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August 15, 2018

VIA HAND DELIVERY AND E-FILING

Mark D. Marini, Secretary
Department of Public Utilities
One South Station, 5th Floor
Boston, MA 02110

Re: D.P.U. 15-120 – Petition of Massachusetts Electric Company and Nantucket Electric Company d/b/a National Grid for Approval of Grid Modernization Plan

Dear Secretary Marini:

On behalf of Massachusetts Electric Company and Nantucket Electric Company d/b/a National Grid ("Company" or "National Grid"), and pursuant to the Department's May 10, 2018 Order ("Order") in captioned docket, enclosed please find National Grid's report of its baseline information for the statewide and company-specific infrastructure metrics that the Department approved in the Order.

Please note that National Grid is submitting the remainder of the performance metric compliance items required by the Order in a joint filing with NSTAR Electric Company d/b/a Eversource Energy and Fitchburg Gas and Electric Light Company d/b/a Unitil, also being submitted today.

Thank you for your time and attention to this matter. Please contact us with any questions regarding this filing.

Very truly yours,

Melissa G. Liazos

Andrea G. Keeffe

Enclosures

cc: Hearing Officer Tina W. Chin
D.P.U. 15-120 Service List

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Massachusetts Electric Company
and
Nantucket Electric Company
d/b/a National Grid

Grid Modernization Plan
Infrastructure Metrics

D.P.U. 15-120

August 15, 2018

Submitted to:
Massachusetts Department of
Public Utilities

Contents

1 STATEWIDE INFRASTRUCTURE METRICS

In D.P.U. 12-76-B, the Department of Public Utilities (the "Department") directed Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid ("National Grid" or the "Company"), along with NSTAR Electric Company d/b/a Eversource Energy ("Eversource") and Fitchburg Gas and Electric Light Company d/b/a Unitil ("Unitil") (collectively, the "Companies") to include in their Grid Modernization Plans ("GMPs") infrastructure metrics that track the implementation of grid modernization technologies and systems[1].

Each of the Companies filed a GMP that included a list of proposed statewide and company-specific infrastructure metrics. On May 10, 2018, the Department issued its Order regarding the individual GMPs filed by National Grid, Eversource, and Unitil, respectively. In the Order, the Department preauthorized grid-facing investments over three-years (2018-2020) for the Companies and adopted a three-year (2018-2020) regulatory review construct for preauthorization of Grid Modernization investments. D.P.U. 15-120/15-121/15-122, at 137-173. The Department recognized that achievement of its Grid Modernization objectives[2] is a complex, long-term, and evolving endeavor and that, in the early stages of Grid Modernization, it is reasonable to expect that significant changes will take place associated with the introduction of new technologies and the costs associated with existing and new technologies. Id., at 107-108. Furthermore, the Department found that it is reasonable to expect that the Companies' understanding of how best to deploy Grid Modernization technologies to optimize their performance will evolve over time. Id.

As part of its decision regarding the Companies' GMPs, the Department approved the Companies' proposed statewide and company-specific infrastructure metrics. Id., at 198-201. In approving the infrastructure metrics, the Department found that the purpose of the metrics will be to record and report information: the metrics will not, at present, be tied to incentives or penalties. Id., at 197. The Department ordered the Companies to establish baselines by which the grid-facing performance metrics will be measured against and to file them within 90 days of the Order. Id., at 203. To assist in the development of these baselines, the Department directed each of the Companies to develop and maintain information on its system design, operational characteristics (e.g., voltage, loading, line losses), and ratings prior to any deployment of preauthorized grid-facing technologies. Id. Additionally, the Department directed the

[1] The Department also required the Companies to propose Grid Modernization performance metrics to be included in their respective GMPs. D.P.U. 12-76-B, at 30. Consistent with the Department's directives, including those contained in the Department's Order in D.P.U. 15-120/15-121/15-122, the Companies have made a separate compliance filing containing the proposed performance metrics.

[2] The Department approved a modified set of Grid Modernization objectives, specifically: (1) optimizing system performance; (2) optimizing system demand; and (3) facilitating the interconnection of distributed energy resources. D.P.U. 15-120/15-121/15-122, at 95-106.

Companies, when developing the proposed baselines to use, to the extent possible, information reported in the annual service quality filings, as well as other publicly available information. Id.

Consistent with the Department's directives, National Grid has developed the following baselines for the statewide and National Grid-specific infrastructure metrics. Due to the complexity and data intensive nature of these metrics, the Company has not yet had the opportunity to calculate a baseline for all metrics. Additionally, the Company is undertaking the detailed design and planning analysis necessary to implement its GMP, which will necessarily inform several of the infrastructure metric baselines. Furthermore, in some instances, the Company has developed its baseline using readily available information, and will need to properly validate and quantify the devices and definitions that exist against the devices and definitions jointly agreed and presented. As directed by the Department, the statewide infrastructure metrics shall be reported at the substation and feeder level. For those technologies that National Grid deploys at a circuit level, it will report information on a circuit-specific basis. Similarly, for those technologies deployed at the substation level, the Company will report the information on a substation-specific basis.

The purpose of these metrics is to determine how performance can be changed because of grid modernization activities. Weather, customer behavior, economic conditions and other factors will have a significant influence on the parameters being measured under these metrics. As National Grid begins to implement its GMP, the changes resulting from grid modernization may be subtle and difficult to detect. The use of baselines against which to measure ongoing performance will help develop an understanding of how National Grid's grid modernization efforts are "moving the needle" in terms of progressing towards the achievement of the Department's Grid Modernization objectives.

The statewide metrics use the following common definitions across the National Grid, Eversource, and Unitil infrastructure metrics filings:

Grid Modernization Device - Any device that meets the requirements of either a fully automated or a partially automated device.

Fully Automated Device - Meets all of the following requirements:

- Reacts to system conditions to isolate or restore portions of the electric system;
- Communicates system quantities (e.g., voltage, trip counts) to a central location, such as Supervisory Control and Data Acquisition ("SCADA"); and
- The state of the device can be remotely controlled by dispatch.

Partially Automated Device – Meets at least one of following requirements:

- Reacts to system conditions to isolate or restore portions of the electric system;

- Communicates system quantities (e.g., voltage, trip counts) to a central location, such as SCADA;
- The state of the device can be remotely controlled by dispatch; or
- Capable of upgrade to a fully automated device without full replacement.

Sensor – Equipment that sends or records information of the electric system that can be used to improve the efficiency or effectiveness of workforce or asset management (e.g., Fault locators that would help pinpoint a problem for more efficient crew deployment).

1.1 GRID CONNECTED DISTRIBUTED GENERATION FACILITIES

1.1.1 Type of Metric

Statewide Infrastructure Metric

1.1.2 Objective

One of the primary objectives of grid modernization is to facilitate the interconnection of distributed energy resources ("DER") and to integrate these resources into National Grid's planning and operations processes. This statewide infrastructure metric will quantify the DER units connected to the system on a circuit level and substation level basis.

It is important to note that DER developers decisions regarding DER interconnection may be influenced by tax incentives, subsidies, and costs and availability of the technology, which, in turn, will influence these metrics.

1.1.3 Assumptions

The data used in these calculations consider units that have an executed Interconnection Service Agreement ("ISA") and are in service and connected to the distribution system.

1.1.4 Calculation Approach

The following data will be tracked and reported upon on a substation and circuit basis:

a. Total number by technology or fuel type – count of units by technology or fuel type
b. Nameplate capacity by technology or fuel type – sum total of nameplate capacity
c. Estimated output by technology or fuel type – sum of nameplate capacity * capacity factor * 8760 hours
d. Type of customer-owned or operated units by technology and fuel type – (i.e., count of Photo Voltaic ("PV"), wind, Combined Heat and Power ("CHP"), Fuel Cell, etc.)
e. Nameplate as a Percent of Peak Load – calculated as total nameplate capacity (MW) / peak load (MW).

1.1.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the

end of the calendar year.

This metric is a study of the overall quantity and capacity of grid connected distributed generation facilities. Data will be provided in a tabular basis.

1.1.6 Baseline

The baseline for this metric will be quantified and calculated based upon units in service by December 31, 2017. For National Grid, the baseline is composed of:

Fuel Type	Total Units	Nameplate AC Rating(kW)
Biogas	5	2,460
Hydro	10	5,254
Landfill Gas	9	19,220
Solar	45,115	2,114,163.22
Solar and Battery Storage	203	498,730.55
Wind	53	21,490.25
Grand Total	**45,395**	**2,661,318.02**

1.2 SYSTEM AUTOMATION SATURATION

1.2.1 Type of Metric

Statewide Infrastructure Metric

1.2.2 Objective

Measure automation saturation measures by customer served by fully automated or partially automated device. The terms “fully automated” and “partially automated” refer to feeders for which National Grid has attained optimal or partial, respectively, levels of visibility, command and control, and self-healing capability through the use of automation.

1.2.3 Assumptions

Baseline saturation rate will be calculated based on what exists on the system as of December 31, 2017. Ideally over time this metric will decrease based on GMP installed devices per customers. Customers that can benefit from multiple devices will be counted as one for purposes of calculating the baseline. The installations will not be limited to the main line infrastructure and will include no-load lines and distribution substation supply (“DSS”) lines.

1.2.4 Classification of Grid Modernization Devices

The following matrix has been provided as guidance to determine which type of equipment would be considered partially automated, fully automated or included as a sensor.

Device Type	Not Included	Partial Automation	Full Automation	Included as a Sensor
Feeder Breakers (No SCADA)		X		
Feeder Breakers (SCADA)			X	X
Reclosers (including sectionalizers, single phase reclosers, intellirupters, ASU) (No SCADA)		X		
Reclosers (including sectionalizers, single phase reclosers, intellirupters, ASU) (SCADA)			X	X
Padmount Switchgear (No SCADA)		X		
Padmount Switchgear (SCADA)			X	X
Network Transformer/Protector with full SCADA			X	X
Network Transformer/Protector with monitoring, no control		X		X
Network Transformer/Protector with no SCADA		X		
Feeder Meter (e.g., ION, with comms)				X
Capacitor and Regulator with SCADA		X		X
Capacitor and Regulator no SCADA	X			
Line Sensor (with comms)				X
Fault Indicator (with comms)				X
Other Fault Indicators (no comms)	X			
Other Voltage Sensing (with comms)			X	X
Sectionalizer (no SCADA)		X		
Sectionalizer (SCADA)			X	
Customer Meter	X			
Distribution / step down Transformer	X			
Other Substation Breakers	X			
Fuse	X			

1.2.5 Calculation Approach

As more automation is installed pursuant to National Grid's GMP, the results of this metric will be reduced.

Metric:

$$\frac{\text{Customers Served}}{\text{Fully Automated Device} + 0.5*(\text{Partially Automated Device})}$$

1.2.6 Baseline

The baseline for this metric will be quantified and calculated based upon equipment in service as of December 31, 2017. National Grid provides circuit characteristics, customers served and level of automation by circuit as part of the annual Service Quality filing[3]. The Company will properly validate and quantify the devices and definitions to develop the saturation level for each circuit. The Company will incorporate the baseline in the first Grid Modernization Annual Report on April 1, 2019.

1.3 NUMBER/ PERCENTAGE OF CIRCUITS WITH INSTALLED SENSORS

1.3.1 Type of Metric

Statewide Infrastructure Metric

1.3.2 Objective

Measure the total number of electric distribution circuits with installed sensors which will provide information useful for proactive planning and intervention. The installation of sensors provides the means to enable proactive planning and measure a number of grid modernization initiatives such as Volt VAR Optimization ("VVO") and asset management. A sensor analytics development program is an essential part of grid modernization and provides the visibility into network operations needed to move toward an effective grid modernization program.

1.3.3 Assumptions

The baseline for this metric will be all sensors installations on distribution circuits and substations, including existing installations. The baseline will be calculated as of December 31, 2017.

1.3.4 Calculation Approach

National Grid currently reports whether it has no automation, status only or status and control by circuit. This infrastructure metric will then measure the percent of distribution circuits that have sensors installed.

[3] The information as of December 31, 2017 was filed in D.P.U. 18-SQ-11 for Massachusetts Electric Company and D.P.U. 18-SQ-12 for Nantucket Electric Company.

a. Quantity of sensors by device type by circuit.

Device Type	Circuit 1	Circuit 2	Circuit 3	Circuit 4
Feeder Breakers (No SCADA)				
Feeder Breakers (SCADA)				
Reclosers (including sectionalizers, single phase reclosers, intellirupters, ASU) (No SCADA)				
Reclosers (including sectionalizers, single phase reclosers, intellirupters, ASU) (SCADA)				
Padmount Switchgear (No SCADA)				
Padmount Switchgear (SCADA)				
Network Transformer/Protector with full SCADA				
Network Transformer/Protector with monitoring, no control				
Network Transformer/Protector with no SCADA				
Feeder Meter (e.g., ION, with comms)				
Capacitor and Regulator with SCADA				
Capacitor and Regulator no SCADA				
Line Sensor (with comms)				
Fault Indicator (with comms)				
Other Fault Indicators (no comms)				
Other Voltage Sensing (with comms)				
Sectionalizer (no SCADA)				
Sectionalizer (SCADA)				
Customer Meter				
Distribution / step down Transformer				
Other Substation Breakers				
Fuse				

b. Number of circuits with installed sensors – this will be provided as a count using the information in the table above.

1.3.5 Baseline

The baseline for this metric will be quantified and calculated based upon equipment in service as of December 31, 2017. National Grid provides circuit characteristics by circuit as part of the annual Service Quality filing[4]. The Company will properly validate and quantify the devices and definitions to develop the quantity of device types for each circuit. The Company will incorporate the baseline in the first Grid Modernization Annual Report on April 1, 2019.

[4] The information as of December 31, 2017 was filed in D.P.U. 18-SQ-11 for Massachusetts Electric Company and D.P.U. 18-SQ-12 for Nantucket Electric Company.

2 COMPANY-SPECIFIC INFRASTRUCTURE METRICS

The Department, in approving the infrastructure metrics determined that the use of infrastructure metrics that track the deployment of preauthorized grid-facing investments, as well as associated spending and deviation from planned development, will allow the Department and stakeholders to effectively and efficiently compare each company's implementation with its planned implementation. D.P.U. 15-120/15-121/15-122.

The following investments are included in these National Grid-specific infrastructure metrics:

(1) volt-var optimization ("VVO");
(2) advanced distribution automation;
(3) feeder monitors;
(4) communications information/operational technologies; and
(5) advanced distribution management systems/SCADA.

2.1 NUMBER OF DEVICES OR OTHER TECHNOLOGIES DEPLOYED

2.1.1 Type of Metric

Company-Specific Infrastructure Metric

2.1.2 Objective

These metric measures how National Grid is progressing with its GMP from an equipment and/or device standpoint.

2.1.3 Assumptions

The number of devices for each investment will need to be determined and/or updated from the initial GMP. The number of devices installed will be compared to the total number of devices planned by circuit for each investment.

National Grid notes that its GMP did not include a significant amount of detail and may need to be supplemented with detailed design and planning analysis to clarify the year-by-year construction plans.

2.1.4 Calculation Approach

The following information will be tracked and reported upon per investment at the substation and circuit level where appropriate:

a. Number of devices or other technologies deployed
b. Total number of devices planned
c. Percent – Number of devices installed / total number of devices planned

2.1.5 Organization of Results

This information will be provided on an annual basis. Data will be based upon the results at the end of the calendar year. The metrics will be reported upon at the substation and circuit level where appropriate.

2.1.6 Baseline

The baseline for this metric will be quantified and calculated once detailed design and planning has been completed. The Company will incorporate the baselines in the first Grid Modernization Annual Report on April 1, 2019.

2.2 ASSOCIATED COST FOR DEPLOYMENT

2.2.1 Type of Metric

Company-Specific Infrastructure Metric

2.2.2 Objective

This metric measures the associated costs for the number of devices or technologies installed and is designed to measure how National Grid is progressing under its GMP.

2.2.3 Assumptions

The cost of devices or technologies for each investment will need to be determined and/or updated from the initial GMP. The cost of devices installed will be compared to the total cost of devices planned by circuit for each investment.

National Grid notes that its GMP did not include a significant amount of detail and may need to be supplemented with detailed design and planning analysis to clarify the year-by-year construction plans.

2.2.4 Calculation Approach

The following information will be tracked and reported upon per investment at the substation and circuit level where appropriate:

a. Cost of devices or other technologies deployed
b. Total cost of devices planned
c. Percent – Cost of devices installed / total cost of devices planned

2.2.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year. The metrics will be reported upon at the substation and circuit level where appropriate.

2.2.6 Baseline

The baseline for this metric will be quantified and calculated once detailed design and planning has been completed. The Company will incorporate the baselines in the first Grid Modernization Annual Report on April 1, 2019.

2.3 REASONS FOR DEVIATION BETWEEN ACTUAL AND PLANNED DEPLOYMENT FOR THE PLAN YEAR

2.3.1 Type of Metric

Company-Specific Infrastructure Metric

2.3.2 Objective

This metric is designed to measure how National Grid is progressing under its GMP on a year-by-year basis.

2.3.3 Assumptions

The quantity and cost of devices or technology for each investment will need to be determined and/or updated from the initial GMP on a year-by-year basis. The quantity and cost of devices or technology installed in a given GMP investment year will be compared on a year-by-year basis and any variations will be quantified and addressed.

National Grid notes that its GMP did not include a significant amount of detail and may need to be supplemented with detailed design and planning analysis to clarify the year-by-year construction plans.

2.3.4 Calculation Approach

The following information will be tracked and reported upon per investment at the substation and circuit level where appropriate:

a. Number of devices or technology installed versus plan for a given year
b. Cost of devices or technologies installed versus plan for a given year
c. Reason for discrepancies

2.3.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year. The metric will be reported at the substation and circuit level where appropriate.

2.3.6 Baseline

The baseline comparison for this analysis is based upon a combination of National Grid's GMP and any additional detailed design and planning where appropriate.

2.4 PROJECTED DEPLOYMENT FOR THE REMAINDER OF THE THREE-YEAR (2018-2020) TERM

2.4.1 Type of Metric

Company-Specific Infrastructure Metric

2.4.2 Objective

This metric is designed to show National Grid's projected deployment for the three-year term under its GMP on a year-by-year basis.

2.4.3 Assumptions

The year-by-year investment plan is subject to change based upon the quantity of work completed, the availability of the technology, material lead times, contractor availability, etc. The revised investment plan each year will be used as the basis for projecting the following year's GMP work.

2.4.4 Calculation Approach

The following information will be tracked and reported upon per investment at the substation and circuit level where appropriate:

a. Number of devices or technology to be installed the following year
b. Cost of devices or technologies installed the following year

2.4.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year. The metric will be reported upon at the substation and circuit level where appropriate.

2.4.6 Baseline

The metric will be used as the baseline for measuring the performance of the following year's deployment and will be reported on an annual basis.

THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

Massachusetts Electric Company and Nantucket Electric Company d/b/a National Grid - Petition for Approval of Grid Modernization Plan and Related Provisions	)	D.P.U. 15-120

CERTIFICATE OF SERVICE

I hereby certify that I have this day caused to be served the foregoing documents in the above-referenced docket upon all parties of record in this proceeding, in accordance with the requirements of 220 C.M.R. 1.05 (Department's Rules of Practice and Procedure), by hand delivery and/or first class mail, and E-Filing.

Respectfully submitted,

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