GRID MODERNIZATION INITIATIVE PEER REVIEW

GMLC 1.3.22 – Technical Support to the New York REV Initiative

J. PATRICK LOONEY, BNL

April 18-20, 2017

Sheraton Pentagon City – Arlington, VA

Technical Support to the New York State REV Initiative

High Level Summary

GRID MODERNIZATION INITIATIVE
U.S. Department of Energy

Project Description

Provide objective technical assistance by a team of experts from the national laboratories to New York State agencies and policy makers to enable the **Reforming the Energy Vision** (REV), and, as a result, gain knowledge that can be leveraged for DOE's Grid Modernization Initiative.

Value Proposition

- ✓ The REV vision is for New York State to be an early adopter of advanced grid technologies at scale, resulting in significant penetration of DER.
- ✓ Key questions with regard to grid modernization will be addressed, including what business models work and why, as well as which technologies provide the most benefit and how they should be implemented.
- ✓ REV offers an important and unique opportunity to participate in a ground-breaking effort to develop future utility business models.

Project Objectives

- ✓ Provide technical guidance to regulators, policy makers and stakeholders to address challenges associated with establishing a Distributed System Platform envisioned by REV
- ✓ Obtain insights on what business models work and why, as well as customer adoption of the REV model
- ✓ Extract lessons learned from REV on deploying DER at the distribution level that can be applied to grid modernization efforts in other states

PROJECT FUNDING			
Lab	FY16 $	FY17$	FY18 $
BNL	$225,000	$200,000	-
LBNL	$200,000	$200,000	-
PNNL	$ 75,000	$ 50,000	-
INL	$ 50,000	-	-
Total	**$550,000**	**$450,000**	-

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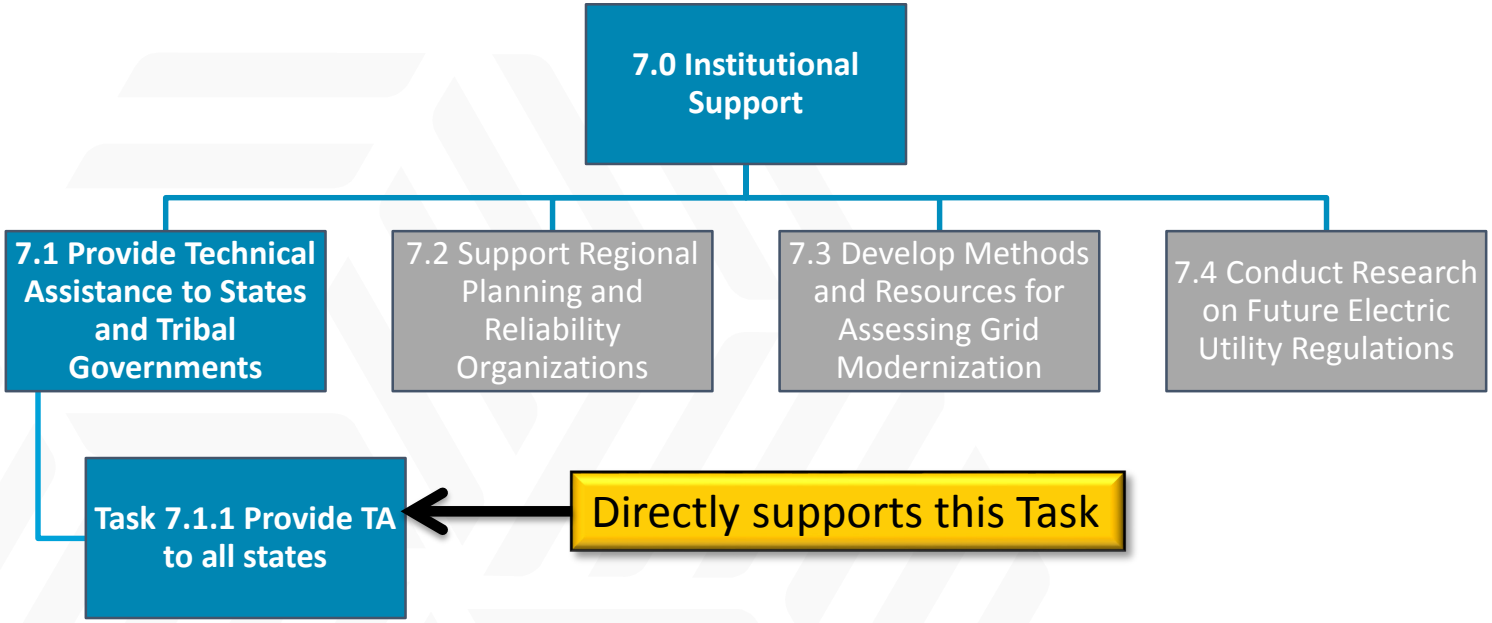
Relationship to Grid Modernization MYPP



MYPP vision for the Institutional Support

- Leverage existing technical expertise, analytical tools, models, and data
- Directly address high priority grid modernization challenges and needs for NY stakeholders
- Convene key grid stakeholders as an honest-broker for collaborative dialogues
- Create an over-arching ongoing suite of grid-related "institutional" analysis, workshops, and dialogues

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Project Team & Approach

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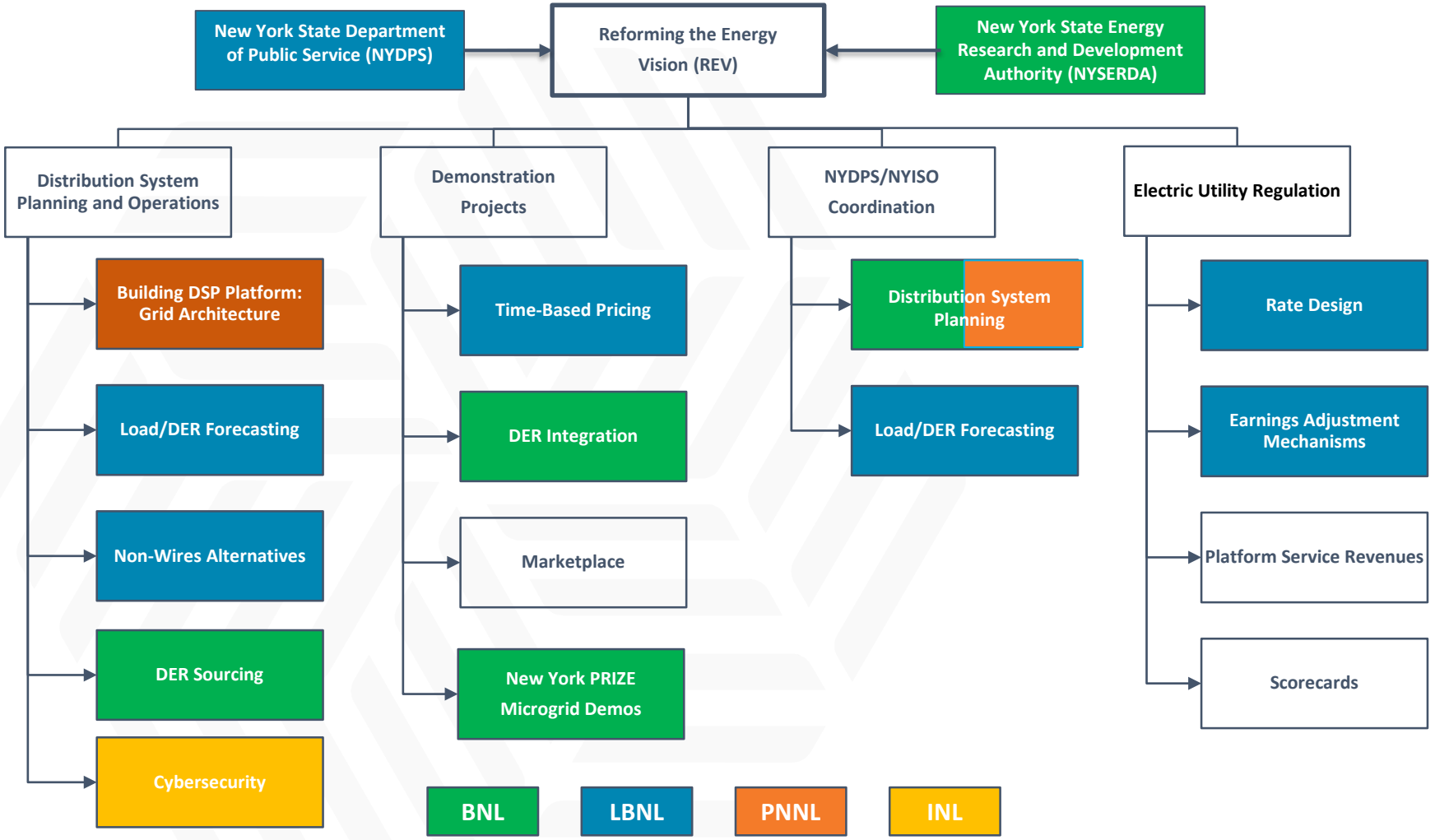

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Key Project Milestones

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Milestone (FY16-FY18)	Status	Due Date
Identify high priority TA tasks by NYS agencies.	Completed	7/15/16
Annual progress report and lessons learned from REV.	Completed	12/31/16
Midterm progress report and lessons learned from REV.	On schedule	5/1/17
Final Annual progress report	On schedule	10/1/17
Summary report with insights and lessons learned from REV	On schedule	10/1/17

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Highlights of Accomplishments to Date

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TA Provided	Impact
Supported NYPSC and NYDPS review of Joint Utilities Supplemental DSIP filings	Directly impacted PSC Order concerning next wave of filings on DSIPs
Provided input to Avangrid and National Grid on their respective residential time-based rate pilots	Improved pilot design to reduce complexity and improve likelihood that results will be actionable
Developed a use case on addressing two-way power flow on the grid for NYSERDA	Improved utility understanding on how to address this issue
Supported NYDPS on grid architecture issues and DSIP implementation planning; developed analysis of selected communication network issues and relationship to data services models	Provided insights on legacy and forward looking architecture issues in preliminary DSIP filings to be addressed during implementation of REV
Worked on a draft NY REV Security framework with security leads from NY utilities	Improved security framework includes wide range of capabilities from joint utilities

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Response to December 2016 Program Review

Recommendation	Response
1. Coordinate and contribute more directly to valuation project (1.2.4).	Will more directly engage with GMLC 1.2.4 project PI to identify specific areas where synergies exist and results can be shared and integrated.
2. Provide detail of accomplishments	TA for REV frequently takes the form of technical memos, presentations, and/or conversations. Provided list of expected upcoming accomplishments.
3. Clarify coordination with Projects 1.2.1 and 1.4.25	Project 1.2.1 "Grid Architecture" led by Jeff Taft, who also participates on the REV project. REV Team will inform Project 1.4.25 (Distribution System Decision Support Tool) of work ongoing in NY REV. REV Team will also coordinate with the DSPx project.
4. Highlight and document specific accomplishments	Will develop a summary report of lessons learned from the project's TA efforts that will be applicable to other state's considering similar issues.

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Project Integration and Collaboration

- **1.1: Foundational Analysis for GMLC Establishment** –Validate and demonstrate grid performance metrics
- **1.4.29: Future Electricity Utility Regulation** – Contribute design and implementation options, issues and concerns associated with NYDPS regulatory reforms
- **1.4.25: Distribution System Decision Support Tools** – Provide lessons learned from participation in DSIP review process
- **1.2.1: Grid Architecture** – Apply compatible process with the architecture defined in this project when reviewing and commenting on NY utilities' distribution system investment plans (DSIPs)
- **1.2.4: Grid Services and Technology Valuation Framework** – Identify insights on the challenges and best practices for siting DER at the distribution level
- **1.3.5 DER Siting and Optimization Tool for CA** – NY and CA regulators are coordinating on tool development and demonstration
- **Next Generation Distribution System Platform** (DSPx)

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Next Steps and Future Plans

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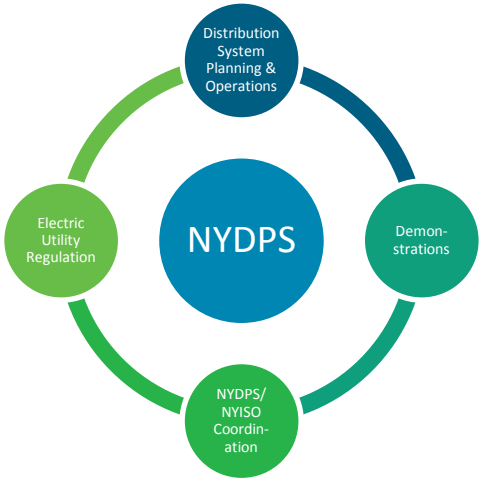
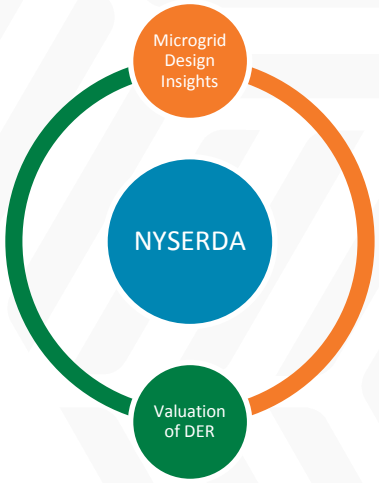
Continue Support to NYDPS

- Work with Staff to review and improve utility's proposed changes to business models and metrics that support REV goals
- Host a workshop for NY utilities on Grid architecture
- Report on selected communication network issues
- Individual meetings with PSC & utilities to review & discuss their approaches to adhering to the REV Cybersecurity Framework





Continue Support to NYSERDA

- Study on NY PRIZE microgrid designs-insights and lessons learned
- TA to address issues with design, development and operation of the Distributed System Platform
- TA on a study of the Value of DER

Prepare Summary Report with Insights and Lessons-Learned from REV

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Technical Details

- Backup Slides

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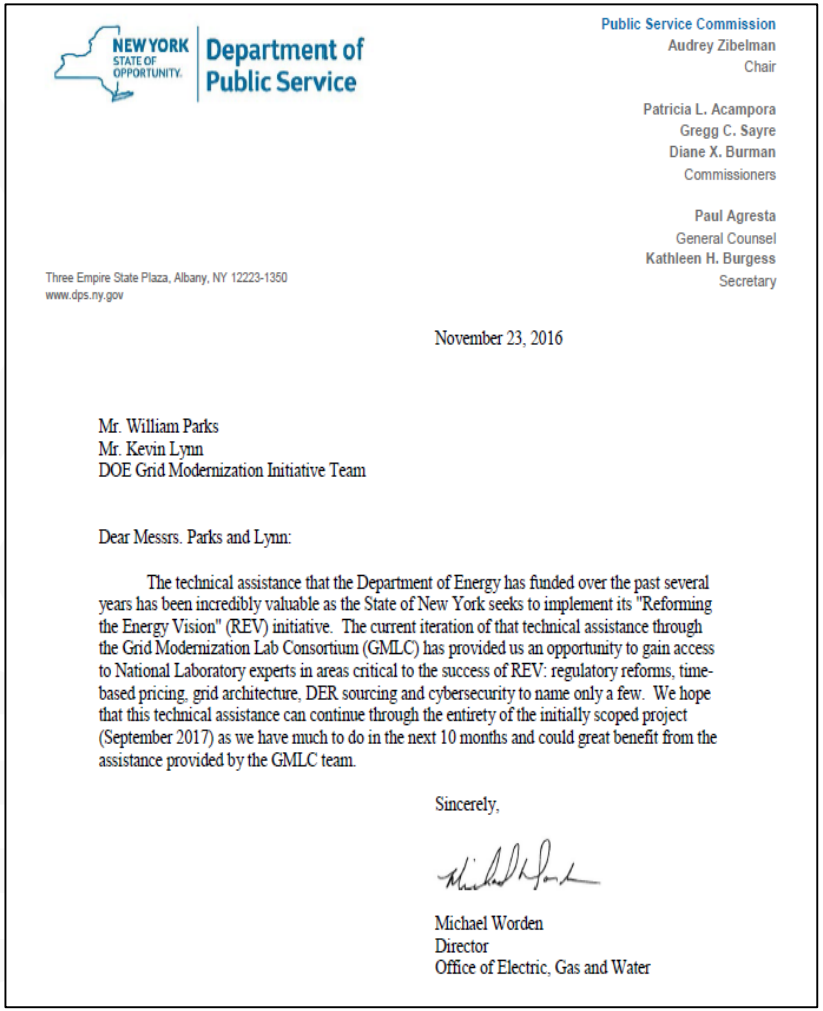
Support from NY DPS

- This project has been very successful and customer response to the TA provided has been very positive
- The current project will expire this year (FY 2017); however, REV implementation is expected to continue for the next 5 or more years
- There is still much work to be done and many more challenges to be overcome, so there is a continuing need for TA



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www.dps.ny.gov

November 23, 2016

Mr. William Parks
Mr. Kevin Lynn
DOE Grid Modernization Initiative Team

Dear Messrs. Parks and Lynn:

The technical assistance that the Department of Energy has funded over the past several years has been incredibly valuable as the State of New York seeks to implement its "Reforming the Energy Vision" (REV) initiative. The current iteration of that technical assistance through the Grid Modernization Lab Consortium (GMLC) has provided us an opportunity to gain access to National Laboratory experts in areas critical to the success of REV: regulatory reforms, time-based pricing, grid architecture, DER sourcing and cybersecurity to name only a few. We hope that this technical assistance can continue through the entirety of the initially scoped project (September 2017) as we have much to do in the next 10 months and could great benefit from the assistance provided by the GMLC team.

Sincerely,

Michael Worden
Director
Office of Electric, Gas and Water

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Sample Deliverable

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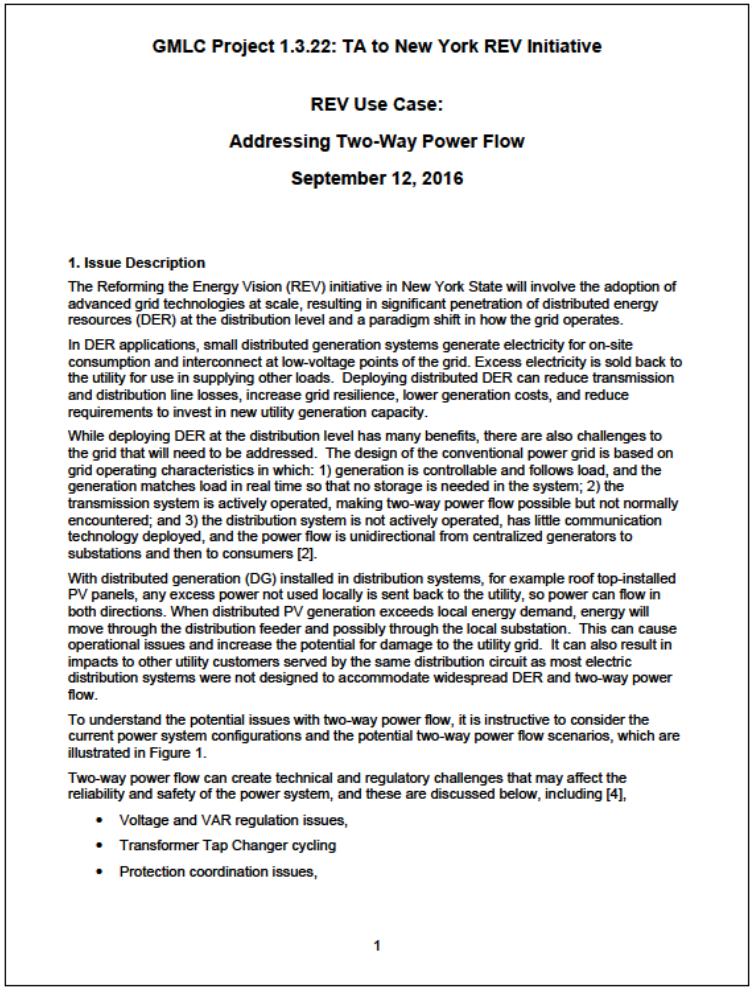
U.S. Department of Energy

Use Case on Two-way Power Flow

- REV will involve significant use of DER at the distribution level
- Deploying DER can improve grid performance, but can also result in two-way power flow
- The GMLC REV Team developed a use case to assist in understanding the challenges of two-way power flow and how to address it



GMLC Project 1.3.22: TA to New York REV Initiative

REV Use Case:

Addressing Two-Way Power Flow

September 12, 2016

1. Issue Description

The Reforming the Energy Vision (REV) initiative in New York State will involve the adoption of advanced grid technologies at scale, resulting in significant penetration of distributed energy resources (DER) at the distribution level and a paradigm shift in how the grid operates.

In DER applications, small distributed generation systems generate electricity for on-site consumption and interconnect at low-voltage points of the grid. Excess electricity is sold back to the utility for use in supplying other loads. Deploying distributed DER can reduce transmission and distribution line losses, increase grid resilience, lower generation costs, and reduce requirements to invest in new utility generation capacity.

While deploying DER at the distribution level has many benefits, there are also challenges to the grid that will need to be addressed. The design of the conventional power grid is based on grid operating characteristics in which: 1) generation is controllable and follows load, and the generation matches load in real time so that no storage is needed in the system; 2) the transmission system is actively operated, making two-way power flow possible but not normally encountered; and 3) the distribution system is not actively operated, has little communication technology deployed, and the power flow is unidirectional from centralized generators to substations and then to consumers [2].

With distributed generation (DG) installed in distribution systems, for example roof top-installed PV panels, any excess power not used locally is sent back to the utility, so power can flow in both directions. When distributed PV generation exceeds local energy demand, energy will move through the distribution feeder and possibly through the local substation. This can cause operational issues and increase the potential for damage to the utility grid. It can also result in impacts to other utility customers served by the same distribution circuit as most electric distribution systems were not designed to accommodate widespread DER and two-way power flow.

To understand the potential issues with two-way power flow, it is instructive to consider the current power system configurations and the potential two-way power flow scenarios, which are illustrated in Figure 1.

Two-way power flow can create technical and regulatory challenges that may affect the reliability and safety of the power system, and these are discussed below, including [4],

- Voltage and VAR regulation issues,
- Transformer Tap Changer cycling
- Protection coordination issues,

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Sample Deliverable

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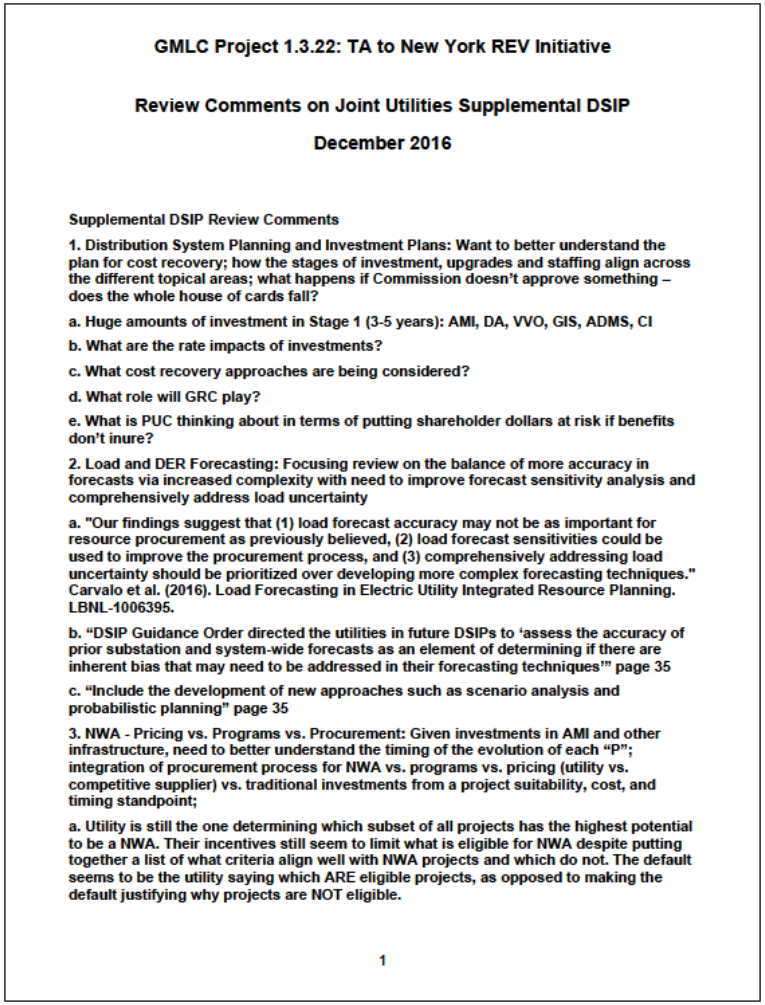
Review of Joint Utilities Supplemental DSIP

- The Joint Utilities filed a Supplemental Distributed System Implementation Plan (S-DSIP) in November 2016
- NYDPS asked the GMLC REV Team to review the S-DSIP and provide comments
- The REV Team comments directly impacted the PSC Order for the next wave of filings on DSIPs



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Review Comments on Joint Utilities Supplemental DSIP

December 2016

Supplemental DSIP Review Comments

1. Distribution System Planning and Investment Plans: Want to better understand the plan for cost recovery; how the stages of investment, upgrades and staffing align across the different topical areas; what happens if Commission doesn't approve something – does the whole house of cards fall?

a. Huge amounts of investment in Stage 1 (3-5 years): AMI, DA, VVO, GIS, ADMS, CI

b. What are the rate impacts of investments?

c. What cost recovery approaches are being considered?

d. What role will GRC play?

e. What is PUC thinking about in terms of putting shareholder dollars at risk if benefits don't inure?

2. Load and DER Forecasting: Focusing review on the balance of more accuracy in forecasts via increased complexity with need to improve forecast sensitivity analysis and comprehensively address load uncertainty

a. "Our findings suggest that (1) load forecast accuracy may not be as important for resource procurement as previously believed, (2) load forecast sensitivities could be used to improve the procurement process, and (3) comprehensively addressing load uncertainty should be prioritized over developing more complex forecasting techniques." Carvalo et al. (2016). Load Forecasting in Electric Utility Integrated Resource Planning. LBNL-1006395.

b. "DSIP Guidance Order directed the utilities in future DSIPs to 'assess the accuracy of prior substation and system-wide forecasts as an element of determining if there are inherent bias that may need to be addressed in their forecasting techniques'" page 35

c. "Include the development of new approaches such as scenario analysis and probabilistic planning" page 35

3. NWA - Pricing vs. Programs vs. Procurement: Given investments in AMI and other infrastructure, need to better understand the timing of the evolution of each "P"; integration of procurement process for NWA vs. programs vs. pricing (utility vs. competitive supplier) vs. traditional investments from a project suitability, cost, and timing standpoint;

a. Utility is still the one determining which subset of all projects has the highest potential to be a NWA. Their incentives still seem to limit what is eligible for NWA despite putting together a list of what criteria align well with NWA projects and which do not. The default seems to be the utility saying which ARE eligible projects, as opposed to making the default justifying why projects are NOT eligible.

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