Quanta Technology

Quanta Technology, headquartered in Raleigh, NC, is the division of Quanta Technology Inc. that provides strategic resources for utilities. Quanta Technology offers a full range of technical and analytical services related to electrical transmission and distribution systems. Through the collaborative and integrated efforts of its specialized operating companies, Quanta Technology is uniquely qualified to provide comprehensive infrastructure services including strategy, planning, design, engineering, program management, procurement, construction, and maintenance on a project or turnkey basis.

This document contains a summary of qualifications for Quanta Technology to assist electric utilities and owners of electrical delivery facilities (transmission, substations, distribution, and industrial) in issues related to strengthening infrastructure against damage from severe weather events and in preparing to respond to those events. Areas of expertise include:

- Post Storm Audit
- System Hardening
- System Resiliency
- Capital and O&M Spending Optimization
- Storm Modeling
- Expert Witness Support

This document contains information about Quanta Technology's services, credentials of key personnel and related projects previously performed by Quanta Technology staff and associates.

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Storm Hardening Services

In the past, it was not deemed economical to design distribution systems to withstand major weather events such as hurricanes, linear wind storms and ice storms. The expectation was that utilities would be prepared for timely customer restorations and repairs. Today, expectations have changed, and utilities are increasingly being expected to "harden" their system so that less damage occurs during such events. Efforts to “harden” the electricity grid must focus on two complementary and balancing elements: adaptation and survivability.

- **System Adaptation:** Preventing future damage due to extreme weather may require changes in assumptions, design standards, equipment specification, construction guidelines, maintenance & inspection procedures, “flood proofing” critical facilities … or the use of innovative approaches and/or technologies.

- **System Survivability:** Survivability during and after an extreme weather event entails the ability to maintain some basic level of electrical power functionality to the communities. This necessitates some level of “resiliency” in the supply. Resiliency would include protection, switching, vegetation management and other measures. It will also include requirements associated with timely and accurate communications to customers.

Quanta Technology has helped dozens of utilities address nearly every aspect of this complicated endeavor. Our extreme weather hardening projects are designed to and typically customized based on specific customer needs, but below the typical engagement areas are described.

**Post Storm Audit**

After a major storm, utilities are often the focus of media and regulatory investigations. This is complicated by the fact that system restoration and repairs have often been completed before storm damage data collection has been considered. Our experts have performed independent post storm audits for many utilities and for a variety of weather events. Often, we are able to counter many of the negative accusations while simultaneously identifying opportunities for improvement in data collection, storm response and hardening.

**System Hardening**

System hardening is denoted as activities which make distribution systems less susceptible to damage during major storms. This includes issues related to trees, pole strength, pole loading, small wire issues, flood related issues, underground conversion and many others. Our experts have helped many utilities quantify the benefits of potential hardening options so that they can be applied in a targeted and cost-effective manner. Typically this includes: 1) a short-term plan to address critical issues and gain hardening experience, and 2) a long-term hardening roadmap which systematically addresses the entire system over time.

**System Resiliency**

System resiliency includes activities which allow a system to decrease the number of customers who experience interruption during major storms and it allows for faster restoration. System resiliency includes hardening, but also includes issues such as line switching, automation, right-of-way access, restoration sequencing, inventory management and contractor management. A goal of a resilient system is to "bend" rather than "break" when a major storm strikes. The approach is also similar to system hardening.
Capital and O&M Spending Optimization
Hardening measures need to be analyzed for cost-versus reliability and risk-versus reliability. This includes the required amount of spending required to optimally achieve various levels of hardening according to an overall hardening roadmap. These would include capital, operational and maintenance improvements. This typically includes development of equipment replacement criteria and roadmap.

Storm Modeling
Storm modeling is becoming increasingly important for both storm operations and hardening efforts. When a storm is approaching, system modeling can estimate the type, amount, and locations of damage, so crews can be stocked and pre-dispatched. During hardening and resiliency efforts, storm modeling helps to identify the most cost effective ways to achieve specific hardening and resiliency goals. Quanta Technology has more experience than anyone else in the world in the area of electric utility storm modeling.

Expert Witness Support
It is not uncommon for utilities to receive a large amount of negative publicity during and after a major storm. This can result in regulatory hearings, mandated investigations, difficulties in cost recovery, and difficulties in rate cases that include hardening and resiliency spending. It has proven helpful in these situations for utilities to retain independent experts to provide written and oral testimony. Quanta Technology has multiple people who have successfully provided expert witness support for utilities in the areas of storm damage and storm hardening.

Training
Quanta Technology is one of the few organizations in the world which offers a complete course in electricity infrastructure storm hardening. Hardening is also included as a standard material in our reliability courses. Typical subjects covered include: weather modeling, failure modes, hardening tactics, resiliency tactics, vegetation management, extreme wind ratings, failure rate models, cost-to-benefit analysis and developing a hardening roadmap.
Selected Project Experience

The following is a selected list of projects that members of the Quanta Technology team have led in recent years. These projects have been selected due to their relevance to the topic of this document. Brief project descriptions are provided and detailed descriptions are available upon request.

**Transmission & Generating Facilities Storm Resiliency, NYPA**

Provide a comprehensive study to review power system hardening, operations and grid improvements. This included field inspections/sampling of the target population (generation facilities, transmission lines) to understand the current system and as appropriate, develop statistical models of the as-built conditions on the system. Quanta’s focus was assessing sufficiency of existing facilities for the levels of wind and ice resistance and flooding that are experienced in the NYPA territory. Quanta looked at transmission towers and generation plants for susceptibility to extreme weather and flooding.

**Power System Hardening, Operation & Grid Improvements, New York Department of Public Service (DPS)**

Evaluate existing NY regulated utility system storm hardening practices and their respective emergency plans. Quanta also assessed how future climate change expectations may affect electric system assets. Pre and post Hurricane Sandy plans were reviewed as part of this process. The plans are reviewed in light of extreme wind and ice conditions and potentially flooding for transmission, distribution and generation facilities. The review of these plans and information was used to make comparisons among the utilities included in this study.

**Reliability Study of the Entergy New Orleans Electric System, Entergy New Orleans, Inc.**

Quanta project engagement focused on review and evaluation of Entergy’s emergency restoration plans, processes, and practices, as well as engineering practices applied and/or available to affect “hardening” of the T&D system for storm resiliency. Quanta provided a comprehensive system review that was categorized into four main areas: 1) Infrastructure management; 2) Storm restoration planning and execution; 3) Infrastructure upgrade/hardening business case analysis; and 4) Use of technology as a storm resiliency.

**Structural Analysis and Hardening, Northeast Utilities**

In support of the Northeast Utilities plan submitted to the Connecticut Public Utility Regulatory Authority, Quanta Technology is performing in-depth analyses of the NU distribution system structures, including wood poles, for capability to withstand severe wind forces, ice conditions, and drop forces such as limbs and falling trees. This included a combination of traditional static loading analyses as well as dynamic loading analysis using an approach unique to Quanta Technology.

**Cost-Benefit Analysis of Storm Hardening, Public Utility Commission of Texas**

This project examined the costs and benefits associated with vegetation management and pole inspection programs throughout the State of Texas. The project also determined the costs and benefits associated with storm hardening efforts such as locating electric substations and telecommunications central offices above the 100-year floodplain, backup generation at these facilities, hardened transmission structures, the use of concrete and steel structures, and underground construction of new transmission and distribution. The project also examined the potential benefits of smart grid technologies on storm restoration.

**Florida Undergrounding for Storm Resiliency Study, Florida Electric Utilities**

This project performed a three-phase project for a consortium representing all electric utilities in Florida (managed through the Public Utility Research Consortium of the University of Florida). Phase 1 performed a comprehensive literature review and assessment. Phase 2 performed four case studies of completed underground conversion projects, and Phase 3 developed a model capable of predicting the costs and benefits to all stakeholders for potential underground conversion projects, as well as comparing these costs and benefits to a hardened overhead system. The result presented to the Florida regulator was successfully accepted for effective storm hardening design guidelines.
Hurricane Wilma Damage Assessment, Florida Power & Light
Quanta Technology personnel (under other employment) were engaged by FPL to assess the damage caused to their system as a result of Hurricane Wilma in 2005. The damage from that storm was considered excessive by customers and regulators, when compared to the relative intensity of the event. The study was an in-depth analysis of the amount of damage, types and causes of damage, locations of major damage, etc. with a comparison to site specific storm intensity information. This study then led to the development of a hurricane hardening strategy and roadmap for the utility.

Hurricane Hardening Roadmap, Florida Power & Light
Developed a hardening roadmap for Florida Power & Light to improve distribution reliability performance during hurricanes. This included the development of a “hardening toolkit,” standards, specifications, criteria, application guidelines, and supporting tools. It also includes a pilot study that demonstrated these concepts, and provided a basis for a ten-year roadmap in terms of projected cost, effort, and reliability benefits.

Windstorm Investigation, Puget Sound Energy
Quanta Technology personnel conducted a review and critique of the 2006 “Hanukkah Eve Storm” that resulted in extreme damage and extended power outages on the Puget Sound Energy system. The study was focused on evaluating all aspects of PSE’s response to this major event: customer call handling, field damage assessment, crew and contractor logistics, prioritization and dispatch of work, and right of way conditions and management. The study was used with the state of Washington Commerce Commission as part of PSE’s storm recovery filing.

Storm Response Investigation, Ameren
Quanta Technology personnel performed a storm response review and critique for Ameren following severe summer storms and winter ice storms experienced in the Missouri service territory in 2006-2007. Similar to the PSE investigation, the study focused on storm planning and execution by the organization of the documented storm plan.

Wood Pole Failure Assessment, Midwest Energy
Quanta Technology performed a structural analysis of transmission and distribution wood pole structures that failed during a high wind event in central Kansas. The results were used to verify existing construction standards, determine the impact of pole treatments on structural integrity, and confirm the point of failure for the broken poles.

Pole Loading Study, Northern Virginia Electric Cooperative
Quanta Technology analyzed the existing loading on NOVEC’s transmission poles and with the resulting loading after adding new distribution line under-build. Different distribution lines that would be potentially used as under-built were also analyzed. The deliverables for this project included the cost effectiveness of adding new distribution under-build as oppose to erecting new stand-alone distribution lines in the existing right of way.

Distribution Wood Pole Life Cycle Strategy, Pacific Gas & Electric
This project developed a life cycle strategy for PG&E’s 2.3million distribution wood poles. The project had four phases: review of PG&E’s pole annual inspection and test and treat programs; review of practices against NESC, CPUC and PG&E standards; develop a risk analysis of individual pole failures; and developed a metric and methodology for prioritization and prioritized listing of wood poles to be replaced.

Extreme Wind Hardening Benchmark Survey, BC Hydro
This project performed a survey of hardening initiatives of utilities in the Pacific Northwest following the severe wind storms of December 2006. This project also surveyed hardening initiatives in other parts of the country and around the world.
Key Personnel

Bill Snyder, Senior Vice President, Technical Consulting

Bill has an extensive background in utility operations, management and change initiatives resulting from over 28 years’ experience in the electric utility industry. He has led and participated in consulting engagements on asset management, T&D operations and maintenance programming, and outage restoration processes. He has successfully led major process change identification and implementation programs in the engineering and operations functions, as well as leading consulting engagements to review and evaluate operational processes and standards and business cases for capital project decisions. As both a utility manager and as a consultant, Bill has experience working with senior officers to develop and implement operational strategy to achieve new levels of operational efficiency, service reliability and cost savings. Bill earned a BS degree in Operations Engineering from North Carolina State University and MBA degree from Wake Forest.

Carl Wilkins, PE, Principal Advisor

Carl is a seasoned utility professional with over 30 years’ experience working in the electric utility industry in a variety of consultative roles. Mr. Wilkins is currently involved with evaluating the transmission and distribution impacts of a high penetration of distributed energy sources. He is also developing utility-scale energy storage solutions. His projects look closely at the technical and operational impacts of intermittent resources, including the development of detailed grid models of wind and solar PV generation. Mr. Wilkins is also evaluating distribution grid impacts for distributed resources and validating transmission line inspection procedures for various utilities across the US. He has worked with utilities in areas of smart utility grid, plug-in hybrid electric vehicles and policies to address climate change and environmental sustainability. He is involved in the development of services in areas of energy efficiency, renewable portfolio standards, renewable business case development, carbon strategies, renewable engineering and design, system planning and analysis and energy storage services. Prior to joining Quanta, Mr. Wilkins had responsibility for large commercial accounts, military, federal and state government accounts at Duke Progress Energy where he consulted with large commercial customers to manage their utilities and central energy plants, including chillers, boilers, compressed air, water and sewage. Carl has experience with distribution automation, AMR, DSM technology and thermal energy storage. Mr. Wilkins holds BSEE from NC State University and is a registered professional engineer in North Carolina.