Agenda Date: 05/28/2019
Agenda Item: 8D

# STATE OF NEW JERSEY

**Board of Public Utilities**
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CLEAN ENERGY

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| IN THE MATTER OF THE NEW JERSEY BOARD OF PUBLIC UTILITIES - A STUDY TO DETERMINE THE OPTIMAL VOLTAGE FOR USE IN THE DISTRIBUTION SYSTEMS OF EACH ELECTRIC PUBLIC UTILITY IN THE STATE | ) | ORDER |
| | ) | DOCKET NO. EO19040499 |

**Parties of Record:**

**Philip J. Passanante, Esq.,** Atlantic City Electric Company
**Joseph A. Shea, Esq.,** Public Service Electric and Gas Company
**Joshua R. Eckert, Esq.,** Jersey Central Power & Light Company
**Margaret Comes, Esq.,** Rockland Electric Company
**Robert H, Oostdyk, Jr., Esq.,** Butler Power and Light
**Stefanie A. Brand, Esq., Director,** New Jersey Division of Rate Counsel

BY THE BOARD:

On May 23, 2018, Governor Phil Murphy signed into law the Clean Energy Act P.L. 2018, c. 17. ("Act"). The Act required the New Jersey Board of Public Utilities ("Board") to direct each electric public utility to undertake a study to determine the optimal voltage for use in their respective distribution systems.

> No later than one year after the date of enactment of P.L. 2018, c.17 (C.48:3-87.8 et al.) (pending before the Legislature as this bill), the Board of Public Utilities shall direct each electric public utility in the State to undertake a study to determine the optimal voltage for use in their respective distribution systems, including a consideration of voltage optimization. An electric public utility shall be entitled to full and timely recovery of the costs associated with this analysis.
>
> [N.J.S.A. 48:3-87.10(a)]

Board Staff and the New Jersey Division of Rate Counsel ("Rate Counsel") have engaged in discussions on how best to fulfill the statutory mandate with Atlantic City Electric Company ("ACE"), Jersey Central Power & Light Company (JCP&L), Public Service Electric and Gas Company ("PSE&G"), Rockland Electric Company ("RECO"), and Butler Power and Light ("Butler") (collectively, the "Electric Distribution Companies" or "EDCs"). Through these discussions, the EDCs reviewed some of the available optimal voltage/voltage optimization literature, revealing that numerous studies have already been undertaken on these issues in other jurisdictions. Board Staff believes that the appropriate process to maximize the benefit to New Jersey is a comprehensive analysis of the information already available. This review will include an analysis of the parameters prior studies, steps and measures taken in other jurisdictions to establish an optimal voltage; and their success. Board Staff believes this analysis would shed light on the potential costs and benefits of pursuing optimal voltage within New Jersey's individual distribution systems and inform the Board and EDCs in their consideration of any benefits of voltage optimization in each of their distribution systems.

Board Staff therefore recommends that pursuant to the Clean Energy Act, the Board direct the EDCs to conduct a study, by analyzing the data available nationwide on voltage optimization and on optimal voltage, with recommendations on the individual EDCs' ability to implement specific measures and the anticipated impact to each EDCs' respective system. While each EDC will submit a separate report to the Board, Board Staff recommends that the EDCs be directed to jointly hire a consultant to analyze the readily available information. Such information would include studies performed by other electric companies as well as the results of any relevant implementation that may have occurred. In addition, Board Staff recommends that the Board direct each EDC to extrapolate the data in the consultant study to the EDC's own distribution system. Such extrapolation would aid in gauging whether or not tangible and cost-effective benefits can be attained from establishing an optimal voltage.

If after the Board reviews the reports submitted by each EDC, it determines that additional information is necessary and warranted, the Board will direct the EDCs to conduct additional analysis and review, which may include: a system modelling study utilizing the options available to the individual EDC systems, on varying voltage class circuits, for optimal voltage measures. The modeling study would include analysis of the measures identified as feasible to implement and a pilot program to determine the optimal voltage in one or more EDC systems. This process will allow the Board to make an informed decision at each juncture, while avoiding waste of utility resources and ratepayer dollars.

Board Staff recommends that the Study be guided by the proposed outline submitted by the EDCs on March 27, 2019 and reviewed by Board Staff and Rate Counsel. (Attachment A.) Board Staff further recommends that the Study be required to consider all operational conditions, such as on-peak and off-peak times, changes to time of day, static load profile, and average loads.

More specifically, Board Staff recommends that the Board require the Study to include the following considerations:

- The effect of raising system voltage including system losses, total usage, customer experience, Distributed Generation ("DG") hosting capacity, and constraints on when voltage adjustments can and cannot be made

- The effect of lowering system voltage including system losses, total usage, customer experience, DG hosting capacity, and constraints on when voltage adjustments can and cannot be made
- The effect and cost of flattening the voltage profile, including the effect on Conservation Voltage Reduction ("CVR") and hosting capacity (the maximum quantity that can be accommodated without impacting the system) for Distributed Energy Resources ("DER")
- Advantages and disadvantages of using different system voltages, including operational considerations, storm response, maintenance, effects on Capital equipment, planning parameters and RTO interaction
- A discussion of Volt/VAR optimization ("VVO") and DER integration, including a discussion on the impact and losses of DER hosting, impact of smart inverters and other new technology, and the impact of battery storage
- Potential reductions of energy losses that could be achieved by an optimal voltage
- A discussion of voltage optimization and its potential uses and benefits
- Equipment necessary to carry out future EDC-specific testing, if necessary
- What kind of minimal reactive power losses and electrical demand via CVR can be achieved?
- EDC's ability to optimize power factor such that the utility has to generate less power to satisfy the demands of its customers

Board Staff believes that distribution and transmission issues should be clearly delineated in the Study and voltage optimization issues distinguished from reliability issues. For maximum utility to the Board, the Study should include a narrative section and provide the EDCs' conclusions regarding the following:

1. Handling voltage volatility due to increasing penetration of intermittent renewable generation sources and increasing diversity and variability of loads;
2. Providing the ability to optimize within operating parameters especially when running at the system capability limits; and
3. Optimizing the power factor such that the utility has to generate less power to satisfy the demand of its customers.

Lastly, Board Staff recommends that the study be provided no later than December 15, 2019 and include, at a minimum, the following sections:

1. Executive summary;
2. Glossary of terms;
3. Calculation section;
4. Recommendations and findings; and
5. List of all resources relied upon, such as technical literature, company engineering manuals, etc.

**DISCUSSION AND FINDINGS**

After careful review, the Board **FINDS** that a joint study of the existing literature by the EDCs is an efficient way to initiate the review of the optimal voltage for use within each EDC's respective distribution system. The Board **ALSO FINDS** that such a study will provide a useful mechanism to initiate consideration of the possible role of voltage optimization in New Jersey's energy future. The Board **FURTHER FINDS** that extrapolation of the study data onto the individual

New Jersey electric distribution systems will effectively advance the Board's consideration of whether to pursue the establishment of an optimal voltage and/or implement voltage optimization in the State. The Board **HEREBY ADOPTS** Staff's recommendations regarding the structure and contents of the Study.

The Board **DIRECTS** the EDCs to develop a joint proposed Request for Proposal ("RFP") for a consultant to perform this study. The RFP should be submitted to Board Staff and Rate Counsel by June 28, 2019 in anticipation of an RFP being released soon thereafter by the EDCs in a manner that is consistent with appropriate requirements. The Board **FURTHER DIRECTS** the EDCs to identify costs to date as well as anticipated future costs for each EDC as well as the allocation method of the cost of the RFP to each EDC associated with this study by June 28, 2019. The EDCs' filings should also include individual proposals for cost recovery.

The Board **DIRECTS** each EDC to File its study report with the Board, no later than December 15, 2019, with a copy to Rate Counsel. Board Staff may grant up to a 30-day extension of the date of filing of each EDC's report. The Board may order additional analysis and review under the study, as outlined above, after reviewing the report.

This Order shall be effective on June 7, 2019.

DATED: 5/28/19

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ATTEST:

AIDA CAMACHO-WELCH
SECRETARY

I HEREBY CERTIFY that the within document is a true copy of the original in the files of the Board of Public Utilities.

In The Matter Of The New Jersey Board Of Public Utilities - A Study To Determine The Optimal Voltage For Use In The Distribution Systems Of Each Electric Public Utility In The State

DOCKET NO. EO19040499

**Board of Public Utilities**

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3/27/19

**OUTLINE PROPOSAL FOR VOLTAGE STUDY**

No later than one year after the date of enactment of P.L.2018, c.17 (C.48:3-87.8 et al.), the Board of Public Utilities shall direct each electric public utility in the State to undertake a study to determine the optimal voltage for use in their respective distribution systems, including a consideration of voltage optimization. An electric public utility shall be entitled to full and timely recovery of the costs associated with this analysis."

The proposed study will provide context and data in regard to the following issues:

- Utility equipment constraints
- Customer equipment constraints/experience
- Tariff voltage requirements
- Industry Consensus Standard requirements (ANSI C84.1)
- Operational concerns steady state N-0 as well as N-1 contingencies- both planned and unplanned.
- Distribution feeder operation (inside and outside substation fence- LTC's, cap banks, voltage regulators)
- Seasonal issues
- Distribution impacts on the subtransmission/transmission systems- var support

Physical layout of the study:

**Section #1**

Introduction of the EDC's distribution system design and operation

- Summary of voltage design (FE's current design guidance below ... would be interesting to compare to other NJ EDU's)
  - Primary Conductor Voltage Drop – 5%
  - Distribution Transformer Voltage Drop – 2%
  - Secondary and service Conductor Voltage Drop – 3-4%
  - Bandwidth (regulator/tap-changer control tolerance) +/- 1.5%
- Distribution circuit parameters- quantity by voltage class, typical configuration, etc.
- Radial feeders- line lengths, loading, typical operation
- Loop-tie schemes- discussion of operation and overall quantities
- Underground Networks- characteristics and quantity, locations
- Distribution system primary voltages- evolution, and current standards
- Customer mix- residential, commercial, overall
- Secondary voltages
  - Discussion of Tariff limits (+/- 5%)
  - Design of secondary system – new customers, legacy connections- distribution transformer and secondary/service voltage drops)
- Discussion of what affects the end use customer voltage- both on the utility side and downstream of the meter- primary/secondary/transformer/service voltage drop, customer wiring and customer owned dry type transformers.

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# OUTLINE PROPOSAL FOR VOLTAGE STUDY

**Section #2**

Equipment currently in place to adjust voltage/vars and description of how it currently operates, with numbers of each type in service

- LTC's
- Voltage regulators
- Cap banks

**Section #3**

Effect of raising system voltage

- Positive- with EDC specific circuit analysis/calculations (system losses, total usage, customer experience, DG hosting capacity)
- Negative- with EDC specific circuit calculations (same criteria as above)
- Constraints on when voltage adjustments can and cannot be made- under current conditions. (seasonal variations, long and short feeders off a common bus, etc.)

Effect of lowering system voltage

- Positive- with sample calculations
- Negative- with sample calculations
- Constraints on when voltage adjustments can and cannot be made- under current conditions. (seasonal variations, long and short feeders off a common bus, etc.)

Effect and cost of flattening the voltage profile

- Effect on Conservation Voltage Reduction (CVR)- if implemented.
- Effect on Hosting Capacity for DERs (PV, battery)
- Discussion on Cost

Different system voltages – (EDC specific)

- Advantages
  - Ability to implement CVR strategies
  - Hosting Capacity for DERs (PV solar)
- Disadvantages
- High level estimates to change circuit voltage (conversions)

Discussion of VVO and DER integration

- EDC specific circuit calculations/examples
  - Equipment required
  - Potential benefits/drawbacks
- Communications/monitoring and active control schemes
- Impact on losses and DER hosting
- Impact of Smart Inverters (autonomous, coordinated control, fixed PF) or any other new technology (DVARs, SVCs, secondary dynamic Var Devices (Varentech) and GridBridge)
- Impact of battery storage.

**Section #4**

Conclusions

- Summary of higher/lower voltages on utility equipment/operation
- Summary of voltage changes on customer equipment
- Summary of voltage changes on overall kwhr usage