 **Current Quarter Spend:** \$254,324.65 **Cumulative Spend:** \$2,558,973,



Project Progress Bar to indicate which phase the project is in **Summary:** In Power

2017, Niagara Mohawk Corporation d/b/a National Grid (the “Company”) proposed a cost-sharing solution for increasing the pace and scale of interconnecting distributed generation (“DG”) systems through upfront investment by the Company coupled with a cost-allocation methodology aimed at removing barriers for DG interconnection applicants. The Company installed 3V₀ technology at two substations, Peterboro and East Golah, creating 40 MW of hosting capacity. In 2018, the Company expanded the Project, upgrading four additional substations (Cedar, Indian River, Butler and Prospect Hill) to create an additional 71MW of hosting capacity and testing methods for further enhancing the effectiveness of the approach at increase DG interconnections.

Cumulative Lessons Learned		
The Customer	Market Partner	Utility Operations
<ul style="list-style-type: none"> • Prebuilt 3V₀ system upgrades at substations reduce interconnection lead times. • The cost-allocation methodology reduces upfront costs, enabling developers to pay a proportionate share of common upgrade costs. • Upfront engagement with municipalities is a key to reduce permitting and zoning delays for DG projects. 	<ul style="list-style-type: none"> • Developing DG projects on municipal landfills and brownfield sites may benefit municipalities by reducing energy costs, meeting local sustainability commitments, providing an additional stream of revenue via lease payments, and protecting farmland. 	<ul style="list-style-type: none"> • Prebuilt 3V₀ system upgrades at substations located near landfills and brownfields may lead to increased DG in those areas. • The Company believes that reducing upfront costs for DG projects and accelerating the installation will help meet clean energy goals. • The potential benefits of switch-source technology are outweighed by the cost of required system protections.

Application of lessons learned: By expanding the initial successful phase of the Project to test strategies for community / municipal engagement, facilitating DG development on landfill / brownfield sites, and evaluating the potential benefits of new technologies, the Company believes it can further reduce upfront costs and accelerate interconnections.

Explanation for overbudget: N/A

Issues Identified: To further increase hosting capacity, the Company researched Switch-Source Tie Controller technology. Initial analysis identified some uncertainties around device behavior, requiring a detailed system protection analysis. The protection analysis identified major system upgrades to safely operate the device. The cost /time required to implement the required upgrades exceeded the anticipated benefits. As a result, this portion of the project was cancelled.

Solutions Identified: N/A

Recent Milestones/Targets Met: *Substation Design completed / Project construction -Civil work started (Cedar /Indian river – 2 months ahead of schedule - Butler / Prospect Hill – 1 month ahead of schedule)*

Upcoming Milestones/Targets: *Community Outreach /Complete by December 2019 (National Grid DER event scheduled for October 3, 2019).*