RFI Response Submitted to the

New York Power Authority

On behalf of the

New York Energy Highway Task Force

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Quanta Technology LLC is the high-growth, independent consulting arm of Quanta Services (NYSE:PWR) and a member of the S&P 500. We are headquartered in Raleigh, NC and have regional offices in the USA, Canada and Europe. Our Mission is to provide business and technical expertise to energy utilities and industry and assist in deploying strategic and practical solutions to improve their business performance. Our Vision is to be the firm that energy companies seek to help solve their strategic and operational needs. We strive to provide an environment that attracts and develops the best energy industry professionals. Our Core Value is to provide value to our clients in every engagement with the industry-best technical and business expertise, holistic and practical advices, and industry thought leadership. Our Management Team is the industry's top acknowledged leaders in their fields. Quanta Technology, founded in 2006, has grown to more than 100 staff members. We are an Equal Opportunity Employer.

Our Client Base is well established in North American and international markets. Our clients include energy delivery utility companies, large industrial companies, energy suppliers, Regional Transmission Operators and Independent System Operators (RTOs/ISOs), and energy industry research and support organizations. We attribute Our Success to our Exceptional Staff, many of whom are industry leading experts in Smart Grid, Asset Management, System Reliability, Storm Investigation and System Hardening, Sustainable Energy, and Workforce Development. Our staff has provided extensive assistance to major utility entities in New York that include the New York Independent System Operator, the New York Power Authority, National Grid and Con Edison.

2 PROJECT DESCRIPTIONS

Quanta Technology, LLC (Quanta Technology) is pleased to submit two recommended initiatives for implementation to the New York Power Authority, on behalf of the New York Energy Highway Task Force, in response to the Request for Information (RFI) presented at the *Conference of RFI Respondents and Interested Parties* on April 19, 2012. These recommendations are submitted with the understanding that the contents of this document may be publically disclosed by the New York Energy Highway Task Force.

These recommended projects are focused on transmission smart grid technology and quite technical. They are for extending the development and deployment of synchrophasor-based technology. Their objective is to support enhanced Energy Management System (EMS) and control center operation of the electric utility bulk power system to assure high reliability while increasing energy transfer capability and accommodating larger amounts of intermittent renewable generation sources, such as wind turbines and solar photovoltaics (PVs).

These projects are entitled *Phasor Data Cleaning for Linear Phasor State Estimators* and *Phasor-based Voltage Stability Monitoring*. Either or both of these recommendations may be pursued at the discretion of the New York Energy Highway Task Force.

The US Department of Energy (DOE) stipulated in its American Recovery and Reinvestment Act (ARRA) Smart Grid Investment Grant (SGIG) co-funding initiative that the development and deployment of synchrophasor-based technology is essential to assure the reliability of the bulk power grid and prevent wide-area cascading outages. The DOE cited in a 2006 report the specific benefits to include:

- Provide early warning of deteriorating system conditions, so operators can take corrective actions
- Limit the cascading effect of disturbances by providing wide-area system visibility
- Analysis and visualization through the use of archived monitoring system data
- Improve transmission reliability planning and allow for immediate post-disturbance
- Provide more diagnostic tools than are currently available
- Allow for the more effective use of automatic controls for self-correction, such as automatic switching or controlling the flow of power
- Improve computer models of the power system

The New York ISO (NYISO) applied for and was awarded in 2010 co-funding by the DOE for one of the largest synchrophasor-based systems (approximately $75 million) to help assure the system reliability as well as increase the energy transfer across the New York State grid. All of the New State transmission owners are sub-awardees and participants in the project. The deployment project is scheduled for completion in 2013.

The recommended initiatives to New York Energy Highway Task Force will build upon the NYISO synchrophasor-based project by extending the application functionality needed to fully evolve the

state-wide energy management control centers. It is suggested that the NYISO project would eventually serve as a deployment platform for these initiatives.

2.1 Phasor Data Cleaning for Linear Phasor State Estimator

The on-going NYISO project will bring to the NYISO control center the phasor data from the entire High Voltage network of the NY Control Area, and at a very fast rate (60 frames per second). This recommendation aims comprehensively improving (clean) the quality of data from all phasor measurements available at the NYISO control center. The approach is based on using a process *called Linear Phasor State Estimation.* This cleaning would provide quality high-speed phasor data to the phasor applications similar to the manner that a current technology state estimator provides a clean data foundation for the much slower-speed EMS applications.

2.2 Phasor-based Voltage Stability Monitoring

Voltage management and stability/instability monitoring have become an area of increased complexity and focus. The voltage stability limit is closely related to the maximum deliverable power that can be drawn by the system loads, while preserving a stable operation of the combined generation-transmission system. Voltage instability occurs when the combined generation-transmission system is unable to provide the power requested by the loads, which may happen due to system outages and/or limitations of reactive power generation. Once this happens, it can further evolve into further voltage collapse and cause system disruption.

The objectives of this recommended study and implementation initiative would be:

a) Prepare a comprehensive comparative review of the existing real-time voltage management techniques
b) Compare, simulate and report on differing voltage instability prediction algorithms for real-time monitoring of voltage stability/power margins and capability to enable stability controls, protection and alarming
c) Perform comprehensive testing and demonstration of the method on the NY Control Area network with simulated data
d) Develop a visualization tool suitable for bringing situational awareness to system operators and provide alarms when margin reserves cross critical thresholds
e) With the visualization tool, investigate improved techniques for real-time monitoring of the system voltage stress

3 PROJECT JUSTIFICATION

Fundamentally, these projects would enable greater precision in monitoring the dynamic transmission line capacity ratings and stability limits to enable increased energy transfer particularly from upstate and western New York generation sources to congested lines downstate while assuring operation within acceptable safe operating margins.

The energy transfer benefits would available to generators to increase their production levels during periods of high demand and end users would likely have reduced congestion charges.

The high-speed monitoring enabled by these phasor-data based programs would also likely enable increased generation levels by intermittent renewable generation sources.

4 FINANCIAL

These projects are proposed to be take advantage of the already-funded and in-progress NYISO Smart Grid Investment Grant (SGIG) project. The US DOE is co-funding approximately half of the initial project budget of $75 million. The other portion is funded by the NYISO and the New York transmission owners.

The sum of these two projects from conceptualization to implementation is envisioned to be between $800,000 and $1,200,000.

Cost recovery could be imbedded into the NYISO tariff structure. DOE and NYSERDA might be interested co-funding partners.

5 PERMIT AND APRROVAL PROCESS

No environmental, siting, grid interconnection or operational permits are required.

6 POTENTIAL IN-SERVICE DATE AND SCHEDULE

The engineering study work could begin late 2012. Implementation is contingent on first completing the NYISO SGIG project, which is targeted for July 2013. Competitive procurement, design, testing and implementation are envisioned to be complete for the recommended project during early 2015.

7 OTHER CONSIDERATIONS

The recommended projects are technology in nature, which would provide lasting value to all energy stakeholders in New York.

- Critical factors:
  - An applicable system technology platform for applying these capabilities is already funded and underway
  - We believe the NYISO would be willing sponsor to demonstrate the functionality

  - Incremental cost is modest
- These recommendations are centric to the goals of the New York Energy Highway Vision with respect to using technology to maximize the utilization of the existing grid capability prior to requiring added physical capacity to meet the electric energy needs of New York.