Review of Dunkirk Repowering Options

Prepared by:

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Introduction

The New York State Public Service Commission (“Commission”), as part of Dockets 12-E-0136, Petition of Dunkirk Power LLC and NRG Energy, Inc. for Waiver of Generator Retirement Requirements, and 12-E-0577, Proceeding on Motion of the Commission to Examine Repowering Alternatives to Utility Transmission Reinforcements, is currently engaged in reviewing and deciding upon solutions to reliability issues associated with the intended mothballing of the Dunkirk power facility in western New York. Pinewood Power Solutions LLC (PPS) has been retained by the Sierra Club, a Party in the aforementioned Commission proceedings, to review the materials submitted in both dockets and provide technical recommendations on the proposed repowering alternatives. PSM Consulting, Inc. (PSM) has been retained as a subcontractor by PPS to perform power flow analyses as needed to further understand the technical issues surrounding the repowering alternatives. This report is issued jointly by PPS and PSM (“the Consultants”) and provides a high-level summary of the Consultant’s findings, offered to further the understanding and resolution of reliability issues surrounding the retirement of the Dunkirk facility. The curricula vitae of the principals associated with PPS and PSM are included in Appendices A and B of this report.
Summary

The Consultants have reviewed the materials filed under DPS Dockets 12-E-0136 and 12-E-0577 and offer the following observations and recommendations:

- The transmission analysis performed by National Grid\(^1\) ("2012 Study") was done in accordance with applicable reliability standards.
- The shunt capacitor bank solutions proposed by National Grid are appropriate to address the low voltage problems identified in the 2012 Study.
- The transmission solutions proposed by National Grid are appropriate to address overload conditions identified in National Grid’s 2012 Study.
- It would be advantageous for National Grid to consider demand response technologies as part of the planning and operational steps taken in the period of time between completion of the initial set of transmission projects (2015) and completion of the remaining transmission projects (2018-2019).

The following sections expand upon each of the points noted above.

The Transmission Analysis was Performed in Accordance with Applicable Reliability Standards

In the 2012 Study, system performance is evaluated using steady-state techniques (power flow analysis) to report on thermal overloads and/or voltage violations. The bulk of the 2012 Study involved running contingency analyses to detect violations to all applicable planning standards (NERC\(^2\), NPCC\(^3\), NYSRC\(^4\), and National Grid\(^5\)). A comprehensive set of contingencies were simulated, representing the loss of a single element (transmission line, generator, bus, transformer, etc.), loss of multiple elements, breaker failure, bus failure, and others.

To complete the requirements of the mandatory NERC Transmission Planning Standards (Transmission System Planning Performance Requirements), N-1-1 contingency analyses were performed. Category P3 and P6 planning events as described in TPL-001-2 involve an initial loss of a generator or transmission

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component, followed by system adjustments\(^6\), followed by another loss of a generator or transmission component.

There are numerous combinations of outages that can be tested for N-1-1. For the studies, National Grid selected three possible combinations: 1) any loss of a single element followed by another single element, 2) loss of a Bulk Power System (BPS) element followed by a design contingency, and 3) loss of a long lead time element (such as a large transformer, generators, and others) followed by a design contingency, thus appropriately covering NERC Standards.

**The Shunt Capacitor Bank Solutions Proposed by National Grid are Appropriate to Address the Low Voltage Problems Identified in the 2012 Study**

The 2012 Study identified a hierarchy of N-1 (single contingency) and N-1-1 (single contingency followed by a second unrelated contingency) cases that result in system problems (either low bus voltages or line flows in excess of Long-Term Emergency (LTE) ratings), and proposed a wide range of transmission additions and/or modifications that would alleviate the problems noted. It is significant to note that early in the report the following statement is made:

*The 2011 study determined that severe post-contingency low voltages exist today and will get worse though time. The 2011 study was done with all generation at Dunkirk in service.*\(^7\)

This statement (referring to a 2011 study conducted prior to Dunkirk’s notice of intent to mothball) acknowledges that there are underlying issues associated with the transmission system that exist even with the Dunkirk units in service. Therefore, while removal of the Dunkirk units would exacerbate the low voltage problems, simply replacing existing generation at Dunkirk without additional remedial transmission measures will not fully address the low voltage problems identified in the 2012 Study.

As noted in the 2012 Study\(^8\), the simplest solution for addressing these low voltage problems involves installation of shunt capacitor banks, specifically:

- addition of two 33.3 MVAr capacitor banks on the two Dunkirk 115kV bus sections, and
- addition of a second 75 MVAr capacitor bank at the Huntley 115kV switchyard.

Shunt capacitor banks, by virtue of their size, flexibility, and relative low cost per kVAR, have been used for many decades to correct low voltage problems on transmission systems. It is difficult to conceive that the cost of repowered generation used to solve low voltage issues even on multiple bulk power

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\(^6\) A set of corrective actions intended to mitigate the effects of a contingency. Corrective actions may include, among others, the opening or closing of a transmission element; the opening, closing, or re-dispatch of a generator; and load curtailment.


system buses can be competitive with what has long been recognized as a standard solution for low voltage problems on the bulk power system. National Grid’s proposed solutions to the observed low voltage problems look to the Consultants to be the most cost-effective solutions.

The Transmission Solutions Proposed by National Grid are Appropriate to Address Overload Conditions Identified in National Grid’s 2012 Study

To address the overload conditions noted on the Five Mile-Homer Hill and lines #180 and #181, the proposed reconductoring projects are logical solutions, with consideration given to the amount of reconductoring needed to eliminate the most vulnerable portions of the transmission facilities. Given that a significant number of contingencies result in overloads on these facilities, it is apparent that these lines are the weak links in this portion of the transmission system and reconductoring is the cost-effective solution here.

Once the most severe set of N-1 and N-1-1 contingencies were identified, the 2012 Study considered a number of alternative transmission system modifications to address the full set of problems, including the addition of new 230 kV and 345 kV lines, the addition of one or more transformers at Stolle Rd, and reconfiguration of breakers at various substations. These were all rejected for various technical and cost reasons, indicating that the proposed transmission solutions are viewed as the most cost effective package of transmission additions to mitigate potential low voltage and overload contingencies.

National Grid Should Consider Use of Demand Response Technologies for the Period Beyond 2015

In the 2012 Study, National Grid noted that non-wires alternatives such as demand response programs and distributed generation were investigated. It was determined that both the magnitude (in MW) and duration (likely call hours) of such solutions would be impractical and not viable as an alternative that could completely replace the proposed new transmission facilities and capacitor additions. Notwithstanding this conclusion, in National Grid’s report on repowering alternatives, the following statement is made:

“The Company would rely upon operational measures to address any reliability issues remaining in the period following completion of the first three projects (estimated at June 1, 2015) and before the completion of the #180 and #181 line reconductoring.”

We believe that non-wires alternative solutions, specifically the use of demand response programs, should be considered by National Grid as an additional operational measure to ensure reliability over the period in question. Rather than considering demand response as the sole alternative to alleviate potential voltage problems and overloads, National Grid should develop a program to subscribe

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industrial and commercial customers (with minimum kW aggregation limits) to a load relief program tailored to National Grid’s western NY system configuration. As with the Emergency Operating Procedures followed by the New York Independent System Operator (NYISO)\(^{11}\), implementation of demand response programs would play a crucial role in a multi-step program designed to address potential reliability issues through system operating procedures. Under such a program, the MW penetration and exposure hours can be limited to achievable levels while providing additional operational tools that provide additional flexibility to system operators. The timeframe over which such programs are clearly useful (3-4 years) justifies serious consideration.

The Consultants note that programs such as the NYISO’s Special Case Resource and Emergency Demand Response Programs\(^{12}\), and Con Edison’s Distribution Load Relief Program\(^{13}\) and Commercial System Relief Program\(^{14}\) provide good models for a similar program administered by National Grid to address western NY reliability issues. All of these programs use demand response solutions to address specific bulk power system, distribution system, and local network problems in ways that provide meaningful relief and provide reasonable compensation to participants.


\(^{13}\) Con Edison DLRP program description, located at http://www.coned.com/energyefficiency/dist_load_relief.asp.

\(^{14}\) Con Edison CSRP program description, located at http://www.coned.com/energyefficiency/commercial_relief.asp.
APPENDIX A

PPS QUALIFICATIONS
Appendix A – Qualifications of Pinewood Power Solutions LLC
Pinewood Power Solutions LLC, a New York State Limited Liability Corporation, was founded in November 2012 by David J. Lawrence, with the purpose of providing consulting services related to wholesale electricity markets, particularly focused on demand response programs, capacity market initiatives, and renewable resource market participation. Currently, Pinewood Power Solutions LLC is engaged in the following projects:

- Serving as consultant to a Demand Response provider in the New York Independent System Operator’s (NYISO) wholesale demand response programs.
- Developing a suite of graduate-level courses on deregulated electricity markets for an upstate NY graduate school.

Prior to founding Pinewood Power Solutions LLC, Mr. Lawrence retired from the NYISO as Manager of Capacity Market Products; his complete resume follows.

Nov. 2005 – Dec 2011  

Responsible for design, development and deployment of NYISO’s demand response and Installed Capacity (ICAP) market products. Major initiatives include:

- Leading NYISO governance process discussions on ICAP demand curve reset (2007, 2010).
- Developing and implementing capacity market mitigation measures for New York City.
- Developing criteria for establishing new capacity market localities.
- Establishing capacity market participation rules for solar generation facilities.

Represented NYISO on numerous environmental initiatives, including the Northeast Regional Greenhouse Gas Initiative (RGGI) and New York’s Renewable Portfolio Standard (RPS). Worked collaboratively with NY State Energy Research & Development Authority, NY Dept. of Public Service and NY Dept. of Environmental Conservation on design of a NY generator attributes tracking system and various environmental rulemakings. Received NYISO Core Values Awards in 2007 and 2008.

Nov. 2001 - Nov. 2005  

Managed demand response programs, Installed Capacity (ICAP) market design, environmental initiatives and coordination of inter-regional Independent System Operator activities. Designed and implemented internal issues management process. Presented numerous technical outreach talks to NYISO stakeholder groups, US and Canadian organizations. On behalf of the NYISO, accepted from the Peak Load Management Alliance the 2002 and 2004 awards for best ISO Demand Response Program in the U.S.

Apr. 2000 - Nov. 2001  

Spearheaded development of NYISO reliability-based and economic demand response programs with NYISO stakeholders. Prepared monthly transmission congestion reports; developed initial process for system reliability impact studies.
P/L responsibility for PTI’s monitoring and control products and associated services. Devised marketing and sales strategies; led new product development; negotiated contracts on a worldwide scale. Department expanded in 1997 to include power plant performance analysis software development and services personnel. In 1999, assumed responsibility for all of PTI’s professional training courses. Elected to the PTI Board of Directors, 2 terms.

1994-1995  **Product Manager, Industrial Load Shedding System, Power Technologies, Inc.**
Managed all marketing, sales, product development, and client support associated with PTI’s industrial load shedding system.

1990-1994  **Product Manager, Dynamic System Monitor, Power Technologies, Inc.**
In coordination with equipment manufacturing and marketing partner, managed product development and client technical support for PTI’s Dynamic System Monitor phasor measurement system. Also developed algorithms for DSP-based voltage, frequency, and power sensors.

1984-1990  **Senior Engineer, Power Technologies, Inc.**
Responsible for contractual, technical, and financial aspects of project management, including supervision of project staff. Projects included:
- Project Engineer for Electric Power Research Institute RP2542-1, Characteristics of Lightning Surges on Distribution Systems,
- developed and presented PTI Short Course on Disturbance Monitoring and Analysis,
- developed three-phase analysis and transmission line fault location software for use with digital transient recorders, and
- served as instructor for Power System Reliability and Transmission System Reliability courses.

1976-1984  **Analytical Engineer, Power Technologies, Inc.**
Developed software, performed studies, and prepared reports for a number of utility-related projects, including:
- design and development of a short-term hydro-scheduling computer program, along with on-line control software, for a Spanish utility,
- development of a fault data analysis software package for a distribution fault current study sponsored by the Electric Power Research Institute,
- several bulk power system and substation reliability studies, and
- development of a microprocessor-based high impedance fault detection algorithm.

**Education**
1975-1976  **Graduate School of Engineering, Rensselaer Polytechnic Institute, Troy, New York**
Master of Engineering Degree in Electric Power Engineering, May 1976
1971-1975 Rensselaer Polytechnic Institute, Troy, New York
Bachelor of Science Degree in Electric Power Engineering, with a minor concentration in Technical Writing.

Professional Certification
Certified as an Intern Engineer in New York State, October, 1975.

Professional Societies
Member, Institute of Electrical and Electronics Engineers.
Past Chairman, Power Engineering Society, Schenectady Chapter.
Past Chairman, Institute of Electrical and Electronics Engineers, Schenectady Section.
Past Member of Power System Relay Committee Working Groups H5, Common Data Format for Exchange of Transient Data, and I11, Digital Fault Recorder Data Standards.

Honors and Awards
Nominated for the Eta Kappa Nu Outstanding Young Electrical Engineer Award, 1985.

Technical Papers by David J. Lawrence:


APPENDIX B

PSM QUALIFICATIONS
Appendix B – Qualifications of PSM Consulting, Inc.
Located in Guilderland, New York, PSM Consulting, Inc. is a minority-owned, New York State Corporation, founded in 2003, with expertise in power systems engineering and electricity markets. We also provide Environmental Engineering Services with a focus on the power industry.

Our staff performed numerous power system analysis and studies across many regions in the US and abroad. PSM Consulting, Inc. has experience in projects of various sizes and levels of complexity.

Our experience related to this Project is illustrated in the following selected projects:

- Transient Stability Studies to determine the feasibility of the largest transmission project of the country: The TransWest Express Project (TWE) which will deliver 3,000 MW of wind power from Wyoming to the southwest (Nevada).
- Feasibility Studies for the Interconnection of renewable energy generation including wind power, energy storage devices, and power production using Landfill gas.
- Power flow analysis to analyze the potential mothballing of generating plants in New York and New England.
- Full System Reliability Impact Study (SRIS) for wind farms (Evaluated the interconnection of more than 2,000 MW to the electrical grid).

**Resume: Ricardo J. Galarza, Ph.D.**

**President, PSM Consulting, Inc.**

Experience with PSM Consulting: 9 years (Founding President)

Experience with other firms: 13

**Education**

- Ph. D., Electric Power Engineering, Rensselaer Polytechnic Institute, 1996.
- B. S., Electrical Engineering, Northeastern National University, Argentina, 1985.
Experience Summary

Dr. Galarza has worked in the electric power industry for over 20 years in various positions, gaining extensive experience in power system engineering and the electricity markets.

After obtaining his B.S. degree, he worked for an electric utility in various capacities. In 1987, he became Project Manager in two studies supported by the European Community. The first involved energy and transmission planning (for the northeastern part of Argentina) and the second concerned the utilization of alternative generation sources for small isolated systems. In 1991, he joined the graduate engineering program at Rensselaer Polytechnic Institute. His dissertation title was: “Power System Dynamic Equivalencing: Advanced Analysis and Improvements”.

Dr. Galarza joined Power Technologies, Inc. (PTI) in late 1996 as a Senior Consultant, Transmission Planning, in the System Planning and Operations Department. At PTI, Dr. Galarza led and performed numerous consulting studies in the areas of transmission planning (across many regions in the US and abroad), software development, generator interconnection studies, modeling of electrical apparatus for steady state and dynamic analysis. Dr. Galarza was also involved in development of training material for using steady-state techniques and dynamic modeling in power system analysis, use of appropriate software for system planning and grid reliability, and power system fundamentals. He was the course instructor for many courses offered by PTI.

In 2001, he joined the Market Monitoring and Performance Unit of the NYISO where as a Senior Analyst he was involved in a variety of projects as the only transmission system specialist. He designed a market simulator software that included the transmission system model, conducted numerous market analysis studies, participated in the implementation of most of the changes introduced to the NY market, performed analysis of market design as it relates to grid operation, monitored the Transmission Congestion Contract (TCC) market, and developed a congestion cost allocation method that allow for better understanding of the impact of the transmission system on prices, hence allowing for system-wide congestion savings.

Dr. Galarza founded PSM Consulting, Inc. in September of 2003. As an independent consultant at PSM Consulting, Inc. he was involved in numerous transmission planning project such as: analysis of alternatives of interconnections for new substations in Connecticut and voltage control issues in the same area, feasibility and system impact reliability for the interconnection of renewable energy generation including wind power and and power production using Landfill gas, addition of new technology to the grid such as energy storage and frequency regulating devices. As a Project manager, he supervised PSM Consulting, Inc. staff for evaluating more than 2,000 MW to the electrical grid. Dr. Galarza also assisted clients to Committees and participated actively on the Transmission Planning Advisory Committee of the NYISO. He also worked as a technical auditor for the NYISO, reviewing and supervising technical work performed by other companies. He is the current technical advisor on Transmission Planning for the New England Committee on Electricity (NESCOE).
As a consultant, Dr. Galarza continued assisting the NYISO on the implementation of numerous market changes and new market products into the market operation software. Dr. Galarza also provided technical support for Standard Market Design Implementation for the Market Monitoring Unit, New York ISO.

**Relevant Publications**


